ERP
DEMYSTIFIED

Third Edition

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To

Mathews Leon

my brother, friend and critic

for his love, encouragement and support

Preface to the Third Edition

Enterprise Resource Planning (ERP) is an integrated enterprise-wide information system. It integrates the information system of an organization and automates most of the business functions. A properly implemented ERP system can dramatically improve the efficiency and competitive advantage of an organization. The main advantages of ERP packages are: improved efficiency, information integration for better decision-making, faster response time to customer queries, etc. The indirect benefits include better corporate image, improved customer goodwill, customer satisfaction and so on. Other benefits are business integration, flexibility, better analysis and planning capabilities and use of latest technology.

ERP systems provide an integrated suite of information technology applications that support the operations of an enterprise and are not, as the acronym ERP implies, limited to planning functions. The activities supported by ERP systems include all core functions of an enterprise, including financial management, human resources management, and operations. Increasingly, ERP vendors are offering "bolt-on" products that provide specialized functionality to augment the core, such as Business Intelligence (BI), Business Analytics (BA), data warehousing, data mining, On-line Analytical Processing (OLAP), Product Lifecycle Management (PLM), Advanced Planning and Scheduling (APS), Customer Relationship Management (CRM), Supply Chain Management (SCM), Geographic Information System (GIS), etc.

History of ERP

The ERP model took years to emerge and is still evolving. The concept began in the 1960s with MRP or material requirements planning systems, that assisted manufacturing companies in planning and scheduling. The first actual ERP system was created in 1972, in Mannheim Germany, by five former IBM employees who founded the company SAP to produce and market standard software for integrated business solutions. In the early 1980s, MRP evolved into Manufacturing Resource Planning or MRP II, introducing the concept of integrating financials with the manufacturing work-in-process. These early MRP and ERP systems were mainframe based.

In late 1980s, the second phase of ERP development occurred when organizations increased the integration of their business and focused on quality measures. In the 1990s, with the Year 2000 computer problem looming and the advent of client/server platforms, businesses decided there were benefits to integrating all the core systems across their internal enterprise. ERP soon became known as Commercial Off-The-Shelf (COTS) solutions that specialized in business processes, functions and industries. This integration focus resulted in a dramatic increase in the widespread use of ERP.

Benefits of ERP

The main value, ERP systems provides is, the opportunity to integrate an entire organization. End-to-end business processes that were traditionally disjointed, now share information through a common

database. The information flow is much more efficient in that, there are clear lines of business processes across the enterprise. There is no time lag, re-entry of information or dependency on paper documents. By having a single point of entry, the risk of inaccuracy in the end-to-end transaction is reduced, resulting in fewer reconciliation points. Additionally, the ERP systems of today provide utilities for vertical integration with suppliers and distributors. When properly implemented as part of a comprehensive transformation effort, ERP solutions can yield the following results:

- Integrated processes and information systems
- Consolidation and/or elimination of current systems
- Reduced complexity of application and technology portfolios
- Reduced reliance on programmers to make software changes
- Authoritative data source
- Reduced data redundancy and duplicative data entry
- More effective and efficient business processes

Changes in the Third Edition

This book explains the concepts of ERP, demystifies its myths and misconceptions, and gives an overview of the technologies that will work with ERP systems to make organizations work at high efficiencies. The book covers very comprehensively the implementation of an ERP system that is best suited for an organization—right from package selection, team selection, implementation plan preparation, implementation, project management and monitoring, training, post implementation tasks, and so on. The various tasks that must be performed after implementing the ERP system are also covered in detail. The different modules of the ERP package and the profile of the leading ERP vendors are also discussed. The future trends in ERP, the emergence of new technologies and the integration of ERP systems with Internet and WWW is also covered. The appendix includes ERP Case Studies.

The book has been revised to include the latest developments in the field of ERP and information technology like popularity of Internet and WWW, new technologies, new deployment models, new security issues and their solutions, changes in the market dynamics, new ERP vendors, and so on. In short the book has been updated and revised to reflect the current state and enlarged to make it more comprehensive. The highlights of this edition are:

- New chapters on 'Business Processes and Enterprise Systems', 'Advanced Technology and ERP Security', and 'ERP Deployment Models'
- Coverage of business processes, enterprise systems, ERP security, on-demand (SaaS) ERP, and cloud or hosted ERP
- Completely revamped chapters on 'ERP Marketplace and Market Dynamics', 'ERP Vendors' and 'Future Directions and Trends in ERP' to reflect the latest trends
- New ERP case studies from a variety of vendors in diverse industries
- Comprehensive reference list and bibliography is provided at the chapters' end for those who want to explore more

Organization of this Book

The book is about Enterprise Resource Planning (ERP)—its evolution, implementation, and advantages. It is divided into eight sections—Introduction, ERP and Technology, ERP Implementation, ERP in Action, Business Modules, ERP Market, Present and Future of ERP and Appendices.

The first section gives an overview of the enterprise, the business processes, enterprise systems, and how the business processes help to improve the efficiency of businesses. It also introduces ERP, explains the basic concepts, demystifies the common ERP myths, discusses the risks and benefits of ERP, and helps in justifying the ERP investments and explains why it is imperative that the organizations should implement ERP.

The second section, ERP and Technology gives an overview of the technologies that are related to ERP and are necessary to improve the capabilities of the ERP system, and that help in transforming businesses using ERP systems; by enabling executing business at Internet speed. The technologies discussed include Business Intelligence (BI), Business Analytics (BA), E-Business and E-Commerce, Business Process Reengineering (BPR), Data Warehousing, Data Mining, On-line Analytical Processing (OLAP), Product Life Cycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM), and Geographic Information Systems (GIS). This section also deals with the ERP security—the various security issues and their solutions.

Section three deals with the ERP implementation issues. It starts right from the beginning—selection of the ERP package for the company—and discusses all issues that will crop up before, during and after implementation. Some of the topics that are discussed are package selection, implementation life cycle, implementation methodologies, deployment methods, implementation costs, implementation team, role of vendors and consultants, contracts with vendors and consultants and so on. It also discusses the factors that determine success and failure of the ERP systems.

The fourth section—ERP in Action—deals with the post-implementation scenario. It discusses what will happen after going-live, what tasks should be performed for maintaining the momentum of the ERP implementation, what skills are required, what should be the organizational structure of the ERP team that is responsible for the operation and maintenance of the ERP system, what are the activities during the operation and maintenance phase and how to get the best out of the ERP system.

Section five deals with the major modules in an ERP package and how each module functions. The sixth section is about the ERP market place and the major players in the ERP market. The seventh section deals with the technological advancements that will change the nature of today's ERP packages. This section includes topics like turbo charging the ERP system, Enterprise Integration Applications (EIA), ERP and E-Business, ERP II, ERP and Total Quality Management (TQM), and future directions and trends of ERP.

The Appendices include ERP Case Studies taken from diverse industries and different ERP vendors. Besides this, the book is supported by a companion website at ***http://mhhe.com/9383286679***. It includes ERP Resources on the Internet, ERP—A Manufacturing Perspective, Careers in ERP, and ERP Glossary. The companion website also contains many other resources like PowerPoint slides and solutions manual for instructors, study guides and presentations for the readers, etc. The 'Student Edition' of the resources can be freely accessed and used; the 'Instructor Edition' can be provided on special request.

Who should Read this Book?

The book is mainly for managers and executives who are entrusted with the job of implementing an ERP system in their organization. A more specific classification of the audience of the book is given below:

- **Top Management** – This book provides the decision makers—the top management—an overview of ERP. Why it should be implemented and facts and figures for convincing others—board of directors, shareholders, employees, and so on—why implementing the ERP system is a must for survival.

- **ERP Project Manager or Implementation In-charge** – This is the person whom the organization entrusts with the task of implementing the ERP system. His task involves conducting a feasibility study, finding out the requirements, selecting the right ERP package, dealing with vendors and consultants, forming the implementation team, training the team members, implementation project monitoring, managing the consultant and package vendors, training the employees, moving from the old system to the ERP system, operation and maintenance of the ERP system, how to improve the effectiveness of the ERP system, and so on. This book gives detailed and practical instructions on how to perform all these tasks.
- **Middle/Functional Management Executives** – The middle management or the functional management executives like managers of the departments of production, finance, human resources, etc., need to become aware of the advantages of ERP system and what a properly implemented ERP system can do in improving their departmental efficiency and raising the effectiveness of their team. The successful implementation of any ERP project requires the co-operation and support of these managers. This book helps in raising the awareness and creating an environment where the ERP project implementation can succeed. The book also dispels the wrong notions and rumors about ERP thus making the managers open towards the idea of implementing the ERP system.
- **Employees (Implementation team members, end-users, etc.)** – The most critical factor that decides the success of any ERP implementation project is, the attitude and cooperation of the people implementing the system and using the system once it is implemented. This book provides information on how to win support from the users, how to deal with employee resistance, how to convince people to use the system in the correct way, and how to make people adopt the system and reap benefits out of it.
- **Students** – This book gives a comprehensive treatment of ERP systems, its advantages, its implementation, its modules, the major vendors, and so on. It is a one stop reference of the what, why, how and who of ERP systems and its related technologies. This book would be an ideal text book for a post-graduate course in ERP and would be an interesting read for a general management reader.

Why should you Read this Book?

Today, having an ERP system is not a luxury, but a necessity. Having a properly implemented ERP system and a fully trained workforce that knows how to use the system in the best possible way is a must for survival in this competitive world. Selecting the ERP system that is best suited for the organization and implementing and operating it in the most efficient manner is a very difficult task and the chances of failure are very high. A wrong ERP package or faulty implementation or both can put the organization out of business. So it is imperative that the right package should be chosen, the implementation should be meticulously planned and perfectly implemented.The transformation from the legacy system to the ERP system should be done without any major glitches, having trained the employees properly, and the implemented system should be used and maintained in the best possible manner to realize the full potential of the ERP system.

This book gives a comprehensive treatment to all aspects of the ERP system from concepts to implementation, operation, and maintenance. The writing style is simple, easy-to-understand and jargon free with lots of illustrations, bullet lists and tables. The concepts are introduced first, and the content is organized in the most logical manner so as to enable the best possible understanding

of the ERP system; its benefits, related technologies, the different modules, the market leaders, ERP system implementation, operation and maintenance. Case studies are also provided so that the user can see how ERP systems are implemented in the real world.

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I am grateful to my brother **Mathews Leon** for his suggestions, comments and for helping me with the illustrations in this book. Thanks to my father **Leon Alexander** and my mother **Santhamma Leon** for their support and love.

Finally...

I hope that you will enjoy reading this book and it will help you in choosing, implementing and operating an ERP system that is best suited for your organization and then turbo charge it using the various technologies available. I hope that you will play a vital role in taking your organization to greater heights by streamlining its operations, automating its business process, by extending its reach using the Internet and WWW and by enabling it to do business at Internet speed. I wish all the readers all the very best in their endeavor to make their businesses globally competitive and market leaders.

I request you to make use of the companion site of this book which is at ***http://mhhe.com/9383286679***. I would like to hear from you. You can send your comments, suggestions and queries to alexis@leon-leon.com.

Alexis Leon

Preface to the First Edition

To survive, thrive and beat the competition in today's brutally competitive world one has to manage the future. Managing the future means managing information. Today, the difference between market leaders and followers, successful companies and sick industries, is the way in which companies make use of information—information generated by the company (the internal information) and the information about the business environment. Companies generate huge amounts of data—financial data, details about customers, purchase details, employee data, and so on. Only an organization that makes the best possible use of this information can succeed. But the problem is that in this age of information explosion, collecting, collating, summarizing and refining huge amounts of data is a daunting task. People alone cannot do the job. In order to manage information, in order to deliver high quality information to the decision makers at the right time, in order to automate the process of data collection, collation and refinement, organizations must make Information Technology an ally and should harness its full potential and use it in the best way possible.

Almost all organizations are turning to some sort of **Enterprise Resource Planning** (ERP) package as a solution to their information management problems. ERP packages if chosen correctly, implemented judiciously and used efficiently have the ability to raise productivity and profits of companies dramatically. But many companies fail in this because of incorrect selection of a package, incompetent and haphazard implementation and inefficient or ineffective usage. The most crucial factor that decides the success of an ERP implementation is how the employees use the system. Even the best ERP system can fail if the employees are not interested in using it or using it wrongly or inefficiently. To receive total and complete employee support and participation, the organization must make it a point to educate its employees about the potential benefits and provide them the requisite training.

ERP Demystified is mainly meant for managers and executives who are entrusted with the job of implementing an ERP system in their organization. The book contains all they need—package selection, costing, implementation methodologies, team organization, training, dealing with vendors and consultants, post implementation strategies and so on. The book is not specific to any package. It will come in handy for anybody who wants to know about ERP, its future, how a company can benefit from ERP and for the people who want to make a career switch to ERP segment. This book assumes nothing; all concepts are developed from ground up and integrated in such a manner that will provide the necessary logical flow for a reader.

This book describes the evolution, implementation, and advantages of ERP. It is divided into five sections—*Introduction, Implementation, Business Modules, ERP Market,* and *Present and Future of ERP*. The first section provides an introduction to ERP, what it is, what are the benefits and what are the related technologies. Section two deals with ERP implementation issues. It starts right from the beginning—selection of the ERP package for the company—and discusses all issues that will crop up before, during and after the implementation. Topics discussed include package selection, implementation lifecycle, implementation methodologies, implementation costs, implementation team, role of

vendors and consultants, contracts with vendors and consultants and so on. Section three deals with the major modules in an ERP package and how each module functions. The fourth section is about the ERP market and the major players. Section five deals with the technological advancements that will change the nature of the existing ERP packages and future trends.

The appendices include ERP resources on the Internet, ERP—A manufacturing perspective, Frequently Asked Questions, glossary and case studies (success stories). A special appendix on Careers in ERP provides guidelines on how to make a switch from other areas to the ERP profession and how to make that transition successful and as risk free as possible has been included.

I hope you will enjoy reading this book. I hope too that you will help your organization in successfully implementing the ERP system, so that it is ready to face the challenges of the next millennium. I wish all the readers all the very best.

I am deeply grateful to all those people who helped me bring this book from idea to print. I am extremely grateful to my sponsoring editor V. Deepa for her valuable inputs in making this book more structured and organized. Thanks also to the competent editorial staff, layout designers and production team at McGraw-Hill, for their valuable contribution in making this project a success. I am grateful to Mathews Leon for his suggestions, comments and for helping me with the illustrations in this book. Thanks to my father Leon Alexander and my mother Santhamma Leon for their support and love.

Any suggestions, comments and corrections are welcome. You can send your comments and suggestions to alexis@leon-leon.com.

Alexis Leon

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Chapter 1

Enterprise—An Overview

INTRODUCTION

What is an enterprise? The term is often used in general business situations to describe a corporate entity, anything from a sidewalk espresso cart to an organization as large as TELCO or Hindustan Lever.

An **enterprise** is a group of people with a common goal, which has certain resources at its disposal to achieve this goal (see Fig. 1.1). The enterprise acts as a single entity. This view of a company or organization is drastically different from the traditional approach. In the traditional approach, the organization is divided into different units based on the functions they perform. We have the manufacturing or production department, the production planning department, the purchasing department, the sales and distribution department, the finance department, the R&D department, and so on. These departments are compartmentalized based on their own goals and objectives, which, from their point of view, is in line with the organization's objectives.

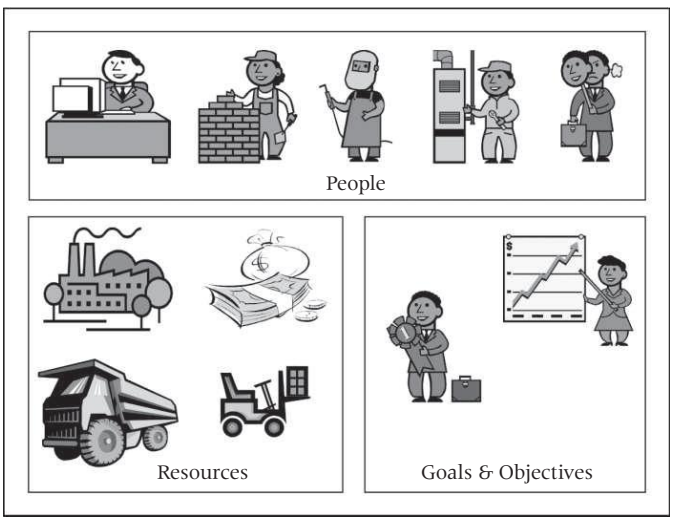

Figure 1.1 The enterprise.

These departments function in isolation or as silos and have their own systems of data collection and analysis. The information that is created or generated by the various departments is thus, in most cases, available only to the top management (that too as summary reports) and not to the other departments (see Fig. 1.2). The result is that instead of taking the organization toward the common goal, the various departments end up pulling it away in different directions. This is because one department does not know what the other does. Also sometimes the departmental objectives can be conflicting. For example, the sales and marketing people will want more product variety in their products to satisfy the needs of their customers. But the production department will want to limit

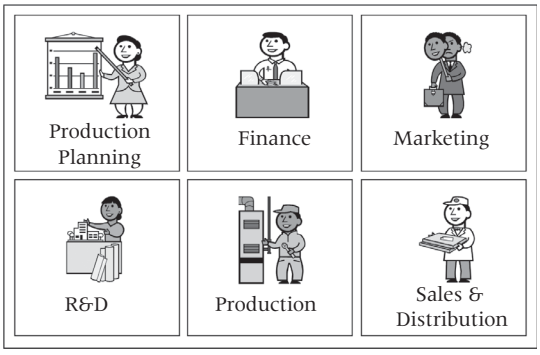

Figure 1.2 Organization where there is no or little communication between departments.

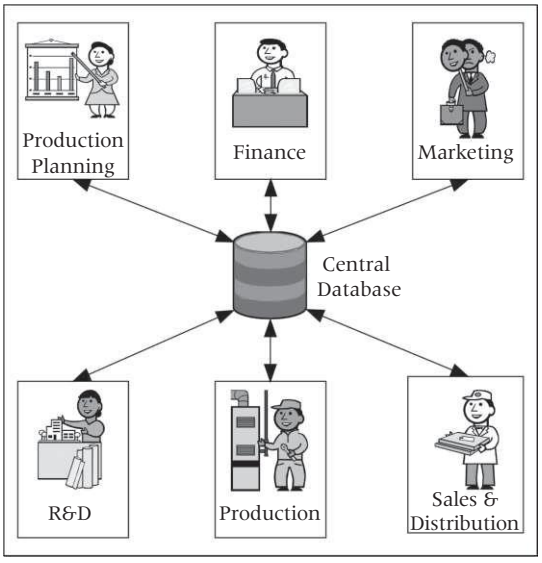

Figure 1.3 An enterprise where all departments know what others are doing.

the variety to cut down production costs. So unless and until all departments know what the others are doing and for what purpose, these kinds of conflicts will arise, disrupting the normal functioning of the organization. This phenomenon is commonly referred to as the **silo effect** because employees complete their tasks in their functional "silos" without regard to the consequences for the other components and departments.

The silo nature of the functional organizational structure and the cross-functional nature of the business processes are at odds with each other. While workers focus on their specific function, each business process involves workers located in multiple functional areas. A major challenge facing the enterprises is to coordinate the activities of the different functional areas so that the organizational goals are achieved. In the **enterprise way**, the entire organization is considered as a system and all the departments are its sub-systems. Information about all the aspects of the organization is stored centrally and is available to all departments as shown in Fig. 1.3.

This transparency and access to information ensures that the departments no longer work in isolation pursuing their own independent goals. Each subsystem knows what others are doing, why they are doing it, and what should be done to push the company toward the common goal.

ERP systems help to make this task easier by integrating the information systems, enabling smooth and seamless flow of information across departmental barriers, automating business process and functions, and thus helping the organization to work and move forward as a single entity.

BUSINESS FUNCTIONS AND BUSINESS PROCESSES

Enterprises exist either to serve some commercial purpose or to achieve some social objective. They differ depending on the purpose or the goal they are trying to achieve, their ownership or management structure, and the regulatory environment in which they operate. Some create and deliver products or services to customers to make a profit. For example, a car manufacturer produces a variety of cars. It then sells these products to numerous retailers who, in turn, sell them to the final consumers. Other companies provide services—for example, an advertising firm creates advertisement campaigns for the cars. Yet others provide the manufacturer with the parts and materials needed to make the cars. Achieving the organization's objectives involves different types of work. For example, the manufacturer must design the cars, identify what parts it will use to make them, determine where to obtain these parts, produce the cars, identify its customers, and market and sell the cars to them. In addition, it must determine how to manage its money, its various facilities such as factories and warehouses, and the people that it must recruit, employ, train, and retain. This function is categorized into numerous processes.

Enterprises thus have many functional areas of operation—marketing and sales, production and materials management, accounting and finance, human resources, etc. Each functional area comprises a variety of business functions and business activities within that functional area of operation. Earlier business systems functioned as, what happened in one functional area was not closely related to what happened in others, and one area's information system had no impact on those of other functional areas.

The drawbacks of the silo effect forced managers and organizations to think in terms of business processes rather than business functions. A **business process** is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. Viewing an enterprise from a process perspective requires employees to view the business across functional boundaries and focus on the end-to-end nature of the process and its intended outcomes. Learning to view a process from end-to-end is essential to understand how enterprises manage their processes efficiently. Thinking in terms of business processes also helps to look at their organizations from a customer's perspective. An organization uses many processes to achieve its objectives. The key business processes are financial accounting, purchasing (or procurement), manufacturing (or production), fulfillment (or sales), production planning, materials management, product data management, human resources management, project management, etc. These key business processes are closely related to the enterprise's functions such as buying, making, selling, designing, planning, storing, serving, employing, training, etc.

Every business process is triggered by some event, such as receiving a customer order or recognizing the need to increase inventory. For example, if a person wants to buy a car, he has to essentially make enquires about the car, choices, quick and efficient service, fast order processing and delivery, availability of finance and completion of other formalities like registration, insurance, etc., with minimum trouble. The customer is not bothered about who is interacting with him, what the policies of the company with regards to employee selection are, where the raw materials are purchased and for what price, and so on. The customer wants a good quality product, delivered to him at a competitive price as fast as possible with minimum hassles. The specific steps in the process are completed in different functional areas. In the above example, when the customer places an order

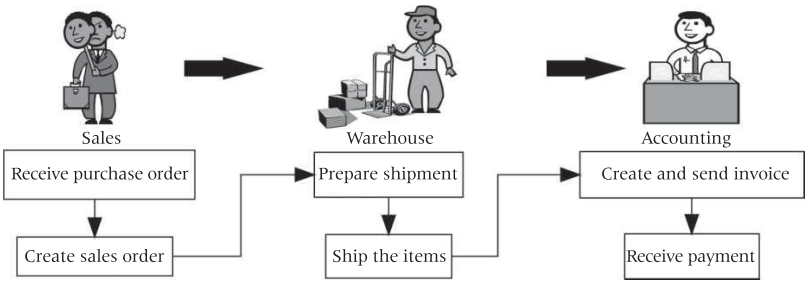

Figure 1.4 An order fulfillment process.

for the car, the manufacturer uses a specific process to ensure that the correct product is shipped to the customer in a timely manner and that payment for the order is received. These process steps can include validating the order, preparing the shipment, sending the shipment, issuing an invoice, and recording the receipt of payment. The sales department receives and validates the customer order and passes it on to the warehouse, which prepares and ships the order. The accounting department handles the invoice and payment steps as shown in Fig. 1.4. This example highlights the fact that processes consist of interdependent steps that are completed in different parts (functions or departments) of the organization.

The difference between a business function and a business process is that a process cuts across more than one business function to get a task done. Although organizations exist for different purposes, are of different sizes, and operate in different industries, they all exhibit similarities in the ways they operate. Regardless of their type or size, successful organizations and industries use business processes to complete the work needed to achieve their goals. Suppose a car was damaged during delivery, it is the responsibility of the customer service to accept the damaged item depending on the severity of the damage and replace it or repair it. The actual repair or replacement of the car is a business process that involves several functional areas and functions within those areas. Thus, it can be understood that the customers are looking across the company's functional areas in their process of buying and obtaining a car.

Business managers are now trying to view their business operations from the perspective of a satisfied customer. For a company to provide better customer satisfaction, it must make sure that its functional areas of operation are integrated. For example, the people in sales and marketing should know the up-to-date details of the latest products, their prices, their features, etc., so that they can convey this information to the customers. Similarly, the people in the manufacturing plants should know which models are being ordered in large quantities so that they can buy the necessary materials and start manufacturing those items to deliver to the customers. Because the various process steps are carried out by different functional areas or departments, effective communication and collaboration among the departments is essential to the smooth execution of these processes. Without this interaction, the process cannot be completed efficiently and effectively. If the customer order is not properly communicated to the warehouse, then it cannot be shipped on time. Similarly, if the order and shipment information is not communicated to the accounting department, billing and payment will not be completed efficiently and accurately. Clearly, completing a process successfully requires more than just communicating information. Close coordination of work among the people involved is also essential. Sharing data effectively and efficiently between and within functional areas leads to more efficient business processes. Information systems can be designed so that accurate and timely data are shared between the functional areas. These systems are called **integrated information systems**.

INTEGRATED MANAGEMENT INFORMATION

An information system is an open, purposive system that produces information using the "input-process-output" cycle. The minimal information system consists of three elements—people, procedures, and data. People follow procedures to manipulate data to produce information. In today's computer world, the definition of information systems has undergone a slight change. Today an information system is an organized combination of people, hardware, software, communications networks, and data resources that collects, collates, transforms, and disseminates information in an organization.

Management information systems (MIS) also called information-reporting systems were the original type of management support systems, and they still are a major contributor of information systems. MIS produce information products that support many of the day-to-day decision-making needs of the management. Reports, charts, graphs, displays, and responses produced by such systems provide information that managers have specified in advance. Such pre-defined information satisfies the needs of managers at the operational levels of the organization who are faced with the structured type of decision-making.

But the problem with these information systems is that they operate at a departmental level and they give only information that has been pre-defined. Therefore, each department will have its own database and information systems. These systems will produce various reports of varying detail that were specified when the systems were built.

This method of information gathering has two major disadvantages. *One*, the people in one department does not have any information about what is happening in the other departments. May be at the top management level, the summary reports are being circulated to other departments also, but these summary reports often fail in capturing the real picture. The *second* drawback is that these systems give only the information that they are designed to produce at the time they were built. Suppose a manager wants some information, which is not in the reports, then, these systems are of no help.

As mentioned, these systems lack an integrated approach. There will be an accounting system for the finance department, a production planning system for the manufacturing department, an inventory management system for the stores department, and so on. All these systems will perform in isolation. If a person wants some information, which has to be derived from any of these two systems, he has to get the necessary reports from both systems and then correlate and combine them.

Because the systems work in isolation, collecting and analyzing the data needed for functioning of one department, as discussed earlier, and getting information about some aspect that is dependent on more than one department, is a difficult task. But no business executive or decision-maker can take right decisions with this isolated data that he can get from the various reports produced by separate departments. Even if he collates the data and gathers the information that he requires, he would have lost valuable time that would have been better spent in decision-making.

In reality, an organization cannot function in isolation from different departments. Production planning data is required for the purchasing department. The purchasing details are required for the finance department and so on. Therefore, if all the information islands, which were functioning in isolation, were integrated into a single system, then its impact would be dramatic. For example, if the purchase department can see the production planning details, then it can make the purchasing schedule. If the finance department can see the purchase details as soon as it is entered into the system, they can plan for the cash flow that will be necessary for the purchases.

We have discussed that in today's competitive business environment, the key resource of every organization is information. If the organization does not have an efficient and effective mechanism that enables it to give decision-makers the right information at the right time, then the chances of that organization succeeding are very remote.

The three fundamental characteristics of information are **accuracy**, **relevancy**, and **timeliness**. The information has to be accurate, it must be relevant for the decision-maker and it must be available to him when he needs it. Any organization that has the mechanism to collect, collate, analyze, and present high quality information to its employees, thus enabling them to make better decisions will always be one step ahead of the competition. Today, the time available for an organization to react to the changing market trends is very short. To survive, the organization must always be on its toes, gathering and analyzing the data—both internal and external. Any mechanism that will automate this information gathering and analysis process will enhance the chances of the organization to beat the competition.

Therefore, what is needed is a system that treats the organization as a single entity and caters to the information needs of the whole organization. If this is possible, and if the information that is generated is accurate, timely, and relevant, then these systems will go a long way in helping the organization to realize its goals.

THE ROLE OF THE ENTERPRISE

The company's decision-makers have to do a detailed, consistent, and technically sound job of selecting a software package. They have to ensure that all the business's key personnel, in one way or another, are involved and committed to the project's implementation. The enterprise has to identify a consulting firm that possesses all the attributes necessary to conduct the implementation project successfully—qualified professionals, proven methodology, and excellent references. Is anything still lacking for the project to work and for it to be a success?

We have discussed that an enterprise is the group of people with a common goal, which has certain resources at its disposal to achieve this goal. The group has some key functions to perform in order to achieve the goal. An enterprise resource planning (ERP) implementation project consists of a lot of people and groups, each playing different roles. There are a group of people, the company employees, the package vendors, the hardware vendors, the communications experts, the implementation consultants, and so on. All of them have a common goal—the successful implementation of the project. They have a lot of resources at their disposal for achieving the goal. This makes the ERP implementation project an enterprise in its own right.

We have discussed earlier that it is the duty of the organization to select the package and the people. Since all the ingredients are present and have been carefully chosen, the results should be quite adequate. But as with any recipe, we must measure the quantity of each ingredient so that the mixture will create something that is more than some ingredients thrown in. An ERP implementation project does not depend solely on the software vendor, the consultants, or the dedication of the company's personnel. Success for a project of this magnitude and scope depends largely on each party playing its role well, because the roles are singular in nature; there can be no substitution without there being a decline in the quality of the final outcome. It is in this task—the integration of the various components—that the enterprise has to play a vital role—the role of the facilitator. The success of the ERP implementation project depends on how well this is done.

Apart from playing the role of the integrator and facilitator, the organization has to play a lot of other roles in the implementation. The company—represented in the person of certain professionals—must act like the true owner of the project, the party most interested in the success of the work, the entity that will do anything and everything to comply with what was originally set forth in the schedule. It may sound ridiculous, but experience has shown that many a times, the company has lost sight of the final goal and has thus allowed the projects to fail. Therefore, it is not a bad idea to get the help of the consultants to clarify the role of the company representatives, the tasks they have to do, the activities

they have to perform, and so on. The consultants have done the implementation before and have seen successes and failures. They will know the warning signs and when to take corrective action. Therefore if they can develop a job description or job profile and list out the important tasks and activities that the company has to perform, it will be of tremendous help for the in-house staff.

The most important and critical activity the company management has to do is to designate the right people to lead the project. These people should be high up in the corporate ladder and should be willing to dedicate themselves to learning how to operate the package correctly to provide for the needs of the business. These individuals must acquire a reasonable degree of knowledge about the ERP package. They should also be involved with all the aspects of the implementation and should be able to manage the system after the consultants leave the place. The task of the employees could be made easier if the consultants document everything in great detail (including why a particular parameter has a particular value and why some option is disabled and so on, thus creating a knowledge-base). The vendor's documentation will also help in understanding the system and it's working, but it is important that the employees know where to look and how to use the information. Thus, it is the responsibility of the organization to learn and to assimilate information about the software package in order to achieve a reasonable level of independence. Therefore, the success of the implementation depends partially on which employees are allocated to the project and to what extent they can devote their time to the project, and assimilate knowledge and successfully transfer it to their colleagues and subordinates. This means that the company personnel involved in the implementation project should attain a level of proficiency in managing the ERP package and should request additional support only for problems that justify the cost of the consulting fees that will inevitably be charged to resolve them.

In addition to understanding the package, the enterprise should assume additional responsibilities. For example, it must guarantee that all users who are supposed to participate full-time or during specific tasks or phases are made available at the necessary times established by the project schedule. This will involve re-allocating these people's responsibilities (although temporarily). It also means putting on hold, for the time being, everything that is not absolute priority. Finally, it is the company that should motivate its employees to change and to learn new technologies and prepare them to assume their new responsibilities. In short, the company should create an environment where the ERP system can grow, thrive, and produce the dramatic benefits it is capable of.

BUSINESS MODELING

Business modeling or creating a business model is one of the primary activities in any ERP project. As discussed earlier, the ERP systems should mirror the business processes. A business model is not a mathematical model, but a representation of the business as one large system, showing the interconnections and interdependencies of the various sub-systems and business processes.

Based on the organization's goals, objectives, and strategic plans, a business model consisting of the business processes is developed. The different individuals in the organization (the people) control these business processes in order to achieve the common goals. The ERP system is developed based on the business model with the aim of providing the required information and necessary assistance to the various individuals to perform their business processes more effectively and efficiently.

In business modeling, as the name suggests the business is modeled as an integrated system by processing its facilities and materials and the resources. Information is a very important resource and is very critical in managing all the other resources without it.

Thus, the business model is a representation of the actual business, what the various business functions of the organization are, how they are related, what their interdependencies are, and so on.

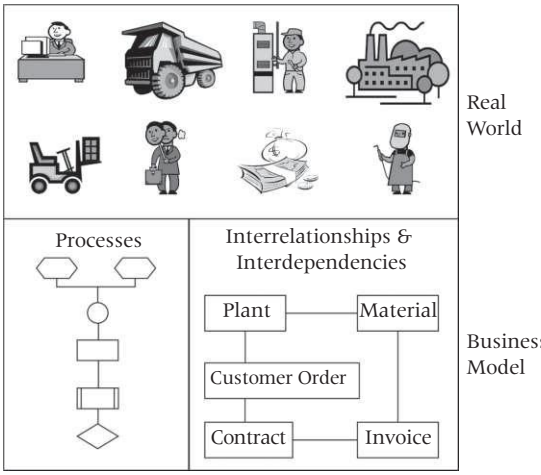

Figure 1.5 Real world and the business model.

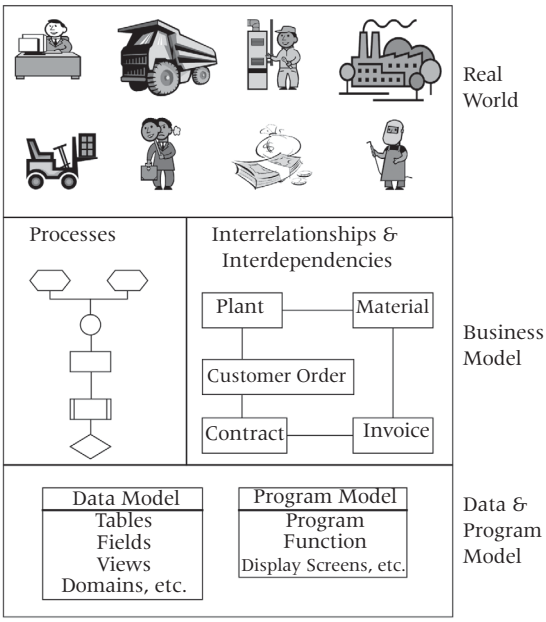

Figure 1.6 Data model and its relationship with the real world.

The business model is usually represented in the graphical form using flowcharts and flow diagrams as shown in Fig. 1.5. The data model of the system is created from the business model.

INTEGRATED DATA MODEL

One of the most critical steps in the ERP implementation is the creation of an integrated data model. One of the advantages of having an ERP system is that all the employees from different departments get access to the data—the integrated data. The company uses this integrated data for its analysis and decision-making.

With the implementation of ERP systems, the departmental information systems and the departmental databases will have to go. There can no longer be isolated databases, which cater to the needs of a particular department. All the data has to be integrated. This approach will reduce data redundancy and give all employees a chance to have updated and up-to-the minute information about the entire organization.

For the integrated database to be effective, it should clearly depict the organization, it should reflect the day-to-day transactions, and it should be updated continuously. At any given time, the database should give a snapshot of the organization at that point in time. Thus, if orders are entered, the sales are done, and the goods are dispatched, then the database should reflect those changes. The inventory should be reduced and the account receivables should be increased. All these things have to happen instantaneously and automatically. That is the challenge and also the advantage of an integrated database or the integrated data model.

While designing the data model for the ERP system, the most important thing that should be kept in mind is the information integration and the process/procedure automation. The data model should reflect the entire organization and should successfully depict and integrate the data structures of the entire organization as shown in Fig. 1.6.

SUMMARY

An enterprise is a group of people with a common goal, which has certain resources at its disposal to achieve their goal. The enterprise acts as a single entity. The enterprise view of a company or organization is drastically different from the traditional approach. In the traditional approach, the organization is divided into different units based on the functions they perform. But in the enterprise way, the entire organization is considered as a system and all the departments are its sub-systems. All aspects of the organization are stored centrally and information is available to all departments.

The ERP systems help to make this task easier by integrating the information systems, enabling smooth and seamless flow of information across departmental barriers, automating business process and functions, and thus helping the organization to work and move forward as a single entity.

A business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. Thinking in terms of business processes helps managers to look at their organizations from a customer's perspective. The difference between a business function and a business process is that a process cuts across more than one business function to get a task done. Sharing data effectively and efficiently between and within functional areas leads to more efficient business processes.

Information systems are designed such that accurate and timely data are shared between functional areas. These systems are called integrated information systems. Therefore, what is needed is a system that treats the organization as a single entity and caters to the information needs of the whole organization. If this is possible, and if the information that is generated is accurate, timely, and relevant, then these systems will go a long way in helping the organization to realize its goals.

REVIEW QUESTIONS

1. What is an enterprise?
2. Give an example of conflicting departmental interests.
3. What is the traditional approach of an organization?
4. What are the drawbacks of the traditional approach?
5. What do you mean by silo effect? Explain it with an example.
6. Explain the enterprise way of functioning of organizations?
7. How do ERP systems make the task of information integration easier?
8. What are the advantages of the enterprise way of functioning?
9. What is an enterprise and what are the different types? Give examples.
10. Give examples of some functional areas of operation of enterprises.
11. What are business systems? How did they function?
12. What are the drawbacks of the business systems approach?
13. What are business processes and how different is it from business functions?
14. What is the difference between a business function and a business process?
15. Explain the difference between a business function and business process with an example.
16. What is an information system?
17. What are the three elements of an information system?
18. What is the new definition of information system?
19. What are integrated information systems?
20. Why is it said that the business process way of doing things is like viewing the organization from the customer's point of view?
21. How does a company ensure customer satisfaction?
22. What is MIS, what are its uses and who are its end-users?

23. What are the disadvantages of management information systems?
24. Why is information said to be the key resource of an organization?
25. Why is MIS called information-reporting systems?
26. Why is it difficult to make quality decisions with the information that one gets from the MIS?
27. What are the three fundamental characteristics of information? Explain with examples.
28. Describe the role of the enterprise in the ERP implementation.
29. What is business modeling and what are its uses?
30. What do you mean by integrated data model and what is its importance?

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Chapter 2

Business Processes

INTRODUCTION

In Chapter 1, we discussed about the divisions of an enterprise into functional departments like finance, purchasing, production, sales, human resources management, materials management, etc. We also discussed the drawbacks of the various departments functioning in isolation creating information islands and pulling the enterprise into different directions away from the common goal. We have studied in detail those business processes look at the organization from the customer's point of view. These processes could cut across the departmental or functional barriers and help in facilitating seamless information flow across departments and thus lead to smooth and efficient operation of the enterprise. In this chapter, we will see more about the integrated business processes and how an enterprise system helps in transforming enterprises.

BUSINESS PROCESSES

A **business process** is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. Most companies maintain functional departments to compartmentalize their operational units, the integrated business processes that companies use to perform their work cut across these departments horizontally. Business processes, such as the order fulfillment process discussed in Chapter 1 (see Fig. 1.4), consist of activities that occur in different, seemingly unrelated functions or departments.

In other words, these processes are cross-functional; meaning no single group or function is responsible for their execution. Rather, it is a shared responsibility among many functional areas. The cross-functional nature of business processes is illustrated in Fig. 2.1. The information management system, human resources management system, and other support functions are common for all enterprises and help them to perform better. For a process to be successfully completed, the enterprise must rely on each functional group to execute its individual role in a coordinated manner, which is not always an easy task to accomplish. The main reason is the silo effect where employees belonging to different functional units or departments perform their functions without considering its implications on the other departments and the organization as a whole.

The silo nature of the functional organizational structure and the cross-functional nature of processes are against each other. In other words, while workers focus on their specific functions, the business processes involve workers located in multiple functional areas. A major challenge facing organizations is to coordinate activities among the different functional areas or departments. Viewing a company from a process perspective requires the employees to think from the customers' point of view. The employees must view the business across functional boundaries and focus on the end-to-end nature of the process and its intended outcomes.

As we have seen, business processes span different parts of an organization. Before globalization, all the business processes were under one roof. In today's global economy, the various process steps are increasingly executed by people in various locations throughout the world. For example, a company

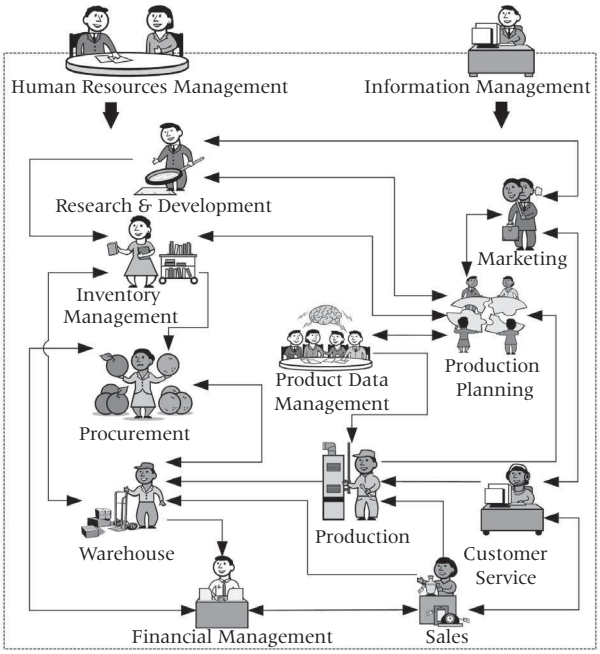

Figure 2.1 Cross-functional nature of business processes.

will manufacture its products in different countries, acquire raw materials from different locations, market the products in many countries, and so on. Consider the case of a computer manufacturing company that designs its products in India—purchases components from China, manufactures the computers in China and Korea, and sells those computers worldwide. Because the steps in business processes are performed in locations that are geographically dispersed, it is impossible to manage such processes effectively without the use of modern communication systems and IT. Systems that support end-to-end processes are called **enterprise systems**, and they are essential to the efficient and effective execution and management of business process. Thus, investing in communications systems and IT, particularly enterprise systems, significantly increase the profitability, productivity, and competitiveness of corporations by removing the barriers to sharing information between functional areas and managing processes in an integrated manner.

The prime mover for this productivity and efficiency is the ability of modern enterprise systems to effectively manage a business process from beginning to end in an integrated, consistent, and highly efficient manner. Further, once a business process is managed by an integrated enterprise system, it can be monitored and improved very easily. As a result, we cannot discuss contemporary business processes without considering the role of enterprise systems. In the subsequent sections, we will identify the key processes that typically exist in organizations.

As we have seen in Chapter 1, even though organizations have different purposes, sizes, and operate in various sectors, they all exhibit similarities in the ways that they operate. Successful organizations use processes and enterprise systems to complete the work needed to achieve their goals.

MAJOR BUSINESS PROCESSES

A business process, as we have seen, is a set of tasks or activities that produce desired outcomes. Every process is triggered by some event, such as receiving a customer order or recognizing the need

to increase inventory. Each business process requires the coordinated effort of different functional areas. For example, fulfilling a customer order requires the participation of at least four functional departments—sales, warehouse, manufacturing, and accounting. Thus, the specific steps in the process are completed in different functional areas.

Because the various process steps are carried out by different functional areas or departments, effective communication and collaboration among the departments is essential for the smooth execution of these processes. Without this interaction, the process cannot be completed efficiently and effectively. For instance, if the customer order is not properly communicated to the warehouse, then it cannot be shipped on time. Similarly, if the order and shipment information is not communicated to the accounting department, billing and payment will not be completed efficiently and accurately. Clearly, completing a process successfully requires more than just communicating information. Close coordination of work among the people involved is also essential. For example, when the salesperson accepts the order, he or she must collaborate with the warehouse to determine when the order can be shipped. Without this collaboration, the salesperson may make promises that the organization may not be able to meet realistically. Consequently, the products will not be available as promised. The salesperson must also collaborate with the accounting department to verify that the customer is credit-worthy. Accepting orders and shipping goods to customers who have not made payments for previous shipments can cause serious financial problems for the organization.

An organization has numerous processes to achieve its objectives. Four processes are directly related to creating and delivering products. They are buy, make, sell, and finance. Organizations use specific terms to identify these processes.

- **Procurement or purchasing process (buy)** refers to all of the activities involved in buying or acquiring the materials used by the organization, such as raw materials, components, consumables, etc., that are needed to make the goods.
- **Production or manufacturing process (make)** involves the actual creation of the products within the organization. While the production process is concerned with acquiring needed materials internally (by making them), the procurement process is concerned with obtaining needed materials externally (by buying them).
- **Fulfillment process (sell)** consists of all the steps involved in selling and delivering the products to the organization's customers.
- **Financial management process (manage money)** consists of two major areas—financial accounting and management accounting (also known as management controlling). Financial accounting processes track the financial impact of process steps with the goal of meeting legal reporting requirements, while management accounting or controlling processes focus on internal reporting to manage costs and revenues.

Closely related to buying, making, selling, and money management are four processes used to design, plan, store, and service products. Once again, organizations use specific terms for these processes.

- **Product data management process (design)** supports the design and development of products from the initial product idea stage through the discontinuation of the product.
- **Production planning process (plan)** uses historical data and sales forecasts to plan which materials will be produced, in what quantity and when.
- **Inventory management process (store)** is used to store and track both the raw materials and finished goods ensuring that there is no surplus stock or shortage.
- **Customer service process (service)** is used to deliver after-sales customer service such as repairs.

There are two support processes, which are equally important: managing the people and meeting the information needs of the organization.

- **Human resources management (HRM) process (people)** focus on the people within the organization and include functions such as recruiting, hiring, training, and benefits management.
- **Information management (IM) process (information)** focus on providing the decision-makers the right information at the right time so that they can make quality decisions and use information as a competitive weapon.

These processes and their interdependencies are shown in Fig. 2.1. Each of these processes can include numerous sub-processes. For example, the components of production or manufacturing process like material and capacity planning, shop floor control, quality management, JIT, repetitive manufacturing, engineering change control, configuration management, tooling, etc., too are complex processes. In addition, each process can impact other processes. For example, the procurement of raw materials influences on what can be produced and when. Similarly, the production process impacts what goods are available to sell and when. All processes will have an impact on the organization's financials system.

Clearly, then, in addition to understanding the details of how each process works, it is essential for the employees, to understand the interrelationships among the processes. In the next sections, we will see the important business processes in a little detail.

Procurement (Purchase)

The procurement process includes all of the tasks involved in acquiring needed materials externally—from suppliers. The procurement process is shown in Fig. 2.2. It is clear that the procurement process involves mainly four departments and contains 10 steps. Keep in mind that this is a simplified version of the procurement process; the real-life process is more complicated and involves more departments. The figure depicts only the procurement of materials required for the production of goods in the figure. However, in the real world there are many other items that need to be procured

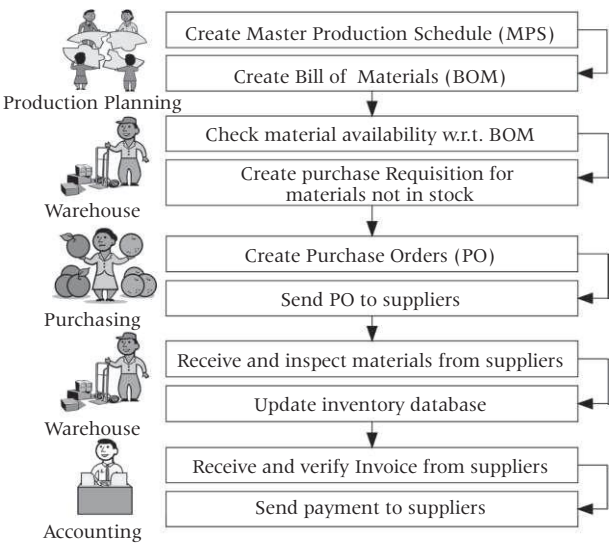

Figure 2.2 The procurement (or purchasing) process.

like paper, pens, writing pads, furniture, machinery, and so on. Another point to be noted here is that the bill of materials (BOM) is not the only trigger for a purchase requisition. The purchase requisition will be automatically created when the quantity of an item falls below the reorder level or a material requisition is received from a department for an item that is not in stock. Thus, the three instances that can trigger a purchase requisition from the warehouse are:

1. Quantity of an item falls below the reorder level
2. Non-availability or shortage of materials in the BOM
3. Request for an item that is not in stock

In each of the above situation, the warehouse will prepare a material requisition form that contains the item code, description, quantity required, priority (urgent, normal, low), etc., and pass it to the procurement or purchasing department. In the purchasing department, the details are verified, the item number and item description are matched, and the preferred supplier or suppliers for each item are identified. Then a purchase order (PO), which contains details like item code, description, quantity, required time, etc., is created and sent to the supplier. This usually happens in the case of companies that have a supply chain management (SCM) system where the terms and conditions (T&C) for the purchase have already been discussed and finalized.

In other cases, either a supplier is chosen at random or a tender is called. Both these processes are time consuming and do not ensure the delivery of high-quality good on time. That is why most companies prefer to work with suppliers whom they know, trust, and have done business in the past. A SCM system helps in speeding up the procurement process and reduces the chance of errors as it automates most of the tasks involved.

Once the supplier receives the PO, the goods are delivered as per the T&C and details in the PO. The goods are send to the warehouse and the invoice to the accounting department. In the warehouse, the goods are inspected for quality and quantity and if everything is fine, the same is intimated to the accounting department. The accounting department will check for the accuracy of the invoice and will make the payment to the supplier once it receives the NOC from the warehouse.

Production Planning (Plan)

Production and material planning process is mainly concerned with what to produce and when, how much to produce, and what are the materials (raw materials, components, consumables, spares, etc.) needed for producing them. The product, quantity, and time are determined after considering many factors:

1. Input by the marketing department in the form of market trends and sales forecasts
2. Quantity of different products sold in the previous years
3. Orders-in-hand
4. Stock-in-hand and reorder levels
5. Production and inventory costs
6. Time required for production or production lead-time
7. Time required (lead-time) to purchase the materials required for production
8. Production capacity and capacity utilization goals

Production planning decides what to produce from market analysis and previous years' production quantities and from orders in hand. Once the production quantity is decided the **master production schedule (MPS)** is created using the production quantity and when and how much to produce. The MPS will specify the required quantity for a particular period for each finished product. With the help of MPS, one can know the requirements for each product by date and quantity. MPS is used to

know the number of the items that are to be produced, the planned inventories of raw materials, finished products and parts, etc. MPS tells the company what is to be produced and the time by which the production has to be completed.

From the MPS, the production planning department creates the **bill of materials (BOM)**. BOM is the list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, components, parts and the quantities of each needed to manufacture an end product. BOM will give the complete list and quantities of each and every raw material, component, and other consumables that are required for producing the goods according to the MPS. The production planning database will have the complete list of materials required to produce each product. Therefore, creating the BOM is done by multiplying the raw materials required for the products that are to be produced with the quantity to be produced.

Once the production planning department creates the MPS, it is given to the production department for production setup like layout changes and tooling. The BOM is given to the warehouse or inventory management department. The warehouse will check whether all materials specified in the BOM are available by checking in the inventory database. If there are any items that are out of stock or not available in sufficient quantity, the purchase requisitions are prepared and are sent to the purchasing department. The purchasing department will create purchase orders and will send them to the suppliers who will supply the materials. The production planning process is shown in Fig. 2.3.

Production (Make)

Production process makes the products that the company sells. The production planning department decides the products and the quantity to be produced. The time schedule is also determined. This results in the creation of the MPS and BOM as we have seen before.

The MPS and BOM are sent to the production department and the copy of the BOM is also sent to the warehouse for preparing the required raw materials and other supplies. The production department will convert the MPS in production plans. The production plan is a day-wise breakdown of the MPS. It will specify which products are going to be manufactured and in what quantity each day. Based on the production plan, the documents like production process plan, plant layout document, skill inventory and manpower chart, etc., are prepared.

The **production process plan** contains the list of raw materials, the machines, and other resources required and the sequence of operations that have to be performed to produce a product.

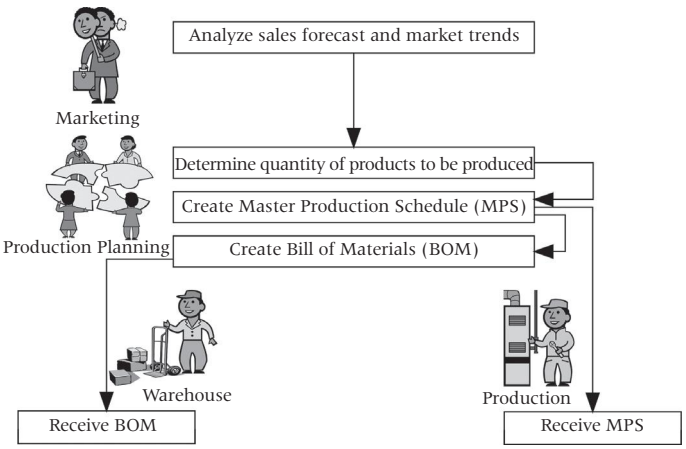

Figure 2.3 The production planning process.

The **plant layout document** will show the arrangement of the workstations and machines that is required to produce the product.

If there is more than one product, there will be more than one production line as the sequence of operations (and hence the layout of machines and workstations) for one product will not be the same as that of another. If there is only one product, then things are much easier as there will be only one production line and only one layout.

The machines and workstations are inspected and maintenance is done, if required. The tooling is fine-tuned as per the product specifications. The raw materials, components, consumables, and spares are received and inspected.

If the company has multiple products and they are produced on the same plant using the same machines, the production setup becomes unmanageable. Depending on the product, the layout has to be customized as the sequence of operations required to produce different products are different. Thus, either the plant layout (order in which machines and workstations are arranged in the plant) or the routing of the products have to be changed. With the advancements in plant layout and material handling technologies, making these changes have become rather easy and now it is a common practice to produce different products in the same assembly line.

The **skill inventory** is a list of skills required for producing the product. It will depend on what operations are to be performed and how much time each operation will take. If the line has to be balanced, then for operations that requires more time more people have to be allocated, particularly people with specific skills. The skill inventory will list the skills needed and the number of workers required for each. A balanced line is a production line where material flow is smooth and there is no accumulation of WIP (work in progress) goods due to lack of manpower. Therefore, when balancing a production line, jobs or operations that require less time are combined wherever possible, more manpower and machines are allocated to tasks that require more time, and so on.

The **manpower chart** is a list containing names of people delegated in the production line. The production department will have a skill inventory database which will have the list of people and the skills they possess. Thus once the skill inventory is prepared, the manpower chart is prepared by querying the skill inventory database. Modern organizations try to make their employees multi-skilled (skilled in more than one job) so that there is a resource pool where they can pick employees for the job. This strategy of multi-skilling will prove resourceful when employees leave the organization, as there will be people with similar skills to replace the ones who have left.

Once the layout is ready, machines are serviced and tooled, employees are assigned the tasks, and the raw materials and other supplies are ready, production starts. The raw materials are transformed into the finished product. Once the product is finished it is given to the quality control (QC) department who will inspect it and if it passes the quality checks, it will be sent to the warehouse. The products that fail the QC tests are either discarded/destroyed or send back for repair. The Production planning process is shown in Fig. 2.4.

Fulfillment (Sell)

Fulfillment of orders or selling involves all such activities from receiving the customer order to delivering it safely to the customer and collecting the payment (see Fig. 2.5). The departments involved in this process are sales, warehouse, accounting, customer care, and sometimes production. The customer (it can be an individual or an organization) places an order for certain goods. The sales department checks the order and ensures that the details in the order are correct. It then issues a sales order which is sent to the warehouse. The warehouse checks whether the items in the sales order are in-stock, and if everything is available, packs and ships the product to the customer and send the details to the accounting department. The accounting department sends an invoice to the customer and collects the payment.

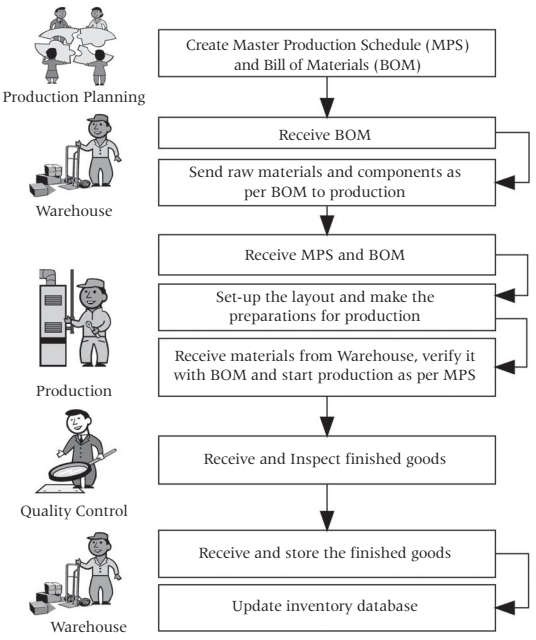

Figure 2.4 The production process.

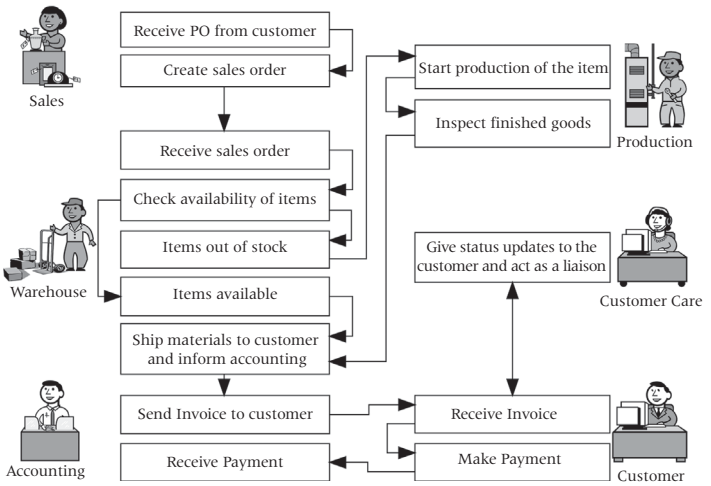

Figure 2.5 The fulfillment process.

The role of the customer care department is to interact with the customer, if there is a problem, like a delay in shipment or change in price or product the customer received is faulty or damaged and so on. In such cases, the customer care department acts as a liaison between the customer and the organization. Sometime customer care department is part of the sales department. Customer care department will also interact with the customer even if things are going according to plan giving him updates so that the customer knows what is happening to the order.

When the warehouse receives a sales order and finds that the items are not-in-stock, it will inform all the departments concerned. If it is possible to make the product within the allowed delivery time or if the customer is willing to wait for it, the production department will initiate production of that item. If the items are available at some other warehouse of the company, then it will be supplied from there. If is not possible to make the product on time and if the customer is not willing to wait, then the order is cancelled and the payment (advance or full) is returned to the customer. Usually this situation will not happen as there are safety measures like reorder quantities and buffer stocks for each product the company sells in the inventory management system.

Whenever the quantity of goods fall below the safety level, the production process for those goods is initiated to avoid a stock-out situation. However, if a huge order comes or too many orders come simultaneously due to some unanticipated spike in demand, the reorder level and buffer stock will be sold out and the company will have to take some drastic steps like rush unscheduled production and keeping the customer informed about the situation and asking for more time.

Inventory Management Process (Store)

The purpose of production planning is to match supply of finished goods with demand and also ensure that there are enough resources—raw materials, components, sub-assemblies, consumables, spares, etc.—to produce the finished goods. The actual management of finished goods and other resources is done by the inventory management process, but it is the production planning that gives the necessary inputs.

The availability of raw materials and other material resources is dependent on many external factors like availability from suppliers, lead time, quantity required, whether the product is purchased locally or have to be imported, whether it is a restricted item that needs special permissions and clearances, etc. The inventory management process deals with these factors.

As soon as the BOM and MPS are available, the inventory management process checks the inventory database to find out what is in stock and what has to be purchased. Once the items to be purchased and the required quantities are identified, the inventory management process passes that information to the purchasing department in the form of purchase requisitions.

The purchasing department will thus have information like lead time, the list of regular and reliable suppliers, cost of the items, T&C with the suppliers, etc. Considering all the above factors and the time available, the purchasing department will create purchase orders (POs) and will send them to the suppliers who will in turn supply the items to the warehouse.

Once the items are in the warehouse, they are verified for quality as well as quantity and the inventory database is updated. The accounting department is also informed so that the payment to the suppliers can be made. Here the most critical resource is the inventory database which is kept up-to-date. The inventory database contains up-to-the-minute information on the quantity of all the finished goods and other materials in the warehouse.

Only after checking with the inventory database, sales and production departments will sell or make. Because excess goods in the warehouse will result in increased inventory carrying costs—costs associated with storing materials. Insufficient goods mean stock-out which means that the company will not be able to fulfill customer orders. Both situations can have a negative impact on the organization's goodwill and profits. Therefore, a fine balance between production and sales should be struck so that there are neither excess goods nor insufficient goods. This is the goal of the inventory management process which is shown in Fig. 2.6.

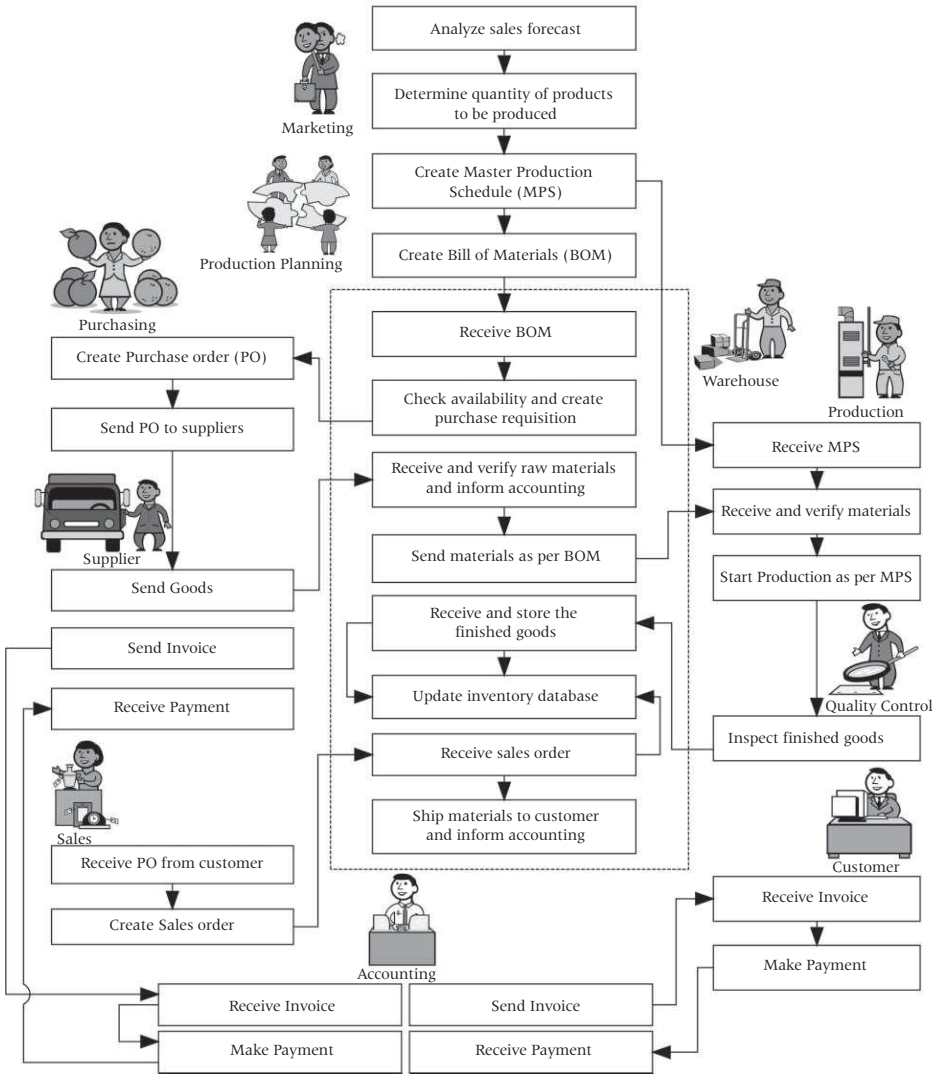

Figure 2.6 The inventory management process.

SUMMARY

A business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. Business processes consist of activities that occur in different, seemingly unrelated functions or departments. Business processes are cross-functional. No single group or function is responsible for their execution. Rather, it is a shared responsibility between many functional areas. The management information systems, human resources management, and other support functions are common for all functions and help them to perform better.

Viewing a company from a process perspective requires the employees to think from the customers' point of view. The employees must view the business across functional boundaries and focus on the end-to-end nature of the process and its intended outcomes. The major business processes in an organization are procurement or purchasing, production or manufacturing, fulfillment, financial

management, product data management, production planning, inventory management, customer service process, human resources management, information management, etc.

REVIEW QUESTIONS

1. What are the problems of the various departments of an organization functioning in isolation?
2. What are business processes and how are they different from business functions?
3. Discuss the advantages of business processes over business functions.
4. Why are business processes called cross-functional?
5. What is silo effect and how does it affect the functioning of an organization?
6. How does the business processes change the way things are done in an organization?
7. Business processes requires the employees to think from the customer's point of view. Discuss.
8. What are enterprise systems and why are they important?
9. How does an enterprise system improve efficiency and productivity?
10. Why is effective communication and collaboration among departments important for the smooth execution of the business processes? Explain with an example.
11. Identify the main business processes in your organization.
12. Explain how the different business processes function and identify the functional departments involved in each business process.
13. Explain the various business processes and their interdependencies with the help of a diagram.
14. Explain the procurement process with the help of a diagram.
15. Explain the production planning process with the help of a diagram.
16. What are the factors that determine what, how much, and when to produce the products?
17. What do you mean by master production schedule or MPS?
18. What is bill of materials or BOM? What is its importance in the procurement and production processes?
19. Explain the production process with the help of a diagram.
20. What is the importance of production process plan and plant layout document in the production process?
21. What is the importance of skill inventory and manpower chart in the production process?
22. Explain the fulfillment process with the help of a diagram.
23. Explain the inventory management process with the help of a diagram.
24. What is the goal of the inventory management process?
25. Explain the financial management process with the help of a diagram.
26. Explain the product data management process with the help of a diagram.
27. Explain the customer service process with the help of a diagram.
28. Explain the human resources management process with the help of a diagram.
29. Explain the information management process with the help of a diagram.
30. Discuss the importance of enterprise systems for business processes.

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Chapter 3

Introduction to ERP

INTRODUCTION

ERP stands for **enterprise resource planning** and means—the techniques and concepts for integrated management of businesses or management of business as a whole with the objective of efficient and effective use of management resources, and to improve the efficiency of enterprise management. ERP packages are integrated software packages that cover all business functions and support the ERP concepts.

Originally, ERP packages were targeted at the manufacturing industry and consisted mainly of functions like general planning and managing of core business such as sales management, production management, accounting and financial affairs, etc. However, in recent years, ERP adaptation is not limited to the manufacturing industry only, but it is being implemented in diverse types of industries, and its expansion and utility has been progressing on a global level.

ERP software is designed to automate many of the basic processes of a company, from finance to the shop floor, with the goal of integrating information across the company and eliminating complex, expensive links between computer systems that were never meant to interact with one another.

ERP software reflects the major business processes of an organization such as customer order fulfillment and manufacturing. Its success depends upon its reach—a circumscribed ERP system is not in any way better than the legacy system it replaces. In many cases, it is inferior because the old code at least was written keeping the specific tasks of the company in mind. The set of generic processes of the ERP system produce dramatic results only if it is capable of connecting parts of an organization and integrating its various processes seamlessly. For example, when a warehouse in Noida enters a customer order, the data should automatically flow to others in the company who need to see it—to the finance department at headquarters in Mumbai or the manufacturing department in Chennai. The lure of information integration struck a chord with CEOs, CIOs, and CFOs—the primary targets of ERP vendors—and sales of ERP took off in the early 1990s.

COMMON ERP MYTHS

There are number of myths that surround the concept, infrastructure, implementation, and practice of ERP. Very often people are hesitant to adopt ERP because of these misconceptions. In this section, we will discuss some of the most common myths about ERP and will try to demystify them.

ERP Means More Work and Procedures

Proper implementation and management of an ERP system is not an easy task. The transition period from the traditional system or manual processing to ERP is difficult as new skills have to be acquired, new procedures and processes have to be followed, and so on. Many employees think that ERP will burden them with additional work, complicate the work, and will add unnecessary procedures. Thus, transformation from the old system to the ERP system is a serious business. However, if the management and the implementation team do their job correctly, ensuring that the employees are told what to

expect and give them proper training, then the transition can be smooth. Once the employees get used to the new system, they will understand the potential benefits and the labor saved through automation of jobs. Today's ERP tools automate many of the repetitive, monotonous, and tedious procedures, tasks and processes thus making the life of the employees a lot easier.

ERP will Make Many Employees Redundant and Jobless

Another popular misconception about ERP systems is that its implementation will make many jobs redundant (because of the automation), and hence many employees will lose their jobs. A properly implemented ERP system will automate many tasks in the organization, but it does not mean that the ERP systems will make people redundant. Yes, there will be changes in job descriptions and job responsibilities. Many tasks will be automated and the jobs that people were doing will become redundant, but ERP systems will also create new job opportunities and the very same people whose jobs were automated could be used to fill the new positions after giving them proper training on the new tasks. Here, the amount of planning that goes into re-location and re-training of the employees by the management and the implementation team can go a long way in reducing the anxieties of the employees. ERP is a people-specific system made possible by computer software and hardware.

ERP is the Sole Responsibility of the Management

Making an ERP system successful is the responsibility of all the employees. It involves virtually every department and every employee within the company. The management is not responsible for the day-to-day operation of the ERP system. Their main job is to create an organizational environment in which ERP can thrive—give ERP the full backing of the management. They should also be involved in the development of ERP policies, usage guidelines, allocation of budget, package selection, and appointment of competent professionals to implement and manage the ERP system. Only when the ERP team has the full backing and support of the management, they will be able to implement the system smoothly. The management should monitor the implementation and operation of the system, review the progress and status periodically, and take necessary corrective action, if required. The management should also ensure that the ERP implementation team gets the support and co-operation of all the departments. However, assuming that the ERP system will succeed just because the management is fully committed to its implementation and operation is one of the biggest mistakes that an organization can make. In fact, it is the employees—the day-to-day users of the system—who will decide the fate of the ERP system. If the employees are not fully appraised, trained, satisfied, and are not happy with the system and are not using it properly, then the ERP system will be a failure.

ERP is for the Managers/Decision-makers Only

The managers and decision-makers are the major users of the ERP system. They are the people who benefit the most from a suitable ERP system. They will have all the information they need at their fingertips for making informed decisions. The quality of the decisions and the speed with which the decisions are made are dramatically improved as the ERP systems provide high-quality, timely, and relevant information. However, every employee in an organization will benefit from the ERP system. An ERP system gives the store clerk access to the inventory record and enables him to find out the exact quantity of an item. It allows the production supervisor to plan his activities. It allows all employees to apply for leave, get loans approved, travel expenses reimbursed, and so on.

But for making the best use of the information processing power of an ERP system, the users should be trained to apply the available features to its maximum. If people are ignorant about the system, they will find it useless and if they are not properly trained, they will find the experience

frustrating and tedious. These people will not use the ERP system, or even if forced will use it but not to its fullest potential. They will find ERP as a waste of time and do it just because they are forced to do it. This hostility towards ERP can be eliminated if the users are educated appropriately and sensitized about the benefits of the ERP system.

ERP is Designed for Manufacturing Organizations

This assumption is basically due to the fact that ERP was historically developed from the methods of material requirement planning (MRP) and manufacturing resource planning (MRP II), which are functions of manufacturing organizations. In the manufacturing industry, MRP became the fundamental concept of production management and control in the mid 1970s. At this stage, BOM (bill of materials), which is a purchase order management system that utilizes parts list management and parts development, was the prevailing trend. This concept unfolded from order inventory management of materials to plant and personnel planning and distribution planning, which in turn became MRP-II. This incorporated financial accounting, human resource management functions, distribution management functions, and accounting functions and came to globally cover all areas of enterprise mainstay business and eventually came to be called ERP. However in reality, the concept of enterprise-wide planning of resources is not limited to any particular segment of the industry.

ERP is for the ERP Implementation Team Only

The ERP implementation team usually consists of external consultants, vendor representatives, and select group of employees. But once the implementation and user training is over, the consultants and vendor representatives will leave. Thereafter it is the responsibility of each and every employee of the company to use the ERP system effectively and to optimize the new features and facilities to their advantage.

Customization is Better than Changing Current Practices

ERP package comes with the proven and time-tested best practices that have been collected from the industry and integrated into the system by the ERP vendors. Some of the business practices of the organizations where the ERP packages are implemented will be different from the best practices in the ERP system. One way to solve this problem is customization—changing the code to make the ERP system function to match the existing company practices. This will help the organization to continue doing business as it was doing before. The downside of the customization is that the customized code is not eligible for free upgrades from the vendor. This can complicate and substantially increase the cost of implementation and maintenance, which would make upgrades impossible. These changes also run the risk of making your company and solution to a "community of one." The better option is to change the business practices of the organization and adopt the best practices that are part of the ERP package. Thus, the company's efficiency will improve, business processes will become streamlined, and the complication of customization is avoided. So go in for customization only when it is absolutely necessary and only after thorough consulting with the experts.

Once the ERP Implementation is Complete, there will not be Additional Expenses

The ERP implementation is never really over, the maintenance activities like upgrading the software as new versions are released, upgrading the hardware as new technologies evolve, renewing the support contract with the vendors, training new employees, conducting refresher courses for the current employees, etc., which also adds to the expenditure. In fact, the key to successful ERP is a strong ERP strategy, not just for implementation, but to keep it operating, growing, and adapting with the

company. So the spending on ERP is never a one-time investment. Once the initial deployment is over, major portion of the costs are over with the investment of purchasing the software and hardware, cost of setting up the ERP system, the fees for the consultants and vendor support team, etc. However, maintenance and operation of the ERP system will continue as long as the ERP is operational. The organizations should allocate budget for this, otherwise the company will end up working with outdated software and hardware and untrained employees.

ERP Slows Down the Organization

Before the advent and popularity of ERP tools, most business tasks were performed manually and this was a time-consuming process. Often lots of efforts were duplicated. The ERP systems automated the information flow across departments thereby eliminating duplication of work and providing faster and accurate results. In the case of an ERP system, a single command can trigger a host of events that will take care of the material procurement, production planning, invoice preparation, informing the suppliers, making and collecting payments, and so on. Today, the ERP system never functions in isolation. It is completely and seamlessly integrated with the supply chain tools and techniques right from customer relationship management to supply chain management to logistics management. This level of automation has dramatically improved the response time of organizations and has helped them in serving the customers better. So an ERP system makes the organizations efficient and will never slow it down.

ERP is Meant Just to Impress Customers

It is true that a properly implemented ERP system can help in serving the customers better as it helps the organizations to react faster, respond better, and deliver high quality products and services at astonishing speeds. This improved efficiency and quality will go a long way in improving customer goodwill and customer relations. So with an ERP system you get more satisfied customers, but that is only one of the advantages of an ERP system.

ERP Package will Take Care of Everything

ERP is not a silver bullet or a panacea. Of course, an appropriately implemented, operated, and maintained ERP system can dramatically improve productivity, automate tasks, reduce wastages, and increase profits. But an ERP system needs people to operate, use, and maintain it. If the employees are not interested in using the ERP system or are using it incorrectly, if managers are not making use of the decision-making capabilities of the system, or if the system is not maintained properly, then the ERP will not deliver it promises.

It is a fact that the ERP tools have evolved over time and have now become very sophisticated. Today's ERP tools automate most business functions and processes thus making the lives of the users a lot easier. But assuming that the ERP tools will take care of everything can be a recipe for disaster. There are many business activities that need human intervention and judgment. While the ERP tools make jobs easier, there is no substitute for human intelligence and decision-making.

One ERP Package will Suit Everybody

There are hundreds of ERP tools available in the market. These tools differ in features, capabilities, size, functionality, price, technical support, customizability, scalability, etc. Organizations are also different from one another. Each has its own characteristics and identity. Assuming that one tool will be suitable for all organizations is wrong. Selecting and purchasing an ERP tool without analyzing its suitability for the organization will have disastrous consequences. For an ERP implementation

to be successful, the tool that is implemented should be compatible with the organizational culture, practices, and procedures. Thus, while purchasing an ERP package proper attention should be given to the selection of a tool that is best suited for the organization.

ERP is Very Expensive

ERP packages come in all shapes and sizes. The sophisticated and high-end ERP tools are very expensive. ERP system needs people to manage it. Thus, implementing and managing an ERP system is an expensive affair. But these expenses should be weighed against the benefits of the ERP system. An efficient ERP system will increase the productivity of the human resources, shorten development and change cycles, streamline the production process, reduce errors by automating monotonous and repetitive tasks, enable better management of projects by providing quality information, improve customer satisfaction by resolving problems quickly, and so on. When the benefits of the ERP system are considered, it becomes evident that the money spent on it is worthwhile and the system will payback.

Organizations can Succeed Without ERP

Before the advent of ERP, organizations were running manually. Do we really need ERP now in order to succeed? If an organization is very small in size, caters to a niche market, and has very limited scope, it may continue to survive without an ERP. However, today's organizations are growing across borders and the products are becoming more and more complex in size, sophistication, and technologies. Also, a single group does not necessarily build the different components of a product. This is the era of multi-site, distributed production, where different groups situated in different parts of the world develop the components of a system. In such a scenario, managing the activities of an organization is a very complex task. If proper control mechanisms and procedures are not in place, very soon the operations can get out of control and products and organizations can fail.

ERP will Reduce Costs as Soon as it is Implemented

ERP systems will dramatically improve the efficiency and profitability of the organization. But this will not happen overnight or not even within the first few months. ERP like any other system will require time to get established—the employees have to get used to it, the managers have to start using it for decision-making, the suppliers and other business partners have to fine-tune their systems, etc. While, all these activities are going one, how long it will take for the ERP systems to provide return on investment depends on the organization, employees, and organizational culture and business environment. For example, organizations that have employees who are ready to embrace change and new technologies will make the changeover faster. Similarly organizations that have been using some sort of computerized system for managing the business processes and have techno-savvy employees will also make the transformation faster. Once the ERP system stabilizes, the system will deliver improvements in productivity and efficiency that it is capable of.

A BRIEF HISTORY OF ERP

In the manufacturing industry, MRP became the fundamental concept of production management and control in the mid 1970s. At this stage, BOM, which is purchase order management that utilizes parts list management and parts development, was the mainstream. And this concept unfolded from order inventory management of materials to plant and personnel planning and distribution planning, which in turn became MRP-II. This incorporated financial accounting, human resource management functions, distribution management functions, and management accounting functions came to globally cover all areas of enterprise mainstay business and eventually came to be called ERP. We will trace

the evolution of ERP in a little detail in the forthcoming section.

Material Requirements Planning (MRP)

An MRP is an evolved version of the BOM processing. MRP began its life in the 1960s and gained popularity in the 1970s. The manufacturing and production planning people were searching for better and more efficient methods of ordering materials and components. They found that MRP was a perfect answer for their needs. MRP answers the following questions:

- What products are we going to make?
- What are the materials needed to make the products?
- What are the materials that we have in stock?
- What are the items that need to be purchased?

MRP uses the master production schedule (MPS) to find out the answer to the first question—what products are we going to make? It gets the details of the materials required to make the products from the BOM. It searches the inventory records to find out what items are in stock. It then calculates the items that need to be purchased for producing the goods. Thus, MRP solved the crucial manufacturing and production planning problems and made the manufacturing of goods easier.

Closed-loop MRP

MRP evolved into something more than merely a better way to order, and the evolution was very fast as there were many followers for MRP, and they wanted more. These MRP supporters realized that MRP had more capabilities than producing material re-ordering schedules. The MRP system maintained schedule dates and could be used to trace and alert when an item did not arrive on the due date. This new capability helped in reducing the uncertainty that is part of any production process.

Soon, techniques for planning capacity requirements were merged into MRP. Tools were developed to support the planning of sales and production levels, development of production schedules, forecasting, sales planning, capacity planning, and order processing. Various plants, production, and supplier scheduling techniques for automating the processes both internal and external to the organization were built into the MRP system. These developments resulted in the creation of closed-loop MRP.

Closed-loop MRP is not merely planning for the material requirements but involves a series of functions for automating the production process. It contains tools and techniques to address both priority and capacity and supports both planning and execution. It has provisions for accepting feedback from the execution functions back to the planning function thus enabling the plans to be revised and updated depending on the actual execution or changes in priorities.

Manufacturing Resource Planning (MRP II)

The third stage in the evolution of ERP is called MRP II. It is the next logical step of closed-loop MRP and contains the following additional capabilities—sales and operational planning, financial interface, and simulation capabilities (for better decision-making).

Thus, MRP II is a methodology adopted for effective planning of all the resources of a manufacturing company. It addresses operational planning in units, financial planning in rupees, and has a simulation capability to answer "what if" questions. MRP II comprises a variety of functions, all of them interlinked: planning for business, sales and operations, production, material requirements, and capacity requirement; master scheduling; demand management; and the execution support systems for capacity and material. Output from these systems is integrated with financial reports such as the business plan, purchase commitment report, shipping budget, inventory projections, and so on.

Enterprise Resource Planning (ERP)

The final step in the evolution is the emergence of ERP. The fundamentals of ERP are the same as that of MRP II. However, the enterprise software makes ERP a set of business processes that is broader in scope, is capable of dealing with more business functions, and has a better and tighter integration with the finance and accounting functions. The ERP system is also capable of integrating with other tools like customer relationship management, supply chain management, and so on, thereby supporting businesses across company boundaries.

ERP predicts and balances demand and supply. It is an enterprise-wide set of forecasting, planning, and scheduling tools, which links customers and suppliers into a complete supply chain, employs proven processes for decision-making and co-ordinates sales, marketing, operations, logistics, purchasing, finance, product development, and human resources. Its goals include high levels of customer service, productivity, cost reduction, and inventory turnover, and it provides the foundation for effective supply chain management and e-commerce. It does this by developing plans and schedules so that the right resources—manpower, materials, machinery, and money—are available in the right amount at the right time. ERP is a direct outgrowth and extension of MRP and, as such, includes all of MRP II's capabilities. ERP is more powerful, in that it applies a single set of resource planning tools across the entire enterprise, provides real-time integration of sales, operations, and financial data and connects resource planning approaches to the extended supply chain of customers and suppliers.

The primary purpose of implementing ERP is to run the business efficiently and effectively in this brutally competitive and rapidly changing business environment. The goals of ERP include high levels of customer service, improved productivity, cost reduction, better inventory turnover (just-in-time inventory), etc.

ERP, as we have seen, is the evolved version of MRP II. From a business perspective, ERP has expanded from co-ordination of manufacturing processes to the integration of enterprise-wide back-end processes. From technological aspect, ERP has evolved from legacy implementation to more flexible tiered client–server architecture. Table 3.1 summarizes the evolution of ERP from the 1960s to the 1990s.

REASONS FOR THE GROWTH OF THE ERP MARKET

There is no doubt that the market for ERP systems is booming. Industry analysts are forecasting growth rates of more than 30% for at least the next five years. Why are so many companies replacing their key business systems? Here are some reasons:

- Enable improved business performance
  - Cycle time reduction
  - Increased business agility
  - Inventory reduction
  - Order fulfillment improvement
- Support business growth requirements
  - New products/product lines, new customers
  - Global requirements including multiple languages and currencies
- Provide flexible, integrated, real-time decision support
  - Improve responsiveness across the organization
- Eliminate limitation in legacy systems
  - Century dating issues
  - Fragmentation of data and processing

Table 3.1 Evolution of ERP

Timeline	System	Description
1960s	Inventory Management and Control	Inventory management and control is the combination of information technology (IT) and business processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory management include identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances, and reporting inventory status.
1970s	Material Requirement Planning (MRP)	MRP utilizes software applications for scheduling production processes. MRP generates schedules for the operations and raw material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels, and the lot sizing procedure for each operation.
1980s	Manufacturing Requirements Planning (MRP II)	MRP II utilizes software applications for coordinating manufacturing processes from product planning, parts purchasing, inventory control to product distribution.
1990s	Enterprise Resource Planning (ERP)	ERP uses multi-module application software for improving the performance of the internal business processes. ERP systems often integrate business activities across functional departments from product planning, parts purchasing, inventory control, product distribution, order fulfillment to order tracking. ERP software systems may include application modules for supporting marketing, finance, accounting, and human resources.

  - Inflexibility to change
  - Insupportable technologies
- Take advantage of the untapped mid-market (medium-size organizations)
  - Increased functionality at a reasonable cost
  - Client server/open systems technology
  - Vertical market solutions

The above said are some of the reasons of the explosive growth rate of the ERP markets and ERP vendors. As more and more companies are joining the race and as the ERP vendors are shifting their focus from big—Fortune 1000—companies to different market segments (medium-size companies, small companies, etc.) the future will see fierce battles for market share and mergers and acquisitions for strategic and competitive advantage. The ultimate winner in this race will be the customer, who will get hi-tech products and services at affordable prices.

THE ADVANTAGES OF ERP

Installing an ERP system has many advantages—both direct and indirect. The direct advantages include improved efficiency, information integration for better decision-making, faster response time to customer queries, etc. The indirect benefits include better corporate image, improved customer

good will, customer satisfaction, and so on. The following are some of the direct benefits of an ERP system:

- Business integration
- Flexibility
- Better analysis and planning capabilities
- Use of latest technology

Business Integration

The first and most important advantage lies in the promotion of integration. The reason ERP packages are called integrated is because of its automatic data updating capacity (automatic data exchange among applications) between related business components. Since conventional company information systems were aimed at the optimization of independent business functions in business units, they were almost all weak in terms of the communication and integration of information that transcended the different business functions. In the case of large companies, in particular, the timing of system construction and directives differ for each product and department/function and they are sometimes disconnected. For this reason, it has become an obstacle in the shift to new product and business classification. In the case of ERP packages, the data of related business functions is also automatically updated when a transaction occurs. For this reason, one is able to grasp business details in real-time, and carry out various types of management decisions in a timely manner based on the data.

Flexibility

The second advantage of ERP packages is its flexibility. Diverse multinational aspects such as language, currency, accounting standards, etc., are covered in one system, and as functions that are spread across multiple locations are integrated they can be implemented easily. To cope with globalization and system unification, this flexibility is essential and one could say confidently that it has major advantages, not simply for development and maintenance, but also in terms of management.

Better Analysis and Planning Capabilities

Yet another advantage is the boosting of planning functions. By enabling the comprehensive and unified management of related business and its data, it becomes possible to fully utilize many types of decision support systems and simulation functions. Furthermore, as it becomes possible to carry out flexibly and in real-time the filing and analysis of data from a variety of dimensions, one is able to give decision-makers the information they want, thus enabling them to make better and informed decisions.

Use of Latest Technology

The fourth advantage is the utilization of the latest developments in IT. The ERP vendors were very quick to realize that in order to grow and sustain, they have to embrace the latest developments in the field of IT. Therefore, they quickly adapted their systems to take advantage of the latest technologies like open systems, client–server technology, Internet/Intranet, CALS (Computer-Aided Acquisition and Logistics Support), electronic commerce, etc. It is this flexibility of the IT that made it possible to adapt to the changing environments and incorporation of the latest technology during the system customization, maintenance, and expansion phases.

As discussed earlier, ERP includes many of the functions that will be necessary for future systems. However, undertaking reforms to streamline the business processes so as to enable optimization of

the features is the greatest challenge for companies that adapt them. It is necessary to note that proceeding slowly with the implementation of ERP for system reconstruction or for regulatory compliance is likely to result in turning the above-mentioned advantages into disadvantages.

HOW IS ERP DIFFERENT?

As for application packages, many products have been developed thus far and are selling well. So, how do conventional application packages and ERP packages differ?

The first difference is that the function of ERP packages are not limited to individual business functions such as accounts and inventory, but include a total range of business operations.

The second difference is that ERP packages are targeted at everything from small businesses to the large organizations, and that it can include a highly flexible decentralized database and an information system cluster linked by a network.

The third difference is global adaptation, represented by ERP packages' multi-lingual and multi-currency capacity. In the present day, when companies irrespective of their size and market share are manufacturing and selling in various parts of the world, the globalization of management platforms is being hastened along with the global adaptation of enterprise information systems.

OVER-EXPECTATIONS IN ERP

The most important thing when installing an ERP system in a company is the attitude change of employees at all levels. How managers use information systems and IT as strategic management tools is likely to become the turning point to this change. Companies were the response to change is fast, there is a greater chance of survival and growth.

Among the limitations, it is very essential that the executives have a definite timetable. Questions like, "by when and in what way do we want to do such-and-such?" or "how should such-and-such a thing be achieved?" and so on, should be answered. If time schedules and deadlines are not set and adhered to, then it must be borne in mind that not only ERP implementation, but anything else the company attempts to do will be in vain.

Also, there are many misunderstandings caused by wrong estimates. For example, the company does not have any previous experience in estimating the cost of such a massive project. In such a case, if implementation costs are estimated based on the figures from the in-house team, chances are that it will be wrong because developing and implementing a solution within one's own company is normally less expensive. But in the case of ERP implementation, there are substantial additional costs that are necessary such as consultation, customization, training, and education.

ROADMAP FOR SUCCESSFUL ERP IMPLEMENTATION

The most important step of ERP implementation is the gap analysis phase, which is the negotiation phase between the company requirements and the functions a package possesses.

As persons with differing viewpoints come together to work in a project, it is important to ensure the smooth functioning of the team. Thus, it is advisable to invite outside consultants with wide experience in package implementation, and assign him/her the role of a coordinator between the package vendors and system integrators. The consultant can act as a neutral person to resolve conflicts and steer clear the project ahead while conforming to the set standards.

The first important point is to clearly define the objectives and goals of the company by notifying it and getting it approved throughout the entire organization. Next is the involvement of the

management in the project and the prompt decision-making skills. Last is the selection of experienced (it is better not to limit this to package implementation) consultants and integrators.

Unfortunately, in the present state of affairs, getting experienced experts could be difficult. This is because there are few experienced persons and too many projects. Thus, the best way to solve this problem is to select employees with the right aptitude, commitment, and functional knowledge, and train them and make them work along with the external consultants. Thus the company will have enough in-house consultants and integrators when the vendor's staff and the external consultants leave the scene.

THE ROLE OF CIO

Most companies use the obsolete development models like waterfall model for the development of their information systems. EDP/IS professionals and system analysts have constructed systems that are tailor-made for the organization. These systems are usually designed to cater to the current needs of the company, leaving no scope for growth or scalability. The development periods are longer and there is lack of flexibility in respect to changes in business processes. However, the implementation procedures in ERP packages are completely opposite. The core step is the gap analysis, and how to eliminate redundant business processes. Gaining the approval of the management to eliminate unwanted and redundant business process, to integrate the various business functions, and to ensure effective information flow between the various business functions decides the success of the implementation of ERP.

Along with changes in development processes for a system that uses ERP package as the platform, limitations lie in the abilities of system analysts and system engineers. In the past, it was acceptable to design and concretize systems along with the existing or conventional business flows. However, in the future, the system analysts and system engineers must understand the organizational goals and continue planning and working toward their realization, and design and develop information systems that will help the organization in achieving its objectives.

In simple terms, information systems must be centralized—as a strategic weapon—to reform the business, designed from a managerial perspective, and having persuasiveness in business areas. For this to happen, there should be a change in the attitude of all the people—managers and EDP professionals. They should come out of the traditional business methodologies and should work toward making IT and other resources work to their advantage by developing systems that will deliver high-quality information to all the decision-makers, when they need it.

THE FUTURE OF ERP PACKAGES

In order to enable flawless package selection and implementation, it is essential to collect and collate a wide range of accurate information. Clubbing common functions and putting them into modules will minimize customization during the implementation phase and streamline the functions and costs. Also, one must establish and master the methodology needed to enable an efficient implementation project.

One company alone cannot possibly realize this in a short time-frame. It is difficult to construct the core business concept by just one company without the support of an integrator. In terms of improved package functions and implementation project promotion, vendors have a major role to play. There are still limitations with ERP packages, but they are likely to be adapted in a big way in the future. At the same time, in terms of package selection, competition among vendors increases the options for users and will probably be advantageous in terms of function expansion and services.

The most important point in using ERP packages is its flexibility to upgrade its version. Even in case of standard spreadsheet and word-processing software, its inability to upgrade its version is felt significantly. In core business functions, especially adaptation to the latest version cannot be ignored. Otherwise, it makes no sense to shift to a new system by investing in constructing a legacy system with no flexibility and short shelf life. The selection of packages so as to ensure that only minimum processes need to be customized, and those customized portions are guaranteed for new versions, is important in this aspect.

SUMMARY

ERP is an abbreviation for enterprise resource planning; it implies the techniques and concepts for integrated management of businesses as a whole to effectively use the management resources to improve the efficiency of the organization. ERP packages are integrated (covering all business functions) software that support the ERP concepts.

There are number of myths that surround the concept, infrastructure, implementation, and practice of ERP. Very often people are hesitant to adopt ERP because of these misconceptions. Some of the common myths about ERP are that ERP means more work and procedures, it will make many employees redundant and jobless, it is the sole responsibility of the management, it is designed for the managers/decision-makers, it is solely meant for manufacturing organizations, it is suitable only for the ERP implementation team, it slows down the organization, it is implemented only to impress customers, ERP package will take care of everything, one ERP package will suit everybody, it is very expensive, organizations can succeed without it, etc.

ERP has its origins in the manufacturing industry, where MRP became the fundamental concept of production management and control in the mid 1970s. At this stage, BOM, which is purchase order management that utilizes parts list management and parts development, was the mainstream. And this concept unfolded from order inventory management of materials to plant and personnel planning and distribution planning, which in turn became MRP-II . This incorporated financial accounting, human resource management functions, distribution management functions, and management accounting functions, and came to globally cover all areas of enterprise mainstay business and eventually came to be called ERP.

The main reasons for the growth of ERP are that it enabled improved business performance, supported business growth requirements, provided flexible, integrated, real-time decision support, and eliminated limitation in legacy systems.

The main advantages of ERP packages are improved efficiency, information integration for better decision-making, faster response time to customer queries, etc. The indirect benefits include better corporate image, improved customer goodwill, customer satisfaction, and so on. Other direct benefits of an ERP system are business integration, flexibility, better analysis and planning capabilities, and use of latest technology.

In this chapter, we also discussed the roadmap for successful ERP implementation, the role of the CIO, the problems with over expectations from ERP, and the future of ERP systems.

REVIEW QUESTIONS

1. What is ERP?
2. Discuss ERP and its uses.
3. What is the role of company management in the implementation of the ERP system?
4. Can organizations succeed without an ERP system?

5. What is the main goal while designing the ERP software?
6. Does introduction of ERP systems result in more work and procedures?
7. Will the ERP systems make employees redundant and jobless?
8. Is ERP the sole responsibility of the management?
9. Is ERP just for the managers and decision-makers?
10. Is ERP just for the manufacturing organizations?
11. What is the role of the ERP implementation team?
12. Is changing current practices better than customization?
13. Will there be any expenses once the ERP implementation is complete?
14. Will ERP slow down the organization's growth?
15. Is ERP meant just to impress the customers?
16. How will an ERP system improve customer satisfaction and goodwill?
17. Will the ERP system take care of all business functions and processes?
18. Will one ERP package suit all organizations?
19. Are ERP systems expensive? If yes, then what are the advantages in implementing them?
20. Can organizations succeed without an ERP system?
21. Will ERP reduce the costs as soon as it is implemented?
22. Discuss the common myths about ERP and find practical solutions for dispelling them in your organization.
23. What do you mean by MRP? Explain.
24. What is closed-loop MRP?
25. Explain MRP II.
26. What is the connection between ERP and MRP?
27. How is ERP different from MRP II?
28. What do you mean by BOM?
29. What are the differences between MRP and closed-loop MRP?
30. What are the additional capabilities that MRP II has over closed-loop MRP?
31. What is ERP and how it is different from MRP, closed-loop MRP, and MRP II?
32. Discuss the history and evolution of ERP.
33. Discuss the various reasons for the growth of ERP.
34. Explain the advantages of ERP.
35. How do ERP systems achieve business integration?
36. How does ERPs help organization in using the latest technology?
37. How do conventional application packages and ERP packages differ?
38. Discuss the roadmap for a successful ERP implementation.
39. What is the role of the CIO in implementing an ERP system?
40. Discuss the future of ERP systems.

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Chapter 4

Basic ERP Concepts

INTRODUCTION

To remain competitive, organizations must deliver products of the highest quality, on time, and at the best possible price. The set of business processes known as enterprise resources planning or ERP has proven to be an effective tool in achieving these objectives.

ERP is a set of tools and processes that integrates departments and functions across a company into one computer system. ERP runs off a single database, enabling various departments to share information and communicate with one another. ERP systems comprise function-specific modules designed to interact with the other modules, e.g., accounts receivable, accounts payable, purchasing, etc. ERP software is designed to function as a system for operating and managing a business.

ERP is an enterprise reengineering solution that uses new business computing paradigms to integrate IT processes across the company's divisions and departments. From software optimization to support and services infrastructure, ERP provides solutions for the business every step of the way. The appropriate architecture, customization features, installation procedures, and levels of complexity that is needed in ERP solutions will vary depending on the size and nature of the company.

ERP offers a means of effectively increasing and managing the required resources (materials, equipment, tools, labor, money, etc.). For each of these resources, ERP can identify what is needed, when it is needed, and how much is needed, thus making the operation of the organization efficient and effective. In this chapter, we will focus on three issues:

1. Will ERP fit the way a company does business?
2. Why ERP is important to a company?
3. How does ERP create value?

WILL ERP FIT THE WAY A COMPANY DOES BUSINESS?

It is critical for companies to figure out if their ways of doing business will fit within a standard ERP package before the checks are signed and the implementation begins. The most common reason that companies walk away from multi-million dollar ERP projects is when they discover that the software does not support one of their important business processes. At this point, there are two things they can do. They can change the business process to accommodate the software, which will mean in-depth changes in long-established ways of doing business (that often provide competitive advantage) and redesignate important peoples' roles and responsibilities (something that few companies have the stomach for). Or they can modify the software to fit the process, which will slow down the project, introduce dangerous bugs into the system, and make it excruciatingly difficult to upgrade the software to the ERP vendor's next release, because the customizations will need to be torn apart and re-written to fit in with the new version.

Needless to say, the move to ERP is a project of breathtaking scope and the price tags on the front-end are enough to make the most placid CFO a little twitchy. In addition to budgeting for software costs, financial executives should plan to write checks to cover consulting, process re-work, integration testing and a long laundry list of other expenses before the benefits of ERP start to manifest

themselves. Underestimating the price of teaching users their new job processes can lead to a rude shock down the line; so can failure to consider data warehouse integration requirements and the cost of extra software to duplicate the old report formats. A few oversights in the budgeting and planning stage can send ERP costs spiraling out of control faster than oversights in planning almost any other information system undertaking.

WHY IS ERP IMPORTANT TO A COMPANY?

ERP is quiet important to companies, because it improves the way a company takes a customer order and processes it into an invoice and revenue—otherwise known as the order fulfillment process. That is why ERP is often referred to as **back-office software**. It does not handle the up-front selling process (although most ERP vendors have developed CRM software to do this); rather, ERP takes a customer order and provides a software roadmap for automating the different steps along the path to fulfilling it. This roadmap shares the identical information at all stages of the transition, from the sales representative the loading dock, each will be able to view and modify the data. When one department finishes with the order, it is automatically routed via the ERP system to the next department. To find out where the order is at any point, you simply need only log in to the ERP system and track it down.

The truth about ERP is that it unifies a company, it allows the customer service team to understand the financial background of a client or to check if there is stock in the warehouse. It allows the warehouse to update the system if something is in stock or not, without having to send e-mails or documents. It minimizes inventory time. There is however a catch. People do not like to change and ERP asks them to change the way they do their jobs. That is why the value of ERP is so hard to pin down. The software is less important than the changes companies make in the ways they do business. If you use ERP to improve the ways your people take orders, manufacture goods, ship them, and bill for them, you will see value from the software. If you simply install the software without changing the way people do their jobs, you may not see any value at all—indeed, the new software could slow you down by simply replacing the old software that everyone knew with new software that no one knows.

ERP systems are transforming the way organizations do business. They are indispensable tools with a huge impact on both the business and information technology (IT) worlds. An ERP system does the following:

- Affects almost all organizations—irrespective of their size and nature
- Forces the competition to change their strategies and processes
- Influences business partners to become more competitive
- Improves the profits of the consulting organizations
- Is the most important tool for business process reengineering
- Enforces best practice business processes in organizations
- Utilizes the true potential of client–server computing fully to deliver an enterprise product
- Changes the nature of the information systems (IS) function and IT professionals
- Changes the nature of jobs in all functional business areas
- Involves the organization in a very costly implementation process

Now we will see each of these areas in a little more detail.

ERP Affects Almost All Organizations

ERP affects almost all organizations irrespective of their size, industry segment, and nature of business. It has changed the way organizations do business. It has increased the efficiencies and

competitiveness of organizations. It has automated many business processes, streamlined day-to-day operations, and has helped organizations in serving customers better. Today, almost all organizations around the globe from large multinational conglomerates to small and medium-sized businesses (SMBs) are using some ERP package or another. Organizations that do not have an efficient ERP system will find it very difficult in this brutally competitive business environment.

ERP Forces Competition to Change

ERP forces competitors to change their business strategies and processes. It provides competitive advantage and creates value. A properly implemented ERP system is a strategic weapon and can help in beating the competition and moving ahead as it provides the tools necessary for the company to react quickly to changes. So when one organization implements ERP, the competitors have no option but to follow suit. If they fail in implementing the ERP system or fail to implement the system that is best suited for them in the best possible way, they will be left behind and will find it very difficult to survive.

ERP Forces Business Partners to Become More Competitive

When an organization adopts ERP it becomes more efficient. ERP systems automate the business processes and make the organization more agile. The company's decision-makers can make better decisions much faster as they have all the information they need at their fingertips. So organizations that have implemented ERP systems can better process information and integrate it into their business procedures and decision-making. This increase in the speed and efficiency will put pressure on the organization's business partners and they too will be forced to implement the ERP system in their organizations in order to keep pace. Thus, the implementation of the ERP system in an organization forces the business partners to adapt to the changes—changes in speed and efficiency of operations. For example, companies that have implemented ERP systems operate in real-time and they will expect the same from their partners. Further, these companies will want their suppliers also to implement ERP systems so that the entire supply chain becomes integrated and operates at peak efficiencies. This is like a chain reaction, and companies that fail to join the ERP bandwagon will soon find them out of business.

ERP Improves the Profits of the Consulting Firms

Consulting firms offer a variety of ERP-related services. These services range from business process reengineering (BPR) to selecting the right ERP package, ERP implementation, end-user training, post-implementation support, and so on. ERP systems have been critically important to the growth of the major consulting organizations that offer consultancy in ERP-related areas. The advantage of consulting firms is that they gain more and more expertise and experience with each ERP implementation. For example, if one company successfully implements ERP for competitive advantage, then the same software and consulting team would be chosen to implement ERP for its competitors, because they would have greater experience with the industry. Thus, the firms offering ERP consultancy are growing at a rate that is keeping pace with the growth of the ERP packages.

ERP is the Most Important Tool for Business Process Reengineering

Business process reengineering (BPR) is the analysis and re-design of workflow within and between enterprises. BPR reached its heyday in the early 1990s when Michael Hammer and James Champy published their best-selling book, *Reengineering the Corporation*. The authors promoted the idea that sometimes radical re-design and re-organization of an enterprise (wiping the slate clean) was necessary to lower costs and increase quality of service and that IT was the key enabler for the radical change. Hammer and Champy felt that the design of workflow in most large corporations was based

on assumptions about technology, people, and organizational goals that were no longer valid. They suggested seven principles of reengineering to streamline the work process and thereby achieve significant levels of improvement in quality, time management, and cost:

1. Organize around outcomes, not tasks
2. Identify all the processes in an organization and prioritize them in order of re-design urgency
3. Integrate information processing work into the real work that produces the information
4. Treat geographically dispersed resources as though they were centralized
5. Link parallel activities in the workflow instead of just integrating their results
6. Put the decision point where the work is performed, and build control into the process
7. Capture information once and at the source

Enterprise resource planning provides perhaps the primary tool for guiding those efforts, so much so that ERP is often called the electronic embodiment of reengineering.

ERP Enforces "Best Practice Business Processes" in Organizations

Best practice business processes deliver measurable, sustainable benefits over time, and improve business performance. They are an operational imperative for any organization whose goal is achieving world-class operations, characterized by the highest levels of service with the most cost-effective implementation. In finance, where there are numerous different processes, best practice solutions share the following attributes. They:

1. Support each organization's unique environment and requirements
2. Distil lengthy, complex, multi-step processes into the fewest number of steps
3. Consistently handle all document types (paper, fax, electronic) via a standard process
4. Automate the streamlined new processes
5. Ensure the inclusion of all key participants—from line-of-business managers to suppliers—in the process
6. Automatically associate all relevant information involved with each ERP transaction.

ERP systems are based on so-called best practice business processes—the best ways of doing processes. For example, consider SAP's mySAP Business Suite. It incorporates over a thousand of best practices. mySAP Business Suite enables companies to succeed in today's economy. With SAP Best Practices, you can get your solution up and decide quickly, and contribute to your bottom line. For three decades, SAP has developed best business practices with their most successful partners and customers. SAP Best Practices get you started with a fully documented and re-usable prototype that you can turn into a productive solution quickly. So you can control costs, reduce risks, and immediately experience the benefits of mySAP Business Suite. SAP Best Practices empower your company with:

1. A proven methodology that leverages a prototype approach to implementation
2. Thoroughly documented scenarios—from both business and technical perspective
3. Proven pre-configurations of SAP solutions
4. Benefits for companies of any size, for both new and existing customers—so you can easily adapt techniques to meet your specific requirements or use them as a starting point for customized SAP or hosted solutions

SAP Best Practices contains industry-specific, cross-industry, and generic best practices. What this means is that any firm that installs **SAP ERP** has access to a wide range of best practices. Furthermore, new business practices are being added all the time. As new best practices are found and embedded in particular applications, they become available for inclusion in new versions of the ERP system; as they

become available, other firms install them. Hence there is a cycle of finding best practices, building them into the software, and diffusing them out to new users. Organizations should ask the following questions.

1. What business processes give us competitive advantage?
2. What new processes would give us competitive advantage?
3. How do we know that there is something unique in those processes?
4. Is this process worth more or less than moving to a set of processes that are widely available?
5. What would be the cost of this best practice diffusing to my competition?

ERP Fully Utilizes the True Potential of Client-Server Computing to Deliver an Enterprise Product

Initially ERP packages were available only for the mainframe platform. This seriously limited the number of organizations that could afford an ERP system and prevented ERP systems from delivering their true potential. In the early 1990s, client–server computing was an available technology that offered many advantages over existing mainframe solutions. Unfortunately, there was limited software available to exploit the advantages. ERP packages changed all that when it became one of the first dominant corporate applications of client–server computing.

ERP has Changed the Nature of IS Function and IT Professionals

Traditionally, the job of the IS function was primarily one of designing, developing, and implementing software. Now, with ERP systems, the design and development functions are being outsourced. ERP systems are replacing major portions of the software needs of most firms. This changes the basic nature of the IS function from where systems analysts and programmers are needed to where knowledge of existing software packages is critical. Not only have needs changed, but personnel too have become more mobile.

Historically, IS personnel would have knowledge only of firm-specific legacy applications. With ERP software, knowledge can now be used at more than one firm. Knowledge of almost any ERP package is useful not just in one organization; it is useful around the world. Thus, as the use of ERP package software grows, there is more mobility among personnel in IS than has ever been seen. In addition, this mobility is changing the consulting business that supports ERP package software. IT professionals and consultants gaining expertise about such a package can now take that knowledge from one firm to another. The professional actually becomes more and more valuable with each new implementation of the software.

ERP has Changed the Nature of Jobs in All Functional Business Areas

Enterprise resource planning has changed the nature of jobs in functional areas, such as manufacturing. IT professionals in manufacturing say ERP systems are blurring the lines between IT and users. There is a huge demand for users or line-of-business personnel who also have professional level IT skills. But traditional IT types who know only about technology and nothing about the business are not needed now, as they once were. Understanding the business is probably the most critical aspect. It is more important to understand how you want things to flow through your factory than to have the skill of programming.

ERP Implementation is Very Costly

The ERP implementation costs include the cost of the software, hardware, implementation, maintenance, upgrading, etc. ERP software price is only a part of the total ERP system cost. Following a common rule,

software is 30% of total implementation cost, hardware might be another 20%, and half of the total goes for implementation services, data conversion, consulting, and training. Most ERP system providers charge an annual maintenance fee in the range of 18–20% of the purchase price.

One of the most cited studies of the total cost of ownership (TCO) of ERP was completed by Meta Group (acquired by Gartner 2005) in 2002. This TCO study accounted for hardware, software, professional services, and internal staff costs. Costs included initial installation and the two year period that followed, which is when the real costs of maintaining, upgrading, and optimizing the system for the business are felt.

Among the 63 companies surveyed—including small, medium, and large companies in a range of industries—the average TCO was $15 million (the highest was $300 million and lowest was $400,000). While it is difficult to draw a solid number from such a diverse range of companies and ERP efforts, Meta came up with one statistic that proves that ERP is expensive no matter what kind of company is using it. The TCO for a user over that period was a staggering $53,320.

In 2007, Aberdeen Group surveyed more than 1,680 manufacturing companies of all sizes and found a correlation between the size of an ERP deployment and the total costs. Therefore, "as a company grows, the number of users goes up, along with the total cost of software and services," states the Aberdeen report. The same study also calculated the total cost per user and found that the costs decreased as the number of users increased but only in steps.

For example, a company with less than $50 million in revenue should expect to pay an average of $384,295 in total ERP costs at $13,854 per user, according to the survey results. A mid-market company with $50 million to $100 million in revenue can expect to pay (on average) just over a $1 million in total costs and $15,304 per user; a much bigger mid-market company, with $500 million to $1 billion in revenue, should expect to pay just over $3 million in total costs and $7,738 per user. And those companies with over $5 billion in revenue can expect to pay, on average, nearly $6 million in total ERP costs and $2,068 per user. The correlation between company size, total cost, and cost per user is shown in Table 4.1.

ERP costs can run as high as 2%–3% of revenues. So, it is very important to get the implementation right, from the very first time. Many companies have gone out of business because of wrong or failed ERP implementation. Some of the reasons for the failures are wrong product selection, flawed implementation, employee resistance, poor employee training, lack of management support, etc.

Table 4.1 Correlation between company size and total cost of ownership of ERP

Company Size	Total Costs	Total Costs/User
Under 50 million	$384,295	$13,854
50 million – 100 million	$1,081,869	$15,304
100 million – 250 million	$1,719,551	$18,157
250 million – 500 million	$1,987,616	$7,738
500 million – 1 billion	$3,092,021	$7,812
1 billion – 5 billion	$5,920,785	$6,025
Over 5 billion	$5,918,809	$2,068

Source: Aberdeen Group, July 2007

ERP MARKET HAS GROWN AND WILL CONTINUE TO GROW

Although ERP had its genesis in manufacturing, users from a range of other industry sectors are taking advantage of ERP benefits, resulting in an expected compounded annual growth rate of 4.8% over the next five years. According to Lucintel (www.lucintel.com), the global ERP software industry reached an estimated $47.5 billion in 2011 with 7.9% CAGR and is forecasted to attain an estimated $67.7 billion by 2017 with a 6.1% CAGR over 2012–2017. According to Forrester (www.forrester.com), the ERP market size has been climbing steadily over the couple of years with $40.6 billion in 2009, $43 billion in 2010, and $45.5 billion in 2011, and is expected to reach $50.3 billion by 2015.

Historically and traditionally, ERP was exclusive to manufacturing, going back to its roots in MRP (manufacturing resource planning). For the past decade, major portions of ERP solutions, most notably financials and human resources and, more recently, supply chain management applications, have found their way into sectors like government, banking/finance, health, retail, distribution and education/ administration under the ERP umbrella. These sectors are becoming increasingly more acceptable to seeking relief from ERP solutions, and in countries like India and China ERPs are now being sold into the real estate and construction markets.

While consolidation continues in this segment, the market continues to grow in spite of itself. As many industry leaders attempt to encroach on SAP's dominant market share through aggressive acquisition strategies, they face challenges of the post-acquisition phase such as defining a forward strategy for integrating various products and the installed base.

The need for an integrated solution has always been felt, especially when talking about an integrated enterprise from the shop floor up to the executive offices. Integration has been difficult, but service-oriented architecture (SOA) provides value to the enterprise by freeing key pieces of business functionality from individual systems and making them available for integration with other applications.

Most ERP vendors are incorporating the other enterprise applications—customer relationship management (CRM), enterprise asset management (EAM), product lifecycle management (PLM), supply chain management (SCM), and supplier relationship management (SRM) and offering them under the ERP umbrella. Most ERP vendors are adding more and more products aimed at improving the supply chain and these improvements are fuelling the growth of the ERP market. Another factor that is improving the growth of the ERP market is the expansion of the market. Now ERP packages that suit the needs of organizations of all sizes are available. These factors will sustain the growth of the ERP market in the coming years.

HOW DOES ERP CREATE VALUE?

Legacy information systems have been functionally based and not integrated across multiple locations or functional areas. The same information was captured multiple times, in multiple places, and was not available in real-time. Jobs and processes were narrowly defined in concert with the division of labor and the industrial revolution. As a result, some information never made it out of different pockets of the corporation. Processes and job definitions saw to it that information remained a local good. When information did go global, often there were different informational reports of the same events. Thus, there were information asymmetries between the different local and functional groups and top management.

Enterprise resource planning systems provide firms with transaction processing models that are integrated with other activities of the firm, such as production planning and human resources. By implementing standard enterprise processes and a single database that spans the range of enterprise activities and locations, ERP systems provide integration across multiple locations and functional areas. As a result, ERP systems have led to improved decision-making capabilities that manifest

themselves in a wide range of metrics, such as decreased inventory (raw materials, in-process, and finished goods), personnel reductions, speeding up the financial close process and others. Thus, ERP can be used to help firms create value. In particular, ERP facilitates value creation by changing the basic nature of organizations in a number of different ways, such as:

- Integrate the organizations activities
- Force the use of "best practices"
- Enable organizational standardization
- Eliminate information asymmetries
- Provide on-line and real-time information
- Allow simultaneous access to the same data for planning and control
- Facilitate intra-organization communication
- Enable inter-organization collaboration

Integrates Organization's Activities

ERP connects various functions of the organization in an integrated fashion. Integration is the defining characteristic of ERP. Enterprise resource planning processes are cross-functional, forcing the firm out of traditional, functional, and locational islands. In addition, an organization's different business processes are often integrated with each other. Further, data that were formerly resident on different heterogeneous systems are now integrated into a single system.

The first and most important advantage of ERP systems lies in the promotion of integration. The reason ERP systems are called integrated systems is because they have the ability to automatically update data between related process and functions. For example, you need to only update the status of an order at one place, say, in the logistics management module; all the other modules will automatically get updated. The beauty of this system is that information updating happens instantaneously. So you get up-to-the-minute information at your fingertips. This information integration leads to better decision-making and resolution of problems. Another advantage of this integration is that the people who are involved are also connected to each other. This integration has tremendous potential for improving productivity.

Forces the Use of "Best Practices"

As we have seen in the previous section, ERP systems have integrated within them thousands of best practice business processes. These best practices can be used to improve the way that firms do business. Choice and implementation of an ERP requires implementation of such best practices. So, by implementing an ERP system the organization is forced to change the way it has done business and adopt new and more efficient ways of accomplishing the tasks. The ERP system, thus, brings with it time tested and successful business practices that will help the organization to become more competitive.

Enables Organizational Standardization

Enterprise resource planning systems permit organizational standardization across different locations. As a result, those locations with substandard processes can be brought in line with other, more efficient processes. Moreover, the firm can show a single image to the outside world. Rather than receiving different documents when a firm deals with different branches or plants, a single common view can be presented to the world; one that puts forth the best image.

Eliminates Information Asymmetries

Enterprise resource planning systems put all the information into the same underlying database, eliminating many information asymmetries, redundancies, and duplication. This has a number of implications.

- It allows increased control
- It opens up access to information to those who need it, ideally providing improved decision-making information
- Information becomes available both up and down the organization
- It reduces the IS workforce. Because information is widely available, there is no need for non value-adding workers whose primary activity is to prepare information for upward or downward dissemination

Provides On-Line and Real-Time Information

In legacy systems, much information is captured on paper and then passed to another part of the organization, where it is either re-packaged (typically aggregated) or put into a computer-based format. With ERP systems, much information is gathered at the source and placed directly into the computer. As a result, information is available on-line to others and in real-time.

Allows Simultaneous Access to Data for Planning and Control

Enterprise resource planning uses a single database, where most information is entered once and only once. Since the data is available on-line and in real-time, virtually all organizational users have access to the same information for planning and control purposes. This can facilitate more consistent planning and control, in contrast to legacy systems.

Facilitates Intra-Organization Communication

Enterprise resource planning also facilitates intra-organization (between different functions and locations) communication and collaboration. The existence of interlocking processes brings functions and locations into communication and forces collaboration. The standardization of processes also facilitates collaboration, since there are fewer conflicts between the processes. Further, the single database facilitates communication by providing each location and function with the information that they need.

Facilitates Inter-Organization Collaboration

The ERP system provides the information backbone for communication and collaboration with other organizations. Increasingly, firms are opening up their databases to partners to facilitate procurement and other functions. In order for such an arrangement to work, there needs to be a single repository to which partners can go; ERP can be used to facilitate such exchanges.

ERP ARCHITECTURES

Information technology is changing at a fast pace. Underlying ERP technology is needed to keep pace with the fast-changing IT scenario and should also be flexible to adopt ever-changing business scenario. ERP technical architecture basically defines layout of layers of application deployment between servers and desktops, interfaces, and software objects. ERP architecture is no more meant to just provide technical functionality, user interface, and platform support but should be able to absorb emerging technologies. It

should be expandable and maintainable to meet future business needs such as business process changes, merger and acquisitions, compatibility with future regulations, etc.

Mainframe Architecture

During the 1980s, ERP systems were running on mainframes capable of supporting hundreds of users concurrently. The most common ERP system on mainframes was SAP R/2 from SAP AG. SAP R/2 is a real-time ERP software produced by SAP. What was unique about R/2 was that it was a packaged software application that processed real-time on a mainframe computer taking advantage of time sharing option (TSO) and integrated all of an enterprise's functions, such as accounting, manufacturing processes, supply chain logistics and human resources. Users were connecting to this mainframe system through dumb terminals (terminals without any memory or processing power), only to access and input data.

Two-Tier Client-Server Architecture

During the 1990s, the two-tier client-server ERP application became popular. PC became powerful and provided a better user interface, through graphic users interface (GUI). Mainframe computers were getting replaced by midrange system such as AS/400 or powerful PC servers. PCs (clients), networked with server/cluster of servers, are known as client–server platform and have the following characteristics:

- In typical two-tier architecture, the server handles the database management.
- The clients are responsible for the application logic processing and for presenting the data and passing user input back to the server.
- While there may be multiple servers and the clients may be distributed across several types of local and wide area links, this distribution of processing responsibilities remains the same.

In a two-tier system, each client requires a dedicated connection to the server as shown in Fig. 4.1. The overheads of maintaining the dedicated connections limit the number of clients that can be connected to the server. In addition, since the application logic contained on every client machine, it is critical that all the client computers run exactly the same version of the application software. Upgrading the application logic software to a new version can become a very time-consuming process in such a scenario and if one or two machines are accidently omitted from the upgrade to the new version, then the data from those clients could corrupt the database and cause serious data integrity problems. Today, the two-tiered system is seen as increasingly obsolete, or even viewed as an impediment to a more open, efficient, and reliable computing environment.

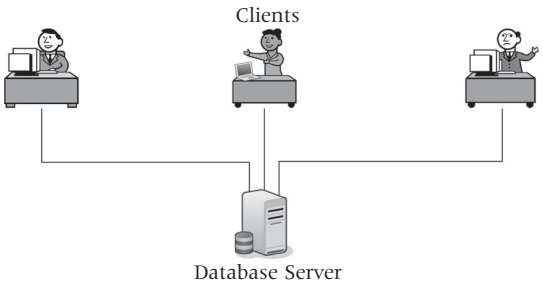

Figure 4.1 Two-tier client-server architecture.

Three-Tier Architecture

Most of the ERP systems have now moved to the three-tier architecture. In this arrangement, additional servers are placed between the client and database server. In the most common configuration of the three-tier architecture, one or more application servers are placed between the client and the database servers. This is shown in Fig. 4.2.

The application servers are responsible for executing the business logic and interacting with the client application. As the application server does not have to dedicate its services to the clients, the number of clients that can be serviced by a server increase tremendously. The client does not process the business logic; it only processes the user's input and display the information supplied by the application server. This allows the number of types of clients to interact with the application server—from fat clients (clients that run the clients from the user's PC) to thin clients and web browsers that offer all the information needed without the rich interface of the fat clients. The advantage of the web browser is that they can run from a variety of machines and platforms and offer identical experience from all. So the three-tiers of the architecture are presentation tier, application tier, and database tier.

The **presentation tier** uses a GUI to capture user's input, passes on that request to the application server and displays the information received using the same GUI. This tier uses dedicated clients (fat clients) or thin clients like web browsers connected to the company intranet or through the Internet. The **application tier** is where the core ERP software or business logic resides. These are available as different modules from the ERP vendors. These are the software programs that contain the software to run the business and automate the business processes. The application tier also provides process management services such as process development, process enactment, process monitoring, and process resourcing that are shared by multiple applications. The application tier server improves performance, flexibility, maintainability, reusability, and scalability by centralizing process logic. Centralized process logic makes administration and change management easier by localizing system functionality so that changes must only be written once and placed on the application server to be available throughout the systems. With other architectural designs, a change to a function (service) would need to be written into every application as it resides on the clients. The **database tier** stores the ERP data and is accessed and modified by the application programs. The database management system ensures the ACID (atomicity, consistency,

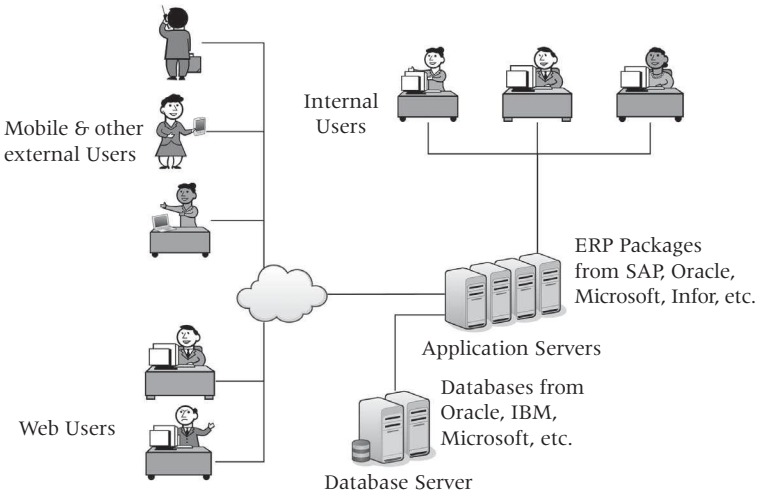

Figure 4.2 Three-tier architecture.

isolation, and durability) are maintained and all other database management functions like concurrency control, integrity constraint management, data back-ups, etc., are done.

Today most ERP systems use the three-tiered architecture because of the flexibility and advantages that it offers. The three-tier architecture scales to meet the demands of most ERP systems. Additional features required could be included by adding more tiers to the existing ones. Three-tier architecture also provides improved performance and availability.

SUMMARY

To remain competitive, organizations must deliver products of the highest quality on time, and at the best possible price. The set of business processes known as enterprise resources planning or ERP has proved to be an effective tool in achieving these objectives. ERP offers a means of effectively increasing and managing the required resources (materials, equipment, tools, labor, money, etc.). For each of these resources, ERP can identify what is needed, when it is needed, and how much is needed, thus making the operation of the organization efficient and effective.

ERP systems are transforming the way organizations do business. They are indispensable tools with a huge impact on both the business and IT worlds. Enterprise resource planning systems provide firms with transaction processing models that are integrated with other activities of the firm such as production planning and human resources. By implementing standard enterprise processes and a single database that spans the range of enterprise activities and locations.

ERP systems provide integration across multiple locations and functional areas. As a result, ERP systems have led to improved decision-making capabilities that manifest themselves in a wide range of metrics, such as decreased inventory (raw materials, in-process, and finished goods), personnel reductions, speeding up the financial close process, and others. Thus, ERP can be used to help firms create value.

ERP technical architecture basically defines layout of layers of application deployment between servers and desktops, interfaces, and software objects. ERP architecture is no more meant to just provide technical functionality, user interface, and platform support but should be able to absorb emerging technologies. The main ERP architectures are mainframe, two-tier and three-tier out of which the three-tier is most popular because of its many advantages.

REVIEW QUESTIONS

1. What do you mean by ERP?
2. What does an ERP system comprise off?
3. What are the main functions of ERP systems?
4. Why ERP is important to a company?
5. Will ERP fit the ways a company does business?
6. How will ERPs make the operation of the organization efficient and effective?
7. Why it is being said that ERP affects almost all organizations?
8. How does ERP force the competition to change?
9. Explain how ERP forces business partners become more competitive.
10. What are the advantages of using ERP consultants?
11. What are the services offered by ERP consulting firms?
12. How will ERP improve the profits of the consulting firms?
13. Why is ERP called the most important tool for business process reengineering?
14. What are the seven principles of reengineering suggested by Hammer and Champy?
15. How does BPR help in streamlining the work process and achieving significant levels of improvement in quality, time management, and cost?

16. What are best practice business processes and what do they deliver?
17. How will ERP enforce best practice business processes in organizations?
18. What are the main attributes of best practice business processes?
19. ERP utilizes the true potential of client–server computing to deliver an enterprise product. Explain.
20. What is the role of IS function in a traditional organization?
21. How has ERP changed the IS function?
22. How does ERP help in reducing the IS workforce?
23. How has ERP changed the nature of IS function and job profile of IT professionals?
24. How has ERP changed the nature of jobs in all functional business areas?
25. What are the factors that will sustain the growth of the ERP market in the coming years?
26. How does ERP help organizations in creating value? Explain in detail with suitable examples.
27. Why are ERP system called integrated systems?
28. How does ERP integrate into an organization's activities?
29. ERP forces the use of best practices. Explain
30. How does ERP help in enabling organizational standardization?
31. How does ERP eliminate information asymmetries?
32. ERP systems provide on-line and real-time information. Explain
33. ERP systems allow simultaneous access to the same data for planning and control. Illustrate.
34. How does ERPs facilitate intra-organization communication?
35. How does ERP enable inter-organization collaboration?
36. Explain the different architectures with figures.
37. Explain the mainframe architecture of ERP systems.
38. What is two-tier client-server architecture? Explain it with a diagram.
39. What are the limitations of two-tier architecture?
40. Explain the working of the three-tier architecture with a diagram.
41. What are the advantages of three-tier architecture?
42. Give an overview of the ERP market and the future of the ERP systems.

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Chapter 5

Justifying ERP Investments

INTRODUCTION

The requirement that enterprise software vendors deliver a measurable return on investment (ROI) has never been greater than right now. Customers are demanding that ROI analysis be a critical factor in their decisions to acquire new enterprise software. Without a demonstrable return, few customers are willing to invest scarce capital and human resources in the new enterprise software.

While most vendors have been able to construct comprehensive ROI models for their products, these models largely fall short in their ability to accurately measure the total value of an enterprise software investment. This is due to the fact that most ROI models are focused on quantifiable measures of return. While this is a useful and often necessary function, it leaves little room for a discussion of more qualitative success factors (or intangible benefits) that are often difficult to fit into a fixed economic model.

Looking at the overall payback that enterprise software can offer to a company gives a more complete analysis of return. Enterprise software payback includes not only quantifiable improvements in bottom and top line functionality, but also additional qualitative measures such as new business opportunities, improved customer satisfaction and customer goodwill, better relationships with partners, suppliers, and other business associates, improved time to market, etc. These intangible benefits also contribute significantly to the success of a company's enterprise software implementation and use. Enterprise software buyers who understand the overall payback that a given product suite can offer their company will be able to make more informed choices that lead to success, not only in software deployment but in the overall business functionality.

The ability to define a broad range of payback benefits can be an important addition to understanding how enterprise software provides value across an organization. The broader value of an enterprise software investment defined by payback allows the software buyer to better understand not only the direct financial impact of the investment—the domain of traditional ROI analysis—but also the impact on such areas as new opportunity development, improved customer and partner relations, better business process management, and improvements in other organizational and structural factors. The major key payback parameters are:

1. Faster time to market
2. Improved business processes
3. Improved customer support
4. Rapid capitalization of new business opportunities
5. Lower implementation costs

The sum of the parameters described by enterprise payback offers a much more complete picture of the value of the software and services provided by a given vendor. This more complete view can make the difference between a software acquisition that merely succeeds, if at all, and one that has the ability to significantly improve tangibles such as profits and margins as well as intangibles such

as new business development and customer and partner satisfaction. Prospective enterprise software customers who look at both sides of the payback equation can make better decisions regarding their software acquisitions, business process requirements, total cost of ownership, and the true value of their enterprise software.

Thus, we have seen that the expected ROI provides the cost justification and motivation for investing in ERP. There are quantifiable benefits as well as intangible benefits in the ERP investment decision. The quantifiable benefits have a bottom-line impact on profitability and asset turnover and a potential effect on stock value. But a word of caution; ROI does not come from ERP. ROI comes from what you do using ERP. ERP is a tool and it all depends on how well you use this tool. There are organizations that have benefitted substantially, many times their investment, and there are organizations that have not achieved the desired benefits, and there are organizations that have gone bankrupt implementing ERP.

We will discuss the quantifiable or tangible and the intangible benefits of an ERP system. Other scenarios are encountered in justifying ERP investments. For example, a firm may be considering replacement versus upgrade or re-implementation of an ERP software package. There are significant costs for not successfully implementing an ERP system. Organizations often pay more for the lack of systems than they would have paid for improved systems. For example, they carry excess inventory or provide poor customer service. Organizations also may invest in ERP without gaining the benefits because the systems are partially, poorly, or unsuccessfully implemented, improperly used or inefficiently maintained.

Quantitative (Tangible) vs. Qualitative (Intangible) Benefits

It is important to note that qualitative payback parameter does not include the rigorous financial analysis that is employed in more traditional ROI analysis. This inability to quantify every aspect of the payback parameters, discussed in this chapter, does not diminish their value. The fact that a given customer cannot assign a specific money value to the development of a new business opportunity or improvement in customer support does not mean that it should be ignored in favor of more quantifiable results. In fact, it has been found that the more intangible payback benefits such as new business opportunity or customer satisfaction would in the long run provide greater value than more traditional and quantifiable measures such as increased inventory turns and lower material costs. Thus, while justifying the ERP investments, both the quantifiable and intangible benefits should be given equal weightage.

QUANTIFIABLE BENEFITS FROM AN ERP SYSTEM

Studies that surveyed the impact of ERP systems on the performance of organizations indicate that company size and industry segment do not affect the results. Benefits have been indicated for large and small firms, whether they make standard or custom products or are in the service sector. In this section, we will discuss some of the quantifiable benefits of implementing ERP systems. The most significant quantifiable benefits involve reductions in inventory, and in material, labor, and overhead costs, as well as improvements in manufacturing and delivery of goods. Figure 5.1 shows the performance gained by the use of ERP systems.

Reduced Inventory and Inventory Carrying Costs

Many manufacturing ERP users importantly save on the process and material costs. Savings in these areas are significant and can be readily quantified. The main factor behind these savings is that implementation of the ERP system allows customers to obtain information about costs, revenues,

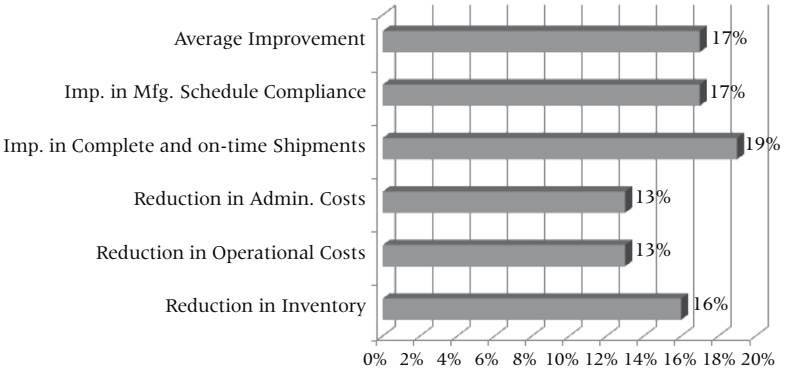

Figure 5.1 ERP performance gains. (*Source*: Aberdeen Group, 2009)

and margins that will better manage its overall materials cost structure. This ability to manage costs is best seen in the savings that organizations can obtain in their inventory systems. Customers can perform a more complete inventory planning and status checking with the ERP system. These checks and plans will be able to reveal surpluses or shortages in supplies.

Improved planning and scheduling practices typically lead to inventory reductions to the order of 20% or better. This provides not only a one-time reduction in assets (cost of the material stocked), but also provides ongoing savings of the inventory carrying costs. The cost of carrying inventory includes not only interest but also the costs of warehousing, handling, obsolescence, insurance, taxes, damage, and shrinkage. For an interest rate of 10%, the carrying costs can be anything between 25 and 30%.

ERP systems lead to lower inventories because manufacturers can produce and buy only what is needed and only when it is needed. Goods will be produced as per the demand and not arbitrarily. Deliveries can be coordinated to actual scheduled dates, and orders for unneeded material can be postponed or canceled. The bills of material ensure that components match with the order rather than too much of one component and not enough of another. Planned changes in the bills also prevent inventory build-up of obsolete materials. With fewer part shortages and realistic schedules, manufacturing orders can be processed to completion faster and work-in-process inventories can be reduced. Implementation of technologies like JIT and Kanban can further reduce manufacturing lead-times and the corresponding inventories.

Reduced Manpower Costs

Improved manufacturing practices lead to fewer shortages and interruptions and to less re-work and overtime. Typical labor savings from a successful ERP system are a 10% reduction in direct and indirect labor costs. By minimizing rush jobs and parts shortages, less time is needed for expediting, material handling, extra setups, disruptions, and tracking split lots or jobs that have been set aside. Production supervisors have better visibility of required work and can adjust capacity or loads to meet schedules. Supervisors have more time for managing, directing, and training people. Production personnel have more time to develop better methods and improve quality and throughput.

Reduced Material Costs

Improved procurement practices lead to better vendor negotiations for prices, typically resulting in cost reductions of 5% or better. Valid schedules permit the purchasing department to focus on vendor negotiations and quality improvement rather than wasting their time on shortages and getting material at premium prices. ERP systems provide negotiation information, such as projected

material requirements by commodity group and vendor performance statistics. Giving suppliers better visibility of future requirements help them in achieving efficiencies that can be passed on as lower material costs.

Improved Sales and Customer Satisfaction

Improved coordination of sales and production leads to better customer service and increased sales. The sales department will be able to know what items are being produced and when they could be delivered. As the details are updated in the inventory database in real time, even the sales executives who are out at the customer site can check the status on his laptop or mobile device and give the customer realistic quotes and assured delivery times. The sales people can also update the order details as soon as they receive the order, thereby helping the production planning department to schedule extra production runs to meet the increased demand, if required.

Improvements in managing customer contacts, in making and meeting delivery promises and in shorter order-to-ship lead-times, lead to higher customer satisfaction, goodwill, and repeat orders. Sales people can focus on selling instead of verifying or apologizing for late deliveries. In custom product environments, configurations can be quickly identified and priced, often by sales personnel or even the customer rather than the technical staff. Taken together, these improvements in customer service can lead to fewer loss in sales and actual increases in sales, typically 10% or more. ERP systems also provide the ability to react to changes in demand and to diagnose delivery problems. Corrective actions can be taken early, such as determining shipment priorities, notifying customers of changes to promised delivery dates, or altering production schedules to satisfy demand.

Improved Production Throughput

Throughput is the movement of inputs and outputs through a production process. It can be best described as the rate at which a system generates its products or services per unit of time. Without access to and assurance of a supply of inputs, a successful business enterprise would not be possible. ERP system makes the information flow between departments efficient and seamless. Thus, the raw materials and other resources required for production will be available readily, when it is needed. For example, as soon as the production planning department creates the MPS and BOM, the production and inventory management departments will take necessary steps to start production at the specified time. The production department can design the plant layout and make necessary changes, design any specialized tools or schedule critical equipment and purchase or loan special machines required for production, select the employees who have the necessary skills, while the warehouse can use the BOM to see all the required materials are available, and place the order for items that are not in stock so that they will be available when the production starts. The ERP system improves the production throughput by eliminating delays, obstacles, shortages, interruptions, and rework by giving the concerned departments adequate time for planning and automating most of the operations.

Shorter Order to Shipment Cycle and On-time Shipment

Since the production planning department, production department, accounting department, and warehouse come to know about a customer order as soon as it is placed, the order fulfillment process can be started immediately. This means that if the items are available, they can be shipped immediately and the invoice could be sent to the customer as per the terms and conditions of the sale. If the items are not in stock, then production runs could be scheduled to meet the demand. Therefore by automating the business functions and storing the information at a centralized location, ERP systems help in reducing the order to shipment cycles and ensure on-time shipment.

Efficient Financial Management

Improved collection procedures can reduce the number of days of outstanding receivables, thereby generating additional revenue. Underlying these improvements is fast and accurate invoice creation directly from shipment transactions, timely customer statements, and follow-through on delinquent accounts. Credit checking during order entry and improved handling of customer inquiries further reduces the number of accounts that are mismatching. Improved credit management and receivables practices typically reduce the days of outstanding receivables by 18% or better. Trade credit can also be maximized by taking advantage of supplier discounts and cash planning, and paying only those invoices with matching receipts. This can lead to lower requirements for cash-on-hand.

THE INTANGIBLE EFFECTS OF ERP

The intangible or non-financial benefits of an integrated ERP system can be viewed from several perspectives. We will see the benefits in some areas like accounting, product, and process design, production, sales, and MIS functions. From the overall company standpoint, ERP provides a framework for working effectively together and devising a consistent plan for action.

Each of the intangible effects could be quantified in terms of cost savings. For example, maintaining multiple copies of the same data requires personnel time in entering data manually (and possibly managerial time in determining which set of data should be used for decision-making). Expediting efforts have a visible effect of consuming man hours. These quantified cost savings can also be used to show impacts on financial results.

Error Reduction and Improved Data Accuracy

ERP systems store all the data in a centralized database. The data entry happens at different points. For example, the inventory data of the goods that arrived at the warehouse is entered by the data entry clerk in the warehouse. The details of the orders placed by the customers are entered by the sales clerk. The details of the orders shipped are entered again by the warehouse clerk. The invoice details are entered by an executive in the accounting department. At each of these data entry points, the data is validated and ensured that it is error free.

Technology integration has made it possible to use gadgets to avoid the manual data entry as far as possible. Bar code scanners can scan the labels on the raw materials and the details would get automatically entered into the database. Orders received through electronic medium can be entered directly to the order fulfillment system, and the invoices can be generated automatically. The electronic transfer of funds can update the accounting details automatically. Thus by using technology and proper data validation, ERP systems reduce manual data entry and increase accuracy and efficiency of manually entered data.

Improved Quality of Information and Better Decisions

Since the data in the ERP system is error free, and the ERP system and the business intelligence tools help in analyzing the data in hundreds of different ways, the quality of information that can be generated from the data would be highly accurate, timely, and relevant. ERP systems give the power to analyze the information to the user. The users can drill down to the minutest detail and see how the summary reports were created. They could do an in-depth analysis to find out the reason for some anomaly or to discover some trend. They could do what-if analyses, simulations, and projections to discover opportunities. They could use data mining tools to find hidden patterns and generate new product ideas or find new markets. This kind of high quality information available at the finger tips of the decision-maker will result in high quality decisions in the shortest possible time. In today's highly competitive world where information is a strategic weapon, it is the capability to use that weapon

quickly and accurately that matters. Thus, ERP systems help in making the organization competitive by enabling the decision-makers to be proactive by making better decisions ahead of the competitors.

Improved Customer Service

The customer service department acts as a liaison between the customer and the organization. Most often the customer service department is contacted when there is some problem. But a proactive customer service department should interact with the customer throughout the order fulfillment process keeping the customer informed about the status of the order. The customer can be kept informed of the progress and status of the order through email so that necessary arrangements could be made to receive it. Since the data required is in the ERP database, most of the status intimation could be automated saving time and improving the efficiency of customer service. The customer service could also conduct automated survey to find out how good is their performance and what they could do to improve the service. The customers would only be happy to provide feedback and would be glad to know that the organization values their opinion. This will go a long way in improving customer goodwill which will result in loyal customers and repeat orders.

Accounting

With a common database from ERP, accounting no longer requires duplicate files and redundant data entry. Product costing, for example, can be performed using accurate and up-to-date product structures. Product costing simulations can be used to analyze the impact of changing material costs, labor rates, and overhead allocations, as well as planned changes to bills and routings. Differences between actual and standard costs are highlighted as variances. Order-related variances help pinpoint problem areas.

Customer invoices can be based on actual shipments (without duplicate data entry), which help to speed invoice processing. Payables can use purchase order and receipt data for three-way matching with supplier invoices. As manufacturing transactions are recorded, the financial equivalents are automatically generated for updating the general ledger. This provides a complete audit trail from account totals to source documents, ensures accurate and up-to-date financial information, and permits tracking of actual versus budgeted expenses.

Detailed transaction activity can also be easily accessed online for answering account inquiries. Since manufacturing transactions automatically update the general ledger, time-consuming manual journal entries can be eliminated. Period-end closing procedures can be performed in hours or days, rather than weeks. This reduces clerical accounting work and improves the timeliness of financial reports.

Financial reports can be easily customized to meet the needs of various decision-makers. Financial projections can be based on detailed ERP calculations for future requirements. Cash planning, for example, can account for current and projected sales orders and planned purchases, as well as current receivables and payables. Decision support tools (such as spreadsheets, graphics packages, and data managers) can use the financial data maintained in the ERP database.

Product and Process Design

The product structure database offers engineering much greater control over product and process design, especially in terms of engineering change control. Planned changes can be phased in and emergency changes can be communicated immediately.

ERP systems offer numerous analytical tools for the engineering function. When diagnosing the impact of changes to materials and resources, for example, engineers can check available information to identify the affected products. Lead-time reduction efforts can use critical path analysis of item lead-times in multi-level bills to focus attention on those key components affecting cumulative

manufacturing lead-time. Costed multi-level bills can be used to focus cost reduction efforts on high-value items. Bill comparisons can be used to highlight differences between products or between revisions of the same product (e.g., to identify and upgrade kit requirements).

ERP systems support custom product configurations. Rules-based configurators reduce the need for expert assistance from engineers and ensure that sales personnel (or even customers) can develop timely and accurate configurations. Cost estimates and pricing for custom product configurations can also be quickly calculated.

Production and Materials Management

ERP systems help establish realistic schedules for production and communicate consistent priorities so that everyone knows the most important job to work on at all times. Visibility of future requirements helps production prepare for capacity problems and also helps suppliers anticipate and meet needs. As changes to demands or supplies occur, ERP helps identify the impact on production and purchasing.

Finite scheduling capabilities in ERP ensure that production activities are scheduled based on capacity, tool, and material constraints. Scheduling rules help minimize setup times and optimize sequencing. Changes in factory demands, as well as changes in available machine time, labor headcount, skill levels, tools and material, can be immediately simulated to assess the impact on production and purchasing.

ERP helps eliminate many crisis situations, so that people have more time for planning and quality. Buyers can spend more time in vendor negotiation and quality improvement. When the shortage list is no longer used to manage the shop, the quality of working life will improve instantly.

Sales

Making valid delivery promises and meeting those promises can help to improve customer service. Custom product quotations can be developed faster and more accurately, and improves job estimating. Delivery lead-times can be shortened and customer inquiries on order status can be answered immediately.

E-commerce capabilities enable customers to place orders and check status over the Internet at any time. In addition to customer convenience, this reduces the time requirement for sales and customer service personnel.

MIS Function

An ERP system implemented as an integrated software package offers several advantages to the MIS function. The software package can offer a growth path from simple to comprehensive applications built on top of a database management system. It provides an upgrade path to technology and functional enhancements supported by the software vendor. It can reduce the development time and cost for software, documentation, and training classes. These costs would be incurred before the firm can start obtaining the benefits of an ERP system. It permits the MIS staff to focus their attention on organizational change and servicing user needs for customization and professional assistance.

OTHER FACTORS

There are several other factors that should be considered while justifying ERP investments. Some of them are quantifiable, while others are intangible. The major factors are:

1. Implementation costs
2. Production and business transaction costs

3. Reporting costs
4. Personnel costs
5. Business process change and enhancement costs
6. Customer and partner support
7. Enabling new business opportunities

The importance of the above factors cannot be overemphasized. The ERP applications can provide a broad and significant level of payback across business domains and functions, from the business inventory savings and IT development savings to new business opportunities for partners, and new sales and support opportunities for customers. While it is impossible to guarantee that every customer will achieve these levels of payback, similar results can be achieved across at least one, if not more of the five factors. Now we will discuss the above factors in further detail.

Lower Implementation Costs

The cost of implementing varies from one ERP system to another. Some are easy to implement, while others require sophisticated tools, expensive hardware, expensive consultants, etc. Good ERP systems allow organizations to realize quantifiable savings in their implementation and systems management costs. If an ERP system's architecture is such that it allows customers to implement the precise components they need in sequence, and not struggle through a forced big bang approach, then it will help in reducing the implementation costs. The component or modular architecture allows the company to improve its internal skills and lower overall implementation time significantly.

Lower Production and Business Transaction Costs

Cost savings for business operations are a significant source of enterprise resource payback. The immediate improvement in cash flow means that the initial cost of the ERP implementation is recovered fast. The decrease in IT spending and increase in profitability as a result of the efficiencies enabled by the ERP systems help to recover the initial investment. While there are a number of different factors that help organizations to save cost, the main factor is that the ERP system allows these companies to improve overall business functioning, better monitor key aspects of the business and streamlines essential processes, resulting in huge cost savings. The fact that results can be achieved rapidly, as well as in the long run, means that ERP-enabled organizations can expect enterprise payback from their software throughout the lifetime of the product.

Lower Cost of Reporting

ERP systems help in improving, monitoring, and reporting key business activities. This yields a mix of quantitative and qualitative savings. On the quantitative side, the ability to report on consolidated operations allows organizations to streamline and speed up important reporting cycles that usually run on hundreds of spreadsheets and take two to three weeks to close. On the qualitative side, this ability to streamline the reporting process allows organizations to do a better job of monitoring their companies both within individual lines of business and across the enterprise. This capability allows a degree of insight into the organizations operations that acts as a strategic tool against competitive and business change.

Lower Personnel Costs

Direct savings in personnel costs come from two factors—savings in training costs and savings from re-deployment of personnel due to newly found efficiencies. Proper training tools and procedures

help in training employees faster and better, thereby reducing employee error. ERP systems with user-friendly interfaces allow employees to shorten the expected learning curve for the new system.

Lower Business Process Change and Enhancement Costs

The broad suite of components of an ERP system allows customers to realize both quantitative and qualitative paybacks in business process management. On the quantitative side, organizations can save on the overall implementation budget by using the modeling tools to manage the business process and change part of the implementation project. While only a small percentage of the total cost, in real rupees this, represents a major saving for the customer. On the qualitative side, the ERP systems allow organizations to implement new, improved business processes, and streamline existing ones in a highly efficient fashion.

Supporting and Enhancing the Customer and Partner Experience

The efficiencies in production and business transactions discussed above have a significant effect on the customer and partner support. The inventory and capacity management improvements offered by the ERP system help organizations to provide lower costs and improved services to their customers. The ability to better manage manufacturing and warehouse resources allows better turn-around times for ad hoc customer requests. The main areas where customer and partner experiences are enhanced are:

- Improved process management, lower costs, and improved customer service
- Improved performance measurement means better customer satisfaction
- Efficient project management supports new product development
- Connectivity of the applications supports e-commerce improvements
- Improves customer service and encourages new business opportunities

Additional key components that assist in cost savings include project management, which helps in streamlining the new product development processes. A more efficient product development process, along with the overall flexibility of the ERP systems allows the organization to set up new business processes that can respond to changing customer needs quickly and efficiently. The organizations can use the EDI and XML connectivity in the ERP systems. This helps in developing direct e-commerce connections with key partners and customers. The overall effect is that organizations can improve their own customer relations in multiple ways, from handling service requests to developing new products and services that meet expanding customer or market requirements.

Enabling New Business Opportunities

By looking at how the ERP systems support payback in customer relations, it becomes obvious that the same payback parameters are involved in driving significant new business opportunities for the organization. The ability to model new processes that in turn manage new products or services can open up these new opportunities. When other features such as ISO certification, a key requirement for business relationships particularly in Europe are added, customers report that additional opportunities emerge. This is true for the direct e-commerce connections cited above as well.

The link between customer support and service and new business opportunities is one of the cornerstones of enterprise resource payback. The flexibility and speed of the enterprise applications environment allow organizations to maximize their opportunities for both new and existing business. For example, the customer relationship management (CRM) software, now being offered by

almost all ERP vendors as part of their systems, tightly integrates with warranty tracking and field service, thereby allowing companies to expand service offerings to their own customers and expand service revenues as a result. In a similar vein, the integrated functionality available in the collaborative planning and engineering functionality allows manufacturing partners to reduce design and production time and get products to market more quickly and efficiently.

SUMMARY

Today, organizations need demonstrable return on their investments before they invest in enterprise software. Customers are demanding that ROI analysis be a critical factor in their decisions to acquire new enterprise software. A decision to acquire new enterprise software that relies solely on quantifiable ROI factors would be limited in its ability to predict the ultimate success of the software. That success would include, particularly in the long-term, payback factors that are harder to quantify and therefore, more often than not left out of the ROI equation. These non-quantifiable or intangible factors should be given as much importance as the quantifiable measures before making the decision to acquire a new ERP system and selecting a vendor/package. While almost all ERP vendors providing enterprise resource payback to their customers, it is the right combination of technology, architecture, functionality, and active customer support that provides maximum payback potential.

REVIEW QUESTIONS

1. Why is ROI becoming important to organizations that plan to implement ERP systems?
2. What are the common problems with typical ROI calculations?
3. Discuss the payback model and various payback parameters.
4. What is the difference between tangible and intangible benefits?
5. What are the quantifiable benefits of ERP?
6. How does ERP reduce inventory and inventory carrying costs?
7. How does ERP reduce manpower costs?
8. How does ERO reduce material costs?
9. How does ERP system improve sales?
10. How does an ERP system increases customer satisfaction?
11. What do you mean by production throughput?
12. How does ERP improve production throughput?
13. What is order-to-shipment cycle?
14. What do you mean by on-time shipment?
15. How does ERP make the order-to-shipment cycle shorter?
16. How does ERP ensure on-time shipment?
17. How do ERP systems help in managing the finances of the organization?
18. What are the other factors that should be considered in addition to the tangible benefits while justifying ERP investments?
19. What are the intangible or non-quantifiable benefits of ERP systems?
20. How do ERP systems help in error reduction and improve data accuracy?
21. How do improved quality of information results in better decision-making?
22. How does ERP improve the quality of information?
23. How can we improve the customer service function using ERP?
24. What are the benefits that the ERP system offers to the financial and accounting functions?
25. How do ERP systems improve product design?

26. How does the ERP system improve process design?
27. How does the ERP system improve the efficiency of production and materials management?
28. What are the benefits offered to the sales function by the ERP system?
29. How does ERP help the MIS?
30. How can we lower the cost of ERP implementation?
31. How does the ERP system lower the production and business transaction costs?
32. How can the ERP system lower the reporting costs?
33. How can the ERP system lower the personnel costs?
34. How can the ERP system lower the business process change and enhancement costs?
35. How does ERP improve customer and partner support?
36. How ERP help to find and capitalize on new business opportunities?

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Chapter 6

Risks of ERP

INTRODUCTION

Tantalizing efficiency and profitability gains are the core promises of enterprise resource planning (ERP) systems. However, they come with special risks for companies, and understanding how to avoid the blind spots and capture the promised benefits can be very difficult and tricky. The implementation of ERP systems has been problematic for many organizations. Given the many reports of substantial failures, the implementation of packaged ERP software and associated changes in business processes has proved not to be an easy task. Khvalev[1] have identified 25 key risks of ERP implementation. They are given below in the order of their frequency and importance:

1. Lack of top management commitment and support
2. Unclear goals and objectives
3. Limitation in resources
4. Insufficient training of end-users
5. Failure to redesign business process
6. Poor changes and risks management
7. Lack of business and technical knowledge
8. Poor project management
9. Ineffective communications
10. Poor conflict management
11. Lack of competence of ERP's consultants
12. Poor motivation and project team work
13. Lack of proper project planning and controlling
14. Underestimation of organizational structure and business processes
15. Lack of metrics for evaluating project efficiency and benefits
16. Lack of vendor support and partnership
17. Ineffective project cost and time management
18. Poor integration of the infrastructure systems
19. The design and implementation of system disrupts the business operations
20. Lack of metrics for evaluating project work by phases
21. Insufficient automation
22. Underestimation of system technical architecture
23. Poor software troubleshooting
24. Poor quality of data and data losses during migration
25. Insufficient testing phase

All application software projects involve risk. Even the simplest effort probably has only a 90% chance of success—i.e., if the project is on time, within budget, and attains all the planned benefits. As projects increase in scope, the odds of achieving success diminish rapidly. Implementation projects require companies to strike a balance between the desires to satisfy everyone's functionality needs

and the need to keep things simple enough to ensure success. If you implement a package with no software modifications, you are more likely to succeed than if you make major software and structural operating adjustments. However, at what cost? Without customization, you may end up with a system that executes flawlessly, but does not support your business adequately. It is necessary to balance risk and results at a level comfortable for your company. Remember that technology is fragile and heavy software modifications can lead to construction of a house of cards that will topple easily.

Many managers understand the risks involved with new software and put all their efforts into minimizing them. What many fail to realize is the high risk associated with existing applications that will be retained—the most onerous of these being bad data in the current system. It is common that many problems with a company's existing system are more related to inaccurate data than to faulty systems. Yet, the system usually takes the blame. Converting to a shiny, new system replete with the latest features and functions and then populating it with rusty, broken-down data does little more than continue yesterday's problems.

How do you minimize risk? Obviously, you could do less in less time, but this is generally not a viable solution. One of the best hedges against risk is the use of a proven methodology. The simpler this is, the better. Going into battle without a firm plan of attack introduces the risk of your soldiers ending up shooting each other on the battlefield. One blanket methodology is not necessary—software selection, acceptance testing, and implementation can each have tailored methodologies.

A methodology will help ward off risk, but a contingency plan is still absolutely necessary. Virtually all planning for such projects has a positive spin to it—the assumption is made that the project will unfold as planned. Ugly surprises that surface during the course of the project can devastate the project and even the entire company. Having a working contingency plan, agreed upon in advance, can come to the project team's rescue.

As many organizations have discovered, the implementation of ERP systems can be a monumental disaster unless the process is handled carefully. In 1999, Hershey Foods Corporation headquartered in Pennsylvania failed in their ERP implementation. Hershey Foods and four different teams of consultants had been working on for 3 years on a massive ERP software system from SAP AG and two other software vendors that was supposed to put the company's operations on one integrated computing platform. The $115 million system was to replace scores of legacy systems that were currently running everything from inventory to order processing to human resources. They were 3 months behind schedule and by September (one of the busiest seasons for the candy and chocolate industry) the company was still trying to fix glitches in its order-processing and shipping functions. Hershey missed the September season of 1999 as big customers like WalMart and Kmart procured the items from competitors like Mars and Nestlé, while Hershey warehouses piled up with undelivered goods. The result was that third-quarter sales dropped by a staggering 12.4% compared with the previous year and earnings were off 18.6%. In the same year, Whirlpool, a leading manufacturer of household appliances, announced similar though less severe problems with its SAP implementation. In fact, the history of ERP implementations is full of such failure stories; many of them still remain untold.

In 2000, Nike, the world-renowned shoe- and athletic gear-maker, went for a $400 million upgrade to Nike's supply chain and ERP systems. The upgrade did not go as per the plan but failed miserably resulting in $100 million is lost sales, a 20% dip in stock value, and a collection of class action law suits. The horrendous results were due to a bold ERP, supply chain, and CRM project that aimed to upgrade the systems into one superstar system. Nike's tale is both of woe and warning.

In March 2004, at the University of Massachusetts, the IT people hoped to have the web portal rollout installed before the return of students to campus. However, delays in testing and fixing the problems caused the system to crash. More than 27,000 students at the University of Massachusetts as well as Stanford and Indiana University were forced battle with buggy portals and ERP applications that left them at best unable to find their classes and at worst unable to collect their financial

aid checks. After a couple of tense days and weeks, however, everyone eventually got their checks and class schedules.

In June 2004, Hewlett Packard started the implementation of a new ERP Software in its North American Enterprise Servers and Storage (ESS) division. HP, known for its expertise in a lot of product fields and consulting capabilities, especially in the segment of SAP ERP implementations, faced several severe problems during the execution of the project. HP's project managers knew all of the things that could go wrong with their ERP rollout, but they just did not plan for so many of them to happen at once. The epic tale of HP's centralization of its disparate North American ERP systems onto one SAP system proves that one can never be too pessimistic when it comes to ERP project management. The project eventually cost HP $160 million in order backlogs and lost revenue—more than five times the project's estimated cost. Said Gilles Bouchard, then-CIO of HP's global operations: "We had a series of small problems, none of which individually would have been too much to handle. But together they created the perfect storm."

In 2012, the U.S. Air Force decided to scrap a major ERP software project after spending US$1 billion, concluding that finishing it would cost far too much more money for too little gain. Dubbed the Expeditionary Combat Support System (ECSS), the project has racked up $1.03 billion in costs since 2005, "and has not yielded any significant military capability," an Air Force spokesman said. It was estimated that an additional $1.1 billion would be required to complete the system with a quarter of the original scope and the system would be ready only by 2020. The Air Force concluded the ECSS program was not a viable option for meeting the FY17 Financial Improvement and Audit Readiness (FIAR) statutory requirement. Therefore, they canceled the program and went with other options in order to meet both requirements. Air Force officials restructured the program three times in three years, and ultimately determined the military division will be better served by developing an entirely new strategy versus revamping the ECSS system of record again. The system dates back to 2005, when Oracle won an $88.5 million software contract, securing the deal over rival SAP and other vendors. It was supposed to replace more than 200 legacy systems.

Hershey, Whirlpool, Nike, University of Massachusetts, and U.S. Air Force are only some names in the long list of companies that include Dow Chemical, Boeing, Dell Computer, Apple Computer, etc., that have struggled in varying degrees with ERP projects.

Implementing an ERP project involves a certain amount of risk. The ERP system cannot be implemented in a totally risk-free environment. The only thing that differentiates successful and flawed or failed implementations is the way in which the risks were anticipated, handled, and mitigated. In this chapter, we will identify the risks and controls used in ERP implementations, with the objective of understanding the ways in which organizations can minimize the business risks involved. The scene can be set for the successful implementation of an ERP system by controlling and minimizing major business risks in the first instance. This is a very important issue as identifying the risks and risk-mitigating strategies is of great significance for organizations as they are critical for the successful implementation of ERP systems.

Enterprise resource planning (ERP) systems have fundamentally changed the way organizations function. The sheer size and complexity of ERP implementations makes managing these projects difficult. There are three basic sides to ERP management: people, processes, and technology. An ERP package touches the entire organization and can affect nearly every employee. And in many cases, an ERP project manager will not be able to know who will be affected, which can lead to some rude shocks. The ERP system will introduce new business processes, and organizations will have to change the way they have being doing things. The only solution to avoid this is to re-configure or customize the ERP system. However, customization might not work in all cases. In some cases, it is better that the organization abandons the existing processes and practices and adapts newer and

efficient businesses processes and practices offered by the ERP system. Choosing between what to change and what to retain is often a challenging task, and any wrong decision can result in a flawed implementation. It is also difficult to understand the technological aspect of the implementation because of the vast combination of hardware and software involved. The project manager must cope with all of this. Whether you are implementing one module or multiple modules, you must ensure consistency and full integration across the various sub-projects, which is an enormous effort involving considerable risks, even for an experienced system analyst.

RISK OF ERP

ERP implementations are famously resource-intensive, highly complex, time consuming, and unpredictable in terms of cost. The primary challenge that often leaves companies stuck when it comes to ERP is that most companies cannot handle a project of such complexity as it requires huge amounts of resources. Lack of budget and skilled personnel prevent many companies from focusing on the steps necessary to ensure that the new ERP is configured and rolled out in order to meet the best business needs of the company. Then there are people, technological, business process, implementation, and operational issues that increase the risk of ERP implementations.

In this section, we will discuss the various risks associated with the planning, implementation, operation, O&M of the ERP system. Of the various risk factors, issues involving are the most critical. According to a study conducted by Deloitte Consulting [2], issues involving people are the key all along the way—before, during, and after the ERP implementation. We must realize that the success of an ERP implementation, which is considered to be a complex technical undertaking, is ultimately a people project. The survey shows how important the people issues are compared to process and technological issues (see Fig. 6.1).

PEOPLE ISSUES

People—employees, management, implementation team, consultants, and vendors—are the most crucial factors that decide the success or failure of an ERP system. Implementing an ERP system is a change and it is human nature to resist change. Thus, any ERP implementation will face some amount of resistance. Users will be skeptical about the new system. But for an ERP implementation to succeed, the co-operation of everyone involved is an absolute necessity.

If employees are not convinced about the importance and the benefits of using an ERP system, there is a danger of non-cooperation, which can result in the failure of the system. It is very important, therefore, that users be convinced before implementing the system. Forcing the system on

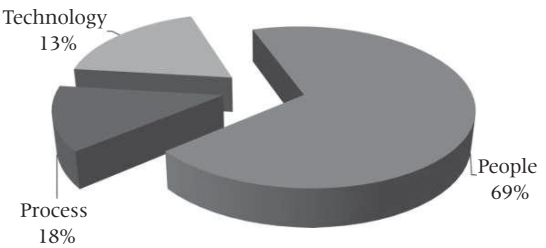

Figure 6.1 Risks of ERP.

unwilling people will only harden their resolve to revolt. The main people issues are given below and explained in the forthcoming sections:

1. Change management
2. Internal staff adequacy
3. Project team
4. Training
5. Employee re-location and re-training
6. Staffing (includes turnover)
7. Top management support
8. Consultants
9. Discipline
10. Resistance to change

Change Management

The ERP system will definitely change the way companies do business and the way people work. The job profile of employees will change; some jobs will no longer be required, while new jobs will be created. The way in which the organization functions will change, the planning, forecasting, and decision-making capabilities will improve, information will get integrated, many processes will be automated, and so on. Managing these changes is a very difficult task and if not done properly can result in failure.

Changing the scope of the project is another hurdle that will create a lot of confusion and chaos. To overcome the scope hurdle, make sure a project charter or mission statement is in place. Be sure to really nail down the project requirements, and have them documented and signed by the users and senior management. Clearly define change control procedures and hold everyone to them. Tight change control procedures may end up causing friction between the project team and those who are not on the positive side of the change. Ultimately, though, the project cannot be successful if the project team is trying to hit a constantly moving target.

Internal Staff Adequacy

ERP implementation requires a large number of people—within the organization and from outside. The external people are consultants and representatives of the hardware and package vendors. However, the majority of the implementation and post-implementation team will be made up of the company employees. It is a good idea to involve more employees for the implementation as it will help in reducing employee resistance. The members of the employment team will be skilled and will be able to provide training to other employees. When a colleague imparts training, the chances of resistance and skepticism are reduced. But the challenge lies in finding people who have the necessary skills. Here the skill set of the employees of the company is critical; if sufficient skilled personnel are not available within the company, more consultants will have to be hired which will increase the implementation cost.

Project Team

ERP implementation is a very complex and sophisticated project, involving technological as well as cultural changes. People with initiative, dedication, and enthusiasm are most preferred. People who can work in coordination with the team and good in communication are most preferred. It is not the place for people whom the boss does not want. In fact, assigning some people just because they are the only ones available is one of the most crucial mistakes that the management can make.

Training

Training is perhaps the most underestimated activity of the implementation life cycle. A major complaint is lack of enough training. Although training is a project-specific activity, it appears to be widely neglected or is inconsistent in application. Furthermore, since the greater part of training takes place toward the end of the implementation cycle, when it looks like the overall cost will exceed the budget, training is the first activity to be compromised. Lack of proper training will limit people and organizations from taking full advantage of the ERP systems resulting in failed or flawed implementation.

Employee Re-location and Re-training

The development of new processes will result in the emergence of new job descriptions. Automation of manual tasks and the creation of new tasks make this inevitable. However, people tend to resist change. Thus, HR personnel need to be involved at an early stage in the implementation. The implications relating to changes in job descriptions need to be handled in an agreeable and friendly manner. Throughout, the benefits of what is being pursued should be promoted along with the well-being of those affected. In organizations where change is a pervasive feature of life, this should not be a problem. In organizations where change is unknown, then this has the potential to become a major issue.

Staffing (Includes Turnover)

The implementation, operation, and maintenance of the ERP system require skilled personnel. The allocation of employees to tasks that match their aptitude and skill set is of critical importance for success. The compensation package and other benefits should be fixed attractively as there will be heavy workload during the implementation phase and also during the initial phases of the operation or transition. Employee turnover—qualified and trained employees leaving the company—during the implementation and transition phases can affect the schedules and can result in delayed implementation and cost overrun. While contingency plans should be in place to face such emergencies, it is better to minimize the employee turnover during critical phases by keeping employees happy and content.

Top Management Support

If the ERP implementation does not have the full backing of the top management, then it is sure to fail. The complex nature of ERP projects makes it necessary to have huge resources at the disposal of the implementation team. This requires the support and permission of the top management. Another area where top management support is critical is in handling employee resistance. If employees get a feel that the management is not supporting the ERP system, then they will not embrace the new system which will result in failure. Thus, it is better not to start the ERP implementation if the top management is not fully convinced about its benefits, and if it does not enjoy the full support of the top management.

Consultants

Consultants are experts in the implementation of the ERP package. They might not be familiar with the internal workings and organizational culture. Therefore, they might inadvertently create trouble by trying to implement the ERP system without taking into account the needs of the organization. This is a sure recipe for disaster. To minimize this risk, the consultants should be assigned a liaison officer—a senior manager—who can familiarize them with the company and its working. He can also act as a guide and intermediary between the consultants and the implementation team, until the consultants are familiar with the company and the people.

Discipline

The ERP project requires great amount of discipline from the management and the employees. The management has to constantly monitor the implementation, O&M of the ERP system and take corrective actions as and when necessary. The employees should learn how to properly use the system and then should use it properly. They should not try to bypass the system or sabotage it, just because the system requires a few things in a different manner. The managers and decision-makers should use the information integration and availability to make better and informed decisions. All this requires discipline and determination—discipline to learn and determination to practice what is learned.

Resistance to Change

One main reason for the resistance is ignorance. People always have a lot of misconceptions about ERP—it will increase workload, it will hinder creative work, it will make people jobless, and so on. However, if the ERP implementation team, backed by the management, spends a little time and effort in educating users about ERP and how it will help them and the company, then user resistance can be reduced if not fully eliminated.

PROCESS RISKS

The ERP system will introduce hundreds of new business processes and will eliminate a lot of existing processes. This is one main reason for the implementation of the ERP system—to improve, streamline, and make the business process more efficient, productive, and effective. Managing the implementation of the business processes is a factor that will decide the success of the ERP implementation. The main areas of concern are given below:

1. Program management
2. Business process reengineering
3. Stage transition
4. Benefit realization

Program Management

ERP is heavily transaction focused and is used to manage essential operational functions such as commercial, materials management, and procurement planning, and order tracking and logistics. ERP applications are multi-module in nature and often include finance and human resource management as well. ERP is highly applicable both in program- and product-based industries. The details of business processes and requirements are different for each industry, but all require up-to-date information about the program or product. This translates into the common requirements of information integrity and availability at the right time and in a right manner. While some of this information is the domain of ERP systems, the rest is program management information that has no place in ERP, but is essential for program execution. In spite of this oft-noticed shortcoming, there are little or no program management links to traditional ERP.

Typically, manufacturing industries do not use enterprise-wide program management and execution applications. At best, desktop project management software may be used, which have no links to live ERP systems and offer little or no collaboration and execution features. The result is an information gap between day-to-day program management activities and ERP-enabled functions like materials and procurement planning, logistics, and manufacturing. Consequently, key activities such as cost, quality, and schedule management functions lack up-to-date information. This is where

program execution and management applications can help the organization. By bridging the information gap between traditional ERP-based functions and high-value operational management functions, such applications can provide reliable real-time information linkages to enable high-quality decision-making.

Business Process Reengineering

Business process reengineering (BPR) means not just change—but dramatic change and dramatic improvements. This dramatic change is achieved by the overhaul of organizational structures, management systems, job descriptions, performance measurements, skill development, training and most importantly, the use of IT. BPR will impact every aspect of how the organization runs its business. Change on this scale can cause results ranging from enviable success to complete breakdown and failure.

Stage Transition

Stage transition or "who is responsible after we go live?", is a question that needs to be addressed very carefully and implemented very judiciously and diplomatically. There are a lot of people involved in the ERP implementation project—IT people, ERP experts, process experts, site leaders, the project manager, the steering committee, and so on. Going live also involves hundreds of people, in dozens of roles. However at go-live, once the program is operational, the way roles change and the way such change is orchestrated, can be an even larger undertaking. It can also be more emotionally intricate: for instance, the often delicate negotiation necessary to establish 'who will decide what' in the post-go-live environment. It is hard to downplay how different this new phase of life really is—for everyone.

Benefit Realization

Implementing the ERP system and realizing the promised benefits are two different ball games. Implementation can be a success, but if the operational phase is not planned and organized properly with the support of all the people involved, then the promised benefits will not materialize. Here, the most important factors are employee participation, training and re-training, management support, and making full use of the capabilities of the system.

TECHNOLOGICAL RISKS

Technology is advancing at an astonishing pace. ERP vendors are bringing out products and features to keep pace with these technological advancements to remain competitive. The organizations that have implemented ERP systems should keep abreast of the latest technological developments and implement what is required to survive and thrive. The technological issues are:

1. Software functionality
2. Technological obsolescence
3. Application portfolio management
4. Enhancement and upgrades

Software Functionality

ERP systems offer a myriad of features and functions that can overwhelm the users. Not all features are required by all organizations. Installing an ERP system that has hundreds of features that nobody

is going to use is a waste of time, effort, and money. Therefore the management, in consultation with ERP experts and vendors, should decide on what features are required by the company and then install only those specific functionalities. The only thing that should be remembered is that the ERP system that is chosen should be capable of incorporating and supporting additional features and functionalities that the organization might require at a future date. Implementing all the functionalities and features just for the sake of it can be a recipe for disaster.

Technological Obsolescence

Any technology that is recent today will become obsolete in a few years, as newer, faster, and more efficient technologies are being developed every day. The ERP system is no exception; it will become obsolete as time goes on. However, the organization should select the packages, vendors, and technology that has the best chance of returning the investment or ones that will not become obsolete in the near future. Here the choice or technology, architecture of the product, ease of enhancements, ease of upgrading, quality of vendor support, etc., are critical.

Application Portfolio Management

The typical IT organization expends as much as 80% of its human and capital resources maintaining an ever-growing inventory of applications and supporting infrastructure. Born of autonomous business-unit-level decision-making and mergers and acquisitions, many IT organizations manage multiple ERP applications, knowledge management systems, and BI and reporting tools. All are maintained and periodically upgraded, leading to costly duplication, and unnecessary complexity in IT operations. Left unchecked, the demands on the IT organization to simply maintain its existing inventory of applications, threatens to consume the capacity to deliver new projects. The application portfolio management processes focus on the selection of new business applications and the projects required to deliver them. They also extend the boundaries of the IT governance process to include the final products of IT—the deployed applications. By bringing to light the sheer number of applications in the current portfolio, IT organizations can begin to reduce duplication and complexity.

Enhancements and Upgrades

The ERP system needs to be upgraded and kept up-to-date. The people who are involved in maintenance of the ERP system should be in regular contact with the vendors to see whether any upgrades or updates are available. All patches and upgrades should be installed to ensure that the tools are working at their maximum efficiency. Also any enhancement requests like adding new features, new modules, etc., should be done periodically. Here the risk is the vendor closing shop or stopping support for the system. Therefore, care must be taken while selecting the vendor and upgrade/support contracts should be signed to minimize the risks.

IMPLEMENTATION ISSUES

ERP implementations are plagued with tales of lost millions and withdrawals after the implementation. Many of the most experienced IT organizations have failed. What are the secrets? What are the traps? Here are a few aspects from the vendor's point of view. They are by no means the core aspects, nevertheless they are missed in many implementations. The major implementation issues are:

1. Project size
2. Lengthy implementation time
3. High initial investment

4. Unreasonable deadlines
5. Insufficient funding
6. Interface
7. Organizational politics
8. Scope creep
9. Unexpected gaps
10. Configuration difficulties

Project Size

The scope and size of the ERP implementation project is one factor that differentiates it from other projects. ERP implementation involves hundreds of people, encompasses the entire organization, affects all the employees, and lasts years. With new technological developments happening every day, the business and technological environment during the start and completion of the project will never be the same. Managing a project of such magnitude handling the uncertainties and coordinating the activities of so many people is a very tough task and involves considerable amount of risk.

Lengthy Implementation Time

ERP implementations are very lengthy projects. A typical ERP implementation takes anywhere between 1 and 4 years depending upon the size of the organization and the methodology. Keeping the momentum high and enthusiasm alive during such a long period is a very difficult task. Employee turnover is another problem that increases the risk of the implementation. All this issues will dramatically improve the complexity of the implementation job.

High Initial Investment

Most organizations do not understand the costs associated with an ERP system when they first commence the implementation. The benefits are usually well understood. The vendor will make sure of this. The costs do not surface until well into the implementation—and why should the vendor talk to an organization about the costs and difficulties when they are trying to make a sale?

ERP implementation involves huge initial investment and only after successful completion and operation of the system, the costs are recovered. However, if the implementation fails or falls short of expectations, the company will incur huge losses and can go bankrupt.

Unreasonable Deadlines

Management can sometimes insist on unreasonable deadlines for the ERP implementation project. However if the project implementation is not done properly and proper procedures are not followed in order to save time, it can result in more delays and project failure. Thus the project management team should only accept reasonable deadlines and achievable targets. Agreeing to something that is impossible and then taking shortcuts to achieve those unattainable goals is a surefire recipe for disaster.

Insufficient Funding

One of the most common reasons for the failure of the ERP implementation is lack of sufficient funds. There are a lot of hidden costs in an ERP implementation. If the budget is allocated without proper homework and without consulting experts, then the implementation will have to be stopped along the way, due to lack of funds. Thus, it is important to allocate necessary funds for the ERP implementation project and then allocate some more for contingencies.

Interface

An ERP system typically becomes the 'center of the universe' for the organization when it is implemented. However, because of gaps in the functionality, time constraints, and political issues, there are usually many interfaces to other systems. Interfacing with legacy data may involve connections to all mainframes, UNIX, Windows NT, and other systems. The interfaces must have the ability to handle complex data sources and legacy data types. Other client/server systems must also exchange data with the ERP system. The ERP software may interface with external business partners via electronic data interchange (EDI) or electronic funds transfer (EFT) protocols. With e-commerce on the rise, ERP systems must also be able to send and receive data over the web, particularly in those organizations involved with electronic commerce. Failing to create the necessary interfaces could provide fatal for the ERP system.

Organizational Politics

Every organization has some amount of internal politics. If the external consultants, vendor representatives, and the implementation team members are caught between these internal fights, it can affect the successful implementation of the project.

Scope Creep

Scope management procedures must also be created and enforced to prevent 'never ending project' syndrome. Constant scope changes, whether increases or decreases, cause confusion among project team members. The primary focus of scope management is on defining and controlling what is and is not included in the project. The project manager must work with other departments to clearly define the project scope. If the project scope is not defined properly, required work is missed, jeopardizing the project success. Work outside the scope of the project may be done, affecting the budget.

The scope of an ERP project has several components. The ERP project team must decide which business processes will be included in the implementation. This choice of the business processes decides the ERP functional modules that are to be implemented. If an organization has more than one business unit or line, the team must decide which divisions to include in each phase of the rollout. The IT organization must determine which technologies will be replaced and upgraded, and which will exchange data through interfaces, until the rollout is complete.

Unexpected Gaps

The gap between the promise of an ERP system and the business value actually delivered once the project has been deployed is great. Enormous cost overruns, deadlines missed in some cases by years, and even abandoned implementations make clear that managing ERP projects is a complex task.

No software, no matter how big and sophisticated fits every organization perfectly. And although ERP vendors will tell you that their software will solve all your problems, there will still be gaps. These gaps may be small, or extremely large and problematic. ERP project managers frequently run into political minefields when doing gap analyses. The main problem is that each time a gap is identified it requires additional money to fix.

To solve this problem, a thorough analysis of the package selection process needs to be carried out and ensured that everyone at every level knows what the software can or cannot do. Start creating a gap document early, because the gap analysis document is very useful for stakeholder management. It provides direction on project management and provides a clear knowledge of what will need to be done. The review of gaps and design of the adapted implementation program should detail the change scope, cost and benefit, as well as the adapted project plan.

Configuration Difficulties

The ERP system is re-configured or customized in a number of ways—customization (changes made to ERP functionality via internal configuration switches), custom-code 'add-ons' (often coded in a vendor-provided language such as SAP's ABAP/4), third-party vendor 'bolt-ons' and modification (changes made to the code of the ERP itself—either by the user or the vendor). Whether to use the processes that come with the package (the best business practices) or to customize the ERP package to suit the needs of the organization is a decision that should be taken with a lot of thought, care, and consultation with experts—both in-house and external. Also, many ERP systems are not fully customizable. There are many areas that cannot be customized or are very difficult to customize. These aspects add to the risk of the ERP implementation.

OPERATION AND MAINTENANCE ISSUES

Most companies treat ERP implementation as projects, with the assumption that someday the project will end. And they are right; the implementation project will end, but the ERP system cannot end with the implementation. In fact, once the implementation phase ends and employees have started using the ERP system, the real benefits of the ERP will be seen. An ERP system is not a project; it is a way of life. No organization can say 'we're finished' and few ever will. There will always be new modules/features and versions to install, new persons to be trained, new technologies to be embraced, refresher courses to be conducted, and so on. Even if an organization could declare final victory on implementation of ERP, more time will be needed to gain real business value from the ERP system. Thus, ERP O&M requires a lifelong commitment by the company management and users of the system.

THE UNIQUE RISKS OF ERP PROJECTS

Are there risks that are unique to ERP projects? What inherent risks are there in enterprise-wide ERP projects that are not found in non-ERP projects? Some of them are risks dealing with organizational factors, employee skills, software systems design issues, and technology integration factors.

One of the most important risk factor is the failure to redesign the business process to suit the best practice business process of the system and instead trying to customize the system to suit the organizations existing and often inefficient business processes. The integration of business functions, elimination of redundant databases, and streamlining of organizational processes are all essential for project justification and this cannot be achieved if inefficient practices are retained.

As we have already discussed in the section 'people issues', a unique challenge involved in ERP systems implementation is acquiring the necessary skills. Insufficient training and re-skilling of the IT workforce in new ERP technology, insufficient internal expertise, failure to mix internal and external expertise effectively, and lack of business analysts are all risks associated with the recruitment and retention of IT professionals. This risk factor is aggravated by the scarcity of ERP-trained systems developers and the high-market demand for their skills. The investment in recruiting, re-skilling, and retraining IT professionals is very high. The problem of retention is further aggravated by the tendency of highly trained ERP analysts to jump to firms offering higher salaries and perks.

Some other risk factors that are unique to ERP implementation are non-adherence to standardized specifications, data migration from legacy systems, lack of top management support, etc. The complete list is given in Table 6.1.

Table 6.1 Risk factors unique to ERP implementation

Risk Category	Risk Factors
Organizational factors	01. Failure to redesign business processes 02. Failure to follow an enterprise-wide design which supports data integration
Employee skills	03. Insufficient training and re-skilling 04. Insufficient internal expertise 05. Lack of business analysts with business and technology knowledge 06. Failure to mix internal and external expertise effectively 07. Lack of ability to recruit and retain qualified ERP systems developers
Management factors	08. Lack of senior management support 09. Lack of proper management control structure 10. Lack of a champion 11. Ineffective communications
Software systems design issues	12. Failure to adhere to standardized specifications which the software supports 13. Lack of integration 14. Poor data quality of legacy data and data migration problems
User training and involvement	15. Insufficient training of end-users 16. Ineffective communications 17. Lack of full-time commitment of customers to project management and project activities 18. Lack of sensitivity to user resistance
Technology planning and integration	19. Inability to avoid technological bottlenecks 20. Attempting to build bridges to legacy applications

MANAGING RISK ON ERP PROJECTS

Ensuring a smooth ERP migration is complex and every implementation entails a certain level of business and technical risk. There are a number of factors that affect an implementation's level of risk, including the number of sites that you are going live with, how many legacy systems are being replaced, and how many users will be affected.

Managing risk on an ERP project is crucial to its success. What is a risk? Simply defined, a risk is a potential failure point. There are thousands, maybe even millions of potential failure points on an ERP project, in the form of untested technology and untested staff, political landmines, etc. Thus, how do you keep failures at bay? While various risk management books and methodologies offer variations on a theme, there are generally five steps to managing risk:

1. Find potential failure points or risks
2. Analyze the potential failure points to determine the damage they might do
3. Assess the probability of the failure occurring

4. Based on the first three factors, prioritize the risks
5. Mitigate the risks through whatever action is necessary

Project team members must rely on their experience, and on advice from others to find potential failure points or risks. Track through the entire project plan and look for areas of improvement. One of the easiest and most effective ways to find potential failure points is to take opinion from other organizations that have implemented similar projects. Cost estimates are probably the most common potential project failure points. Other potential failure points include lack of an executive sponsor, under qualified project managers, and no clear objectives for the project.

The next step is to determine the severity of the potential failure on the budget, project timeline, or the users' requirements. Assessing the likely impact and the probability of the failure occurring is more of an art than science, studying the ERP package in depth and the business. A risk management team should be built that brings together those individuals that have the knowledge and experience to know what might happen. This team must have experience in implementing the specific ERP package for an organization of approximately the same size and in the same industry.

Based on the first two factors, prioritize the risks. Decide which risks should be eliminated completely, because of the potential for heavy impact on critical business processes. Set up a monitoring plan for risks that should have regular management attention. Make the entire team aware of those risks that are sufficiently minor to avoid detailed management attention, but which the team should watch for potential problems.

There are a number of factors that affect an implementation's level of risk, including the number of sites that you are going live with, how many legacy systems are being replaced, and how many users will be affected. In general, the variables that are most likely to reduce the business risk of your migration include the following.

- **Phased instead 'big bang' approach to migration**—Cutting over your systems all at once generally increases your risk, particularly on large projects across multiple locations/countries.
- **Get management support**—Get top management support for ERP implementation by justifying the cost of the implementation by showing the benefits and ROI and establishing strong project leadership.
- **Change management**—Manage change through leadership and effective communications.
- **Sufficient training**—The better the training you provide users, the fewer problems you will face. Identify and implement strategies for re-skilling the existing IT workforce and acquire external expertise through vendors and consultants when needed.
- **Use experts**—Use consultants and business analysts who have both business and technology knowledge.
- **Reengineer the organization**—Reengineer business processes to 'fit' the package rather than trying to modify the software to 'fit' the organization's current business processes.
- **Legacy system planning**—What are you going to do with your systems after go-live? Will you run them parallel for a short period until you know the new ERP system is functional? If so, have you budgeted for these costs in your ROI? Failure to answer these questions before go-live will create significant problems at cutover.
- **Thorough testing**—Unit and integration testing is very important; you significantly reduce your implementation risk if you have thoroughly tested the solution with real data and real user profiles before go-live.
- **Provide plenty of IT support**—Expect more support center call volume and staff accordingly during go-live. You will also want to make sure you have clearly defined escalation policies in place for ERP issues that your support staff is not able to handle.

- **Develop a contingency plan**—What will you do if your system does go down? Do you have manual processes you can revert to if needed? By expecting the worst-case scenario, even though it is unlikely, you will reduce the risk of a massive business failure.

It all boils down to ERP risk mitigation, and the addressing the above issues will help minimize the level of risk your business is exposed to. It is important to ensure that your project plan, budget, and staffing consider these items. You mitigate risks by reducing either the probability or the impact. The probability can be reduced by action up front to ensure that a particular risk is reduced. The project risk plan should include a set of steps to recover from each risk, should failure occur. The team must know the person accountable for recovery from each specific risk and the action to be taken to resolve it. The team must know the symptoms of the impending failure and act to prevent it from occurring, if possible. An example is to test a particular operating system or hardware component to prove that it works, prior to go-live. Doing a pilot implementation or prototyping the first set of ERP interfaces are both examples of risk mitigations.

SUMMARY

The implementation of ERP systems has adversely affected many organizations. Given the many reports of substantial failures, the implementation of packaged ERP software and associated changes in business processes has proved not to be an easy task. The ERP system cannot be implemented in a totally risk-free environment. The only thing that differentiates successful and flawed or failed implementations is the way in which the risks were anticipated, handled, and mitigated. The sheer size and complexity of ERP implementations makes managing these projects difficult. There are really three basic sides to ERP management, namely, people, processes, and technology.

An ERP package touches the entire organization and can affect nearly every employee. In many cases, an ERP project manager will not be able to know who will be affected, which can lead to some rude shocks. Enumerate and discuss the people issues in an ERP implementation. People—employees, management, implementation team, consultants, and vendors—are the most crucial factor that decides the success or failure of an ERP system. The main issues posed by people are change management, internal staff adequacy, project team, training, employee re-location and re-training, staffing (includes turnover), top management support, consultants, cost of ownership, discipline, resistance to change, etc.

The ERP system will introduce hundreds of new business processes and will eliminate a lot of existing processes. This is one main reason for the implementation of the ERP system—to improve, streamline, and make the business process more efficient, productive, and effective. Managing the implementation of the business processes is a factor that will decide the success of the ERP implementation. The main areas of concern are program management, business process reengineering, stage transition, and benefit realization.

Technology is advancing at an astonishing pace. ERP vendors are bringing out products and features to keep pace with these technological advancements to remain competitive. The organizations that have implemented ERP systems should keep abreast of the latest technological developments and implement what is required to survive and thrive. Some of the technological issues are software functionality, technological obsolescence, application portfolio management, enhancements and upgrades, etc.

ERP implementations are plagued with tales of lost millions and withdrawals after implementation. Some of the implementation issues are project size, length implementation time, high initial investment unreasonable deadlines, insufficient funding, interface, organizational politics, scope creep, unexpected gaps, configuration difficulties, etc.

Most companies treat ERP implementation as projects, with the assumption that someday the project will end. Even though the implementation project will end, the ERP system cannot end with the implementation. Thus, ERP O&M requires a lifelong commitment by the company management and users of the system.

Ensuring a smooth ERP migration is complex and every implementation entails a certain level of business and technical risk. There are a number of factors that affect an implementation's level of risk, including the number of sites that you are going live with, legacy systems that are being replaced, number of users affected.

REVIEW QUESTIONS

1. Explain the risks of ERP implementation.
2. Discuss the risks involved in an ERP implementation.
3. Give a list of the most frequent and important risk factors of ERP implementation.
4. What problems can bad data in the current system create when migrated to the new system?
5. How do you minimize risk of ERP implementation?
6. Why do you need a contingency plan during the ERP implementation?
7. Discuss some of the well-known ERP implementation failures.
8. What separates successful ERP implementations from a failed one?
9. Why are ERP packages difficult to implement?
10. What are the three types of issues that increase the risk of ERP implementations?
11. What are the people issues during an ERP implementation project?
12. Why people issues are considered the most crucial factor for the success of the ERP implementation project?
13. What are the main people issues of the ERP implementation project?
14. What is change management and how does it affect the success of the ERP implementation project?
15. Explain the effect of internal staff adequacy on the success of the ERP implementation.
16. How does the constitution of the project team affect the ERP implementation project?
17. Why is training considered a crucial factor that decides the success of the ERP implementation?
18. How employee relocation and re-training affects the outcome of an ERP project?
19. What are staffing and employee turnover issues and how are they related to an ERP implementation?
20. Why is top management support critical for the success of an ERP project?
21. How do consultants contribute to the success of the ERP implementation?
22. What is cost of ownership and what is its relation to ERP implementation
23. How does one deal with problems like discipline and resistance to change while implementing the ERP system?
24. What are the main process risks of the ERP implementation?
25. What is program management and why it is considered as an implementation risk?
26. What is business process reengineering and how does it affect the ERP implementation?
27. What do you mean by stage transition and how does it affect ERP implementation success?
28. What do you mean by benefit realization and what is its connection with ERP implementation?
29. What are the main technological risks of the ERP implementation?
30. What is the importance of software functionality in an ERP implementation?
31. What do you mean by technological obsolescence and why it is an implementation risk?
32. What do mean by application portfolio management?
33. What is the significance of software enhancements and upgrades in an ERP implementation?
34. What are the main implementation issues of the ERP project?

35. How does project size and lengthy implementation time of ERP projects affects the success of implementation?
36. Why do ERP implementations need high initial investments?
37. How do unreasonable deadlines affect the ERP project?
38. Why is sufficient funding important for successful ERP implementation?
39. Why are interfaces important and why are they difficult to implement?
40. How does organizational politics affect ERP implementation?
41. What do you mean by scope creep and why is it an issue for ERP implementation?
42. What are unexpected gaps and how do they affect the ERP implementation?
43. What are configuration difficulties and how do they affect the ERP implementation?
44. What are the operation and maintenance issues of an ERP implementation?
45. What are the unique risks of ERP projects?
46. Explain the five steps of risk management.
47. What are the variables that reduce the business risk of the ERP implementation?
48. Explain how risks are managed and mitigated during an ERP implementation.

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Chapter 7

Benefits of ERP

INTRODUCTION

ERP systems integrate all business management functions including planning, inventory/materials management, engineering, order processing, manufacturing, purchasing, accounting and finance, human resources, etc. The biggest advantage of an ERP system lies in its real-time capabilities and the ability to see what is going on with the organization as it happens. It is handy when you deal with high volume of business process. With an ERP system, your organization will never have inventory shortages or lost time in transferring files.

Installing an ERP system has many advantages—both direct and indirect. The direct advantages include improved efficiency, information integration for better decision-making, faster response time to customer queries, etc. The indirect benefits include better corporate image, improved customer goodwill, customer satisfaction, and so on. Some other benefits of implementing an ERP system are:

- Streamlining processes and workflows with a single integrated system
- Reducing redundant data entry and processes
- Integrating and sharing of information across the departments
- Introducing uniform processes that are based on recognized best business practices
- Improving workflow and efficiency
- Improving customer satisfaction based on improved on-time delivery, increased quality, shortened delivery times
- Reducing inventory costs as a result of better planning, tracking, and forecasting of requirements
- Expediting collections based on better visibility into accounts and fewer billing and/or delivery errors
- Reducing vendor pricing by taking better advantage of quantity breaks and tracking vendor performance
- Tracking actual costs of activities and perform activity-based costing
- Providing a consolidated picture of sales, inventory, and receivables
- Guaranteeing the security of the organization's data
- Communicating better across the various departments

As we have seen in Chapter 5, some of the benefits are quantitative (tangible) while many others are non-quantitative (intangible). We will list some of these benefits and discuss them in detail later.

Figure 7.1 taken from a survey conducted by Deloitte Consulting shows the major quantifiable (tangible) benefits of an ERP system. The respondents who participated in the survey were asked to check the tangible benefits of the ERP systems from a set of benefits. Most respondents felt that inventory reduction was the main benefit, followed by personnel reduction and productivity improvements.

Figure 7.2 also taken from a survey conducted by Deloitte Consulting shows the major non-quantifiable (intangible) benefits of an ERP system. The respondents who participated in the survey were asked to check the intangible benefits of the ERP systems from a set of benefits. Most respondents

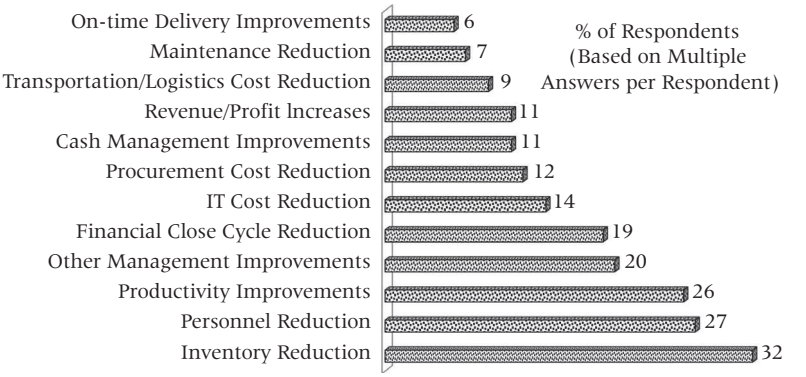

Figure 7.1 Tangible benefits of ERP.

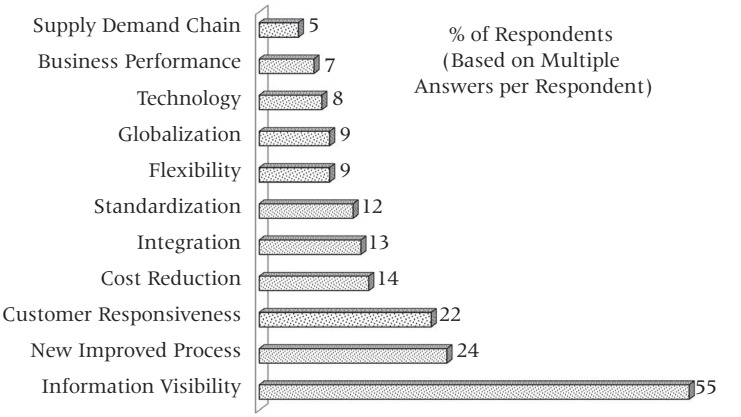

Figure 7.2 Intangible benefits of ERP.

felt that information visibility or better information availability was the main benefit followed by improved business processes and improved customer responsiveness.

In this chapter, we will see some of the benefits—both tangible and intangible—of the ERP systems. They are:

- Information integration
- Reduction of lead-time
- On-time shipment
- Cycle time reduction
- Better customer satisfaction
- Improved supplier performance
- Increased flexibility
- Reduced quality costs
- Improved resource utilization
- Better analysis and planning capabilities
- Improved information accuracy and decision-making capability
- Use of latest technology

INFORMATION INTEGRATION

The first and most important advantage lies in the promotion of integration. The reason ERP systems are called integrated is because they have the ability to automatically update data between related business functions and components. For example, you need to only update the status of an order at one place, say in the order processing system; all the other components will automatically get updated. Therefore, when a customer places an order and the order is entered into the system, it triggers a lot of processes and actions in a number of modules—finance, production planning, production, inventory management, and so on. The invoices are automatically generated, materials requirements are identified, production is planned, the inventory is checked and any item required but not in stock is ordered, and the customer is informed as to when the ordered item can be expected. The uniqueness of this system is that information updating happens instantaneously. Thus, you get up-to-the-minute information at your fingertips. This information integration leads to better decision-making and trouble shooting of problems. Another advantage of this integration is that the people who are involved in a project are also interlinked to each other. This integration has tremendous potential for improving productivity.

REDUCTION OF LEAD-TIME

The elapsed time between placing an order and receiving it is known as the lead-time. It plays a significant role in purchasing and inventory control. Most purchasing departments urge the materials management to anticipate material demands well ahead of actual need. All inventory systems have safety mechanisms like safety or buffer stock, re-order level, and so on built into them to avoid a situation where the material is out of stock. The non-availability of an item that is required for production can result in several hassles like missing delivery schedules, losing customer goodwill due to the delayed delivery or even losing the customer to competition. One can avoid this situation by requesting for the materials well in advance of its requirement (early requests) or by keeping a large buffer stock or maintaining a very high re-order level. Nevertheless all this means that larger inventories must be kept, which means money getting blocked. Also the practical consequence of allowing longer times for delivery is that the present lead-times just grow to take up whatever slack is expected. Perhaps this is due to the 'squeaky wheel principle'—buyers who expect the shortest lead-times complain the loudest when deliveries are late and thereby receive the most attention from suppliers. Thus, the company should find out the minimum lead-time and should attempt to correct supplier's delivery delays instead of automatically increasing allowed lead-times.

Thus in order to reduce the lead-times, the organization should have an efficient inventory management system, which is integrated with the purchasing, production planning, and production departments. In this era of just-in-time (JIT) manufacturing, the knowledge of the exact lead-times for each and every item is of paramount importance for uninterrupted production. For a company dealing with hundreds and thousands of raw materials and components, keeping track of the lead-times for each and every individual item manually is a practically impossible task.

ERP systems help in automating this task and thus make inventory management more efficient and effective. Also, since the ERP system is integrated and the materials management module is integrated with other modules like sales, marketing, purchasing, manufacturing, and production planning, the demand for a particular item can be known as early as an order is received. For example, consider that an order is received for supplying say 100 cars with air-conditioners. As soon as the order details are entered into the system, a series of actions are triggered. The system will check whether the items are available in the finished goods inventory. Then it will generate a BOM for the order and will check whether all the items are available in the inventory. Since all the records are

kept in the system's database and since everything is up-to-date, finding out the parts that are to be ordered takes no time (a task which could have taken days in the case of a manual or non-integrated system). Therefore, once the items that are to be manufactured are identified and once the production planning system prepares a production plan, the materials management module will prepare purchase orders for each and every item taking into account the lead-times and when the items are required for production. If the purchasing process has to go through the invitation of quotations, vendor selection, etc., the system takes care of that also.

As most suppliers are also connected to the organization's system, as soon as a purchase order or requisition is issued, the supplier's system is updated with that information. Thus, the supplier knows what items are to be supplied, and when. Since activities like preparation of contracts, issuing of purchase orders and payments, etc., happen through the system electronically, the savings in time are phenomenal. Thus, the ERP systems by virtue of their integrated nature, the use of latest technologies—like electronic funds transfer (EFT), electronic data interchange (EDI—reduce the lead-times and make it possible for organizations to have the items at the time when they are needed (JIT inventory systems).

ON-TIME SHIPMENT

Today, companies should be ready to deliver customer-specific products (made-to-order) with the lead-time of standard, off-the-shelf products. They should be able to change the mode of production from make-to-stock to make-to-order, yet retain the cost and time advantages of the off-the-shelf products. ERP systems also provide the freedom to change manufacturing and planning methods, as needs change, without modifying or re-configuring the workplace or plant layouts. With ERP systems, businesses are no more limited to a single manufacturing method, such as make-to-stock or make-to-order. Instead, many manufacturing and planning methods can be combined within the same operation, with unlimited flexibility to choose the best method—or combination of methods—for each product at each stage throughout its life cycle. In addition, this control and visibility comes without having to sacrifice the functionality needed to efficiently manage different types of production. Because these systems support the entire range of production strategies, only one system is needed to manage all manufacturing activities. Engineer-to-order products are planned using these systems, while the forecasting and distribution planning features handle make-to-stock items. Products that are assembled to order can be planned using the extensive production planning capabilities of these ERP packages. Various production scenarios can be simulated using the simulation features and the best one can be selected. Also, since the different functions involved in the timely delivery of the finished goods to the customer—purchasing, materials management, production, production planning, plant maintenance, sales and distribution—are integrated and the procedures automated, the chances of errors are minimal and the production efficiency will be high. Since all the information is available to the management at expected details and since the system has exception handling features (which will issue warnings if things are going out of control), the management can keep track of things and can take corrective actions at the appropriate time.

Another step to shorter product development cycles is increased efficiency in design and development activities. ERP systems are designed to help your company trim data transfer time, reduce errors, and increase design productivity by providing an automated link between engineering and production information. Most of these systems allow smooth integration with popular CAD packages to simplify the exchange of information about drawings, items, BOMs, and routings. Using the engineering change control (ECC) system, businesses can gain effective control over engineering change orders (ECOs). The company can define the authorization steps for approving and implementing an ECO. When these steps

are completed, the ERP system automatically implements the change in the production database. Thus, by integrating the various business functions and automating the procedures and tasks, the ERP system ensures on-time delivery of goods to the customers.

REDUCTION IN CYCLE TIME

Cycle time is the time between placement of the order and delivery of the product. At one end of the manufacturing spectrum is the make-to-order operation where the cycle time and cost of production are high. This is because in a make-to-order situation, the manufacturer starts making the product or designing the product only after receiving the order. He will procure the materials and components required for production only after getting the order. On the other end of the manufacturing operations is the make-to-stock approach, where the products are manufactured and kept in the finished goods inventory before the order is placed.

In both cases, the cycle time can be reduced by the ERP systems, but the time will be saved more in the case of make-to-order systems. In the case of make-to-stock, the items are already manufactured and kept in warehouses or with distributors for sales. Here the cycle time is reduced not in the shop floor, but during the order fulfillment. In the earlier days, even for the made-to-stock items, the cycle time used to be high. This is because the process was manual, and if computerized was not integrated. Suppose a customer places an order, the order entry clerk has to check whether the ordered product is available in the warehouse nearest to the customer. If it is not available there, then he will have to check whether it is available in other warehouses or with any of the distributors. Then he will have to process the order, inform the concerned warehouse or distributor to ship the item and then inform the finance department to raise the invoice, and so on. All these used to take time, days and sometimes weeks. But with an ERP system, as soon as the order is entered into the system, the system checks the availability of the items. If it is not available at the warehouse closest to the customer, then the warehouse that is closer and which has the item in stock is identified. The warehouse is informed about the order and the shipment details are sent to the distribution module, which will perform the necessary tasks like packaging, picking, and so on, so that the goods are delivered on time. The finance module is also alerted about the order so that they can raise the invoice. All these actions are triggered by the click of a button by the order entry clerk. Since all the data, updated to the minute, is available in the centralized database and all the procedures are automated, almost all these activities are done without any human intervention. This efficiency of the ERP systems helps in reducing the cycle time.

In the case of make-to-order items, the ERP systems save time by integrating with CAD/CAM systems. Dramatic time and cost reductions are possible when CAD-engineered designs are converted automatically into software programs for computerized production machines using CAD/CAM systems. This automatic conversion eliminates the costly and time-consuming steps of having a person convert design drawings into a computer program for computer-controlled production equipment, such as robots or machine tools. These systems reduce cycle times by 30%–50%. Combined with this, the automation achieved in material procurement, production planning, and the efficiency achieved through the plant maintenance and production systems of the ERP packages go a long way in reducing the cycle times.

IMPROVED RESOURCE UTILIZATION

As manufacturing processes become more sophisticated and as the philosophies of elimination of waste and constraint management achieve broader acceptance, manufacturers place increased

emphasis upon planning and controlling capacity. The creation of an accurate, achievable production schedule requires the availability of both material and capacity. It is useless and indeed wasteful to have financial resources tied up in material if the capacity is insufficient or improperly planned. Waste not only raises costs, it also affects customer service levels and customer goodwill.

The capacity planning features of most ERP systems offer both rough-cut and detailed capacity planning. The system loads each resource with production requirements from master production scheduling, material requirements planning, and shop floor control (detailed capacity planning). All plan in place, firm planned and released production is evaluated and loaded against capacity definitions for each resource, and all capacity requirements are pegged back to the orders comprising the load. Capacity definitions are provided from work center and machine records. Work centers can be facility-specific or enterprise-wide. Any work center can be designated as a critical work center for evaluation by rough-cut capacity planning. This capability provides an easy and efficient way to designate bottleneck operations that act as system constraints. As the constraints change over time, the user can re-designate the work centers as critical or non-critical. High-volume repetitive environments are further supported by both from and to locations where material are consigned. These locations are used for pull system back-flushing/replenishment and can be designated by individual machines within the work center. These systems provide further refinement of available capacity by providing definitions for specific machines or pieces of equipment. Each work center also has user-defined input/output control tolerance factors to control the level of action message sensitivity, a factor for average efficiency, separate speed factors for labor and machine, designation of shift/hours schedule and maximum desired load percentage (with 100% as the default). Capacity minimums can also be designated for processes involving vessel size constraints and fixed cycle constraints (heat treating, pickling, plating, sand blasting, paint dipping, etc.).

Also the ERP systems have simulation capabilities that will help the capacity and resource planners to simulate the various capacity and resource utilization scenarios and choose the best option. The efficient functioning of the different modules in the ERP system like manufacturing, materials management, plant maintenance, sales, and distribution ensures that the inventory is kept to a minimum level, the machine down time is minimum and the goods are produced only as per the demand and the finished goods are delivered to the customer in the most efficient way. Thus, the ERP systems help the organization in drastically improving the capacity and resource utilization.

BETTER CUSTOMER SATISFACTION

Customer satisfaction means meeting or exceeding customers' requirements for a product or service. Assessment of the degree of satisfaction is usually made on at least three measures:

- Whether the product or service includes the features that are most important to the customer
- Whether the company can respond to the customers' demands in a timely manner, a criterion that is especially important for custom products and services
- Whether the product or service is free of defects and performs as expected

ERP systems have proved that they can produce goods at the flexibility of make-to-order approach without losing the cost and time benefits of made-to-order operations. This means that the customer will get individual attention and the features that he/she wants without spending more money or waiting for long periods. Also, with the introduction of web-enabled ERP systems, customers can place the order, track the status of the order, and make the payment from the comforts of their homes. The customer could get technical support by either accessing the company's technical support knowledge base (help desk) or by calling the technical support. Since all the details of the

product and the customer are available to the person at the technical support department, the company will be able to better support the customer. All these are possible because of the use of the latest developments in IT by the ERP systems and go a long way in improving customer satisfaction.

IMPROVED SUPPLIER PERFORMANCE

The quality of the raw materials or components and the capability of the vendor to deliver them on time are of critical importance for the success of any organization. Therefore, an organization needs to choose its suppliers or vendors very carefully and monitor their activities closely so that problems can be rectified before it can disrupt the functioning of the company. To realize these benefits, corporations rely heavily on supplier management and control systems to help plan, manage, and control the complex processes associated with global supplier partnerships.

ERP systems provide vendor management and procurement support tools designed to coordinate all aspects of the procurement process. They support the organization in its efforts to effectively negotiate, monitor, and control procurement costs and schedules while assuring superior quality products. The supplier management and control processes constitute features that will help the organization in managing supplier relations, monitoring vendor activities, and managing supplier quality.

There is a growing trend for organizations to establish partnership agreements with their suppliers. Through such business relationships, mutually beneficial results have been achieved in the areas of quality, delivery, and cost. To realize these benefits, companies rely heavily on procurement support systems to help manage and control processes associated with supplier partnership agreements. Request for quotations, contract negotiation and control, purchase order release and delivery are the process steps considered when formalizing such partnerships. Complexities arise in the areas of types of products or services being procured, quantity and price breaks, terms of the agreement, and methods employed for tracking and controlling the process. The procurement support system that provides immediate feedback, flexibility, and comprehensiveness in managing supplier partnerships will provide a clearer competitive advantage to the enterprise.

ERP systems have features that will enable the companies in realizing the benefits associated with established partnership agreements. Supplier quotations and contracts can be created to support the procurement of all products and services required by the enterprise. Examples of this include inventory and non-inventory products, office supplies and services, as well as products requiring direct shipment to customers. Since each agreement must stand on its own merit, multiple quantity and price breaks, along with terms specifying when the quotation or contract becomes effective and expires, are supported. To address the methods companies employ when tracking and controlling these agreements; these systems provide a number of alternatives.

After contracts are established, purchase orders and requisitions are tracked as they are released against a corresponding contract. The ERP system searches for the best-fit supplier contract and automatically assigns it to the corresponding purchase order or requisition. If changes are necessary, the user can override the contract selection made by the system. As it is imperative to know the status of a supplier quotation or contract, the system provides immediate feedback to the organization. Detailed history provides for the deployment of in-depth procurement analysis tools. The supplier management professional can easily compare total quotation or contract commitments to actual purchasing activities.

With the flexibility and comprehensiveness of the system's supplier quotation and contract management capabilities, organizations can efficiently manage their supply-side trading partners and, as a result, gain significant cost and delivery procurement benefits for their business.

Also, since most suppliers have their systems connected to the company's system, the information

regarding an order is transmitted to the supplier's systems almost instantaneously. This saves a lot of time and gives the supplier more time for fulfilling the orders.

Businesses generally classify their suppliers into certified, approved, and probationary categories for quality management and auditing purposes. Additionally, supplier certification programs must be capable of distinguishing between suppliers and original manufacturers. The objective of supplier auditing and classification programs is to ensure maximum conformance of purchased materials and services to specification, while minimizing lead-times and costs.

The quality management system in the ERP systems provides all the tools needed to implement total quality management programs within an organization's procurement function. Using the system, organizations can establish and manage highly effective supplier certification programs, which ensure maximum conformance of purchased material to specification, while maintaining lead-times and costs. The quality control program can be managed on the basis of original manufacturer, leaving the buyers free to seek the best possible price and delivery terms from a variety of qualified distributors or brokers.

INCREASED FLEXIBILITY

As competition is growing, companies must learn to respond more rapidly to customers' demands as well as changes in the market. They will need to be able to design new products or re-design old products quickly and efficiently. Only then will companies be able to capitalize on opportunities while they are available. The window of opportunity is often quite small. The manufacturing process must be flexible enough to accommodate new product designs with minimal disruption or time loss.

Flexibility is a key issue in the formulation of strategic plans in companies. Sometime flexibility means quickly changing something that is being done or changing completely to adjust to new product designs. At other times, flexibility is the ability to produce in small quantities in order to obtain a product mix that may better approximate actual demands and reduce work-in-progress inventories. Regardless of the definition of flexibility, traditional fixed automation manufacturing facilities, while efficient, are often inflexible. Similarly, extremely flexible operations are often inefficient. The relative merits of both efficiency and flexibility is debatable. However, both are desirable.

Product flexibility is the ability of the operation to efficiently produce highly customized and unique products. Manufacturers tried to introduce some amount of flexibility by using the assemble-to-order approach. This provided some amount of flexibility without increasing the production cost, but could not be applied to all situations. Along the broad spectrum of make-to-order manufacturing, there is a growing convergence between strictly assemble-to-order (limited options and features) and completely engineer-to-order (just about anything goes, at a cost) environments. This evolving environment is often referred to as configure-to-order. Most ERP systems have now added this technique also to their systems. Using a rules-based product configuration system, configure-to-order (CTO) manufacturers are able to simplify the order entry process and retain engineer-to-order (ETO) flexibility without maintaining BOM for every possible combination of product options. Its functions and how this improves flexibility is explained in Appendix C titled, 'ERP—A manufacturing Perspective.'

ERP systems not only improve the flexibility of the manufacturing operations, but also the flexibility of the organization as a whole. A flexible organization is one that can adapt to any changes in the environment, rapidly. With technological revolution, the rules of the marketplace are changing at a rapid pace. Newer and more competitors are emerging each day. New and complex problems have to be tackled every day. New market segments have to be penetrated not in order to succeed but simply to stay in business. New marketing strategies have to be devised and implemented at very short notices. Companies have to constantly find new ways to keep the customer satisfied. For doing

all these, the company has to be flexible. The old methods of functioning will no longer work. ERP systems help the companies to remain flexible by sharing the data across the departmental barriers and automating most of the processes and procedures, thus enabling the company to react quickly to the changing market conditions.

REDUCED QUALITY COSTS

Quality is defined in different ways—excellence, conformance to specifications, fitness for use, value for the price, and so on. While manufacturing and design engineers typically are responsible for some of the technological issues in quality assurance for products, operations managers often conduct the analysis of quality-related costs, which is an important task. Strategic opportunities or threats frequently motivate the launch of aggressive quality management initiatives. Analyzing the cost of quality can provide the financial justification for implementing them. Typically the quality costs are in the range of 20% of the cost of goods sold. Carefully planning quality improvement activities not only improves quality, but lowers quality-related costs.

The American Society for Quality Control (ASQC) has developed a typology of quality-related costs that are based on the efforts of several quality masters. Operations managers have found the classification system useful for collecting data that are consistent and for identifying opportunities for controlling quality costs that will have the greatest effect on efficiency. The typology has four categories:

- Internal failure costs (costs of scrap, re-work, re-inspection, and low production yields for nonconforming items that are detected before they leave the company)
- External failure costs (warranty claims, repairs and service costs that result when the failure is detected in the marketplace)
- Appraisal costs (cost of inspecting upon arrival, during manufacture, in laboratory tests, and by outside inspectors)
- Prevention costs (design and development of new quality equipment, evaluation costs of a new product or service, training of quality personnel)

An extremely important truism is that the further along in the process an item is the more a defect costs. For example, in the design phase of a new product or service, the cost of correcting a defect may be minimal. If that defect goes undetected and the company releases the product or service to the public, it will incur a much greater cost to resolve the problems that result.

Elimination of defects in standard product designs and manufacturing methods before production is just as important as eliminating defects during production. In fact, to achieve quality levels, manufacturers must focus on identifying and correcting defects in underlying product designs and production methods, not simply inspect incoming material or finished goods. The quality management systems in ERP packages support the benchmarking and use of optimal product design, process engineering, and quality assurance data by all functional departments within the manufacturing enterprise, thereby facilitating definition of repeatable processes, root cause analysis, and the continuous improvement of manufacturing methods. This documentation supports the job functions of the quality assurance and production managers in validating the manufacturer's conformance to ISO 9000, good manufacturing practices (GMP) worldwide, and a variety of country-specific standards of quality assurance.

Specification control systems in ERP packages offer a state-of-the-art approach for documenting specifications and enable an organization to standardize and simplify its quality assurance and control functions. Sample types, sample rules, and testing levels are completely user-defined for maximum flexibility and ease of use. Maintenance of standard specifications detailed sampling instructions and testing procedures are performed on-line. Cyclic, subsequent, and repeat testing options are available to support the material acceptance function, with breakdowns of test

procedures into multiple dispositions to improve inventory turnover and reduce inspection lead-times. The ERP system's central database eliminates redundant specifications and ensures that a single change to standard procedures takes effect immediately throughout the organization. The ERP systems also provide tools for implementing total quality management programs within an organization. Original manufacturers may be defined independently from vendors so that businesses can strictly adhere to quality assurance and control functions without preventing their buyers from seeking the best possible price and delivery terms. Each item supplied by an original manufacturer may be linked to a standard product specification. Actual test results and material disposition histories are retained according to item, lot, original manufacturer, and specification for in-depth quality performance review and analysis. Material inspection systems offer a wide range of capabilities for process supervision and control. These capabilities are fully integrated with other modules like purchasing, inventory management, and shop floor control functions to ensure that the right quality control procedures are followed. Thus, by ensuring that the company has an efficient and effective quality assurance and management system, the ERP systems play a vital role in reducing the cost of quality.

BETTER ANALYSIS AND PLANNING CAPABILITIES

Another advantage provided by ERP systems is the boost to the planning functions. By enabling the comprehensive and unified management of related business functions (such as production, production planning, finance, inventory management, plant maintenance, etc.) and their data, it becomes possible to utilize fully many types of decision support systems and simulation functions, what-if analysis, and so on. For example, we could simulate the impact on the cost and schedule of using more than one shift for a product line. Furthermore, it becomes possible to carry out flexibly, and in real-time the filing and analysis of data from a variety of dimensions. The decision-makers can get information they want, thus enabling them to make better and more informed decisions.

IMPROVED INFORMATION ACCURACY AND DECISION-MAKING CAPABILITY

To survive, thrive, and beat the competition in today's brutally competitive world one has to plan for managing the future. Managing the future means managing information. In order to manage information, deliver high-quality information to the decision-makers at the right time, and automate the process of data collection, collation, and refinement, organizations have to collaborate IT and should harness its full potential and use it in the best way possible.

We have seen that in today's competitive business environment, the key resource of every organization is information. If the organization does not have an efficient and effective mechanism that enables it to give the decision-makers the right information at the right time, then the chances of that organization succeeding in the future are very remote.

The three fundamental characteristics of information are accuracy, relevancy, and timeliness. Information has to be accurate, it must be relevant for the decision-maker, and it must be available to the decision-maker when he needs it. Any organization that has the mechanism to collect, collate, analyze, and present high-quality information to its employees, thus enabling them to make better decisions, will always be one step ahead of the competition. Currently, the time available for an organization to react to the changing market trends is very short. To survive, organizations must always be on its toes, gathering and analyzing the data—both internal and external. Any mechanism that will automate this information gathering and analysis process will enhance the chances of the organization to stay ahead of the competition.

One of the major drawbacks of the legacy systems was that they did not have an integrated approach. There will be an accounting system for the finance department, a production planning system for the manufacturing department, an inventory management system for the stores department, and so on. All these systems will perform in isolation. If a person wanted some information, which has to be derived from any of these two systems, he has to get the necessary reports from both systems and then correlate and combine the data. However in reality, an organization cannot function as islands of different departments. The production planning data is required for the purchasing department. The purchasing details are required for the finance department and so on. So if all the information islands, which were functioning in isolation, were integrated into a single system, then the impact of that would be dramatic. For example, if the purchase department can see the production planning details, then it can make the purchasing schedule. If the finance department can see the purchase details as soon as it is entered in the system, they can plan for the cash flow that will be necessary for the purchases. Because the systems work in isolation, collecting and analyzing the data needed for the functioning of their department, getting information about some aspect that is dependent on more than one department is a difficult task in the case of legacy systems. But no business executive or decision-maker can take good decisions with this isolated data that he will get from the various reports produced by each department. Even if he collates the data and produces the information that he requires, he will lose valuable time that could have been better utilized in decision-making.

Therefore, what is needed is a system that treats the organization as a single entity and caters to the information needs of the whole organization. If this is possible, and if the information that is generated is accurate, timely, and relevant, then these systems will go a long way in helping the organization to realize its goals. This is the strength of ERP systems—integration and automation—and thus implementation of the ERP system will help in improving the information accuracy and better decision-making.

USE OF LATEST TECHNOLOGY

Another major advantage is the utilization of the latest developments in IT. ERP package vendors realized that in order to grow and to sustain that growth, they would have to embrace the latest developments in the field of IT. Thus they quickly adapted their systems to take advantage of the latest technologies such as open systems, client/ server technology and the Internet/ intranets. It is this quick adaptation to the latest changes in IT that makes the flexible adaptation to changes in future development environments possible. It is this flexibility that makes the incorporation of the latest technology possible during system design, development, and maintenance phases.

SUMMARY

Installing an ERP system has many advantages—both direct and indirect. The direct advantages include improved efficiency, information integration for better decision-making, faster response time to customer queries, etc. The indirect benefits include better corporate image, improved customer goodwill, customer satisfaction, and so on.

REVIEW QUESTIONS

1. List the benefits of the ERP systems.
2. What are the tangible benefits of ERP systems?
3. What are the intangible benefits of ERP systems?

4. What is information integration and how does an ERP system achieve integration?
5. How does information integration result in increased productivity?
6. How does ERP help in the reduction of lead-time?
7. What do you mean by squeaky wheel principle?
8. What do you mean by EFT and EDT and how do they reduce lead-time?
9. Explain the terms made-to-stock, made-to-order, and engineer-to-order.
10. What is on-time shipment and how does ERP system help to ship goods on time?
11. What do you mean by cycle time?
12. Explain cycle time reduction and ERPs role in it.
13. What is product flexibility?
14. What do you mean by increased flexibility and how is it achieved using the ERP system?
15. Explain the typology of quality-related costs developed by ASQC.
16. How do ERP systems help in reducing quality costs?
17. What is improved resource utilization and how does the ERP system improve resource utilization?
18. How does an ERP system help in achieving better customer satisfaction?
19. How is customer satisfaction assessed?
20. How does an ERP system help in achieving improved supplier performance?
21. How does the ERP system help in improving information accuracy and decision-making capability?
22. What is the role of ERP systems in improving the analysis and planning capabilities?
23. How does ERP make use of latest technology and what are its advantages?
24. Explain the benefits—both tangible and intangible—of ERP systems in detail.

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Part II

ERP and Technology

- ERP and Related Technologies
- Business Intelligence (BI) and Business Analytics (BA)
- E-Commerce and E-Business
- Business Process Reengineering (BPR)
- Data Warehousing and Data Mining
- On-line Analytical Processing (OLAP)
- Product Life Cycle Management (PLM)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Geographic Information System (GIS)
- Advanced Technology and ERP Security

Chapter 8

ERP and Related Technologies

INTRODUCTION

ERP is an abbreviation for enterprise resource planning, constituting the techniques and concepts for integrated management of businesses as a whole for the effective use of management resources to improve the efficiency of enterprise management.

ERP systems serve the core function of integrating separate business functions—materials management, product planning, sales, distribution, financials, and others—into a single application. However, ERP systems have three significant limitations.

1. Managers cannot generate custom reports or queries without help from a programmer and this inhibits them from obtaining information promptly so that they can act on it for competitive advantage.
2. ERP systems provide current status only, such as open orders. Managers often need to look past the current status to find trends and patterns that aid better decision-making.
3. The data in the ERP application is not integrated with other enterprises or division systems and does not include external intervention.

There are many technologies that help to overcome these limitations. These technologies, when used in conjunction with the ERP package, will help in overcoming the limitations of a standalone ERP system and thus help the users in making better decisions. ERP systems along with these technologies will help in transforming the brick and mortar companies into e-businesses. The brick and mortar companies conduct its business in the traditional way, doing most of the process manually, with no information integration and process automation. This kind of a business model is very difficult to succeed in today's competition.

Today organizations are constantly innovating methods to improve operational efficiency, reduce costs, provide high-quality and personalized customer services, improve customer satisfaction, and increase profit margins. Therefore, it is only those companies which are lean, aggressive, and which are constantly looking for ways to improve and streamline their operations will survive. For this to happen, companies have to embrace technological advancements and make full use of them. Companies that use technology, integrate it into the core of their business planning and are ready to face the challenge of conducting business in this Internet age are called e-businesses. ERP is the central or the core component around which the various technologies are integrated to build an organization that works at the speed and efficiencies of the Internet age (e-business) and where most processes are automated and things happen at lightning speed.

In this chapter, we will discuss the technologies that when integrated with the ERP system, will enable the companies to do business at high speed. Some of these technologies are data warehousing and data marts, data mining, on-line analytical processing (OLAP), supply chain management (SCM), customer relationship management (CRM), geographical information systems (GIS), intranets and extranets, electronic data interchange (EDI), digital cash, cryptography, etc. We will have a brief overview of these technologies and see how they play a vital role in transforming brick

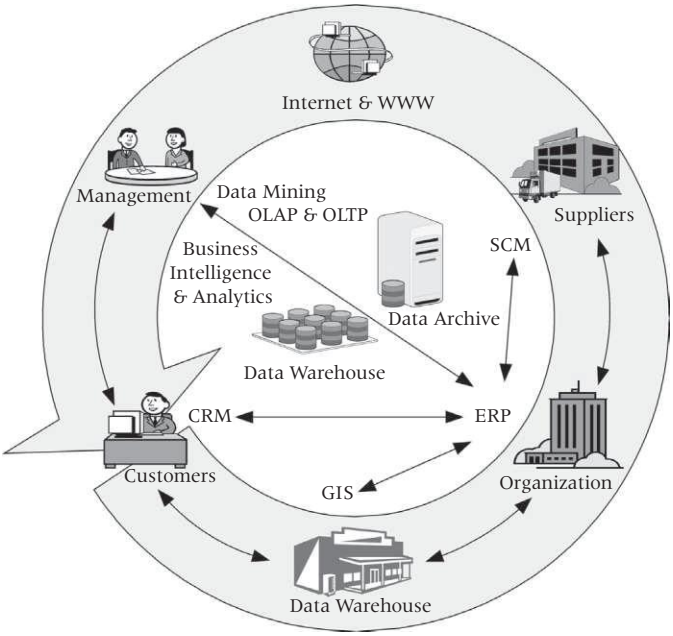

Figure 8.1 Enabling technologies and their relationships with ERP.

and mortar companies into e-businesses. The way in which these technologies fit into the e-business environment is shown in Fig. 8.1.

With the competition in the ERP markets heating up, ERP vendors are searching for ways to penetrate new market segments and expand the existing ones by integrating these technologies into the ERP system. In this chapter, we will also discuss how each of these technologies is related to ERP systems. Each of these topics is discussed in more detail in the following chapters.

BUSINESS PROCESS REENGINEERING (BPR)

BPR has been around for quite some time and a lot has been written about it in both the practitioner trade magazines and the academic research journals. However, the controversy still remains if there is any accurate description of BPR, or if BPR is just a fad—an appealing label to tag on to whatever your company is doing to suggest that your latest and greatest work is 'in vogue.' But if reengineering is to continue in the long run, then it must do more than advertise its considerable successes to date. It must become more proactive and inclusive with regard to human, organizational, and motivational change issues.

Dr. Michael Hammer defines BPR as "… the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed." One of the main tools for making this change is information technology (IT). Any BPR effort that fails to understand the importance of IT and does the pre-BPR analysis and planning phases without considering the various IT options available and the effect of the proposed IT solutions on the employees and the organization is bound to crash before takeoff.

We have discussed how ERP systems help in integrating the various business processes of the organization with the help of the latest developments in IT. With a good ERP package, the organization

will have the capability of achieving dramatic improvements in critical areas such as cost, quality, speed, and so on. Thus, many BPR initiatives end up in the ERP implementation.

BUSINESS INTELLIGENCE (BI)

Business intelligence (BI) represents the tools and systems that play a key role in the strategic planning process of the corporation. These systems allow a company to gather, store, access, and analyze corporate data to aid in decision-making. Generally, these systems will display business intelligence in the areas of customer profiling, customer support, market research, market segmentation, product profitability, statistical analysis, and inventory and distribution analysis, to name a few.

Most companies collect large amount of data from their business operations. To keep track of that information, a business would need to use a wide range of software programs such as spreadsheets, databases, and different database applications for various departments throughout their organization. Using multiple software programs makes it difficult to retrieve information in a timely manner and to perform analysis of the data.

BUSINESS ANALYTICS (BA)

Business analytics (BA) is the practice of iterative, methodical exploration of an organization's data with emphasis on statistical analysis. Business analytics is used by companies committed to data-driven decision-making. BA is used to gain insights that inform business decisions and can be used to automate and optimize business processes. Data-driven companies treat their data as a corporate asset and leverage it for competitive advantage. Successful business analytics depends on data quality, skilled analysts who understand the technologies, and the business and an organizational commitment to data-driven decision-making. Examples of BA uses include:

- Exploring data to find new patterns and relationships
- Explaining why a certain result occurred
- Experimenting on previous decisions
- Forecasting future results

Once the business goal of the analysis is determined, an analysis methodology is selected and data is acquired to support the analysis. Data acquisition often involves extraction from one or more business systems, cleansing, and integration into a single repository such as a data warehouse or data mart. The analysis is typically performed against a smaller sample set of data. Analytic tools range from spreadsheets with statistical functions to complex data mining and predictive modeling applications. As patterns and relationships in the data are uncovered, new questions are asked and the analytic process iterates until the business goal is met. Deployment of predictive models involves scoring data records (typically in a database) and using the scores to optimize real-time decisions within applications and business processes. BA also supports tactical decision-making in response to unforeseen events, and in many cases the decision-making is automated to support real-time responses.

DATA WAREHOUSING

If operational data is kept in the databases of the ERP system, it can create a lot of problems. As time passes, the amount of data will increase and this will affect the performance of the ERP system. Thus, it is better to archive the operational data once its use is over. The phrase 'the use is over', does not mean that the archived data is useless. It is one of the most valuable resources of the

organization. However, once the operational use of the data is over it should be removed from the operational databases. For example, once the financial year is over, the daily transactional data can be archived. Figure 8.2 shows what happens if the data is not archived.

It is evident from Fig. 8.2 that even though the operational data volume is nearly the same each year, if the data is not archived the total amount of data that is stored in the operational data base will keep piling up. The graph in Fig. 8.3 shows the effect of keeping this huge amount of data in the operational database. As the volume of the data in the database increases, the performance of the database and the related applications degrades. From the above discussions, it is evident that we should separate the operational data from the non-operational data. The term archive data is consciously avoided, because if the non-operational data is archived, there is little or no use for it. But this data is a very valuable resource and is too precious to be kept in some tape archive. It is in this situation that a data warehouse comes in handy.

The primary concept of data warehousing is that the data stored for business analysis can most effectively be accessed, by separating it from the data in the operational systems. The most important reason for separating data for business analysis from the operational data has always been the potential performance degradation on the operational system that can result from the analysis processes.

High performance and quick response time is almost universally critical for operational systems. These reasons to separate the operational data from analysis data have not significantly changed with the evolution of the data warehousing systems, except that now they are considered more formally during the data warehouse building process. Advances in technology and changes in the nature of business have made many of the business analysis processes much more complex and sophisticated. In addition to producing standard reports, today's data warehousing systems support very sophisticated on-line analysis including multi-dimensional analysis.

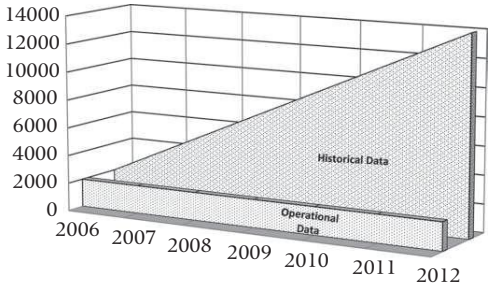

Figure 8.2 Operational data vs. archive data.

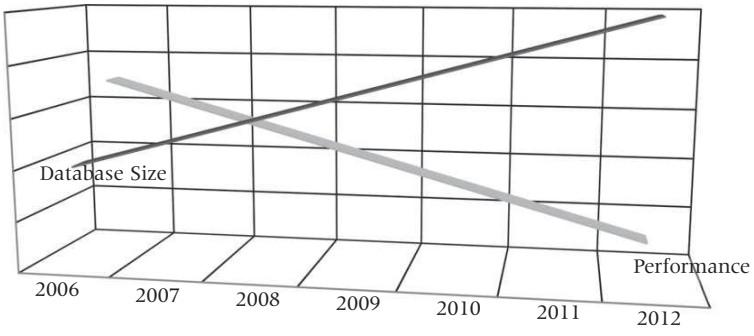

Figure 8.3 Data volume vs. performance.

DATA MINING

We live in the age of information. The importance of collecting data that reflect one's business or activities to achieve competitive advantage is widely recognized now. Powerful systems for collecting data and managing it in large databases are available in most organizations. However, the major bottleneck of turning this data into effective information lies in extracting knowledge about the system from the collected data. Modeling the investigated system and discovering relations that connect variables in a database are the core contents of data mining.

Data mining is the process of identifying valid, novel, potentially useful, and ultimately comprehensible knowledge from databases that is used to make crucial business decisions. Modern data mining systems self-learn from the archives of the investigated system, formulating and testing hypotheses about the rules, which this system obeys. When concise and valuable knowledge about the system of interest has been discovered, it can and should be incorporated into some decision support system, which helps the manager to make wise and informed business decisions.

The main reason for the necessity of automating computer systems for intelligent data analysis is the enormous volume of existing and newly appearing data that requires processing. The amount of data accumulated every day by various businesses, scientific, and governmental organizations around the world is daunting. Research organizations, academic institutions, and commercial enterprises create and store huge amounts of data every day. It becomes impossible for human analysts to cope with such overwhelming amounts of data. Two other problems that surface when human analysts process data are:

- The inadequacy of the human brain when searching for complex multi-factorial dependencies in the data
- The lack of objectiveness in analyzing the data

A human expert is always a hostage of the previous experience of investigating other systems. Sometimes this helps, sometimes this hurts, but it is almost impossible to get rid of this fact.

One additional benefit of using automated data mining systems is that this process has a much lower cost than hiring an army of highly trained (and paid) professional statisticians. While data mining does not eliminate human participation in solving the task completely, it significantly simplifies the job and allows an analyst who is not a professional in statistics and programming to manage the process of extracting knowledge from data.

ON-LINE ANALYTICAL PROCESSING (OLAP)

According to Business Intelligence Ltd. (http://www.OLAPReport.com), OLAP can be defined in five words—fast analysis of shared multi-dimensional information.

- FAST means that the system is targeted to deliver most responses to users within about five seconds, with the simplest analyses taking no more than one second and very few taking more than 20 seconds.
- ANALYSIS means that the system can cope with any business logic and statistical analysis that is relevant for the application and the user, and keep it easy enough for the target user.
- SHARED means that the system implements all the security requirements for confidentiality (possibly down to cell level) and, if multiple write access is needed, provides concurrent update locking at an appropriate level.
- MULTI-DIMENSIONAL means that the system must provide a multi-dimensional conceptual view of the data, including full support for hierarchies and multiple hierarchies.

- INFORMATION is all of the data and derived information needed, wherever it is and however much is relevant for the application.

Simply put, OLAP describes a class of technologies that are designed for live ad hoc data access and analysis. While transaction processing (OLTP) generally relies solely on relational databases, OLAP has become synonymous with multi-dimensional views of business data. These multi-dimensional views are supported by multi-dimensional database technology. These provide the technical basis for the calculations and analysis required by business intelligence applications.

OLAP technology is being used in an increasingly wide range of applications. The most common are sales and marketing analysis, financial reporting and consolidation, and budgeting and planning. Increasingly, however, OLAP is being used for applications such as product profitability and pricing analysis, activity-based costing, manpower planning, quality analysis, in fact for any management system that requires a flexible, top down view of an organization.

PRODUCT LIFE CYCLE MANAGEMENT (PLM)

The conditions under which a product is sold will change over time. The product life cycle refers to the succession of stages a product goes through. Product life cycle management is the succession of strategies used by management as a product goes through its life cycle.

The product life cycle goes through many phases (product development, market introduction, growth, maturity, and decline) and involves many professional disciplines and requires many skills, tools, and processes. Product life cycle (PLC) is to do with the life of a product in the market with respect to business/ commercial costs and sales measures; whereas product life cycle management (PLM) is more to do with managing descriptions and properties of a product through its development and useful life, mainly from a business/engineering point of view.

Product life cycle management gives companies the power to plan, manage, and schedule PLCs by accelerating the introduction of new products, and optimizing life cycle phases of all products. With PLM, organizations can optimize design resources, create product demand forecasts based on the history of similar products, allocate production capacity across new and existing products, and analyze inventory, capacity, and profit margins to determine the optimal end-of-life timeframes. PLM helps organizations in the following areas:

- Reduce time to market through faster design and validation
- Deploy engineering, CAD, and prototyping resources optimally to complete critical projects
- Reduce product development and manufacturing costs
- Reduce levels of obsolete component inventory at multiple locations
- Get product design changes into production quickly

Organizations need an integrated product life cycle management (PLM) software solution for collaborative engineering, product development, and management of projects, product structures, documents, and quality. The PLM software should provide an information backbone to help you access relevant information anywhere, anytime.

SUPPLY CHAIN MANAGEMENT (SCM)

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and

manufacturing industries although the complexity of the chain may vary greatly from industry to industry and firm to firm.

Traditionally, marketing, distribution, planning, manufacturing, and the purchasing organizations along the supply chain operated independently. These organizations have their own objectives and these are often conflicting. High-customer service and maximum sales revenue, which are the objectives of marketing, conflict with manufacturing and distribution goals. Many manufacturing operations are designed to maximize throughput and lower costs with little consideration for the impact on inventory levels and distribution capabilities. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is no single, integrated plan for the organization—there were as many plans as businesses. Clearly, there is a need for a mechanism through which these different functions can be integrated together. Supply chain management is a strategy through which such integration can be achieved.

CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Customer relationship management (CRM) covers methods and technologies used by companies to manage their relationships with clients. Information stored on existing customers (and potential customers) is analyzed and used to this end. Automated CRM processes are often used to generate automatic personalized marketing based on the customer information stored in the system.

Customer relationship management is a corporate level strategy, focusing on creating and maintaining relationships with customers. Several commercial CRM software packages are available which vary in their approach to CRM. However, CRM is not a technology in itself, but rather a holistic approach to an organization's philosophy, placing the emphasis firmly on the customer.

Customer relationship management governs an organization's philosophy at all levels, including policies and processes, front office customer service, employee training, marketing, and systems and information management. CRM systems are integrated end-to-end across marketing, sales and customer service. A CRM system should identify factors important to clients, promote a customer-oriented philosophy, adopt customer-based measures, develop end-to-end processes to serve customers, provide successful customer support, handle customer complaints, track all aspects of sales, create a holistic view of customers' sales and services information, and so on.

CRM applications often track customer interests and requirements, as well as their buying habits. This information can be used to target customers selectively. Furthermore, the products a customer has purchased can be tracked throughout the product's life cycle, allowing customers to receive information concerning a product or to target customers with information on alternative products once a product begins to be phased out. Repeat purchases rely on customer satisfaction, which in turn comes from a deeper understanding of each customer and their individual needs. CRM is an alternative to the 'one size fits all' approach. In industrial sector, the technology can be used to coordinate the conflicting and changing purchase criteria of the sector.

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

A GIS is a computer-based tool for mapping and analyzing events that happen on earth and existing things. Geographic information systems technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it

valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

The main functions of an organization like procurement, distribution, logistics management, etc., all have a critical geographic dimension. Whether it is finding the shortest route to deliver the goods or to compare the transportation cost involved in procurement or figuring out the best route for a delivery vehicle, most problems also have a geographical component. GIS helps in creating maps, integrate information, visualize scenarios, solve complicated problems, present powerful ideas, and develop effective solutions like never before. GIS is a tool used by individuals and organizations, schools, governments, and businesses seeking innovative ways to solve their problems.

INTRANETS AND EXTRANETS

What is the relationship between intranets, extranets, and e-commerce? The answer has three parts. *First*, intranets, extranets, and e-commerce have in common the use of Internet (predominantly web) protocols to connect business users. *Second*, intranets are more localized and can therefore move data faster than many distributed extranets. Bandwidth limitations also apply to e-commerce. *Third*, the amount of control that network managers can exert over users is different for the three technologies.

On an intranet, administrators can narrowly prescribe access and policy for a fixed group of users. For example, a company could specify Windows Vista as its standard desktop operating system, and Internet Explorer 11 as its standard browser and Outlook 2013 as its mail client. The company could then write intranet workflow applications that leverage the uniform computing environment, over which it exercises strong control.

On a business-to-business extranet, system architects at each of the participating companies must collaborate to ensure a common interface and consistent semantics (data meanings). Since one company cannot reasonably enforce standards on its trading partners, extranet application developers must take into account a wider range of technologies than is the case for intranets. For example, one company participating in an extranet might be using Microsoft Internet Explorer, another Mozilla Firefox, and another Apple Safari. In order to collaborate via extranet, the applications have to perform adequately on all represented platforms.

The same is true, even more so, for e-commerce, in which the trading partners may be completely unknown to one another. This is the case when you walk into a supermarket: the common interest in communication is based on the need to transact business, and not necessarily on a long-term trust relationship. Thus, e-commerce applications often support a level of security and transactional integrity (for instance, non-repudiation of orders) not present in intranet or extranet applications.

SUMMARY

We have discussed the various technologies that can and should be in conjunction with the ERP system to improve the efficiency of the organization and to streamline the operations. In this Internet age, where more and more business transactions are carried out over the Internet, it is very important that the ERP packages should integrate these technologies into their ERP system to remain competitive and responsive to customers. Some of the technologies that are used to extend the power of ERP are data warehousing, data mining, on-line analytical processing (OLAP), product life cycle management (PLM), supply chain management (SCM), customer relationship management (CRM), geographical information systems (GIS), intranets and extranets, etc. We have seen a brief overview of these technologies in this chapter.

REVIEW QUESTIONS

1. What are the limitations of ERP?
2. How can we overcome the inherent limitations of the ERP systems?
3. What are e-businesses?
4. What are the technologies that are used to improve the capabilities of ERP systems?
5. Discuss the advantages of each of these enabling technologies.
6. What is business process reengineering and how is ERP connected to BPR?
7. What do you mean by business intelligence?
8. What is business analytics? Give some examples of BA.
9. What is a data warehouse? What is its use?
10. Why should historical data and operational data be separated?
11. What is the use of historical data?
12. What is data mining and what are its business uses?
13. What are problems faces by human analysts that can be solved by data mining?
14. What is OLAP? What is it used for?
15. What do you mean by PLM?
16. How can PLM help an organization?
17. What is SCM and how does it help the organization?
18. What do you mean by CRM and what are its uses?
19. What is GIS and what are its uses?
20. What is the difference between Internet and intranet?

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Chapter 9

Business Intelligence (BI) and Business Analytics (BA)

INTRODUCTION

Business intelligence (BI) is the intelligence of businesses, as the name suggests, and is a new field of in the application of human cognitive faculties and artificial intelligence technologies to support the management and decision-makers in different business problems. It relates to intelligence as information valued for its currency and relevance. It is expert information, knowledge, and technologies efficient in the management of organizational and individual business. Therefore, BI is a broad category of applications and technologies for gathering, providing access to, and analyzing data for the purpose of helping organizations make better business decisions. The term implies having comprehensive knowledge of all of the factors that affect the business. It is imperative that you have in-depth knowledge about factors such as your customers, competitors, business partners, economic environment, and internal operations to make effective and good quality business decisions. Business intelligence enables you to make these kinds of decisions.

A specialized field of business intelligence known as competitive intelligence focuses solely on the external competitive environment. Information is gathered on the actions of competitors and decisions are made based on this information. Little, if any, attention is paid to gathering internal information.

REASONS FOR BI

BI enables organizations to make well-informed business decisions and thus can be the source of competitive advantages. This is especially true when you are able to extrapolate information from indicators in the external environment and make accurate forecasts about future trends or economic conditions. Once BI is gathered effectively and used proactively, you can make decisions that benefit your organization before the competition does.

The ultimate objective of BI is to improve the timeliness and quality of information. Timely and good quality information is like having a crystal ball that can give you an indication of what is the best course to take. BI reveals to you:

- The position of your firm in comparison to its competitors
- The changes in customer behavior and spending patterns
- The capabilities of your firm
- The market conditions, future trends, demographic and economic information
- The social, regulatory and political environment
- The status of other firms in the market

Based on the information gathered, business adjustments can be made. Businesses realize that in this very competitive, fast-paced, and ever-changing business environment, a key competitive quality

is how quickly they respond and adapt to change. BI enables them to use information gathered to quickly and constantly respond to changes.

BENEFITS OF BI

BI provides many benefits to companies utilizing it. It can eliminate a lot of the guesswork within an organization, enhance communication among departments while coordinating activities and enable companies to respond quickly to changes in financial conditions, customer preferences, and supply chain operations. BI improves the overall performance of the company using it.

Information is often regarded as the second most important resource a company has (a company's most valuable assets are its people). Therefore, when a company can make decisions based on timely and accurate information, it can improve its performance. BI also expedites decision-making, as acting quickly and correctly on information before competing businesses do can often result in competitively superior performance. It can also improve customer experience, allowing for timely and appropriate response to customer problems and priorities.

TECHNIQUES FOR INTEGRATING BI INTO BUSINESS PROCESSES

BI has become strategic but still needs to be integrated into every business process to guide business operations toward achieving strategic objectives. The following tips will help you achieve this:

- Clean up your BI before trying to integrate it with any operational applications or portals. First establish consistency across all BI tools and data stores by defining common data names, common data definitions, and common data integrity rules for all data in these systems. Avoid different names for the same measure in different BI data stores or BI tool business views. Avoid the same name for different measures in BI data stores. Avoid different formulae for measures with the same data names. Hold this common metadata in XML preferably in an ETL metadata repository.
- Establish a common BI platform of integrated tools from a single vendor for all BI developments.
- Integrate your BI before integrating your BI. Link corporate performance management (CPM) scorecards to dashboards and analytic applications by defining metrics trees in CPM that calculate scorecard KPIs from underlying lower level metrics in custom and packaged analytic applications. This allows managers to drill from scorecards all the ways into detailed data to identify the reasons why there is a business problem.
- Focus BI integration around achieving a single specific prioritized business objective, e.g. to reduce operational cost.
- Establish a methodology to identify where BI is needed, who (target user communities) or what (applications) need it and when they need it. This involves identifying, who in your organization contributes to the same business objective. From here you must identify their role in the business, the applications they use every day, whether they have time to use a BI tool or need BI integrated into specific applications, the BI they need to help them contribute to the common objective, the business process tasks they perform, the process tasks where BI is needed, the form they need it in (e.g. guided recommendations, alerts, reports, etc), the actions they need to take and whether they need to collaborate with others before taking such action.
- Do not assume one approach for BI integration. Recognize that there is a different closed-loop strategy needed to integrate BI into operations for different roles in the enterprise. For example, an executive needs BI integrated into CPM software while a customer service representative in the call centre needs BI integrated into a specific operational application.

- Implement BI web services by taking advantage of web service APIs available from BI tool vendors. BI web services allow you to easily integrate BI into portlets in enterprise and BI portals. They also allow you to dynamically integrate with other applications without the need to 'hardwire' BI integration into applications.
- For fast results and for people who need to collaborate over BI before making decisions, integrate BI into enterprise portals so that users can take advantage of portal collaboration tools to have net meetings and web discussions over BI content. BI integration in enterprise portals is a strategy particularly well-suited to managers and executives. This strategy is may not be sufficient for operations personnel who are 'tied' to a specific application when performing their job function.
- For tight integration with operational application and application performance leverage BI in the database by exploiting SQL analytical functions, materialized views, and vendor supplied BI application components such as analytical Java Beans.
- Use real-time processing (near real-time event capture, on-demand data integration, automatic analysis, and automated decision-making) and business activity monitoring (BAM) to integrate on-demand recommendations into customer touch points and for dynamic web personalization driven off customer intelligence.

BUSINESS ANALYTICS (BA)

Business analytics (BA) is the practice of iterative, methodical exploration of an organization's data with emphasis on statistical analysis. BA is used by companies committed to data-driven decision-making. It refers to the skills, technologies, applications, and practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning.

BA focuses on developing new insights and understanding of business performance based on data and statistical methods. In contrast, BI traditionally focuses on using a consistent set of metrics to measure both past performance and guide business planning. Both BA and BI are based on data and statistical methods.

BA is used to gain insights that inform business decisions and can be used to automate and optimize business processes. Data-driven companies treat their data as a corporate asset and leverage it for competitive advantage. Successful BA depends on data quality, skilled analysts who understand the technologies and the business and an organizational commitment to data-driven decision-making. Examples of BA uses include:

- Exploring data to find new patterns and relationships using data mining
- Explaining why a certain result occurred with statistical analysis and quantitative analysis
- Experimenting to test previous decisions using A/B testing or split testing, multivariate testing, etc.
- Forecasting future results with predictive modeling, predictive analytics, etc.

Once the business goal of the analysis is determined, an analysis methodology is selected and data is acquired to support the analysis. Data acquisition often involves extraction from one or more business systems, cleansing, and integration into a single repository such as a data warehouse or data mart. The analysis is typically performed against a smaller sample set of data. Analytic tools range from spreadsheets with statistical functions to complex data mining and predictive modeling applications. As patterns and relationships in the data are uncovered, new questions are asked and the analytic process iterates until the business goal is met. Deployment of predictive models involves scoring data records (typically in a database) and using the scores to optimize real-time decisions within applications and

business processes. BA also supports tactical decision-making in response to unforeseen events, and in many cases the decision-making is automated to support real-time responses.

REASONS FOR BA

According to market research firm IDC, the business analytics market is set to grow to $50.7 billion by 2016. According to IDC, organizations embracing analytics are 2.2 times more likely to outperform their industry peers. Some of the reasons for implementing BA systems are:

- Predict trends easily from volumes of business data. With the use of predictive models and forecasting, even small businesses with large amounts of data can leverage on the information and derive trends for the future.
- Better information availability and capability to find required information, BA helps in improving and speeding up the decision-making process.
- Understand your customers better. As a business, you want to understand the mindset of the customer. With today's level of analytics, you can do exactly that. Learning customer behavior from data analytics can lead to focused and efficient service as one can respond to user needs for availability of data on a timely basis.
- Get insights you never thought of. Analytics can open your minds to new possibilities and correlations which could not be made with regular observation or intuition.
- Manage your finances better. With analytics, businesses can use past financial data to develop projections for the next financial cycle, and steps they can take to mitigate possible problems.
- Enhance knowledge sharing. Given that most business analytics solutions include mobile apps as well, every employee can be empowered to gain insights anywhere in the world. It is clear that when every department of an organization has access to analytics, better decisions can be made at every level of the hierarchy.
- Better alignment of resources with strategies. BA solution provides valuable information that helps the management to efficiently and effectively align all the business resources including people so that they can be deployed in the best possible manner to reach the business objectives of the organization.

BENEFITS OF BA

Regardless of your existing applications and the type or quantity of information you deal with, business analytics solutions can help your organization run smarter by enabling you to know your business, decide with confidence, act quickly and effectively, make proactive decisions, and mitigate risks.

Know Your Business

With access to the quality of information you need—in context, on any device, in real time—tailored to your industry and role you will know what is happening as and when it is happening. Business analytics solutions provide improved knowledge for everyone, better outcomes for mission-critical business decisions, and faster, fact-based decisions in a timely manner.

Decide with Confidence

By aligning goals and plans, understanding their impact, balancing risk and opportunities, and modeling your future direction you know what you want and where to go. With the information that you have in hand and acquired through BA, you can make your decisions with confidence. BA systems can help you decide with confidence and maximize your business profitability, improve compliance,

and minimize risk, all through improved decision-making and planning around a long-term growth strategy. BA systems let you understand drivers of past performance and model future directions using 'what if' analysis and predictive functionality. With automated and continuous monitoring of key risk indicators and compliance effectiveness measurements, you gain streamlined and risk-adjusted planning, budgeting, reporting, and forecasting.

Act Effectively, Boldly, and Instantly

BA enables you to respond to events through your business processes and taking coordinated action from anywhere. You can maximize your productivity and improve your competitive advantage by acting on emerging business opportunities and threats. You can make more accurate and timely decisions to optimize operational efficiency. The automated real-time alerting of any process or productivity issues and ability to respond from anywhere enable you to respond instantly to events as they unfold. The ability to coordinate action on the highest-value opportunities while monitoring and managing threats gives you a great competitive advantage. You can collaborate and take coordinated action on your decisions, learn from your experience, adapt, and continually improve over time.

Proactive Decisions

BA systems help to manage huge volumes of data effectively to drive better intelligent decision-making. It gives the decision-maker the ability to view in real-time the status of the business and then drill down into the information you need to make critical decisions at astonishing speed. The ability to accurately predict trends, reduce costs, maximize efficiency, and uncover solutions to your pressing industry and line of business challenges will give you a significant competitive edge and will make the organization more proactive rather than reactive. You can avoid problems rather than solving them after they have occurred.

Risk Mitigation

With the BA system you can proactively balance risk and opportunity across your business processes. These solutions provide continuous monitoring of key risk indicators and compliance effectiveness across your heterogeneous systems, business processes, and IT infrastructure—aligning risks and compliance programs to strategic initiatives, plans, and execution. You can achieve better management of compliance and risk through automated risk management and compliance and monitoring activities, which minimize the associated effort and reduce cost. You also can leverage real-time insights in the context of the industry and role of the decision maker which will help you to define, plan, align, and monitor performance goals and metrics anticipating change and proactively balancing risks and opportunities.

GETTING STARTED WITH BA

In order to benefit from the BA solutions, the BA systems should be integrated with the ERP system of the organization. High-quality data must be integrated and accessible across the organization. It should also be structured in a flexible way that allows your analysts to discover new insights and provide leaders the information they need to adjust strategies quickly. The steps required for the seamless integration of the BA system into the organization are given below:

- **Use the right technology** – Integrated data collection, collation and management is the key to an efficient BA system that will help in making fast and high quality decisions. The information islands and silos should be removed and all the stakeholders should access data

from the central database. This central database should be kept up-to-date by constantly updating it. The technological infrastructure should include optimized data stores, data integration tools, data quality software, analytical software, integrated analytical applications, etc.

- **Do a cost-benefit analysis** – When selecting technologies, consider the costs and benefits. Some of the issues that should be considered include whether the technology selected will help in reducing costs and increasing revenues, is there a need for new technology, whether existing resources could be used, etc.
- **Choose or recruit the right people** – You need people with special skills to do BA effectively. Here the aptitude of the person is equally important as his skills. Train your employees or recruit analytic thinkers who seek and explore the right data to make discoveries. To make analytics work, analysts must also be able to communicate effectively with leaders and link analytics to key decisions and the bottom line.
- **Present information effectively** – The BA system should be able to provide the information the managers need as and when they need them. But the information thus generated should be derived from the historical data and other environmental factors. Here the information should be given to the decision maker in a way that is intuitive and that promotes better decisions. Charts, graphs, tables, interactive dashboards, etc. that will help managers think creatively and thereby come up with novel solutions should be designed, developed and used. Keep the process transparent. Transparency implies openness, communication and accountability; it is key to successful business analytics projects. The value delivered from an investment in business analytics must be visible and measureable. Who the analysts are and what they're seeking to accomplish should be clearly communicated to the business, as should their findings.
- **Develop an analytical center of excellence (ACE)** – Create a centralized team approach that promotes the use of analytics and associated best practices. Your implementation of an ACE will depend on your organization's maturity and requirements, but the most effective implementations address all elements of the organization's analytic infrastructure: people, process, technology and culture to support the business' strategy and operations.
- **Develop an organizational culture and environment suitable for BA** – A strong analytical culture has executive sponsorship and encourages creativity. Experimentation should be seen as part of learning, and employees should be given permission to fail as they learn from trying new things.
- **Continuously innovate** – Once you have made some creative initiatives that have succeeded, don't stop; continue your innovations and review your progress and make corrective actions if required. If you stop innovating, your competitors will catch up and will soon overtake you. The only way to be successful and stay ahead of the competition is to constantly and continuously innovate and find better and efficient ways to do business and an efficient BA system can help you to do this.
- **Get started now** – Find important questions that need answering and problems that need to be solved. Answer these questions, solve these problems and create value for the organization. By creating small wins in any business, function or department, over time your company will become an analytical competitor.

FACTORS INFLUENCING BI AND BA

The main factors that influence the decision of implementing BI and BA are customers, competitors and competition, business partners and suppliers, business environment, and internal factors like efficiency, infrastructure, etc.

Customers are the most critical aspect to a company's success. Without them a company cannot exist. So it is very important that you have information on their preferences. You must quickly adapt to their changing demands. BI and BA enable you to gather information on the trends in the marketplace and come up with innovative products or services in anticipation of customer's changing demands.

Competitors can present a huge hurdle on your way to success. Their objectives are the same as yours and that is to maximize profits and customer satisfaction. In order to be successful you must stay one step ahead of your competitors. In business you do not want to play the catch up game because you would have lost valuable market share. BI tells you what actions your competitors are taking while BA helps you to make informed decisions with

Business partners must possess the same strategic information you have so that there is no miscommunication that can lead to inefficiencies. For example it is common now for businesses to allow their suppliers to see their inventory levels, performance metrics and other supply chain data in order to collaborate to improve supply chain management. With BI and BA you and your business partners can share the same information.

Business environment such as the state of the economy and other key economic indicators are important considerations when making business decisions. You do not want to roll out a new line of products during an economic recession. BI gives you information on the state of the economy so that you can make prudent decisions as to the right time to maybe expand or scale back your business operations. BA enables you to respond to events through your business processes and help to maximize your productivity and improve your competitive advantage by acting on emerging business opportunities and threats.

Internal operations are the day-to-day activities that go on in your business. You need in-depth knowledge about the internal workings of your business from top to bottom. If you make an arbitrary decision without knowing how your entire organization works it could have negative effects on your business. BI and BA give you information on how your entire organization works and informs you what is happening as it is happening irrespective or your physical location.

DIFFERENCE BETWEEN BA AND BI

What is the difference between BA and BI? A lot people use the terms business intelligence and business analytics interchangeably and sometime use the term BI to cover both. BI is one of the key components of a suite of analytic techniques, information handling and performance infrastructures needed to deliver the insights through relevant channels like reports, alerts, dashboards, scorecards, etc. to a wider group of users. BA systems provide everything BI can do plus an additional level of functionality – the statistical analysis tools to complete tasks such as forecasting, regression, and modeling. BA systems mostly include all the key areas needed to successfully implement data-driven decision making—information management, analytics, BI, etc.

According to Angel Hall, Senior Technical Architect at SAS [1], "Intelligence and Analytics can appear as very similar terms but in my mind (and in my thesaurus) they are not. The term '*Intelligence*' is another word for information, news, or communication. Therefore the tools included within a Business Intelligence system would be to provide that information or news to effectively communicate to a large audience. Whereas '*Analysis*', synonymous with examination, evaluation, investigation, and scrutiny, is the actual task of analyzing and mining data, understanding past-present-future by exploring everything available."

BA makes extensive use of data, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management to drive decision making. Analytics may be used as input for human

decisions or may drive fully automated decisions. BI tools (querying, reporting, alerts, OLAP, etc.) can answer questions such as what happened, how many, how often, where the problem is, and what actions are needed. Business analytics can answer questions like why is this happening, what if these trends continue, what will happen next, what is the best that can happen, etc. The key differences are shown in Table 9.1. The competitive advantage increases as the degree of intelligence increases because the organization will start taking proactive decisions instead of reactive ones. This is shown in Fig. 9.1.

BI, BA, AND ERP

ERP systems offer powerful tools to better measure and control organizational operations. Many organizations have found that the power of ERP can be enhanced to provide even greater value through the addition of powerful BI and BA systems. BI systems store data (usually in a data warehouse) and then analyze this data usually using OLAP, ad hoc querying, etc. BA systems also use the data stored in the data warehouse and then analyze them using statistical and quantitative analysis, predictive modeling, data mining, etc.

Data warehouses and data marts are two of the most popular extensions of ERP systems. A data warehouse is an orderly and accessible repository of known facts and related data used as a basis for making better management decisions. Data marts are created with a sub-set of data warehouse information usually focusing on information needed by a specific set of users. We will see more about data warehouses and data marts in Chapter 12. ERP systems, as we have seen, use data mining and on-line transaction processing (OLAP), to derive the information from the data warehouses. More about data mining is given in Chapter 13 and OLAP in Chapter 14.

Table 9.1 Differences between BI and BA

	Business Intelligence	**Business Analytics**
Answers questions like	• What happened? • How often? • When? • Who? • How many? • What is the problem? • Where is the problem? • What actions are required to solve the problem?	• Why did it happen? • Will it happen again? • What will happen if we change x? • What will happen if we change x and y? • What else does the data tell that we never thought to ask? • What is the best course of action?
Includes features like	• Reporting • Automated monitoring • Automated alerts • Dashboards • Scorecards • OLAP (Data cubes, Slice & Dice, Drilling down, etc.) • Ad hoc querying	• Statistical Analysis • Quantitative Analysis • Data Mining • Predictive Modeling • Multivariate Testing

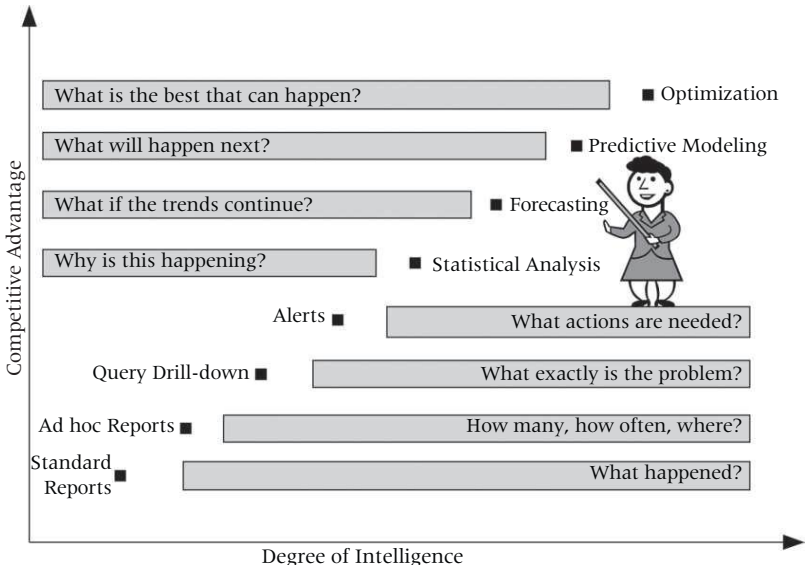

Figure 9.1 Intelligence and competitive advantage. (*Source:* SAS Institute, Inc.)

The ERP systems use the BI generated using data mining, OLAP, multi-dimensional analysis, and other data analysis techniques for a variety of applications like demand forecasting, production planning, product design, retailing, customer relationship management, credit card management, etc.

BA provides the decision-makers of the organization virtually with unlimited knowledge at their fingertips. The BA software can help decision-makers process massive amounts of data instantly–for real-time insights needed to make more informed decisions anytime and anywhere—even from hand-held devices.

FUTURE OF BI AND BA

In this rapidly changing world, consumers are now demanding quicker and more efficient service from businesses. To stay competitive, companies must meet or exceed the expectations of consumers. Companies will have to rely more heavily on their BA and BI systems to stay ahead of trends and future events. Decision-makers are beginning to demand real-time information, intelligence, and analytics and near real-time analysis relating to their business, particularly in frontline operations. They will come to expect up-to-date and fresh information in the same fashion as they monitor stock quotes on-line. Monthly and even weekly analysis will not suffice. Business users do not want to wait for information. Information needs to be always on and never out of date.

In the not too distant future, companies will become dependent on real-time business information in much the same fashion as people come to expect to get information on the Internet in just one or two clicks. This instant 'Internet experience' will create the new framework for BI and BA, but business processes will have to change to accommodate and exploit the real-time flows of business data.

Also in the near future, business information will become more democratized where end users from throughout the organization will be able to view information on their particular segment to see how it is performing. Therefore, in the future, the capability requirements of BI and BA will increase in the same manner that consumer expectations increase. It is therefore imperative that companies increase at the same pace or even faster to stay competitive.

SUMMARY

BI relates to intelligence as information valued for its currency and relevance. It is expert information, knowledge, and technologies efficient in the management of organizational and individual business. BA is the practice of iterative, methodical exploration of an organization's data with emphasis on statistical analysis. It refers to the skills, technologies, applications, and practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning.

BI enables organizations to make well-informed business decisions and thus can be a source of competitive advantages. The ultimate objective of BI is to improve the timeliness and quality of information. BI can eliminate a lot of guesswork within an organization, enhance communication among departments while coordinating activities, and enable companies to respond quickly to changes in financial conditions, customer preferences, and supply chain operations. Regardless of the existing applications and the type or quantity of information being dealt with, BA solutions can help organizations run smarter by enabling to understand the business, decide with confidence, act quickly and effectively, make proactive decisions, and mitigate risks. Both BI and BA improve the overall performance of the company using it. The main factors that influence the decision to implement BI and BA are customers, competitors and competition, business partners and suppliers, the business environment, and internal factors like efficiency, infrastructure, etc.

REVIEW QUESTIONS

1. What is business intelligence?
2. What do you mean by competitive intelligence?
3. What are the reasons for implementing BI systems?
4. What are the benefits of BI?
5. Explain the techniques used for integrating BI into business processes?
6. What is business analytics?
7. What are the reasons for implementing BA systems?
8. What are the benefits of BA?
9. How does BA help to understand the business better?
10. How does BA help in making decisions with confidence?
11. How can you act effectively, boldly, and instantly with BA?
12. How does BA help you to take proactive decisions?
13. How does BA help in mitigating risks?
14. Explain how to get started with BA.
15. What are the factors that influence the decision of implementing BI and BA?
16. What are the differences between BI and BA?
17. How does competitive advantage increase with business intelligence?
18. How can BA and BI help in making ERP systems more effective?
19. How are data warehouses and data marts connected to BI and BA systems?
20. What is the future of BI and BA?

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Chapter 10

E-Commerce and E-Business

INTRODUCTION

Electronic commerce or e-commerce can be broadly defined as the set of business activities involving consumers, service providers, manufacturers, and intermediaries who use computer networks such as the Internet for conducting their business transactions. The primary goal of e-commerce is to bring organizations closer to their actual customers, thus providing the customers with products and services much faster and at a lesser cost than possible by traditional business models. The other goals include reduction in product and service cost (by eliminating unnecessary intermediaries and unwanted procedures), improve customer response time (by making use of technological developments to improve communications and payment processes), improve the quality of the products and services, and improve customer satisfaction. Thus, implementing e-commerce has become a business necessity, as companies that fail to take advantage of this technology will soon find themselves out of business.

The IT Revolution

In today's global economy, the importance of IT technology cannot be overemphasized. Information technology is revolutionizing the way in which we live and work. It is changing all aspects of people's life and lifestyle. The digital revolution has given mankind the ability to treat information with mathematical precision, to transmit it at very high accuracy, and to manipulate it at will. These capabilities are bringing into being a whole world within and around the physical world. The amount of arithmetical power that is available to mankind is increasing at an exponential rate. Computers and communications are becoming integral parts of our lives.

A few decades back communications used to be between people—one person to another. But now inanimate objects are getting into the act—books can convey to the cash registers how much they cost, identity cards can give direction to the door lock whether to open or not, automated guided vehicles can hint the host computer where they are in the shop floor and what they are carrying and when they will be free, missiles can compare the landscape with their own map and hit the target with pin-point precision, on the Internet people engage in lively chats and discussions, and play games even if they are physically on different continents.

The above-mentioned changes (and more) in computation and communication add up to what is called the information revolution or IT revolution. This is beginning to transform the world and the transformation is difficult. To get most out of the digital world one has to change the way things are done. Information technology, which is a combination of computers, telecommunications, and information resources, is fundamentally about adapting changes rather than resisting it. To survive, organizations have to collaborate with the technology or more appropriately manage with the technology. In order to do this, they must understand technology and understand the available options. To survive in this information world, every organization must keep pace with these technological changes. Organizations have to learn new ways of doing business—doing business the IT way. E-commerce is an integral part of doing business in this Internet age.

Technological Advancements

Increasing the computational power of computers and the capacity of networks to carry data has put us on the doorstep of a new era in distributed computer processing. Teraflop computers (Tera or one trillion floating point operations per second) and gigabit networks will enable computers to access remote information and provide services that will—for many applications—diminish the importance of distance to virtual insignificance. These advances in distributed computing will revolutionize the way we acquire information, interact with our colleagues, and carry out business and social activities.

Already researchers have benchmarked processors at 20-gigaflops. Experimental networks have achieved data rates in excess of several gigabits per second. Scientists are also designing machines using massively parallel processors (MPPs); they believe will be able to operate at the rate of a teraflop or more in the very near future. Some network researchers believe that future optical networks will be capable of achieving data rates as high as a terabit per second. Along with these technological advances, many economists believe that economic success will hinge on the ability to innovate, design, and manufacture—areas for which increased computing power is essential. This author believes that the future will see the linking together or convergence of the four major e-commerce drivers—computers, networks, information, and people.

Computers will provide the raw computational power necessary to support new and powerful software applications; high-speed networks will support convenient user-to-user communications and allow access to information throughout the network. Currently, commerce is carried out in a way that is markedly different from the way it has been carried out in the past. Many of our business transactions are carried out without human intervention. Today, we conduct many of our educational endeavors (such as distance learning, interactive classrooms, digital libraries, web-based teaching, etc.) and social interactions (on-line shopping, video conferencing, chat sessions, e-mail, etc.) without leaving our homes. This new manner of carrying out commerce is called electronic commerce or e-commerce.

E-commerce Defined

Electronic commerce integrates communications, data management, and security services to allow business applications within different organizations to automatically interchange information. Communications systems transfer information from the originator to the recipient. Data management services define the interchange format of the information. Security services authenticate the source of information, verify the integrity of the information received by the recipient, prevent disclosure of the information to unauthorized users, and verify that the intended recipient has received the information. E-commerce applies and integrates these infrastructure services to support business and commercial applications including financial transactions such as electronic bidding, ordering and payments, and exchange of digital product specifications, and design data.

E-commerce is a multi-disciplinary field that includes technical areas such as networking and telecommunications, security and storage and retrieval of multimedia information, business areas such as procurement, purchasing, production, marketing, billing and payment, and supply chain management. It also includes legal aspects like information privacy, intellectual property, taxation, contractual obligations, etc. It includes financial aspects like EDI transactions, credit card payments and credit card processing, etc.

Commerce is usually thought of in a business context as exchange of goods or commodities, especially on a large scale. Webster's dictionary defines 'commerce' as an interchange of goods or commodities between different countries (foreign commerce) or between different parts of the same country (domestic commerce). Goods are not conveyed without being accompanied by a variety of information. A typical commerce activity may include a purchase order and invoice. It may require

updating accounting and inventory records, and manipulating and modifying administrative information. Commerce, though, is not limited to business activities. It also applies to social exchanges, such as exchanges of ideas or opinions. Commerce, therefore, is considered to be an exchange of goods or information in carrying out social or business activities. For some commerce activities, it is the exchange or conveyance of information itself that is the end objective. Examples of these types of activities include mail or phone exchanges that may or may not be directly related to a business transaction. Thus, information—as the object of a commerce activity or accompanying a commerce activity—has traditionally, been an integral part of conducting commerce.

Information is also an integral part of e-commerce, but electronic and traditional commerce each deal with information differently. Conveying information has traditionally been done through paper exchanges, direct personal contact, or through the phone or postal systems. In e-commerce, information may be conveyed via a communications network or other electronic media. The way information is processed in e-commerce also differs from the way it has been processed earlier. Traditionally, information accompanying a business transaction had to be acted upon by the individuals involved in the transaction. In e-commerce, information processing is automated, thus reducing or eliminating the need for human intervention and the use of paper. Thus, conducting commerce electronically differs from conducting commerce traditionally in the way information is exchanged and processed. Hence, it is this change in the way information is processed and exchanged that distinguishes electronic from traditional commerce. E-commerce is, thus, commerce that is transacted using automated processing procedures integrated with automated procedures for the interchange of information.

This integration in the processing and exchange of information can be achieved through integrating a set of services. This set is made up of communications, data management, and security services. By integrating these services into the business application, e-commerce can make these services transparently available to the user. Through this integration and automation, commerce is made more efficient, convenient, and accurate.

A number of activities, including mail exchanges, electronic funds transfer, remote access to database systems and automatic monitoring of store inventory levels, automated production planning and JIT manufacturing, automatic purchase order processing and fulfillment, web-based customer support, etc., can be used in e-commerce. It is the expansion of these activities, along with their incorporation into the process of conducting commerce electronically that is one of the major objectives of e-commerce. Ultimately, one would like to see these activities become commonplace as the use of the telephone today.

EVOLUTION OF E-COMMERCE

Developments in IT in recent years have fueled many major advances in several technological areas like telemedicine, distance learning, digital libraries, computer-aided manufacturing, and e-commerce. E-commerce has experienced an explosion due to the convergence of these technological developments, the merging of telecommunications and computing industries, and the appropriate business climate.

Although the term ‘e-commerce’ has gained popularity only recently, electronic commerce has been around in various forms for over 30 years. Electronic data interchange (EDI) and electronic funds transfer (EFT) technologies were first introduced in the late 1970s. The growth and acceptance of credit cards, phone banking, and automated teller machines (ATM) in the 1980s are also forms of e-commerce. While many of these electronic trading technologies have made dramatic changes within their own markets and created reasonable interest among users, none have attracted as much hype or media attention as e-commerce.

The commercialization and privatization of the Internet and WWW and its exponential increase in popularity are the foundations that propelled the growth of e-commerce. The Internet provides

efficient, effective, and affordable means of communication and information sharing across the world. This makes the Internet an attractive and cost-effective medium for e-commerce and for the first time has the potential to deliver the notion of e-commerce as always implied.

In the past, businesses could conduct transactions with one another over closed proprietary (an often very expensive) networks. The exponential growth of the Internet has changed this. Traditional e-commerce activities like EDI and EFT can now be conducted with new participants on a global scale. These new participants include new business partners from across the world, corporations, small- and medium-sized businesses, individuals and even government agencies. In this new global electronic marketplace, the knowledge of the identity of one's business partner is not always a requirement. The Internet has made the global marketplace a level playground where small- and medium-sized businesses or individuals can compete with large conglomerates and fight and win, based on the quality of the products and services they offer.

As, former US Vice President Al Gore said in December 1998, "in this emerging digital marketplace nearly anyone with a good idea and a little software can set up shop and then become the corner store for an entire planet. The Internet makes any connected computer that central location and any desktop can be a doorway to a global mall with a sign that says, 'Open 24 hours a day, 7 days a week, 365 days a year'."

E-COMMERCE: GROWTH FACTORS

E-commerce, as we have seen earlier, is multi-disciplinary in nature. The development, growth, and impact of e-commerce as a common and popular medium of commerce and the most popular way of transacting business are fueled by many factors. In other words, there are many prime movers that play significant roles in making e-commerce a force and a critical business ingredient that can neither be ignored nor overlooked. The most important factor, as we have mentioned earlier, is the growth and commercialization of the Internet and the popularity of the WWW. Another factor that has played a significant role both in the growth of e-commerce and the Internet is the advancements in the field of IT.

Information technology is changing the way we live and do business. It has been responsible for about one-third of real economic growth in the past few years. According to Alan Greenspan, Chairman of US Federal Reserve Board, "the newest innovations that we label information technologies, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago."

Growth of The Internet and Internet Population

The growth of the Internet and WWW has been exponential. In 1992, there were only 1.3 million Internet users. According to Internet World Stats (www.internetworldstats.com), the number of users as of June 30, 2012 is 2.405 billion (2,405,518,376 to be very specific). According to a projection by eTForecasts (www. etforecasts.com), the number of Internet users will grow to 2.9 billion by 2015. India has the third position (after US and China) in the number of Internet users—137 million users (99 million from Urban India and 38 million from rural India).

Indians are getting hooked to the Internet and WWW not only in large numbers; they are also spending longer hours on the Internet. A study jointly conducted by the Internet and Mobile Association of India (IAMAI) and IMRB International [1] shows that 75% of the total 137 million Internet users access the Internet more than once a week compared to 68% in 2006. The number of Internet users in small towns (towns with population less than 10 lakhs) has gone up from 39% in 2006 to 47% in 2011. The number of Internet users in metros has gone down from 61% in 2006 to 53% in 2011 and the reason for the decline in the growth rate is that the metros are gradually approaching saturation. The percentage of Internet users who access Internet on a daily basis has

increased from 28% in 2006 to 54% in 2012. With the Internet becoming an integral part of everybody's lives, the majority is the medium user—people who access the Internet for 7–31 hours per week. Among the various demographic segments, the non-working women access the Internet the most, followed by working women and college going students. This could be mainly due to availability of rich and engaging content online for various user segments. Around 27% of the young men are heavy users (i.e. who access the Internet for more than 31 hours per week).

Technology

Over the last few years, e-commerce has become synonymous with the explosion of methods and applications of IT. E-commerce has come to mean many different things to our society. On one level, it represents a profoundly different way in which businesses relate to one another. On another level, it represents an abundance of educational and shopping opportunities. Finally, e-commerce has challenged governments at all levels to determine what its role should be, when to intervene (if at all), and how to further the promise of the technology while protecting citizens against the risks.

As the Internet and e-commerce continue to grow by leaps and bounds, expanding into the far reaches of the world and transforming the way we live, work, and shop, adherence to principles like private sector leadership, avoidance of unnecessary restrictions, a minimalist government role, etc., becomes even more important. The new information age demands new approaches to old problems, as well as to the novel challenges and opportunities the Internet presents. The private sector has a particularly important role to play in meeting these challenges. Many in the private sector, including industry, academics, and non-profit organizations enhance our civil society, enrich our lives by tapping the broader social benefits of the Internet, and move beyond the digital divide to digital opportunity. The future of e-commerce should be built on the work that has already been done to promote the growth of the Internet and to create a safe and secure on-line environment. We should, while continuing our previous work, challenge both government and the private sector to find new ways to bring the promise of the Internet to all people and move society toward a world of digital equality.

Consumer Protection, Privacy, and Internet Security

Another set of factors that plays an important role in the growth of e-commerce is the increasing confidence in consumer protection, privacy, and Internet security. The robust projections for the growth of e-commerce are unlikely to hold true unless on-line consumers can shop on the web with confidence. Expanding the digital economy means assuring shoppers that their communications are secure, their personal data is protected, they will get what they paid for, and the underlying infrastructure is stable no matter where they shop on the Internet. Bolstering consumer confidence means strengthening self-regulatory mechanisms and formulating and enforcing Internet/cyber laws. The emergence of modern encryption and security methods, like virtual private networks (VPN), secure socket layers (SSL), secure electronic transactions (SET), etc., have played a major role in improving consumer confidence and reducing fraud over the Internet.

Entry of Small- and Medium-Sized Business

The Internet savvy means that anyone with a laptop and modem can open a storefront and have access to a global marketplace. The global nature of the Internet has ensured that even the smallest business can take advantage of the unprecedented access to national and international markets.

Some small businesses may face barriers to adopting e-commerce, such as lack of knowledge about the technology and its costs, insufficient information about the benefits of e-commerce and potentially applicable business models, shortage of technically trained employees, complex and

user-discouraging e-commerce implementations, and the absence of unbiased and qualified assistance. However, by failing to participate in e-commerce, these companies are missing important opportunities for lowering costs, increasing productivity, expanding market access, and improving relationships with customers and business partners alike. By not making the transition to this new way of doing business, small firms run a serious risk of becoming less competitive, affecting both their present market positions and long-term viability. As larger companies integrate e-commerce into their business, small firms run the risk of being rejected if they are unable to establish strong e-commerce ties with others in their supply chains.

Every business now has the opportunity to take advantage of the Internet's geographical reach and potential for profit. Thus, the Internet has made it possible for small- and medium-sized enterprises (SMEs) to compete confidently with larger organizations. The enabling potential of the Internet guarantees that SMEs are appropriately represented and actively participate in the globalized marketplace.

Global Reach

With the global reach of the Internet, e-commerce quickly connects buyers and sellers from around the world. Thus, in order for this global medium to flourish, it is critical that the legal framework supporting commercial transactions on the Internet be governed by consistent principles across state, national, and international borders. Efforts in this direction by many national and international sectors are helping in the exponential growth of e-commerce.

E-COMMERCE TO E-BUSINESS

E-commerce is generally associated with buying and selling of information, products, and services via computer networks. Today e-commerce is a business reality and is rapidly growing and has become an integral part of the business environment. We have an idea of introduction to e-commerce, its benefits and the factors driving its growth.

Back in 1994, when companies started putting up commercial web sites, those web sites were primarily meant for advertising and providing marketing information. Doing e-commerce was not a goal of the organizations at that point in time. In 1994, there were less than 1000 organizations worldwide having a commercial web site. In 1994, the concept of selling products and services over the Internet, reaching new customers and ensuring the loyalty of customers using the Internet, creating new ways of transacting business over the Internet, etc., did not even arise in the wildest dreams of the companies having a web presence. Today, all these and more are possible and the number of commercial web sites has grown exponentially. According to a Netcraft survey conducted in August 2012 (*http://news.netcraft.com/archives/2012/08/02/august-2012-web-server-survey.html*), there are more than 628 million websites worldwide. Companies are realizing that the web is having a profound impact on how they conduct business. With its open-platform-based technology and ubiquitous reach, the Internet is allowing companies to open up new distribution channels, forge communities of buyers and sellers, and increase revenues and increase profits. Thus the concept that was unimaginable just a few years ago, has penetrated such that corporations are utilizing Internet technology to set up e-commerce business and successfully conduct trade over the Internet. Let us look at some examples.

1. The annual revenue of Dell Computers (www.dell.com) the No. 1 provider of computer systems for the fiscal year that ended in January 2012 was $62.1 billion a 1% increase from 2011. Dell has opened stores in many other countries, including India (www.dell.co.in). The

on-line sales model helps Dell in cutting costs and delivering products at a much lower rate than its competitors. However, now most companies have started selling their computer on-line and soon Dell will be facing stiff competition from companies like HP, Acer, IBM Lenovo, etc.

2. Launched as a web site in July 1995, Amazon.com Inc. (www.amazon.com) with two employees in Seattle grew so fast that its revenue in 2011 was $48.08 billion compared to $6.9 billion in 2004. Amazon ousted the two bookstore majors Barnes & Noble and Borders Books & Music from their top slots, who also had to open on-line shops to compete with Amazon. Now the popularity of Amazon.com is so huge that someone has quipped, "Now Amazon is first a bookstore and only then the river!"
3. These days it takes only a few minutes to choose a train/flight or plan a vacation at websites of Indian Railway Catering and Tourism Corporation Limited (www.irctc.co.in). Similarly one can book flight tickets from the websites of the various airline companies or compare and book tickets for the lowest rate from many travel sites like MakeMyTrip.com (www.makemytrip.com) or Expedia (www.expedia.co.in), Yatra.com (www.yatra.com). In the past, this activity used to take hours and one had to go to the travel agent's office or the railway station or airline companies' offices.
4. FedEx (www.fedex.com), DHL Worldwide Express (www.dhl.com), and Blue Dart Express Ltd. (www.bluedart.com) allows its customers not only to track their packages on-line but also allows them to schedule pickups, create airway bills, and so on.
5. McGraw-Hill Education (India) Ltd. (www.tatamcgrawhill.com) opened its web site and is now selling books worldwide, accepting book proposals, offering special deals, etc. through the site.
6. South Indian Bank Ltd. (*http://www.southindianbank.com/*) started its Internet banking—SiBerNet—service, which enables customers to do banking transactions over the Internet.
7. Flipkart (www.flipkart.com) which was started as an on-line book store in 2007 has expanded with many stores like mobiles and accessories, pens and stationery, home and kitchen, cameras, beauty and personal care, games and consoles, TVs and video players, music, movies and posters, baby care and toys, etc., and is growing aggressively into more sectors like clothing, footwear, sport and fitness, eBooks, MP3 downloads, etc., and are introducing many innovative strategies like cash on delivery (CoD), Flipkart self-delivery, 30-day replacement guarantee, EMI options, free shipping, 24×7 customer support, etc.
8. In the United States, it takes only a few minutes to choose a flight or plan a vacation at Microsoft Expedia (http://www.expedia.com), an integrated on-line travel transactions site, whereas it takes hours to do the same thing using a travel agent.
9. Founded in September 1995, eBay is a global on-line marketplace where practically anyone can trade practically anything. eBay India (www.ebay.in) was launched in India in 2000 and has become one of India's leading on-line shopping destinations. eBay India has a community of over 4 million registered users from 3311 towns in India. Approximately 30,000 sellers use eBay India as a primary or secondary source of income.
10. VSNL (www.vsnl.com) introduced Internet services in India in the year 1995, and triggered the Internet boom. In February 2002, VSNL was taken over under the administrative control of Tata's, has become Tata Communications (www.tatacommunications.com) and is offering a host of services like dial-up and broadband internet access, net telephony and Wi-Fi services.

These are only some of the well-known success stories. There are hundreds of other organizations—both foreign and Indian—which conduct their business transactions over the Internet. The pervasive

nature of the Internet and WWW on the business is shown in Fig. 10.1. The customers, suppliers, and organizations are all connected using this new digital medium.

As Fig. 10.1 clearly shows, no organization can ignore the Internet for survival. But doing business on the Internet and doing business the Internet way are very different. When you accept payments through the Internet, advertise your products on the web, or send e-mails to potential customers, you are doing business over the Internet. When you accept payments over the Internet or any other electronic media (like EDI or EFT), we call it e-commerce. However, doing e-commerce is not the end of doing business electronically. In this Internet age, e-commerce is just the beginning. When you accept payments electronically, they reach you or your bank at 'Internet speed'—the speed that you cannot expect in traditional business transactions. Thus, when you are getting your payments at 'Internet speed' you should be ready to do business at the same speed. When you optimize your business operations, streamline your supply chain to meet the challenges of the digital economy, have automated your business processes, achieved information integration and acquired business intelligence, when your organization can take proactive decisions within seconds, and react to changes in customer demands and swings in market trends quickly, then you can say that you are doing business the Internet way. Such a business is called e-business.

E-BUSINESS

"New economy, new tools, new rules. Few concepts have revolutionized businesses more profoundly than e-commerce. The streamlining of interactions, products, and payments from customers to companies and from companies to suppliers is causing an earthquake in many boardrooms. Managers are being forced to re-examine traditional definitions of value as we enter a new millennium." [2]

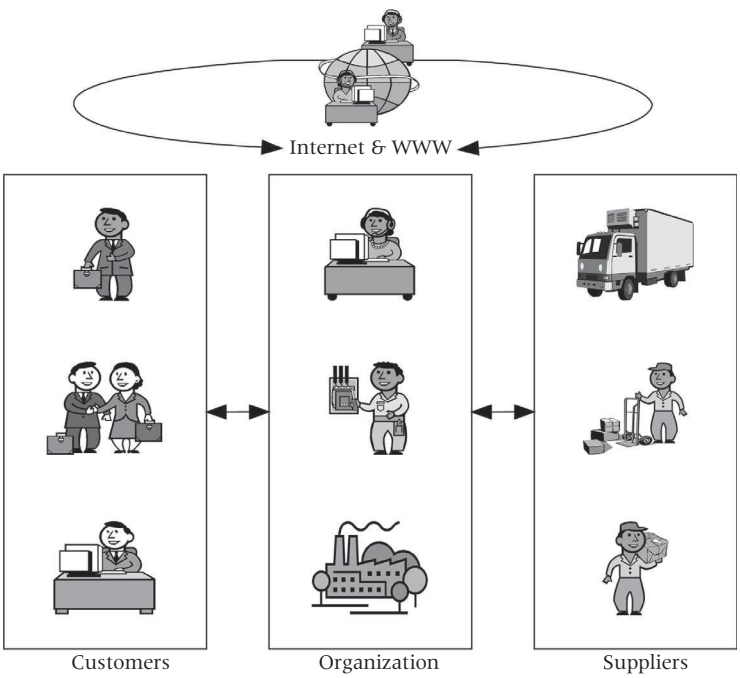

Figure 10.1 Internet as a medium that connects customers, suppliers, and organizations.

E-commerce is here to stay. In this new millennium Internet, WWW and e-commerce are the key industry drivers. No company can survive in this brutally competitive environment if they ignore e-commerce. E-commerce, more specifically business-to-consumer (B-to-C) has changed the way companies do business. It has changed the way the consumers buy products and services. It has changed life for commission agents, brokers, dealmakers, and the like. It has brought the consumers—the end users—and manufacturers or service providers closer than ever before. It has created new distribution channels, new customers, and new business opportunities.

The companies that operate in the traditional mode are called 'brick and mortar companies' in Internet parlance. These brick and mortar companies do business in the old-fashioned way. They do not use the web or Internet for their business operations, at least not in a major way. Therefore, the big question is whether your organization is ready for e-commerce or is it still in the brick and mortar mode. Is your organization capable of doing business at Internet speed? In order to do business in this digital marketplace, adopting e-commerce is not enough. As we have mentioned earlier, the entire business operations—the entire supply chain (right from the suppliers to the end users)—have to be reengineered. The reengineering should be done keeping in mind that the end result—the goal of the reengineering effort—is to do business at Internet speed. When an organization has geared itself, transformed its business structures and cultures and is ready to do business in today's connected world we call that organization an e-business (e-biz for short).

E-business is the convergence and fusion of business process, enterprise applications, business infrastructure, technology, information and organizational structure (people) necessary to create a high performance business. It is not possible for an organization to execute e-commerce transactions efficiently and effectively without first transforming to the e-business model.

What is the difference between e-commerce and e-business? E-commerce is buying and selling using an electronic medium. It is accepting credit card payments over the net, doing banking transactions using the Internet, selling commodities or information using the WWW, and so on.

According to Kalakota and Robinson [2], "e-business, in addition to encompassing e-commerce, includes both front and back office applications that form the engine for modern business. E-business is not just about e-commerce transactions; it's about re-defining old business models, with the aid of technology, to maximize customer value. E-business is the overall strategy and e-commerce is an extremely important facet of e-business."

Thus, e-business involves not merely setting up the company web site and being able to accept credit card payments or being able to sell products or services on-line. It involves fundamental restructuring and streamlining of the business using technology. It includes enterprise resource planning (ERP) systems, supply chain management, customer relationship management (CRM), data warehousing, data marts, data mining, on-line analytical processing (OLAP), geographical information systems (GIS), etc. to name a few. To transform a traditional organization to do e-business involves using technology to the fullest. Technological advancements are making things better, bigger, and bolder. Businesses are capable of doing things that were unimaginable a few years back. For example, an organization can now receive a purchase order and notify the customer within seconds after the customer has confirmed the order, customers can do the order cancellation without involving anybody from the company, and can the track the order status and the status of the shipment on-line over the Internet. These activities took days just a few years back and involved interaction with the customer service staff. Now people can make on-line payments over a secure socket layer (SSL) and be reasonably sure that the information will not be tampered with or end up with the wrong people. They can download and transfer digital cash to their friends or pay for the goods they have bought. It is technology and innovative and new business processes that are making these things possible. Thus, today's organizations—the e-businesses—should make technology an ally and should constantly innovate and continuously improve to stay in business and be competitive.

According to Seybold [3], "…you cannot do business on the Internet in a vacuum. Instead, Internet commerce needs to be part of the broader electronic business strategy—a strategy that embraces all the ways that you let your customers do business with you electronically: by touch-tone phone, by fax, by e-mail, by kiosk, via handhelds, and via the Web."

SUMMARY

E-commerce is emerging as the most prominent method of doing business. When you are executing e-commerce transactions, your organization should be capable of doing business at Internet speed. This means transforming and streamlining the business operations using the latest technologies available making the organization efficient and effective.

The Internet is rapidly transforming the way we live, work, and shop in all sectors of the economy. The Internet makes it possible for anyone, whether a student, researcher, or concerned citizen, to have access to information that previously was available only to those with physical access to a sophisticated research library. People the world over can shop for a wide range of goods and services, at any time of the day or night, from the convenience of their homes, offices, or even public libraries. Businesses of any size can communicate and coordinate on-line with their suppliers, employees, and customers to provide improved products and services at lower costs.

E-commerce—the ability to carry out transactions over the Internet—can make a tremendous difference in people's lives. People are saving time and money, locating hard to find items and becoming entrepreneurs themselves—all through the use of the Internet. The Internet also provides a wealth of information on virtually any product or service available. Already significantly larger in terms of the value (money value) of the transactions, and growing even faster than business-to-consumer e-commerce, is business-to-business e-commerce. The adoption of Internet-based e-commerce by the business community is making a tremendous difference to how business is conducted, fundamentally altering firm behavior and industry structure.

Competition in the new electronic environment will become increasingly intense as both buyers and sellers use the Internet to make deals with customers and suppliers previously beyond their reach. As cost differentials shrink, firms increasingly will rely on innovations in products, services, and delivery to attract and retain their customers. As technology creates an on-line experience we cannot yet begin to imagine, the rule and strategies of traditional business will undergo dramatic changes. A market-driven approach is essential to allow e-commerce to flourish and to stimulate innovation, provide better services, and lower prices. To survive in this new millennium, both the government and the private sectors must embrace policies and initiatives that will allow the Internet and e-commerce to grow and flourish, bringing numerous economic and social benefits to people everywhere.

Companies should develop strategies that are build around the Internet, WWW, IT, e-commerce and should reorganize/reengineer the business processes to make maximum benefit out of these driving forces. In other words, in order to survive and thrive in this highly competitive digital environment, organizations should transform themselves into e-businesses, which are capable of doing business at Internet speed.

REVIEW QUESTIONS

1. What is e-commerce?
2. What is the primary goal of e-commerce?
3. How has the IT revolution influenced the working of businesses?
4. Why is it said that e-commerce is an integral part of doing business in the Internet age?

5. What are the technological advancements that are having an impact on businesses?
6. How does e-commerce integrate communications, data management, and security services?
7. Why is e-commerce called a multi-disciplinary field?
8. Why is it said that information is an integral part of conducting commerce?
9. Why is it said that information is an integral part of e-commerce?
10. How can the integration in the processing and exchange of information be achieved?
11. Describe the evolution of e-commerce.
12. What are the growth factors of e-commerce?
13. How has the growth of Internet and Internet users affected e-commerce?
14. How has the technological advancements helped the growth of e-commerce?
15. How has the advancements in consumer protection and Internet security improved the growth of e-commerce?
16. What is the influence of the entry of small- and medium-sized businesses on e-commerce?
17. What is the impact of the Internet and its global reach on e-commerce?
18. No organization can ignore the Internet and survive. Discuss.
19. What are 'brick and mortar' companies?
20. Analyze some e-businesses with examples.
21. Discuss how e-business is different from traditional business.
22. What is e-business?
23. What is the difference between e-commerce and e-business?
24. Discuss the transformation of organizations from e-commerce users to e-businesses.
25. E-business involves not merely setting up the company web site and being able to accept credit card payments or being able to sell products or services on-line. Discuss.

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Chapter 11

Business Process Reengineering (BPR)

Business reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed.

– Dr. Michael Hammer

INTRODUCTION

Business process reengineering (BPR) means not just change—but dramatic change and dramatic improvements. This is achieved by the overhauling of the organizational structures, management systems, job descriptions, performance measurements, skill development, training and most importantly, the use of IT. BPR impacts every aspect of how the organization runs its business. Change on this scale can cause results ranging from enviable success to complete breakdown and failure.

A successful BPR can result in dramatic performance improvements, increase in profits, better business practices, enormous cost reductions, dramatic improvements in productivity, and so on. It can also create substantial improvements in quality, customer service, employee satisfaction, profitability, and other business goals. The promise of BPR is not an empty one; it can actually deliver what it assures. The stories of BPR failures are due to improper implementation or other factors. BPR can help a successful company to stay on top or transform one that may be on the verge of bankruptcy, into a successful one.

In many cases, BPR projects have failed to meet high expectations. Recent surveys estimate the percentage of BPR failures to be as high as 70%. Some organizations have succeeded only in achieving marginal (and in some case negligible) benefits even after spending huge amounts of time and money on BPR. Some others who were not that lucky have ended up destroying the morale and momentum built up over the lifetime of the organizations. These failures indicate that reengineering involves a great deal of risk. In spite of all these incidents about failures; many companies are willing to take the risk because the rewards can be astounding. Even though there are many cases where BPR has resulted in catastrophic results, the fact still remains that a properly implemented BPR has the ability to produce dramatic improvements.

Many unsuccessful BPR attempts are due to the confusion surrounding BPR and how it should be performed. Also many companies just jumped onto the BPR bandwagon and started their BPR projects without adequate preparation or planning. Organizations were aware that changes needed to be made, but did not know what to change and how to effect the change. As a result, the BPR exercises became a process of trial and error and therefore many of them failed. Also, many companies failed to recognize the importance of IT. However, as more and more businesses reengineer their processes, knowledge of what caused the success or failures is becoming clearer and this will help companies to avoid mistakes and lead to successful BPR projects.

THE EVOLUTION OF BPR

During the period 1990–1993, management experts like Dr. Michael Hammer, James Champy, and Thomas Davenport, after a great amount of research and studies of successful industries created the concept of BPR.

Hammer, named by *Business Week* as one of the four preeminent management gurus of the 1990s, together with Champy, chairman of CSC Index, Inc., gathered information about organizations thriving in their respective industries, along with assorted management consulting experiences. They were asking questions such as, "what worked and why?" along with "what didn't work and why not?" They discovered that most of the companies that had succeeded in changing their processes had used a similar set of tools and tactics. They called this set of procedures business reengineering.

Thomas Davenport also performed research in this area, asking similar questions, through his work at Ernst & Young's Center for IT and strategy. By examining companies that were redesigning processes, he gathered information on methods and practices, which led to the successful implementation of what he called process innovation.

Although slightly different, both business reengineering and process innovation address the concept of redesigning how businesses perform strategic processes. In fact, both approaches shared a number of core activities. Since processes were at the heart of these management philosophies, the term *business process reengineering, or BPR*, was adopted to describe these efforts. Since then, a myriad of books, articles, seminars, workshops, and computer tools have been developed by academicians, management consultants, and software developers to help organizations actually perform BPR.

Today, many organizations have acquired extensive experience in performing BPR. Many of these experts are still not in agreement with the activities necessary for this; yet, the core activities have remained stable during the continuous debate. The disagreements may be, in part, due to the uniqueness of each organization. Because when organizations differ, the activities necessary to successfully perform BPR may also differ.

This chapter discusses the activities identified by experts to be necessary for success in performing BPR. The methods commonly accepted by most BPR experts as the core of successful BPR are illustrated. In addition, optional activities proposed by a variety of management consulting firms who have successfully assisted their clients with BPR are also included. These methods, procedures, and tasks are identified to help organizations decide how they should perform BPR to meet the unique needs of their industry, people, and culture.

BPR: THE DIFFERENT PHASES

According to Peter F. Drucker, "Reengineering is new, and it has to be done." The tasks that experts agree upon to successfully perform BPR can be grouped into seven steps, or phases. All successful BPR projects begin with the most critical requirement—communication throughout the organization.

1. Begin organizational change
2. Build the reengineering organization
3. Identify BPR opportunities
4. Understand the existing process
5. Reengineer the process
6. Blueprint the new business system
7. Perform the transformation

Phase 1: Begin Organizational Change

The main activities in this step are:

- Assess the current state of the organization
- Explain the need for change

- Illustrate the desired state
- Create a communications campaign for change

The first step is to take a long, hard look at how the organization operates. The focus of this analysis is on the operating procedures and the bottom-line results that are generated by them. The purpose of performing the analysis described below is to determine whether dramatic changes are possible by doing the BPR. It may be that only marginal change (the result of continuous process improvements—Kaizen, total quality management (TQM), and other similar programs) is needed—which would trigger the change initiative in the organization and that too at a much lesser risk. Aspects of the business that need to be evaluated are:

- How things are currently done?
- What changes may be expected?
- What new circumstances exist in the business environment?

The next step is to look for harmful operating procedures, if any, within the organization that have caused or will cause irreparable damage to the company's business goal and functioning. What are the sources of the organization's concern? Maybe the demands of the marketplace are dwindling. Perhaps competitors have made significant advancements in products and services. Regardless of the reasons, it should be clear as to whether or not the organization, in its current state, is able to meet the needs of the markets it serves. The consequences of inaction should be identified and well understood. In most cases, these consequences are the loss of jobs by shutting down portions of the business, or perhaps the entire business. Finally, the proper future direction of the organization should be decided. The future 'vision' of how the business must operate will serve as a clear and concise guide with measurable goals for employees to focus on.

If an organization wishes to change the way it operates, it must turn to its people to make this happen. People are the agents of change and it is the same people who can create the maximum amount of trouble. Creating business plans and strategies are important, but they are only tools to guide the actions of people.

Because BPR can potentially require significant changes throughout an organization, it must begin with a communications campaign to educate all those who will be impacted by this change. Communication to all levels of personnel must remain active from start till finish, to keep everyone involved and working towards a common goal. Without a common understanding about what is happening, confusion and uncertainty about the future can result in resistance that is strong enough to stop any reengineering effort. BPR is most effective when everyone understands the need for change, and works together to tear down old business systems and build new ones.

In order for change to be embraced, everyone must understand where the organization is today, why it needs to change, and where it should be in order to survive, thrive, and beat the competition.

Phase 2: Build the Reengineering Organization

The major activities of the second phase are given below:

- Establish a BPR organizational structure
- Establish the roles for performing BPR
- Choose the personnel who will reengineer

An infrastructure must be established to support reengineering efforts. Although this phase consists of only a few tasks, it has tremendous impact on the success of a BPR endeavor. The questions that must be answered as the reengineering staff is gathered together to communicate, motivate,

persuade, educate, destroy, create, rebuild, and implement are:

1. Who are the people that will be enlisted to reengineer the business?
2. What will their responsibilities be?
3. Who will they report to?
4. What will happen to the normal business functions when the BPR is going on?

One of the most important members of the reengineering effort is the *executive leader***.** He must be a high-level executive who has the necessary authority to make people listen and the motivational power to make them follow. Without the commitment of substantial time and effort from the top management, no BPR project can overcome the internal forces and will never reach implementation.

A *process owner* is responsible for a specific process and the reengineering effort focused on it. There should be a process owner for each high-level process being reengineered. Allocating the responsibility of a process to a specific person ensures that someone is in charge of how that process performs. The executive leader usually appoints process owners.

The process owner convenes a *reengineering team* to actually reengineer his/her process. The team, dedicated to the reengineering of a specific process, should include insiders, who perform the process and are aware of its strengths and weaknesses, along with outsiders who can provide objective inputs to spark creative ideas for redesign.

The team must be small, usually five to ten people and as they will be the ones who diagnose the existing process, and oversee the redesign and implementation, they should be credible in their respective areas. The inclusion of employees in the team is very important and plays a vital role in reducing resistance by the employees to the new process.

In some BPR initiatives, it is helpful to institute a *steering committee*. Especially in larger or multiple reengineering projects, a steering committee can control the chaos by developing an overall reengineering strategy and monitoring its progress.

Lastly, a *reengineering specialist or consultant* can be an invaluable addition to the overall effort. Such a specialist can assist each of the reengineering teams by providing tools, techniques, and methods to help them with their tasks.

The impact of key members on a reengineering effort is often underestimated. A study of BPR projects published in the Harvard Business Review (Hall, G. Rosenthal, G. and Wade. J., *How to Make Reengineering Really Work,* Harvard Business Review, November–December 1993) listed 'Assigning average performers' as one of the four ways in which redesign efforts tend to fail.

The study showed companies were afraid of assigning their top performers because it could have impacted the performance of business units while reengineering was underway. Table 11.1 shows more details:

Phase 3: Identify BPR Opportunities

This phase consists of the following activities:

- Identify the core/high-level processes
- Recognize potential change enablers
- Gather performance metrics within industry
- Gather performance metrics outside industry
- Select processes that should be reengineered
- Prioritize selected processes
- Evaluate preexisting business strategies

- Consult with customers for their desires
- Determine customer's actual needs
- Formulate new process performance objectives
- Establish key process characteristics
- Identify potential barriers to implementation

In this phase, we begin to break away from normal patterns of identifying business opportunities. We start by dividing the entire organization into high-level processes rather than the usual vertical business areas such as marketing, production, finance, etc. These processes, usually less than a dozen, are the major or core processes of the organization. This activity is not a time-consuming task, but it is difficult because it requires a good knowledge of what the company thinks of itself. One goal here is to identify the process boundaries (where the process begins and where it ends), which will help set the project scope for those processes that are to be reengineered.

In many cases, seeing the company from the customer's point of view can help identify what these high-level processes might be. For example, when Texas Instruments outlined the major processes for

Table 11.1 Keys to success and ways to fail

Five Keys to a Successful Redesign	... And Four Ways to Fail
Set an aggressive reengineering performance target. The target must span the entire business unit to ensure sufficient breadth.	Assign average performers. Companies often shy away from assigning their top performers to the redesign project for fear of impacting business unit performance during the redesign. This is a critical misjudgment.
Commit 20%–50% of the chief executive's time to the project. The time commitment may begin at 20% and grow to 50% during the implementation stage.	Measure only the plan. Though most companies invest a lot of resources in estimating the effects of the redesign on cost, quality, and time before implementation, they rarely follow through with a comprehensive measurement system that can track the new process's performance as it is actually being rolled out.
Conduct a comprehensive review of customer needs, economic leverage points, and market trends.	Settle for the status quo. Most companies have difficulty thinking outside their own skill level, organizational structures, or system constraints. Help from an outside expert can be crucial here. Moreover, companies that do come up with innovative approaches find them watered down by political infighting during the implementation stage.
Assign an additional senior executive or hire a reengineering expert to be responsible for the implementation. This person should spend 50% or more of his or her time on the project.	Overlook communications. Companies always underestimate the level of communication that must occur during the implementation stage. It helps to assign a top-level manager to develop and implement an on-going communication program.
Conduct a comprehensive pilot of the new design. The pilot should test the design's overall impact, as well as the implementation process, while at the same time building enthusiasm for full implementation.	

Source: Hall. G., Rosenthal, J., and Wade, J., How to Make Reengineering Really Work, *Harvard Business Review*.

their semiconductor business, they came up with only six processes as follows: strategy development, product development, customer design and support, order fulfillment, manufacturing capability development, and customer communications. Each of these processes converts inputs into outputs.

At this point, it is helpful to begin thinking about potential change levers that may lead to dramatic changes in the organization's processes. Change levers usually fall under one of three categories: the use of information, the use of IT, and human factors. Try answering the following questions:

- What is the latest in information that is easily accessible to the organization?
- What are the technologies that have recently been introduced, or are on the horizon, that can change how businesses and customers interact?
- What are the new ways of structuring cross-functional work teams, compensation systems, and incentive methods that have proven to be effective in improving operations in other organizations?

In many instances, a modification in one of these areas—information, IT, and people—requires changes in the other two in order to be most effective. Once the major processes have been defined, we need to decide which of our high-level processes needs to be reengineered. The most objective and accurate way is to compare the performance of the high-level processes, identified earlier, with the performance of the competitors as well as organizations in other industrial segments. Even if the direct competition is outperformed, there may be companies in other industries that may be much more effective in performing a similar task—such as order fulfillment or product development.

If a company fulfills orders in six months, while a competitor does it in two weeks, then this process can definitely be considered as a contender for reengineering. What one should look for are overall, bottom-line performance metrics for the high-level processes that will help in selecting the processes that must be reengineered. Typically, organizations use the following three criteria:

- Dysfunction (which processes are the most ineffective)
- Importance (which processes have the greatest impact on customers)
- Feasibility (which processes are at the moment most susceptible to accomplish a successful redesign)

Choosing a process which has high success rate and which can show success fast is very important to build the necessary momentum and enthusiasm at all levels of the organization. Prioritizing the processes that have been chosen for reengineering results in a schedule—the order in which the processes will be reengineered.

The first step is an assessment of the existing business strategy. Most likely, this existing business strategy is not focused on driving a process; therefore, a new process strategy has to be defined. This new process strategy should reflect the new strategic goals for the process. Customers are an important source of information to set the new direction. They should be consulted not only to discover their desires, but also to find out what they actually need. Process goals and objectives can be determined by combining customer needs with competitor strategies and best practices of the business. In addition to goals and objectives, the conception of the new process need to be completed by identifying key performance measures, key process characteristics, critical success factors, and potential barriers to implementation.

Phase 4: Understand the Existing Process

The main activities of the fourth phase are:

- Understand why the current steps are being performed
- Model the current process

- Understand how technology is currently being used
- Understand how information is currently being used
- Understand the current organizational structure
- Compare current process with the new objectives

Now that we know which process to reengineer, we need to take a look at why we currently perform the process the way it is. Understanding is a key word here. We may not need to scrutinize every detail of how we are performing the process—this effort sometimes referred to as analysis paralysis, has the potential to go on indefinitely, and can weaken the momentum needed to carry the project all the way to implementation. What we need to do is understand the underlying reasons, why the existing process is carried out the way it is so that we can question those assumptions during our reengineering sessions later on. Once we have the new process objectives clearly defined (in Phase 3), we can measure the existing process in terms of the new objectives to see where we are and how far we have to go.

Modeling the current process is an important part of this phase. It not only helps to better understand the existing process, but also helps with planning the migration from the old to the new process and executing the physical transformation of personnel, organizational structures, information requirements, and how technology is used. Information that should be included in the models are process inputs (such as task times, data requirements, resources, demand, etc.) and process outputs (such as data outputs, cost, throughput, cycle time, bottlenecks, etc.).

Understanding how and why the current processes use information is also important. Answering these questions will be helpful:

1. Do staff members have access to essential information?
2. Are some processes wasting time and effort by creating duplicate information when it can be shared across organizational boundaries?
3. Why is technology used to support some tasks and not others?
4. How effective are the current interfaces?
5. Are they easy to use, or are they counterintuitive and thus inhibit the effectiveness of current tasks?
6. In what way does the existing process take advantage of technology, and in what way has technology imposed artificial restrictions?

We need to end up with an estimate of the current cost, robustness, and functional value of each technology and information system that is currently being used.

Phase 5: Reengineer the Process

The major activities are:

- Ensure the diversity of the reengineering team
- Question current operating assumptions
- Brainstorm using change levers
- Brainstorm using BPR principles
- Evaluate the impact of new technologies
- Consider the perspectives of stakeholders
- Use customer value as the focal point

The actual 'reengineering' begins during this phase. We have moved from the strategy and analysis phases into the redesign phase. The reengineering team that was formed to take part in the

reengineering sessions should consist of designers and implementers, including people well-versed in technology. These team members should come from both inside and outside the existing process.

The 'inside' perspective may reveal information about the existing process that was not uncovered in Phase 4. Having people, who will be the future process owners or those responsible for the new process, is a critical component of the team. Including the future owners will help to ensure that the reengineered process succeeds once it is implemented.

Equally important is the 'outside' perspective of someone who will look at the process with a 'fresh pair of eyes' and raise questions about operating assumptions that may not be obvious to the insider because they may be too close to the process to realize this.

Lastly, a technologist will provide insight as to how technology can be applied in new and innovative ways. In other words, he will help to visualize how the process can be performed outside the boundaries of the current implementation. Including both outsiders and technologists on the team will help spark 'out-of-box' thinking—thinking creatively above and beyond the current restrictions.

Having developed a good understanding of how the existing processes work in the previous phase, it is now necessary to question the operating assumptions underlying the processes.

- Is there a reason why a process has been performed in a certain way?
- Are there customer requirements that dictate the steps in a process?

Many times the operating assumptions can be eliminated and new ones developed. However, it is important to evaluate the impact the assumptions have outside the process in question.

The reengineering team now has to conduct brainstorming sessions to create new process ideas. According to Dr. Hammer, brainstorming sessions are most successful when the following BPR principles are considered:

- Several jobs are combined into one
- Workers make decisions
- The steps in a process are performed in a natural order
- Processes have multiple versions
- Work is performed where it makes the most sense
- Checks and controls are reduced
- Reconciliation is minimized
- A case manager provides a single point of contact
- Hybrid centralized/decentralized operations are prevalent

For example, hybrid centralized/decentralized operations encourage the formation of cross-functional workgroups. Ideally, the team will identify those processes that should be centralized as well as the processes, which are of value to a specific group within the organization. An organization might maintain a customer database on a centralized system, but it would provide data for a variety of processes throughout the organization such as sales, purchasing, or accounts receivables.

During the brainstorming sessions, the reengineering team must also consider new technologies. They will need to evaluate the impact of new technology on the process. Technologies that are often considered enablers of reengineering include:

- ERP systems
- Supply chain integration technologies
- Business intelligence technologies

- Internet technologies
- Distributed computing platforms
- Client/server architectures
- Workflow automation technologies
- Groupware

The reengineering team should also search for uses of new information as well as new ways to use the existing information. The reengineered process may enable the organization to collect data that was not gathered before, thereby bringing new knowledge into the process to help in decision-making. Another benefit is the sharing of data across the organization to eliminate redundancies in data storage and increase internal communication.

The act of reengineering a process may require evaluation of the organizational model and the management strategy. A newly formed cross-functional workgroup will not fall neatly into a traditional hierarchical management structure. In addition, this workgroup will most likely require new measurement systems and reward programs. Changes in infrastructure can also have an impact on corporate values and belief systems. It may be found at this stage that a new process simply will not fit into the current organization without a new process-oriented organizational structure.

Lastly, the reengineering team must consider all process stakeholders in the redesign of a process. Stakeholders are those people whose actions impact the organization, and those who are impacted by the organization's actions. Stakeholders include both those internal to the process as well as those external to the process. External stakeholders may not be concerned with how a process is performed but they are certainly concerned with the output of the process if they are the recipients.

Throughout this phase, the team must consider the impact on external processes that interact with the reengineered process. Does the implementation of client/server architecture have an effect on another process? Will that process need to be reengineered also? Reengineering cannot be performed in a vacuum. However, it cannot be performed on all processes simultaneously either.

Phase 6: Blueprint the New Business System

The activities of Phase 6 are the following:

- Define the new workflow
- Model the new process steps
- Model the new information requirements
- Document the new organizational structure
- Describe the new technology specifications
- Record the new personnel management systems
- Describe the new values and cultures required

Blueprints are detailed plans required to build something in accordance with the designer's intentions. In BPR, blueprints must be created to identify all the necessary details of the newly reengineered business system and ensure it will be built as intended. This phase of the project takes the reengineered process developed in the previous phase, and provides the details that are needed to actually implement it.

Blueprinting involves modeling the new process flow and the information required to support it. Just as we modeled the 'as is' process and information requirements in Phase 4, we need to create 'to be' models to illustrate how the workflow will be different. The information models, or data models, will indicate where the new process will use information that is shared across functional areas of the business.

The blueprints should also contain models of the redesigned organizational structure. Instead of the traditional organization chart, a different kind of chart is needed. This chart will show the new process flow along with the process team members, the process owners, the case managers, and the process facilitators. The chart should also indicate parts of the organization, which interact with the process personnel.

In addition, detailed technology specifications that are required to support the new process should be defined. Although minor changes, or fine tuning adjustments to the technical configuration will probably occur during the implementation phase, an initial physical description of the technologies used and their physical specifications should be recommended in this phase, to set the stage for rapid application development.

The blueprints should include the new management systems and values or belief systems of this redesigned area of the business. New management strategies, along with new performance measurements, compensation systems, and rewards programs should be outlined. The reengineered process may require a change in the values or belief systems of the company. The redesign may require an entirely different culture, or atmosphere, than what is prevalent in the organization today. It is critical to have these areas, and their responsibilities, defined as we go into the implementation phase.

Phase 7: Perform the Transformation

The activities of this last phase are:

- Develop a migration strategy
- Create a migration action plan
- Develop metrics for measuring performance during implementation
- Involve the affected staff
- Implement in an iterative fashion
- Establish the new organizational structures
- Assess current skills and capabilities of workforce
- Map new tasks and skill requirements to staff
- Reallocate workforce
- Develop a training curriculum
- Educate the staff about the new process
- Educate the staff about the new technology used
- Educate management on facilitation skills
- Decide how new technologies will be introduced
- Transition to the new technologies
- Incorporate process improvement mechanisms

Now we are ready to transform the organization. We have communicated, developed strategies, analyzed, reengineered, and blueprinted our ideas for the new process. This is where all of the previous efforts are combined into an actual business system thus enabling the business to meet the market demands of today and tomorrow.

The first step in transforming the organization is to develop a plan for migrating to the new process. We need a path to get from where the organization is today and to where the organization wants to be. Migration strategies include:

- Full changeover to the new process
- Phased approach

- Pilot project
- Creating an entirely new business unit

An important point to consider is the integration of the new process with other processes. If only one process is reengineered, then it must interact with the other existing processes. If multiple processes are slated for reengineering, then the new process must not only integrate with the existing processes, but also with the newly reengineered processes that will come on line in the near future. Therefore, the implementation of the new process must be flexible enough to be easily modified later on.

Successful transformation depends on consciously managing behavioral as well as structural changes, with both sensitivity to employee attitudes and perceptions, and a tough-minded concern for results. BPR implementation requires the reorganization, retraining, and retooling of business systems to support the reengineered process. The new process will probably require a new organization, which is different in structure, skills, and culture. The new management structure should result in the control paradigm being shifted to the facilitation paradigm. The new process team structure should result in the managed paradigm being shifted to the empowered paradigm. Once the new structures are established, we should map tasks in the process to functional skill levels, and ultimately to the workers.

Transforming the workforce will require an array of activities beginning with an assessment of the current skills or capabilities of the workforce to include soft, operational, and technical skills. This skill inventory compilation may require personal evaluations, peer evaluations, and supervisor evaluations. Feedback should be provided to all personnel to ensure accuracy of current skills and interests for all staff. Armed with the new process skill requirements and a current skills inventory, the gaps can be assessed. Is the new process feasible with the current skill set? Which are the areas to focus on in order to enhance personnel skills to meet the requirements of the new process? An education curriculum needs to be established to educate all employees on the business and, most importantly, on how their jobs relate to the customer.

An educational pyramid is an effective way to transfer knowledge of team building, self-mastery, and subject matter knowledge. Systems' training is essential in understanding the use of new information systems and how to take advantage of their capabilities. Process training may be needed to help employees think beyond a linear process to a more holistic interdependent process. Facilitation training for management is critical to develop their abilities to listen, allow mistakes, handle disputes among process experts, and transition to a coach/facilitator role. Education may be necessary for total quality management (TQM), statistical process control (SPC), or continuous process improvement (CPI) if these mechanisms are designed into the new processes. Finally, a structured on-the-job training (OJT) program is instrumental in providing continuity of the new process during periods of personnel turnover or conflicts.

As with any dramatic change, people will have personal difficulties, to varying degrees, with the paradigm shift that has taken place. All new process implementations are surrounded by confusion, frustration, and sometimes panic. The best transition strategy is one that minimizes, as much as possible, the interference caused to the overall environment. Attempts should be made to keep the new process chaos under control and not to divert the focus of the reengineering team and the faith of the employees.

Transforming information systems to support the new process may involve retooling the hardware, software, and information needs for the new process. One approach to this transition could be a controlled introduction. The method would ensure that each part of the system is operational for a segment of the business before going on to the next module to be implemented. Although the risk may be low until the bugs in the new system are ironed out, it may be difficult to integrate the hybrid old/new systems in a step-wise manner. The one-step approach is where the entire system is developed in parallel to the existing system, and a complete transition occurs all at once. This may put the organization

at a higher risk if the systems do not function properly at first, but it is the more common approach due to the 'all-or-nothing' nature of BPR. Most reengineered processes function in an entirely different manner than the existing processes; thus, a step-wise introduction would be advisable, not to be fully functional until all steps were introduced anyway. An important reason to justify the one-step approach is that the reengineering benefits can be realized much sooner with a controlled introduction.

Transitioning the information used to support the old process to become useful in the new process, involves reducing some requirements while expanding others. Usually 30%–40% of the outdated information can be discarded because it was administrative data needed to tie the old disjointed, linear processes together. On the other hand, the old systems may have poor data integrity, incorrect data, or insufficient data to support the new business needs. In these cases, the data must be expanded to fill the gaps in the existing data and supply the new information requirements of the reengineered process. The information blueprints help manage the development of the new information systems.

CHALLENGES FACED BY REENGINEERING EFFORTS

Unfortunately, all BPR projects are not as successful as those described. Most of the BPR projects will fall short of expectations. Even BPR supporters admit the likelihood of a project failing is greater than its success rate. Companies that begin BPR projects face many of the following challenges.

- Resistance—Change, especially radical change, always meets a great deal of resistance. In many cases, this is the most serious problem companies face in BPR.
- Tradition—Traditional ways of doing things do not die easily; they are often a part of the organization's culture. This means the culture and beliefs held by individuals will also have to change.
- Time requirements—BPR is a lengthy process, almost always taking two or more years to complete.
- Cost—It is costly to examine thoroughly the way business is handled and to question the way everything is done in order to find a faster and more efficient way to accomplish it.
- Skepticism—Some people are skeptical about BPR. Some view it as traditional systems development, but in a new wrapper with a fancy name. Others do not believe it can be done. A big obstacle is outlasting those who say it cannot be done.
- Job losses—BPR often results in employees being laid off. Some estimates range as high as 25 million jobs being eliminated before BPR runs its course.

MAXIMIZING YOUR CHANCES FOR BPR SUCCESS

There are guidelines that can be followed to maximize the chances for success in a BPR effort.

- Realize that not every company needs to reinvent itself. Do not embark on a BPR project simply because it is the thing to do. Do not try to fix something you should not be doing in the first place.
- Expect strenuous resistance and manage it properly. Sell the change by constantly stressing the positive aspects of the change and the benefits to be derived by employees and the company.
- Surround the project with a sense of urgency, since projects tend to die unless the need to change is urgent and is constantly reemphasized.
- Get top management to fully support the project and have them make it clear that everyone is expected to support the project.
- Keep the lines of communication to employees open to prevent damaging and inaccurate rumors and misunderstandings.

- Create an atmosphere of trust and co-operation. Allay fears and provide assurances that the company is genuinely concerned about the employees.
- Make sure the people who are affected by will be involved in the new system in the change process.
- Change the way employees are evaluated and rewarded to motivate them to support the system.
- Staff the project with the best people and provide them with resources they need to be successful.
- Design the system from the customer's point of view, not from that of the company. Eliminate processes or steps that add no value to the customer.
- Make sure employees are adequately trained on how to use the new system.
- Be prepared to change the company's culture and its organizational structure, and to reorganize the information systems function.
- Take small steps initially. Go for more dramatic projects once you have gained some experience in BPR.

Observing these guidelines is time-consuming and expensive. As a result, some people skip the more difficult steps to speed up the BPR process. Unfortunately, ignoring these guidelines usually results in a project failing to meet its intended objectives or in the project being unduly delayed. The old adage, 'take time to save time,' certainly applies when considering a BPR project.

SUMMARY

This chapter contains the methods and procedures that have been the sum total of the thoughts of many management experts, the experiences of many consulting firms, and the research conducted by academicians. In order to establish the dramatic change, we need to dramatically increase our chances of successful BPR. The phases and activities described here must be considered, as a minimum, and then adapted to the circumstances, when attempting to successfully plan and perform business process reengineering.

REVIEW QUESTIONS

1. What does business process reengineering mean?
2. What are the results of a successful BPR?
3. Why have so many BPR projects failed?
4. Discuss the evolution of BPR.
5. What are the different phases of BPR?
6. Discuss the activities to be performed in the different phases.
7. Why communication is important to the success of the BPR project?
8. What are the duties of executive leader, process owner, reengineering team, steering committee, and reengineering specialist or consultant?
9. What are five keys to successful reengineering?
10. What are the four pitfalls to be avoided in a BPR project?
11. Seeing the company from the customer's point of view can be beneficial for identifying BPR opportunities. Explain.
12. Why should one understand the existing processes before starting the reengineering?
13. Which technologies are considered as enablers in a BPR project?
14. How is the transformation of the new process done?
15. What are the challenges faced by BPR efforts?
16. How do you maximize your chances for BPR success?

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Chapter 12

Data Warehousing and Data Mining

INTRODUCTION

Data warehouse is a collection of data designed to support decision-making of the management. Data warehouses contain a wide variety of data that present a coherent picture of business conditions at a single point in time. Development of a data warehouse includes development of systems to extract data from operating systems plus installation of a warehouse database system that provides managers flexible access to the data. The term 'data warehousing' generally refers to the combination of different databases across an entire organization.

Data mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses.

DATA WAREHOUSING

The primary concept of data warehousing is that the data stored for business analysis can most effectively be accessed, by separating it from the data in the operational systems. Many of the reasons for this separation have evolved over the years. In the past, legacy systems archived data onto tapes as it became inactive and many analysis reports ran from these tapes or mirror data sources to minimize the performance impact on the operational systems. Much of the business analysis was done using batch reports that ran during off-peak hours without interfering with the operations of the applications. These reports were designed to run on an already set schedule regardless of any specific need in any given period. The primary goals of a data warehouse are the following:

- Provide access to the data of an organization
- Data consistency
- Capacity to separate and combine data
- Inclusion of tools set up to query, analyze, and present information
- Publish used data
- Drive business re-engineering

Data in the Data Warehouse

The collection of data used by a data warehouse may be characterized as subject-oriented, integrated, non-volatile, and time variant.

- **Subject-oriented**—The data warehouse is oriented toward those major subject areas of the organization, which have been defined in the data model. Examples of typical subject areas include the following: customer, product, transaction or activity, account, etc.
- **Integrated**—The data warehouse potentially can receive data from a number of sources. Each of these sources has an application designer(s), each freely encoding, naming conventions,

physical attributes, and measurement of attributes. The filtering and translation necessary to transform the many sources into one consistent database is known as integration.

- **Non-volatile**—While it is common in the operational environment for data to be updated and therefore, changed, the same is not true in a data warehouse. Data is loaded and accessed, but not changed.
- **Time variant**—The following table compares the time horizon, valuation, and presence of the time element of an operational system to that of a data warehouse.

Data Warehouse Architecture

In this section, I present an overview of the architecture and major components of a data warehouse and describe each of the components of a data warehouse (see Fig. 12.1). This description is based upon the work of W. H. Inmon, credited as the father of the data warehouse concept. The major components of a data warehouse are given below:

- Summarized data
- Operational systems of record
- Integration/ transformation programs
- Current detail
- Data warehouse architecture or metadata
- Archives

Summarized Data

Summarized data is classified into two—lightly summarized and highly summarized. Lightly summarized data are the hallmark of a data warehouse. All enterprise elements (department, region, function, etc.) do not have the same information requirements, so effective data warehouse design provides for customized, lightly summarized data for every enterprise element. An enterprise

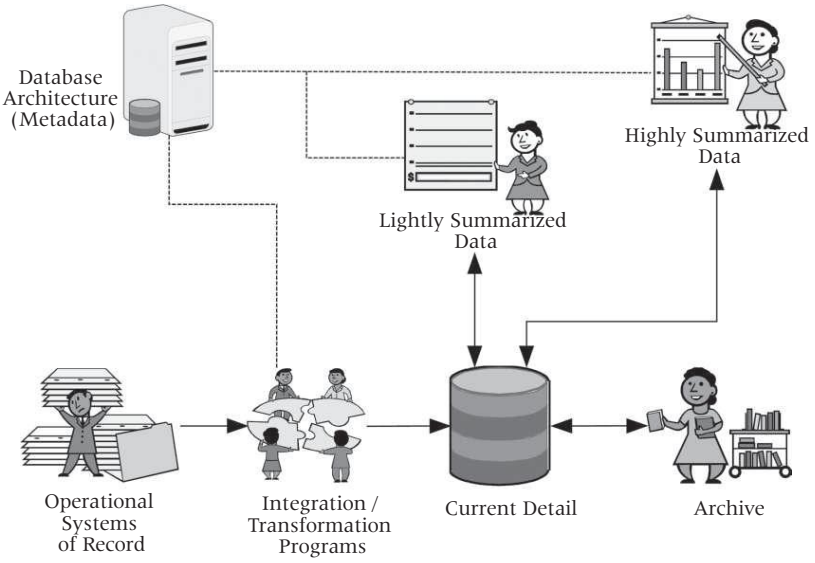

Figure 12.1 Components of a data warehouse.

element may have access to both detailed and summarized data, but there will be much less than the total stored in current detail. Highly summarized data are primarily for enterprise executives. Highly summarized data can come from either the lightly summarized data used by enterprise elements or from current detail. Data volume at this level is much less than at other levels and represents an eclectic collection supporting a wide variety of needs and interests. In addition to access to highly summarized data, executives also have the capability of accessing increasing levels of detail through a 'drill down' process.

Current Detail

The heart of a data warehouse is its current detail, where the bulk of data resides. Current detail comes directly from operational systems and may be stored as raw data or as aggregations of raw data. Current detail, organized by subject area, represents the entire enterprise, rather than a given application. Current detail is the lowest level of data granularity in the data warehouse. Every data entity in current detail is a snapshot, at a moment in time, representing the instance when the data are accurate. Current detail is typically two to five years old. Current detail refreshment occurs as frequently as necessary to support enterprise requirements.

System of Record

A system of record is the source of the data that feed the data warehouse. Data in a data warehouse differ from data in the operational systems, in that they can only be read, not modified. Thus, it is necessary that a data warehouse be populated with the highest quality data available, i.e., data that are most timely, complete, accurate, and have the best structural conformance to the data warehouse. Often these data are closest to the source of entry into the production environment. In other cases, a system of record may be one containing already summarized data.

Integration and Transformation Programs

Even the highest quality operational data cannot usually be copied, as it is, into a data warehouse. Raw operational data are virtually unintelligible to most information users. Additionally, operational data seldom conform to the logical, subject-oriented structure of a data warehouse. Further, different operational systems represent data differently, use different codes for the same thing, squeeze multiple pieces of information into one field, and more. Operational systems in most enterprises have been developed independently (no common enterprise data architecture), which means that most operational data are stored and managed redundantly and may even reside in many different physical sources—old mainframe files, non-relational databases, indexed flat files, even proprietary tape, and card-based systems. These operational data must be cleaned up, edited, and re-formatted before being loaded into a data warehouse.

As operational data items pass from their systems of record to a data warehouse, integration and transformation programs convert them from application-specific data into enterprise data. These integration and transformation programs perform functions such as:

- Re-formatting, re-calculating, or modifying key structures
- Adding time elements
- Identifying default values
- Supplying logic to choose between multiple data sources
- Summarizing, tallying, and merging data from multiple sources

When either operational or data warehouse environments change, integration and transformation programs are modified to reflect that change.

Archives

Data warehouse archives contain old data (normally over two years old) of significant, continuing interest and value to the enterprise. There is usually a massive amount of data stored in the data warehouse archives, with a low incidence of access. Archive data are most often used for forecasting and trend analysis. Although archive data may be stored with the same level of granularity as current detail, it is more likely that archive data are aggregated as they are archived. Archives include not only old data (in raw or summarized form); they also include the metadata that describes the characteristics of the old data.

Metadata

The physical implementation of a data warehouse is defined using a naming convention and syntax rules which, while it may be convenient to IT staff, can be obscure and off-putting to business users. It is therefore a requirement that a separate data definition language is implemented, which provides a meaningful description of the information contents. This is usually known as metadata—literally data about data. Many products implement an effective metadata layer and users define their requirements in terms of the meaningful 'real-world' descriptions irrespective of the physical implementation. Unfortunately, while attempts have been made to establish standards in this area, different tool vendors will use their own metadata repository. This makes it more time-consuming to adopt a 'mix and match' approach to tool selection, as the work of defining the metadata may have to be repeated several times.

The term may also be used in a different context. When data is to be extracted from a host system for loading into the data warehouse, the mapping between the two architectures is also sometimes known as metadata—it is still a description of data but used in a different manner. Extraction and transformation products from different vendors will not use or understand the metadata of each other as there are no standards for metadata and the different vendors will be using their own proprietary systems. As we have seen, one of the most important parts of a data warehouse is its metadata—or data about data. Also called data warehouse architecture, metadata is integral to all levels of the data warehouse, but exists and functions in a different dimension from other warehouse data. Metadata that is used by data warehouse developers, to manage and control data warehouse creation and maintenance, resides outside the data warehouse. Metadata for data warehouse users is part of the data warehouse itself and controls access and analysis of the data warehouse contents. To a data warehouse user, metadata is like a ''card catalog'' of the subjects available.

Data Warehousing System

The primary concept of data warehousing is that the data stored for business analysis can most effectively be accessed, by separating it from the data in the operational systems. Many of the reasons for this separation have evolved over the years. In the past, legacy systems archived data onto tapes as it became inactive and many analysis reports ran from these tapes or mirror data sources to minimize the impact of performance on the operational systems. Much of the business analysis was done using batch reports that ran during off-peak hours without interfering with the operations of the applications. These reports were designed to run on a set schedule regardless of any specific need in any given period.

The reasons to separate the operational data from analysis data have not significantly changed with the evolution of the data warehousing systems (see Fig. 12.2), except that they are now considered more formally during the data warehouse building process. Advances in technology and changes in the nature of business have made many of the business analysis processes much more complex and sophisticated. In addition to producing standard reports, today's data warehousing systems support very sophisticated on-line analysis including multi-dimensional analysis.

A data warehouse is a collection of computer-based information that is critical to the successful execution of enterprise initiatives. A data warehouse is more than an archive for corporate data and more than a new way of accessing corporate data. It is a subject-oriented repository designed with enterprise-wide access in mind. It provides tools to satisfy the information needs of employees' at all organizational levels, not just for complex data queries, but as a general facility for getting quick, accurate, and often insightful information. A data warehouse is designed so that its users can recognize the information they want and access that information using simple tools.

One of the principal reasons for developing a data warehouse is to integrate operational data from various sources into a single and consistent architecture that supports analysis and decision-making within the enterprise. Operational (legacy) systems create, update and delete production data that 'feed' the data warehouse. A data warehouse is analogous to a physical warehouse. Operational systems create data 'parts' that are loaded into the warehouse. Some of these are summarized into information 'components' and stored in the warehouse. Data warehouse users make requests and are delivered information 'products' that are created from the components and parts stored in the warehouse. A data warehouse is typically a blending of technologies, including relational and multi-dimensional databases, client/ server architecture, extraction/ transformation programs, graphical user interfaces, and more. A well-defined and properly implemented data warehouse can be an invaluable competitive tool.

Advantages of a Data Warehouse

Implementing a data warehouse provides significant benefits—many tangible, some intangible. The benefits include the following.

- **More cost-effective decision-making**—A data warehouse allows reduction of staff and computer resources required to support queries and reports against operational and production databases. This typically offers significant savings. Having a data warehouse also eliminates the resource drain on production systems when executing long running, complex queries and reports.
- **Better enterprise intelligence**—Increased quality and flexibility of enterprise analysis arises from the multi-tiered data structures of a data warehouse that support data ranging from detailed transactional level to high-level summary information. Guaranteed data accuracy and reliability result from ensuring that a data warehouse contains only 'trusted' data.
- **Enhanced customer service**—An enterprise can maintain better customer relationships by correlating all customer data via a single, data warehouse architecture.

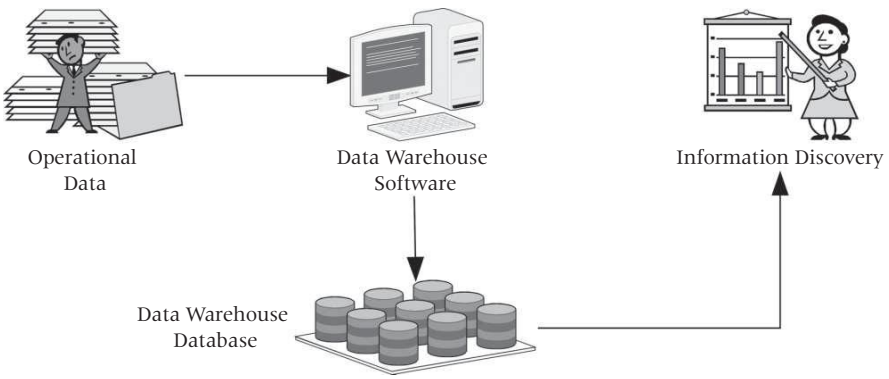

Figure 12.2 A data warehousing system.

- **Business reengineering**—Allowing unlimited analysis of enterprise information often provides an insight into enterprise processes that may yield breakthrough ideas for reengineering those processes. Just defining the requirements for data warehouse, results in better enterprise goals and measures. Knowing what information is important to an enterprise will provide direction and priority for re-engineering efforts.
- **Information system reengineering**—A data warehouse that is based upon enterprise-wide data requirements provides a cost-effective means of establishing both data standardization and operational system inter-operability. Data warehouse development can be an effective first step in re-engineering the enterprise's legacy systems.

Structure of a Data Warehouse

The structure of a data warehouse is shown in Fig. 12.3. The structure consists of the following.

- **Physical data warehouse**—physical database in which all the data for the data warehouse are stored, along with metadata and processing logic for scrubbing, organizing, packaging, and processing the detail data.
- **Logical data warehouse**—also contains metadata, including enterprise rules and processing logic for scrubbing, organizing, packaging, and processing the data, but does not contain actual data. Instead, it contains the information necessary to access the data wherever they reside. This structure is effective only when there is a single source for the data and they are known to be accurate and timely.
- **Data mart**—Data mart is a sub-set of an enterprise-wide data warehouse, which typically supports an enterprise element (department, region, function, etc.). As part of an iterative data warehouse development process, an enterprise builds a series of physical (or logical) data marts over time and links them via an enterprise-wide logical data warehouse or feeds them from a single physical warehouse.

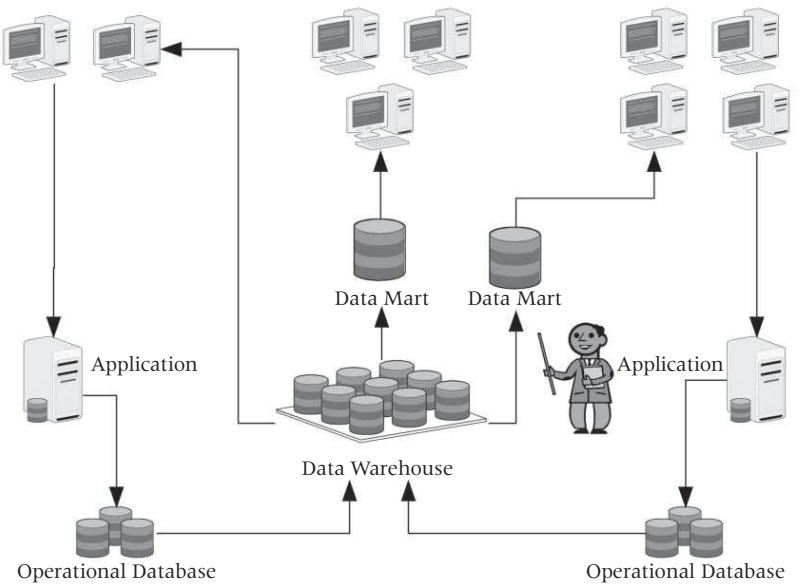

Figure 12.3 Structure of a data warehouse.

Obstacles to Successful Data Warehouse Projects

As the demand for crucial business information increases, decision support structures such as data warehouses are rising in order to meet the needs of the corporate reporting infrastructure. Rushing to data warehouse development, information systems staff often discover obstacles 'on the fly', causing timelines and expenses to grow exponentially. This common situation has caused more and more data warehouse projects to result in failure before reaching production. Even with these prevalent and predictable failures, businesses are becoming more determined to succeed with this data management approach. Subsequently, the demands placed on the traditional data warehouse architecture continue to increase. Presently, companies primarily focus on transaction-based data warehouse maintenance (e.g. update, delete, etc.), along with the use of a complete array of supporting aggregate tables summarizing facts and activities.

On the other hand, data warehouse developers should become familiar with the potential challenges to a successful data warehouse deployment. When left unchecked, these challenges can become full-fledged barriers, bringing developers to their knees and halting large-scale data warehouse production. Table 12.1 lists the common mistakes that should be avoided in a data warehousing project. Some challenges facing data warehouse developers could be described as follows:

Complex Extract, Transformation, and Load Characteristics

- **Source vs. Target**—Typically, data warehouse developers deal with highly normalized source schemas and must design a method to port this data into the traditional de-normalized dimensional model of the data warehouse. The schema differences pose various challenges. For example, loading one data warehouse dimension table may require data extraction from a large number of source tables (e.g. 5+ in some cases). In this case, the most obvious design issues are source table joins and the propagation of updates.
- **Data transformations**—Many business rules embedded in corporate reports demand intricate manipulation of source data. This adds complex criteria into data warehouse management and increases processor overhead during the number crunching stage of the data load.
- **Transaction-based loading**—Extracted data from the source database must be loaded into the data warehouse on a source semi-independent transactional basis. In many instances, a transaction applied at the source database will not map directly to the target data warehouse (e.g. resulting from de-normalization of the data warehouse). Thus, regardless of the transaction enacted at the source, the data transported to the data warehouse must be compared to the existing target table to determine whether to execute an update, insert or delete.

Immense Volumes of Daily Data

Almost every data warehouse implementation requires a massive amount of data movement. Thus, a method for efficiently cleansing, absorbing, and aggregating the data into

Load Methodology (Load Control and Auditing)

One of the most overlooked enhancements to a functioning data warehouse is a method of controlling and auditing the data warehouse load. Mechanisms, such as a control structure that validates complex load dependencies and an audit trail of accumulated load statistics, are essential for efficient loading, tracking, and debugging of both the development and production environments.

Data Warehouse Recovery (Load Recovery)

Conventional media backup, the most common form of recovery implemented, is excellent for preserving data warehouse availability after a system failure. However, a data warehouse load recovery can be

relatively precarious, especially for the loading of aggregate values/tables or the population of dimensions with fabricated key derivations. In these cases, identifying the exact point of failure is critical.

Data Warehouse Validation

As data warehouse development progresses closer to completion, data validation must be revisited to ensure integrity. After performing summary-to-summary crosschecks, many aggregate functions might prove to be inadequate and require re-formulation.

Data Warehouse Read Performance

1. **Database structural design**—In many databases, physical constructs such as indexes and tables partitioning exist to enhance table read performance. These structures usually have inherent disadvantages (e.g., indexes yield poor write performance).
2. **Summarization**—Though data summarization dramatically improves data warehouse performance, including aggregate tables in a data warehouse may be the most intimidating aspect of data warehouse design. By nature, a single aggregation incorporates the individual values of numerous source records. Consequently, updating these aggregate values becomes a significant challenge since individual values can either increase or decrease.

Table 12.1 Ten mistakes to avoid in a data warehousing project

• Starting the data warehousing project without the right sponsorship and top management support
• Setting expectations that cannot be met and causing frustration to executives at the moment of truth
• Promoting the value of their data warehouse with arguments such as, 'this will help managers make better decisions', which can backfire
• Loading the warehouse with information 'just because it was available'
• Believing that data warehousing database design in the same as transactional database model
• Choosing a data warehousing manager who is technology-oriented rather than user-oriented
• Focusing on traditional internal record-oriented data and ignoring the potential value of external data and of text, images, and—potentially—sound and video
• Delivering data with overlapping and confusing definitions
• Believing the performance, capacity and scalability promises
• Believing that once the data warehouse is up and running, your problems are finished

Source: The Data Warehousing Institute (TDWI), (http://www.dw-institute.com)

Metadata Management

Possibly the most overlooked requirement for implementing a successful data warehouse is the capture, management, and usage of metadata. Metadata, defined as data about the data, is mainly presented to the users at project completion. The dictionary for business-to-technical translations allows the user the independence required for ad hoc analysis. On the other hand, capturing the metadata of the data warehouse load procedures and the execution of such load procedures become critical for efficient and thorough development and implementation. Ignoring the value that metadata could have within a data warehouse can cause the misunderstanding of and/or improper usage of data warehouse data. These architectural issues must be resolved during the data warehouse planning stage. In addition, a thorough assessment should be prepared to detect other potential issues specific to each business data environment.

Uses of a Data Warehouse

No discussion on data warehousing concepts is complete without a review of the type of activity supported by a data warehouse. Some of the activity against today's data warehouses is pre-defined and not much different from traditional analysis activity. Other processes such as multi-dimensional analysis and information visualization were not available with traditional analysis tools and methods (See Figure 12.4).

Standard Reports and Queries

Many users of the data warehouse need to access a set of standard reports and queries. It is desirable to periodically, automatically produce a set of standard reports that are required by different users. When these users need a particular report, they can just view the report that has already been run by the data warehouse system rather than running it themselves. This facility can be particularly useful for reports that take a long time to run.

Queries against Summarized Data

As introduced earlier, the summary views in the data warehouse can be the object of a large majority of analysis in a data warehouse. Simple filtering and summation from the summary views account for most of the analysis activity against many data warehouses. These summary views contain predefined standard business analysis.

Data Mining

Even though data mining in the detailed data may account for a very small percentage of data warehouse activity, the most beneficial data analysis is done in the detailed data. The reports and queries of the summary tables are adequate to answer many 'what' questions in the business. The drill down into the detail data provides answers to 'why' and 'how' questions. Data mining is an evolving science. A data mining user starts with summary data and drills down into the detail data looking for arguments to prove or disprove a hypothesis. The tools for data mining are evolving rapidly to satisfy the need to understand the behavior of business units such as customers and products.

Interface with other Data Warehouses

The data warehouse system is likely to be interfaced with other applications that use it as the source of operational system data. It may feed data to other data warehouses or smaller data warehouses

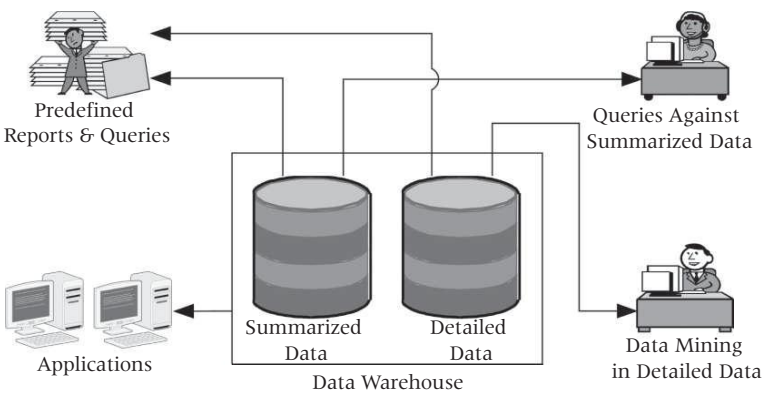

Figure 12.4 Uses of a data warehouse.

called data marts. Data warehouse can be a better single and consistent source for data instead of the operational systems. It is important to remember that much of the operational state information is not carried over to the data warehouse. Thus, it cannot be a source of all operation system interfaces.

DATA MINING

Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. The automated, prospective analyses offered by data mining move beyond the analyses of past events provided by retrospective tools typical of decision support systems. Data mining tools can answer business questions that traditionally were too time-consuming to resolve. They scour databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations.

Most companies already collect and refine massive quantities of data. Data mining techniques can be implemented rapidly on existing software and hardware platforms to enhance the value of existing information resources, and can be integrated with new products and systems as they are brought on-line. When implemented on high performance client/ server or parallel processing computers, data mining tools can analyze massive databases to deliver answers to questions such as, 'which clients are most likely to respond to my next promotional mailing, and why?'

What is Data Mining?

We live in the age of information. The importance of collecting data that reflect your business or scientific activities to achieve competitive advantage is widely recognized now. Powerful systems for collecting data and managing it in large databases are already in place in most large and mid-range companies. However, the bottleneck of turning this data into your success is the difficulty of extracting knowledge about the system that you study from the collected data.

- What goods should be promoted to this customer?
- What is the probability that a certain customer will respond to a planned promotion?
- Can one predict the most profitable securities to buy/sell during the next trading session?
- Will this customer default on a loan or pay back on schedule?
- What medical diagnosis should be assigned to a particular patient?
- How large are the peak loads of a telephone or energy network going to be?
- Why does the facility suddenly start to produce defective goods?

These are all the questions that can probably be answered if information hidden among megabytes of data in your database can be found explicitly and utilized. Modeling the investigated system and discovering relations that connect variables in a database are the subjects of data mining.

Modern data mining systems self-learn from the previous history of the investigated system, formulating and testing hypotheses about the rules, which this system obeys. When concise and valuable knowledge about the system of interest had been discovered, it can and should be incorporated into some decision support system, which helps the manager to make wise and informed business decisions.

Evolution of Data Mining

Data mining techniques are the result of a long process of research and product development. This evolution began when business data was first stored on computers, continued with improvements in data access and more recently, generated technologies that allow users to navigate through their data in real-time. Data mining takes this evolutionary process beyond retrospective data access and navigation to prospective and proactive information delivery.

Data mining is ready for application in the business community because it is supported by three technologies that are now sufficiently mature:

- Massive data collection
- Powerful multiprocessor computers
- Data mining algorithms

Commercial databases are growing at unprecedented rates. The accompanying need for improved computational engines can now be met in a cost-effective manner with parallel multiprocessor computer technology. Data mining algorithms embody techniques that have existed for at least 10 years, but have only recently been implemented as mature, reliable, understandable tools that consistently out-perform older statistical methods.

In the evolution from business data to business information, each new step has built upon the previous one. For example, dynamic data access is critical for drill-through in data navigation applications, and the ability to store large databases is critical to data mining. From the user's point of view, the four steps listed below were revolutionary because they allowed new business questions to be answered accurately and quickly.

- **Data collection (1960s)**—Answered questions like, 'what was my total revenue in the last five years?' This technology is characterized by its retrospective nature and static data delivery.
- **Data access (1980s)**—Answered business questions such as, 'what were unit sales in Maharashtra last March?' Relational databases (RDBMS), structured query language (SQL), ODBC, etc. were used for querying and reporting. This phase is characterized by its retrospective nature and dynamic data delivery at record level.
- **Data warehousing and decision support (1990s)**—These technologies were capable of answering business questions like, 'what were unit sales in Maharashtra last March? Drill down to Mumbai.' The technologies used are on-line analytic processing (OLAP), multi-dimensional databases, data warehouses, etc. The main characteristics are its retrospective nature and dynamic data delivery at multiple levels.
- **Data mining**—Capable of answering questions like 'what is likely to happen to southern region sales next month? Why?' Uses advanced algorithms, multiprocessor computers, massive databases, etc. The characteristics include prospective nature and proactive information delivery.

The core components of data mining technology have been under development for decades, in research areas such as statistics, artificial intelligence, and machine learning. Today, the maturity of these techniques, coupled with high-performance relational database engines and broad data integration efforts, make these technologies practical for current data warehouse environments.

Data Mining—Verification vs. Discovery

Decision support systems (DSS), executive information systems (EIS), and query/report writing tools are used to produce reports about data, usually aggregating it through any number of dimensions. Another use of these tools is to detect trends and patterns in customer data that will help answer some questions about the business. When used in this mode, a query is created to access the records relevant to the question(s) being formulated. After the data is retrieved, it is examined to detect the existence of patterns or other useful information that can be used in answering the original question(s). We call this the verification mode. In this mode, the user of a DSS generates a hypothesis about the data, issues a query against the data, and examines the results of the query looking for affirmation or negation of the hypothesis. In the first case, the process ends; in the latter case, a new query is re-formulated and

the process iterates until the resulting data either verifies the hypothesis or the user decides that the hypothesis is not valid for his data.

Consider the following example. A sales executive has a limited budget to do a mailing campaign for a new product. In order to optimize the use of this money, the marketing executive wants to identify the largest set of people who are the most likely candidates to buy the new product and who can be reached within the budget limitation. To identify these customers and to verify that the customer set has been adequately narrowed to match the available promotional budget, the executive makes a hypothesis about the potential customer set. Issuing a query against the databases that contain historical data about customer purchases and demographic information, respectively, the set of customers that have made significant purchases of competitive products can be obtained. Furthermore, to limit the number of customers found to a reasonable number, the executive requests information only about those customers that are characterized by falling in the age group of 30–45 years, being heads of households with combined incomes between Rs. 50,000 and Rs.100,000 and living in any of the four metros—Delhi, Mumbai, Kolkota and Chennai. If the result of this query returns a number of customers that match the available budget for mailing promotions, the process ends. However, if either significantly more (or less) customers are found than the number that can be reached with the given budget, a new query limiting (or expanding) the set of customer addresses requested must be issued.

In the above example, the hypotheses used in formulating the queries were quite explicit. (e.g. incomes between certain amounts.) Even when the hypotheses are implicit, the process of finding useful trends or patterns using queries can be described by the above behavior, as shown in the following example involving a query drill down process.

After a report about company sales shows that the last quarter sales were significantly lower than expected, the financial officer of the company wants to discover what caused this situation. A query is first issued to return the sales figures, by region, for the last quarter. The results of this query show that all the sales are up, except for one particular region. The financial officer begins to suspect that the problem may have occurred in some localized store. To better understand the nature of the problem, another query is issued that will return sales results for all the cities in the offending region. A result showing one city significantly lower than the rest reinforces the officers' suspicion; a result showing that sales were uniformly lower among all cities in this region requires that the initial guess about what caused the problem (i.e. the implicit hypothesis), be modified. New queries continuing to drill down looking for the results by store within an offending city follow the previous query; totally new queries need to be devised if the results of the last query contradict the implicit hypothesis.

Queries, such as those used in these two examples, always return records that satisfy the query predicates. Thus, little new information is created in this retrieval process: the hypothesis is either verified, or it is negated. The user does the process of information finding by successive iterations upon examining the results of query after query and linking the verified and refined hypotheses. This is the essence of a verification model.

Many times, while performing a query, a request is made to compute functions related to the records being inspected during the query (e.g. count the number of records, find the average of a given field of the records, etc.) All these operations result in additional information being returned together with the query. For the purpose of this discussion, these derived facts are not considered.

Notice that from the user perspective, he/she is discovering facts about the data. The use of queries to extract facts from databases is a common practice. There are other tools that, like query generators, are used in a mode that follows the verification model described earlier. Examples of these other tools are multi-dimensional analysis tools and visualization tools. Multi-dimensional tools make it easier for the user to formulate drill down queries such as those shown in the last example. Visualization tools are used, as their name implies, to present data in a visual manner and to allow

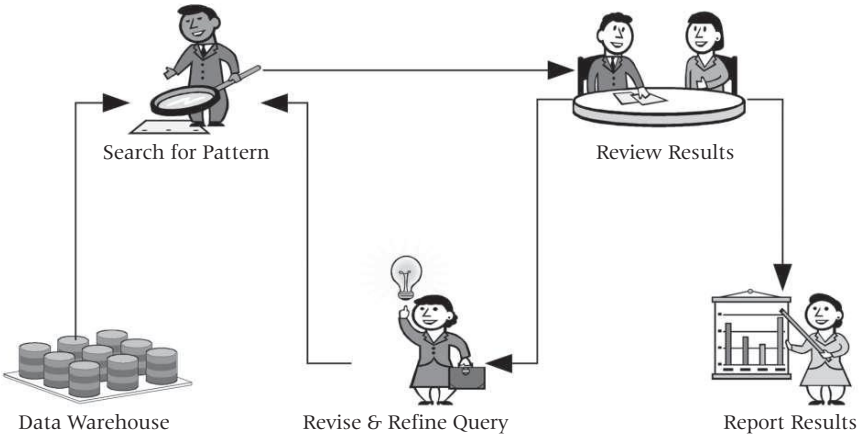

Figure 12.5 Data mining process.

the user to easily interact with the data in search of hidden patterns. The user of a visualization tool takes advantage of human visual perception capabilities, to discern patterns. The three types of tools discussed, i.e. queries, multi-dimensional analysis and visualization, all have in common the fact that the user is essentially "guiding" the exploration of the data being inspected.

Data Mining Process

Data mining uses a different model for the creation of information about data. We call this the discovery model. Data mining uses methodologies that can sift through the data in search of frequently occurring patterns, detect trends, produce generalizations about the data, etc. These tools can discover these types of information with very little (or no) guidance from the user.

The discovery of these facts is not a consequence of a haphazard event. A well-designed data mining tool is one that is designed and built so that the exploration of the data is done in such a way as to yield as large a number of useful facts about the data as possible in the shortest amount of time.

Comparing the process of finding information in a collection of data to that of mining diamonds in a diamond mine, we can say that "verification" is like drilling individual holes in a lode with the expectation of finding diamonds. Finding all (or many) diamonds in this way can be very inefficient. "Discovery", on the other hand, is similar to scooping out all the material in the lode and dumping it on a plain field so that all the glittering stones are thrown up into the open. Diamonds are then separated from the quartz by further inspection. In data mining, large amounts of data are inspected; facts are discovered and brought to the attention of the person doing the mining. Unlike diamonds, which are easily distinguishable from quartz, business judgment must be applied to separate the useful facts from those, which are not. Because this last step does not involve sifting through the raw data, data mining is a more efficient mode of finding useful facts about data. The data mining process is shown in Figure 12.5.

ADVANTAGES OF DATA MINING

Data mining derives its name from the similarities between searching for valuable business information in a large database and mining a mountain for a vein of valuable ore. Both processes require either sifting through an immense amount of material, or intelligently probing to find exactly where the value resides.

Given databases of sufficient size and quality, data mining technology can generate new business opportunities by providing the following capabilities.

- **Automated prediction of trends and behaviors**—Data mining automates the process of finding predictive information in large databases. Questions that traditionally required extensive hands-on analysis can now be answered directly from the data—quickly. A typical example of a predictive problem is targeted marketing. Data mining uses data on past promotional mailings to identify the targets most likely to maximize return on investment in future mailings. Other predictive problems include forecasting bankruptcy and other forms of default and identifying segments of a population likely to respond similarly to given events.
- **Automated discovery of previously unknown patterns**—Data mining tools sweep through databases and identify previously hidden patterns in one step. An example of pattern discovery is the analysis of retail sales data to identify seemingly unrelated products that are often purchased together. Other pattern discovery problems include detecting fraudulent credit card transactions and identifying anomalous data that could represent data entry keying errors.
- **Databases can be larger in both depth and breadth**—The databases can have more columns and rows. Usually, analysts must often limit the number of variables they examine when doing hands-on analysis due to time constraints. Yet variables that are discarded because they seem unimportant may carry information about unknown patterns. High-performance data mining allows users to explore the full depth of a database, without pre-selecting a sub-set of variables. The data mining databases contains larger samples (more rows) as they yield lower estimation errors and variance, and allows users to make inferences about small but important segments of a population.

Data mining techniques can yield the benefits of automation on existing software and hardware platforms, and can be implemented on new systems, as existing platforms are upgraded and new products developed. When data mining tools are implemented on high-performance parallel processing systems, they can analyze massive databases in minutes. Faster processing means that users can automatically experiment with more models to understand complex data. The high speed makes it practical for users to analyze huge quantities of data. Larger databases, in turn, yield improved predictions. Table 12.2 shows the various tasks solved by data mining.

Technologies Used in Data Mining

The most commonly used techniques in data mining are:

- **Neural networks**—Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- **Rule induction**—The extraction of useful if-then rules from data based on statistical significance.
- **Evolutionary programming**—At present this is the youngest and evidently the most promising branch of data mining. The underlying idea of the method is that the system automatically formulates hypotheses about the dependence of the target variable on other variables in the form of programs expressed in an internal programming language.
- **Case-based reasoning (CBR)**—The main idea underlying this method is very simple. To forecast a future situation, or to make a correct decision, such systems find the closest past analogs of the present situation and choose the solution that was the right one in those past situations. That is why this method is also called the nearest neighbor method.
- **Decision trees**—Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a data set.

- **Genetic algorithms**—Optimization techniques that use processes such as genetic combination, mutation, and natural selection in a design based on the concepts of evolution.
- **Non-linear regression methods**—These methods are based on searching for a dependency of the target variable on other variables. The obtained formula is more suitable for analysis and interpreting in principle (reality is usually still too complex for that). Thus, this method has better chances of providing reliable solutions in such involved applications as financial markets or medical diagnostics.

Many of these technologies have been in use for more than a decade in specialized analysis tools that work with relatively small volumes of data. These capabilities are now evolving to integrate directly with industry-standard data warehouse and OLAP platforms.

SUMMARY

We discussed a very brief overview of data warehousing in this chapter. A detailed treatment of this subject is beyond the scope of this book. It is important to note that data warehousing is a science that continues to evolve. Many of the concepts are still in their infancy. The evolution of techniques to manipulate and analyze data at will and with efficiency will greatly influence the quality of the analysis that is possible with data in the data warehouse. If invalid or corrupt data is allowed to get into the data warehouse, the analysis done with this data is likely to be invalid.

The rapid acceptance of data warehousing systems has created a boom and many organizations, companies, and individuals are spending their effort and time in developing new methodologies and better concepts. Because of these efforts, there would be many more enhancements and adjustments to the data warehousing system model. Further evolution of the hardware and software technology will continue to greatly influence the capabilities that are built into data warehouses.

Data mining is the natural evolution of query and reporting tools. Everyone who creates queries and reports benefits from having data mining capabilities. We probably have more data than we can handle; therefore, more data analysis tools are needed. We need to have computers sift through data and report the important patterns for us. Moreover, since the data mining process is systematic, it offers firms the ability to discover hidden patterns in their data—patterns that can help them understand customer behavior and market trends. The advent of parallel processes and new software technologies enable customers to capitalize on the benefits of data mining more effectively than had been possible earlier.

Table 12.2 Tasks solved by data mining

• **Predicting**—The task of learning a pattern from examples and using the developed model to predict future values of the target variable.
• **Classification**—The task of finding a function that maps an example into one of several discrete classes.
• **Detection of relations**—The task of searching for the most influential independent variables for a selected target variable.
• **Explicit modeling**—The task of finding explicit formulae describing dependencies between various variables.
• **Clustering**—The task of identifying a finite set of categories or clusters that describe data.
• **Deviation Detection**—The task of determining the most significant changes in some key measures of data from previous or expected values.

Source: Megaputer Intelligence, Ltd.

QUESTIONS FOR DISCUSSION

1. What is a data warehouse?
2. What are the goals of a data warehouse?
3. What are the characteristics of the data in a data warehouse?
4. Discuss the data warehouse architecture.
5. Explain the data warehousing system.
6. What are the advantages of a data warehouse?
7. Explain the structure of a data warehouse.
8. Discuss the obstacles to successful data warehouse projects.
9. What are the mistakes that should be avoided during a data warehousing project?
10. What are the uses of a data warehouse?
11. Discuss why data warehouses are important and how they can be integrated into ERP systems.
12. What is data mining?
13. Discuss the evolution of data mining.
14. Discuss the difference between knowledge verification and discovery.
15. Explain data mining process.
16. What are the advantages of data mining?
17. What are the tasks solved by data mining?
18. What are the technologies used in data mining?

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Chapter 13

On-line Analytical Processing (OLAP)

INTRODUCTION

The term, *on-line analytical processing* **(*OLAP*)**, was coined by E.F. Codd in 1993, to refer to a type of application that allows a user to interactively analyze data. An OLAP system is often contrasted to an OLTP (on-line transaction processing) system that focuses on processing transactions such as orders, invoices, or general ledger transactions. Before the term OLAP was coined, these systems were often referred to as decision support systems.

OLAP is now acknowledged as a key technology for successful management. It describes a class of applications that require multi-dimensional analysis of business data. OLAP systems enable managers and analysts to rapidly and easily examine key performance data and perform powerful comparison and trend analyses, even on very large data volumes. They can be used in a wide variety of business areas, including sales and marketing analysis, financial reporting, quality tracking, profitability analysis, manpower and pricing applications, and many others.

OLAP technology is being used in an increasingly wide range of applications. The most common are sales and marketing analysis, financial reporting and consolidation, and budgeting and planning. It is, however also being used for applications such as product profitability and pricing analysis, activity-based costing, manpower planning, quality analysis, in fact for any management system that requires a flexible, top down view of an organization.

OLAP is a method of analyzing data in a multi-dimensional format, often across multiple time periods, with the aim of uncovering the business information concealed within the data. OLAP enables business users to gain an insight into the business through interactive analysis of different views of the business data that have been built up from the operational systems. This approach facilitates a more intuitive and meaningful analysis of business information and assists in identifying important business trends.

OLAP is often confused with data warehousing. It is not a data warehousing methodology; however, it is an integral part of a data warehousing solution. OLAP comes in many different shades, depending upon the underlying database structure and the location of the majority of the analytical processing. Thus, the term OLAP has different meanings depending upon the combination of these variables. This chapter examines the different options to support OLAP. It examines the strengths and weaknesses of each and recommends the analytical tasks for which each is most suitable.

OLAP provides the facility to analyze the data held within the data warehouse in a flexible manner. It is an integral component of a successful data warehouse solution; it is not in itself a data warehousing methodology or system. However, the term OLAP has different meanings for different people, as there are many variants of OLAP. This chapter attempts to put the different OLAP scenarios into context.

OLAP can be defined as the process of converting raw data into business information through multi-dimensional analysis. This enables analysts to identify business strengths and weaknesses, business trends and the underlying causes of these trends. It provides an insight into the business

through the interactive analysis of different views of business information that have been built up from raw operating data and which reflect the business users understanding of the business.

The OLAP approach enables a more intuitive interactive analysis of business information. It allows business users to understand the current business position, and the factors contributing to that position, through detailed analysis of the underlying information. It also helps business users to identify important business trends and opportunities through the analysis of historical data and future projections in various 'what-if' scenarios.

The majority of the established OLAP products use multi-dimensional databases as opposed to relational databases. The data consolidation process creates the physical multi-dimensional database structure and the indexing applied to it, storing pre-calculated and aggregated values in arrays, with extensive indexing to facilitate rapid retrieval. However, this data structure does not offer the flexibility needed to easily modify the data warehouse dimensions (business area view of the business data) as the business processes change, as they undoubtedly will.

Some data warehousing experts advocate using a de-normalized design on a relational database to replace multi-dimensional databases. De-normalizing the relational data model should improve response times for flexible analysis queries, i.e., those where the data has not been structured to support a predetermined data access path. For a data warehouse application, a well-designed metadata layer will provide a multi-dimensional view of the data.

The use of relational database technology, along with a well-designed metadata layer, will provide a greater degree of flexibility in the physical design of the data warehouse than the use of a multi-dimensional database. The metadata layer maps the business view of the data (i.e. the multi-dimensional view) on to the physical database. It provides details such as:

- The source(s) of each data item from the operating system(s)
- Business definitions for dimensions and measures
- Details of any data transformation rules applied
- Consolidation paths and any calculation formulas for data aggregations

The OLAP application contains logic, which includes:

- Multi-dimensional data selection
- Sub-setting of data
- Retrieval of data, via the metadata layer
- Calculation formulas

The OLAP application layer is accessed via a front-end query tool, which uses tables and charts to 'drill down' or navigate through dimensional data or aggregated measures.

OLAP AND DATA WAREHOUSING

During the last 10 years, a significant percentage of corporate data has migrated to relational databases. These have been used heavily in the areas of operations and control, with particular emphasis on transaction processing (e.g. manufacturing process control and airline reservations). To be successful in this arena, relational database vendors place a premium on the highly efficient execution of a large number of small transactions and near fault tolerant availability of data.

More recently, relational database vendors have also sold their databases as tools for building data warehouses. A data warehouse, stores tactical information that answers 'who?' and 'what?' questions about past events. A typical query submitted to a data warehouse is: 'what was the total revenue for the southern region in the first quarter two years ago?'

It is important to distinguish the capabilities of a data warehouse from those of an OLAP system. In contrast to a data warehouse, which is usually based on relational technology, OLAP uses a multi-dimensional view of aggregate data to provide quick access to strategic information for further analysis.

USES OF OLAP

OLAP applications span a variety of organizational functions. Finance departments use OLAP for applications such as budgeting, activity-based costing (allocations), financial performance analysis, and financial modeling. Sales analysis and forecasting are two of the OLAP applications found in sales departments. Among other applications, marketing departments use OLAP for market research analysis, sales forecasting, promotions analysis, and customer analysis and market/customer segmentation. Typical manufacturing OLAP applications include production planning and defect analysis.

Important to all of the above applications is the ability to provide managers with the information they need to make effective decisions about an organization's strategic directions. The key indicator of a successful OLAP application is its ability to provide information, as needed, i.e., its ability to provide 'just-in-time' information for effective decision-making. This requires more than a base level of detailed data. Just-in-time information is computed data that usually reflects complex relationships and is often calculated on the fly. Analyzing and modeling complex relationships are practical only if response times are consistently short. In addition, because the nature of data relationships may not be known in advance, the data model must be flexible. A truly flexible data model ensures that OLAP systems can respond to changing business requirements as needed for effective decision-making.

OLAP enables analysts, managers, and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information. OLAP transforms raw data so that it reflects the real dimensionality of the enterprise as understood by the user. While OLAP systems have the ability to answer 'who?' and 'what?' questions, it is their ability to answer 'what if?' and 'why?' that sets them apart from data warehouses. OLAP enables decision-making about future actions. A typical OLAP calculation is more complex than simply summing data, for example, 'what would be the effect on production cost of "G110" fasteners to distributors if metal prices went up by Rs.100/ton and transportation costs went down by Rs 0.50/kilometer?'

OLAP plays the role of a mediator to the various types of data sources and front-end interfaces. Figure 13.1 illustrates the mediating role that an OLAP server provides with respect to the various types of databases and files in which data may be stored and the numerous types of front-end packages that the end users may need. These front-end packages (only three are shown) are placed at the top of the diagram, while the data organization types (only three are shown) are placed at the bottom. The OLAP server is in the center of the diagram. This mediating role is a very important property that an OLAP server should have.

OLAP and data warehouses are complementary. A data warehouse stores and manages data. OLAP transforms data warehouse data into strategic information. OLAP ranges from basic navigation and browsing (often known as 'slice and dice'), to calculations and to more serious analyses such as time series and complex modeling. As decision-makers exercise more advanced OLAP capabilities, they move from data access to information to knowledge.

KEY FEATURES OF OLAP

Although OLAP applications are found in widely divergent functional areas, they all require the following key features:

- Multi-dimensional views of data

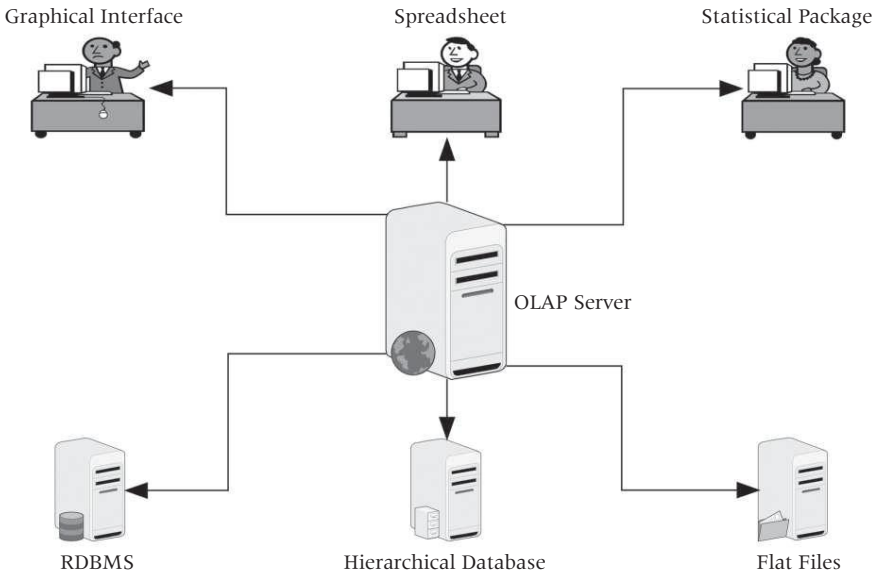

Figure 13.1 Mediating role of the OLAP.

- Calculation-intensive capabilities
- Time intelligence

Multi-dimensional Views

Multi-dimensional views are inherently representative of an actual business model. Rarely is a business model limited to fewer than three dimensions. Managers typically look at financial data by scenario (e.g. actual vs. budget), organization, line items, and time; and at sales data by product, geography, channel and time.

A multi-dimensional view of data provides more than the ability to 'slice and dice'; it provides the foundation for analytical processing through flexible access to information. Database design should not prejudice which operations can be performed on a dimension or how rapidly those operations are performed. Managers must be able to analyze data across any dimension, at any level of aggregation, with equal functionality and ease. OLAP software should support these views of data in a natural and responsive fashion, insulating users of the information from complex query syntax. After all, managers should not have to understand complex table layouts, elaborate table joins, and summary tables.

Whether a request is for the weekly sales of a product across all geographical areas or the year-to-date sales in a city across all products, an OLAP system must have consistent response times. Managers should not be penalized for the complexity of their queries in either the effort required to form a query or the amount of time required in receiving an answer.

Complex Calculations

The real test of an OLAP database is its ability to perform complex calculations. OLAP databases must be able to do more than simple aggregation. While aggregation along a hierarchy is important, there is more to analysis than simple data rollups. Examples of more complex calculations include share calculations (percentage of total) and allocations (which use hierarchies from a top-down perspective).

Key performance indicators often require involved algebraic equations. Sales forecasting uses trend algorithms such as moving averages and percentage growth. Analyzing the sales and promotions of a given company and its competitors requires modeling complex relationships among the players. The real-world is complicated—the ability to model complex relationships is the key in analytical processing applications.

OLAP software must provide a rich tool kit of powerful yet succinct computational methods. To make developers more efficient and business users more self-sufficient, the vehicle for implementing computational methods should be clear and non-procedural. If the method for creating the desired calculations is not clear, development time and/ or usage will suffer. If the calculation method is procedural, changes to the system cannot be done in a timely manner. This effectively eliminates the access to just-in-time information.

Whereas, transaction-processing systems are judged on their ability to collect and manage data, analytical processing systems are judged on their ability to create information from data. An example of a simple OLAP calculation is the calculation of margin (sales minus costs). The computation of the forecast is one of the most complex calculations. Historical data is used to project the future and aggregate data is used to estimate input data. Other more complex calculations, such as allocations and trend analysis, are also often found in OLAP systems.

Time Intelligence

Time is an integral component of almost any analytical application. It is a unique dimension because it is sequential in character (January always comes before February). True OLAP systems understand the sequential nature of time. Business performance is almost always judged over time, for example, this month vs. last month, this month vs. the same month last year.

The time hierarchy is not always used in the same manner as other hierarchies. For example, a manager might ask to see the sales for May or the sales for the first five months of 1995. The same manager might want to see the sales for blue shirts but would never want to know the sales for the first five shirts. Concepts such as year-to-date and period over period comparisons must be easily defined in an OLAP system.

In addition, OLAP systems must understand the concept of balances over time. For example, if a company sold 10 shirts in January, 5 shirts in February and 10 shirts in March, then the total sales for the quarter would be 25 shirts. If, on the other hand, a company had a head count of 10 employees in January, only 5 employees in February and 10 employees again in March, what was the company's employee head count for the quarter? Most companies would use an average balance. In the case of cash, most companies use an ending balance.

DIFFERENT STYLES OF OLAP

Increasingly, companies are implementing OLAP architectures to support their analytical requirements within data warehouse implementations. Older OLAP applications have generally been implemented as stand-alone applications that do not allow easy sharing of data with other OLAP applications. They have also tended to use multi-dimensional database management technology, which imposes restrictions on the degree of flexibility of analysis. The newer OLAP tools are moving away from multi-dimensional database management technology and increasingly use relational database management technology. The four major alternatives for implementing OLAP applications are:

- Multi-dimensional OLAP
- Hybrid OLAP

- Desktop OLAP
- Relational OLAP

All four OLAP styles should implement all the data security requirements for confidentiality, possibly down to individual data item level. This is a major area of weakness in many current OLAP products, which implement only basic security controls. Each of the four OLAP alternatives has its related strengths and weaknesses as outlined in the following sections.

Multi-dimensional OLAP

Multi-dimensional OLAP (MOLAP) is based on a multi-dimensional data base architecture. This stores data in a three-dimensional data cube that is already in the OLAP multi-dimensional format for 'slicing and dicing' into analysis views. Multi-dimensional architectures provide performance benefits where the data retrieval paths follow the pre-defined structure of the data cubes. To maximize performance and provide predictable response times for complex analysis queries, the database is designed to support the intended data analysis, i.e. that known at design time. Frequently data is held in an aggregated format, which limits the 'drill down' capabilities. MOLAP is suitable for applications requiring only pre-defined analysis on multiple dimensions (e.g. sales by customer type by geographic area over time). The MOLAP is not suitable for ad hoc analysis, for example, when attempting to discover why customers are being lost to competitors.

Hybrid OLAP

Hybrid OLAP products integrate specialized multi-dimensional data storage with relational database management technology. This allows businesses to link multi-dimensional data to the underlying source data in a relational database. When the analyst reaches the bottom of the multi-dimensional hierarchy during 'drill down' analysis, the application can obtain the underlying detail data from the relational database (frequently referred to as reach-through). At first glance, hybrid OLAP products seem to combine the better points of both multi-dimensional and relational databases. HOLAP is best suited to applications that require heavy analysis, must provide predictable response times to resource intensive queries, will have a small number of concurrent users (i.e. fewer than 20), etc. It is not suitable for ad hoc analysis, for example, when attempting to discover why customers are being lost to competitors.

Desktop OLAP

The desktop style of OLAP allows users to perform limited analysis, directly against data held within a relational database, while avoiding many of the problems that affect the hybrid and relational OLAP styles. These products provide multi-dimensional analysis features such as slice-and-dice analysis capabilities. These capabilities are achieved by creating a query to select data from the operational relational database, importing the requested data onto the desktop and placing it into a data cube (i.e. a multi-dimensional array), and performing multi-dimensional analysis (i.e. slice, dice, and pivot operations) against the data cube. The data cubes can be stored and maintained on the desktop, thus eliminating the overhead of building the data cube each time the data is analyzed.

The desktop OLAP is suitable for an enterprise that wants to provide pre-defined analysis capabilities to business users without incurring the higher purchase and maintenance cost of more functional products. This type of OLAP is not suitable where there is a requirement for flexible analysis or where multiple users require access to a common view of the business data.

Relational OLAP

Relational OLAP (ROLAP) is the fastest growing area of OLAP technology, with new vendors entering the market at an accelerating pace. Relational OLAP products are designed to operate directly on a data warehouse built on relational databases, through a comprehensive metadata layer. This eliminates any need to create static multi-dimensional data cubes. Multiple multi-dimensional views of the two-dimensional relational data can be created, as new requirements evolve, without the need to restructure the underlying database. New entrants into this marketplace can provide this functionality easily, as they are not constrained by existing product architectures. The ROLAP is suitable for situations where users require unrestricted analysis of a large volume of data, different business areas require different multi-dimensional views over the same source data, where there is a requirement to drill down to a low level of detail without impacting on the operational system, etc. This is not suitable where data storage is a limiting factor due to data redundancy.

How to Choose an OLAP Style?

OLAP is an application type rather than a data warehousing technology or a market. A company embarking on a data warehousing implementation must first determine the type of analysis that they will require. It is essential to consider the longer-term analysis requirements. For example, there may not currently be a requirement to support flexible querying of data, but there may be a need for this in the future. The following provide some guidelines.

- If only pre-defined multi-dimensional analysis is required, a multi-dimensional OLAP approach is most suitable due to the speed of processing. However, it will be difficult to incorporate any great degree of ad hoc analysis at a later stage.
- If the requirement is for intensive analysis of large volumes of data by a small number of concurrent users (i.e. fewer than 20) then a hybrid OLAP solution may be appropriate. The cost of this solution and the skill requirements are the main disadvantages.
- If the requirement is for limited pre-defined data analysis, a desktop OLAP application may provide a cost-effective solution. However, it will be difficult to enhance this to provide flexible analysis at a later stage.
- If there is a requirement for flexible querying, for example, where the business is changing rapidly as in the electricity and gas markets currently, the inflexibility of a multi-dimensional cube will be unsuitable. In this case, relational OLAP is the only option.
- If the business requires unrestricted analysis of a large volume of data where there is a requirement to drill down to a low level of detail, a relational OLAP solution is most appropriate. The main disadvantage of this approach is the data redundancy due to the de-normalized data structures.
- If there is a requirement to move the analysis onto an intranet, or the Internet, at a later stage the heavy client-processing requirement of desktop OLAP is unsuitable.

BENEFITS OF OLAP

Successful OLAP applications increase the productivity of business managers, developers, and whole organizations. The inherent flexibility of OLAP systems means business users of OLAP applications can become more self-sufficient. Managers are no longer dependent on IT to make schema changes, to create joins, or worse. Perhaps more importantly, OLAP enables managers to model problems that would be impossible using less flexible systems with lengthy and inconsistent

response times. More controls and timely access to strategic information are equal to more effective decision-making.

IT developers also benefit from using the right OLAP software. Although it is possible to build an OLAP system using software designed for transaction processing or data collection, it is certainly not a very efficient use of developer time. By using software specifically designed for OLAP, developers can deliver applications to business users faster and provide better service. Faster delivery of applications also reduces the applications backlog.

OLAP reduces the applications backlog still further by making business users self-sufficient enough to build their own models. However, unlike stand-alone departmental applications running on PC networks, OLAP applications are dependent on data warehouses and transaction processing systems to refresh their source level data. As a result, IT gains more self-sufficient users without relinquishing control over the integrity of the data.

IT also realizes more efficient operations through OLAP. By using software designed for OLAP, IT reduces the query drag and network traffic on transaction systems or the data warehouse.

Lastly, by providing the ability to model real-business problems and a more efficient use of people resources, OLAP enables the organization as a whole to respond more quickly to market demands. Market responsiveness, in turn, often yields improved revenue and profitability.

SUMMARY

The term, *on-line analytical processing (OLAP)* was coined by E.F. Codd in 1993, to refer to a type of application that allows a user to interactively analyze data. OLAP is a method of analyzing data in a multi-dimensional format, often across multiple time periods, with the aim of uncovering the business information concealed within the data. OLAP enables business users to gain an insight into the business through interactive analysis of different views of the business data that have been built up from the operational systems. This approach facilitates a more intuitive and meaningful analysis of business information and assists in identifying important business trends.

OLAP can be defined as the process of converting raw data into business information through multi-dimensional analysis. This enables analysts to identify business strengths and weaknesses, business trends, and the underlying causes of these trends. It provides an insight into the business through the interactive analysis of different views of business information that have been built up from raw operating data which reflect the business users understanding of the business. The OLAP application contains logic, which includes multi-dimensional data selection, sub-setting of data, retrieval of data via the metadata layer, and calculation of formulas. The OLAP application layer is accessed via a front-end query tool, which uses tables and charts to 'drill down' or navigate through dimensional data or aggregated measures. The four major types of OLAP applications are multi-dimensional, hybrid, desktop, and relational OLAPs.

QUESTIONS FOR DISCUSSION

1. What is OLAP?
2. Explain the connection between data warehouse and OLAP.
3. What are the uses of OLAP?
4. Explain the mediating role of OLAP.
5. Discuss the key features of OLAP.
6. What do you mean by multi-dimensional views?

7. How does OLAP's capability to perform complex calculations help in solving business problems?
8. What is time intelligence?
9. What are the different styles of OLAPs?
10. What is multi-dimensional OLAP?
11. What is hybrid OLAP?
12. What do you mean by desktop OLAP?
13. What is relational OLAP?
14. How does one choose an OLAP style?
15. What are the benefits of OLAP?

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Chapter 14

Product Life Cycle Management (PLM)

INTRODUCTION

Product innovation brings new challenges on a daily basis—environmental concerns, shorter product life spans, globally distributed sites, and project teams. Today, manufacturers are expected to deliver high-quality products quickly and cost-effectively—while retaining and building a customer base, reducing service costs, and complying with international regulations.

After using sophisticated systems for design, enterprise resource planning, and customer relationship management, you may still need to get new products to market faster. Critical departments and functions may still operate in isolation. Suppliers and partners may have challenges getting through your firewalls.

You need an integrated product life cycle management (PLM) software solution for collaborative engineering, product development, and management of projects, product structures, documents, and quality. The PLM software should provide an information backbone to help you access relevant information anywhere, anytime. The PLM application should provide integrated PLM software—a single source of all product-related information needed for collaborating with business partners and supporting processes including product innovation, design and engineering, quality and maintenance management, and control of environmental issues. The PLM application can help your organization:

- Support strategic sourcing by interfacing with supplier relationship management software
- Provide role-specific, context-driven access for internal and external users to relevant information, tools, and services
- Improve decision-making through insight into projects, flexible reporting, and analytics for portfolio management, occupational health, product safety and quality
- Increase strategic and operative control by monitoring products and production changes affecting timelines, costs, and resources
- Provide an open technology framework that delivers up-to-date data required by enterprise processes for demand planning, manufacturing, purchasing, and sales.

PRODUCT DESIGN AND DEVELOPMENT

Effective product design and development is required to support the strategy of quick response to the market. This overall process has been rolled into PLM. The concurrent and collaborative design process dramatically reduces the overall time to market. Concurrent engineering uses various computer tools to aid in the design process.

The development and use of these computer tools has evolved quickly during the past few years. More importantly, these tools are now enabling collaboration on designs across several links of the supply chain. No longer is it necessary to build physical prototype parts to test for fit and interference. Building physical prototypes is extremely demanding on both time and expense. Complex assemblies can be put together directly on the computer without ever building a physical part through the use of computer-aided design (CAD) systems.

The use of an effective product data management (PDM) system facilitates the design release, distributes the design data to multiple manufacturing sites, and manages changes to the design in a closed-loop fashion. PDM provides the vault infrastructure that controls the design cycle and manages change.

Having control of the electronic and physical documents is essential in a fast moving design process. Effective utilization of this design engine can save an organization 15–20% in product cost. The innovation engine is powered by a PLM system through the collection of what the organization has learned about what works best in designs and provides insight into best practices in design. More than 80% of the final cost of the product is committed during the design phase of the product. Once the design is locked down there is only relatively small improvement that can be made to reduce product cost. Having the loop closed from the manufacturing process back to the design process provides that critical feedback for innovation on the next product. This innovation engine explores design alternatives and defines innovative options and alternatives, including developing products targeted at individual customers. Having direct linkage to the manufacturing system to get feedback to the engineers about the costs and production issues is needed to incorporate this information into the next design. This can be integrated directly into the customer relationship management (CRM) part of the ERP system. PLM can result in several orders of magnitude improvement to the product design process.

PRODUCT DATA MANAGEMENT

The PDM system not only tracks the configuration of the part and the bill of material (BOM), but also tracks the revisions and history of the as-designed and as-built conditions. By utilizing an integrated CAD and PDM system, the quality of the design as well as the response time to the market is significantly improved. After all the virtual tests, a direct link to manufacturing (computer-aided manufacturing or CAM) is also possible. Now it is possible to automatically update the ERP system planning data because of the seamless connection due to the openness of the database tools and the sophistication of middleware used to perform the linkages. This integration into the planning system is essential so that the right part with the right configuration can be ordered at the right time.

The other side of PDM is the definition of what goes into the parent part. Where a machine shop may use relatively few materials to manufacture a part, an assembler may take hundreds if not thousands of parts to make an end item. When ordering for a company that builds sophisticated satellites or ships, an engineer may use thousands of parts to complete the final unit. The as-designed and as-built configuration must be concisely documented in this type of business as part of the total deliverable is the product catalog, to provide critical service information. Keeping track of all these pieces, assemblies, and quantities can be very confusing. A PDM system integrated with the BOMs provides the planning system with a clear definition of the product and the materials required. Having this linked to the as-installed and as-serviced configurations of the products through the field service application provides a full 360-degree view.

Benefits of PDM

The enterprise is faced with many challenges both internal and external. The benefits of PDM can be divided into four categories:

1. Market share
2. Customer satisfaction
3. Profit margins
4. Returns to stakeholders

Market Share

The use of an integrated design system should increase market share as the enterprise can be expected to increase the introduction rate of new products and lower costs. PDM significantly reduces the time it takes to bring new products to market by reducing the amount of non-value added time in the product release process. This increased frequency of introduction can help gain a competitive advantage. If the competition is releasing products at a slower rate, there is significant potential to grab the market share through product innovation. This faster introduction of new products at a lower cost can also allow the enterprise to introduce products that meet the needs of emerging market trends or smaller niches that could not otherwise be accessed in a profitable way. In addition, the selling price of these products can potentially be lower since the cost of the design is lower, thus lowering the break-even point for the product launch. Given the dramatic reduction in product life cycles, being able to bring more products more quickly into the market can provide more opportunities to develop products that may be the next big market success.

Customer Satisfaction

PDM provides enterprises with the ability to increasingly fit its product introductions to the market needs. With this ease of design, the company can try innovative products that leverage what has been learned in prior designs. Feedback from customers can more easily be incorporated and introduced to the market. Since the design, fabrication, and services stems are integrated under a fully implemented ERP system, the components that exhibit early or frequent failure can be identified and the design can be modified to improve overall service levels. These experiences can also be leveraged back into the design system. The PDM system supports the low-cost introduction of additional features, as the market demands them because the design does not have to start from scratch. Derivative products can be introduced to the market at a reduced introduction cost.

Profit Margin

As discussed in the customer section, the use of PDM and CAD can significantly decrease the cost of developing a product. The number of derivatives that are possible from the same base design increases. A derivative is a product that is very similar to another product that has already been introduced. Typically a derivative product would share production processes.

PDM facilitates the re-use of previous designs and knowledge (previously proven material and parts) because this information is easy to access and use. The benefit of this approach is that the volume for these parts goes up and therefore the cost per piece goes down. When proven parts are used, the number of parts that could cause a risk in the project should decline because the start-up production problems have already been resolved.

Returns to Stakeholders

The ability to bring new products to market quickly and profitably has a direct impact on the corporate image. The company will be viewed as being innovative and fresh in its product design. This competitive advantage usually provides improved market share and increased investment in addition to improved returns to stakeholders. When this strategy is continued over time, the returns to stakeholders can continue to improve as well. This steady growth and profit curve is well received by the financial markets and other investors.

PRODUCT LIFE CYCLE PHASES

A product's life cycle (PLC) can be divided into several stages based on the revenue generated by the product. If a curve is drawn showing product revenue over time, it may take one of many different shapes, an example of which is shown in Fig. 14.1. The life cycle concept may apply to a brand or to a category of product. Its duration may be as short as a few months for a fad item or a century or more for product categories such as the gasoline-powered automobile. The first stage of the PLC is product development. Once the product is developed, it is introduced into the market. As the product progresses through its life cycle, changes in the marketing mix (product, price, place [distribution], and promotion) usually are required in order to adjust to the evolving challenges and opportunities.

The PLC is based upon biological life cycle. For example, a seed is planted (introduction), it begins to sprout (growth), it shoots out leaves and roots out as it becomes an adult (maturity), after completing its adulthood it begins to shrink and die (decline). The same theory applies for a product. After a period of development it is introduced or launched into the market, it gains more and more customers as it grows, eventually the market stabilizes and the product becomes mature, then after a period of time the product is overtaken by development and the introduction of superior competitors; it then goes into decline and is eventually withdrawn. However, many products fail in the introduction phase. Others have very limited cyclical maturity phases where declines see the product promoted to regain customers.

New Product Development Stage

Product development is the incubation stage of the product life cycle. There are no sales and the firm prepares to introduce the product. This is a very expensive stage where the organization spends money in research and development (R&D), feasibility study, usability testing, test marketing, user surveys, and so on.

Introduction Stage

When the product is introduced, sales will be low until customers become aware of the product and its benefits. Some firms may announce their product before it is introduced, but such announcements also alert competitors and remove the element of surprise. Advertising costs typically are high during this stage in order to rapidly increase customer awareness of the product and to target the early adopters. During the introductory stage, the firm is likely to incur

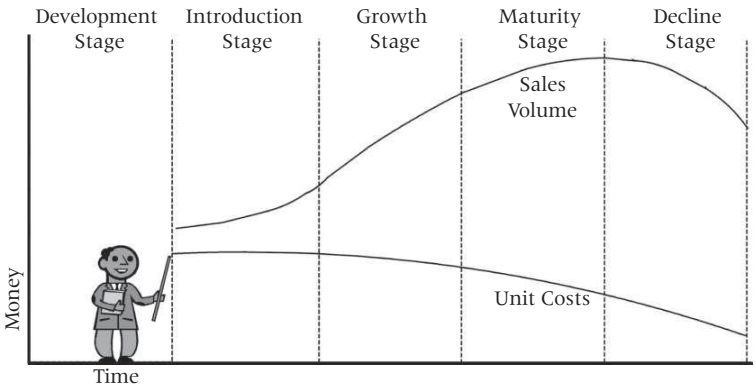

Figure 14.1 Product life cycle phases.

additional costs associated with the initial distribution of the product. These higher costs coupled with a low sales volume usually make the introduction stage a period of negative profits.

During the introduction stage, the primary goal is to establish a market and build primary demand for the product class. The need for immediate profit is not a pressure. The product is promoted to create awareness. If the product has no or few competitors, a skimming price strategy is employed. Limited numbers of the product are available in few channels of distribution. The following are some of the implications of the marketing mix during the introduction stage.

1. **Product**—one or few products, relatively undifferentiated.
2. **Price**—Generally, high, assuming a skim pricing strategy for a high profit margin as the early adopters buy the product and the firm seeks to recoup development costs quickly. In some cases a penetration pricing strategy is used and introductory prices are set low to gain market share rapidly.
3. **Distribution**—Distribution is selective and scattered as the firm commences implementation of the distribution plan.
4. **Promotion**—Promotion is aimed at building brand awareness. Samples or trial incentives may be directed toward early adopters. The introductory promotion also is intended to convince potential re-sellers to carry the product.

Growth Stage

The growth stage is a period of rapid revenue growth. Sales increase as more customers become aware of the product and its benefits and additional market segments are targeted. Once the product has been proven a success and customers begin asking for it, sales will increase further as more retailers become interested in carrying it. The marketing team may expand the distribution at this point. Advertising spend is high and focuses upon building the brand.

Competitors are attracted into the market with very similar offerings. When competitors enter the market, often during the later part of the growth stage, there may be price competition and/or increased promotional costs in order to convince consumers that the firm's product is better than that of the competition. Products become more profitable and companies form alliances, joint ventures, and take each other over. Market share tends to stabilize. During the growth stage, the goal is to gain consumer preference and increase sales. The marketing mix may be modified as follows.

1. **Product**—New product features and packaging options; improvement of product quality.
2. **Price**—Maintained at a high level if demand is high, or reduced to capture additional customers.
3. **Distribution**—Distribution becomes more intensive. Trade discounts are minimal if re-sellers show a strong interest in the product.
4. **Promotion**—Widespread advertising to build brand preference.

Maturity Stage

Those products that survive the earlier stages tend to endure longest in this phase. The maturity stage is the most profitable. While sales continue to increase into this stage, they do so at a slower pace. Because brand awareness is strong, advertising expenditures will be reduced. Competition may result in decreased market share and/or prices. The competing products may be very similar at this point, making it difficult to differentiate the product. The firm tries to divert the attention of the competitors' customers by multiplying the existing customers and converting non-users into customers. Sales promotions, may be offered to encourage retailers to give the product better shelf

space over competing products.

During the maturity stage, the primary goal is to maintain market share and extend the product life cycle. Marketing mix decisions may include:

1. **Product**—Modifications are made and features are added in order to differentiate the product from newly introduced competing products
2. **Price**—Possible price reductions in response to competition by avoiding a price war
3. **Distribution**—New distribution channels and incentives to re-sellers in order to avoid losing shelf space
4. **Promotion**—Emphasis on differentiation and building of brand loyalty and incentives to get competitors' customers to switch.

Decline Stage

Eventually sales begin to decline as the market becomes saturated, the product becomes technologically obsolete or customer tastes change. If the product has developed brand loyalty, profitability may be maintained for longer. Unit costs may increase with the declining production volumes and eventually no more profit can be made. During the decline phase, the firm generally has three options:

1. Maintain the product in the hope that competitors will exit. Reduce costs and find new uses for the product
2. Harvest it, reducing marketing support, and coasting along until no more profit can be made
3. Discontinue the product when no more profit can be made or there is a successor product

The marketing mix may be modified as follows:

1. **Product**—The number of products in the product line may be reduced. Rejuvenate surviving products to make them look new again.
2. **Price**—Prices may be lowered to liquidate inventory of discontinued products. Prices may be maintained for continued products serving a niche market.
3. **Distribution**—Distribution becomes more selective. Channels that no longer are profitable are phased out.
4. **Promotion**—Expenditures are lower and aimed at reinforcing the brand image for continued products.

Limitations of the Product Life Cycle Concept

In reality, very few products follow such a prescriptive cycle. The length of each stage varies enormously. The decisions of marketers can change the stage, for example, from maturity to decline by price-cutting. Not all products go through each stage. Some go from introduction to decline. It is not easy to tell which stage the product is in.

The term 'life cycle' implies a well-defined life cycle as observed in living organisms, but products do not have such a predictable life and the specific life cycle curves followed by different products vary substantially. Consequently, the life cycle concept is not well-suited for the forecasting of product sales. Furthermore, critics have argued that the PLC may become self-fulfilling. For example, if sales peak and then decline, managers may conclude that the product is in the decline phase and therefore cut the advertising budget, thus precipitating a further decline.

Nonetheless, the PLC concept helps marketing managers to plan alternate marketing strategies to address the challenges that their products are likely to face. It is also useful for monitoring sales results over time and comparing them to those of products having a similar life cycle.

The progression of a product through these stages is by no means certain. Some products seem to stay in the mature stage forever (e.g., milk). Marketers have designed various techniques to prevent the process of falling into the decline stage. In most cases, however, one can estimate the life expectancy of a product category.

Marketers' marketing mix (price, promotion, product, and place [or distribution]) strategies change as products go through their life cycles. Advertising, for example, should be informative in the introduction stage, persuasive in the growth and maturity stages, and be reminder-oriented in the decline stage. Promotional budgets tend to be highest in the early stages and gradually taper off as the product matures and declines. Pricing, distribution, and product characteristics also tend to change.

Customers respond to new products in different ways. Diffusion of innovations theory, pioneered by Everett Rogers and other diffusion models posit that people have different levels of readiness for adopting new innovations and that the characteristics of a product effect overall adoption.

The first two stages, introduction and growth, are often seen as offensive in nature. The second two stages, mature and decline, are often seen as defensive in nature. There is also a saturation stage after the maturity stage where the product is not affected by marketing.

PRODUCT LIFE CYCLE MANAGEMENT (PLM)

In today's challenging global market, enterprises must innovate in order to survive. That innovation must occur across all dimensions—product, process, and organization—to improve competitiveness and business performance. For products to be developed faster at lower cost, companies must ensure that all product-specific information is consistent and readily available.

Yet PLC processes are typically cross-departmental, cross-discipline, and even cross-enterprise, making data sharing difficult. Outsourcing to suppliers or development partners can further hinder collaboration and complicate these processes. The typical consequences are: disconnected information and process flows, resulting in increased costs, loss of time, and quality control issues.

That is why today's innovators are opting for a more collaborative and integrated approach to managing the entire process—from initial conception and development to production and product obsolescence. They are recognizing the equal importance of a solution that enables co-operation and data sharing with production, sales, service, and maintenance, while supporting quality management and product costing.

USES OF PLM

The PLM solution provides a comprehensive, closed-loop system to help you streamline product development and gain a holistic view of all product-related business processes. PLM supports new product development and introduction processes, including cross-company product development and strategic sourcing; prototyping and production ramp-up; handovers to sales, service, and maintenance groups; quality engineering and improvement; and product costing. In addition, you can ensure that all product-specific information is available—not only enterprise-wide but to partners and suppliers as well.

For discrete industries, PLM helps transform requirement structures into concept structures and finally into product structures. In addition, the solution provides tight integration into authoring environments such as CAD systems. Development collaboration on product structures with external business partners takes place in a secure, web-based environment. In addition, the solution enables dedicated procurement, production, and evaluation of your prototypes, while production ramp-up

ensures a smooth transition to the shop floor. All sales-relevant product structure and product configuration information is available to sales people and equipment and technical asset structures are accessible to service and maintenance personnel. The solution uses a common master-data layer for all of this information.

For process industries, PLM manages all types of specifications and formulations. Multi-level recipe management functions allow you to transform enterprise-wide recipes at the general or site level into master recipes used for production. Trial management functionality allows you to optimize a recipe before the data is handed over to production. And quality management and product costing support helps ensure that final products meet stringent requirements and that costs are well managed. The result is a streamlined, collaborative approach to product development that offers greater efficiency and responsiveness while reducing your development time and costs.

Reduction in the Time and Cost to Market

The PLM process is the process of learning from prior projects and designs. PLM provides the resources to explore design alternatives and define innovative options for release in the next product. PLM manages the linkages from the early design phase to the final release plan including required tool paths. This integrated process allows the development of the manufacturing information currently with the product design before final design release. This is very different from the iterative steps of drawing release followed by a series of manufacturing engineering changes in traditional product design. The early availability of product and process knowledge offers the option to further optimize the design or push the design to market in order to capture critical market share. The design engineer can see how the product will be built and can quickly determine the tools that may be affected if the design is made changed.

By using PLM, a conscious decision can be made to release the product into the market to gain market share or continue to optimize the product in the design phase to reduce product costs. The overall design lead-time is dramatically reduced in addition to the total product cost, and as a result, the number of designs that can be economically developed and evaluated increases. The enterprise implication of the use of PLM is the ability of the organization and its partners to work together in a more seamless way.

Concurrent Engineering

Concurrent engineering is the process by which different functional areas can work together to design and develop a product that meets the needs of the customer. PLM is the technology that provides the information support that facilitates that process. A close relationship exists in this model between marketing, design, production, service, sales, and suppliers. These different functional areas interact concurrently in a series of tasks that must be accomplished to complete the product design. This concurrent engineering process is also known as participative design and engineering. The intent of this process is to enhance the design with inputs from all key stakeholders. These stakeholders can be from different links in the supply chain. For some manufacturing companies, a key competitive advantage is leveraging the design capability of the supply base. By incorporating the designs that can be more easily manufactured by the supply base, the overall cost of the finished product can be reduced. Decisions made by one functional area directly impact the consequences felt in a different area.

Key new product introduction practices are interrelated and have different benefits to quality, time, and cost, but all rely on integration of the factors of the enterprise, design process, and technology.

Concurrent engineering impacts more in the area of time to market a new product, but also has benefits on cost and quality. Cost is most impacted by gateway management. The gateway management process assesses the readiness of the product for launch into the market in order to ensure that the best design that meets the needs of the customer is available. Utilizing a PLM tool provides extended time where the freedom to act is cost competitive. Quality is most beneficially impacted by the integration of the extended enterprise and the capability of a virtual product introduction through the use of CAM and PLM. When these factors are achieved simultaneously, the benefit is felt directly as an improved bottom line.

PLM—FEATURES AND FUNCTIONS

The PLM offers all the functionality you need for integrated product and asset management. Features and functions include:

- Life cycle data management
- Program and project management
- Life cycle collaboration
- Quality management
- Enterprise asset management
- Environment, health, and safety

Life Cycle Data Management

PLM provides an environment for managing specifications, BOM, routing and resource data, project structures, and related technical documentation throughout the product life cycle. It provides a dynamic, (often web-based) environment for managing all phases of the product and asset life cycle.

PLM offers integrated product and process management functionality for handling features and requirements, BOM, routing and resource data, recipes, CAD models, and related technical documentation. Sophisticated product change management spans engineering and design, production and maintenance management, ensuring consistency of product knowledge. PLM gives you out-of-the-box integration with a range of computer-aided design (CAD) tools. It also supports supervisory control and data acquisition (SCADA) tools, geographic information systems (GIS), and office applications.

PLM gives you control of change management—including claim management and release of engineering changes to manufacturing. For example, you can automatically transfer engineering changes and customer order changes into manufacturing, even for production orders that are already running. Thus, you have unprecedented flexibility to react to last-minute changes. PLM also includes configuration-management features and functions that support all central logistics processes throughout the product and asset life cycle.

Program and Project Management

PLM provides advanced capabilities to plan, manage, and control the complete product development process. PLM enables you to plan, manage, and control the entire project development process, from conception to completion. The solution allows project managers to control project structures, schedules, costs, and resources. This includes network planning techniques and aggregative tools that support cross-project cost, revenue, margin, schedule, and resource management. The PLM tools lets you set up a project and monitor its progress, simplifies project planning and control, combining tabular and graphical data to provide a global overview, gives you a detailed picture of current

status, which you can represent using a variety of reporting tools, and so on. Most PLM applications integrate with the SCM and other solutions; you can conduct complete product-value analyses, cost-revenue analyses, and cost-of-sales projections.

Life Cycle Collaboration

PLM supports collaborative engineering and project management, employing XML-based web standards to communicate information such as project plans, documents, and product structures across virtual development teams. PLM enables and accelerates collaborative processes for engineering, product development, and project management by allowing all parties, both inside and outside the enterprise, to share information quickly and easily.

PLM lets you control information flow across the extended engineering supply chain, using web-based interfaces to share data and designs among development partners, contractors, suppliers, and customers. It also allows contractors, suppliers, and customers to exchange quality data directly—for example, recording inspection results, requesting a deviation from a specification, or exchanging quality certificates electronically.

In addition, you can access and exchange drawings, manuals, service bulletins, and parts information over the Internet. This includes the creation and maintenance of web-based illustrated parts catalogs. For asset management, you can procure supplies electronically and monitor equipment on-line.

Quality Management

PLM provides integrated quality management for all industries throughout the entire product life cycle. Quality management has become complex and multi-faceted. While the integration of processes continues to be a key factor, employee skills and input are increasingly important. PLM puts you in control of quality management through the global exchange of key information. In particular, the solution offers these advantages:

- A single quality management solution for all company processes
- A central role for employees, with the ability to perform a variety of tasks quickly and efficiently
- All employee access to your most current quality manual at any time

PLM enables you to begin quality planning during the product design phase. It also lets you create a foundation for quality inspection processes and in-process control during production.

Enterprise Asset Management

PLM enables project managers, maintenance engineers, and others to manage physical assets and equipment, from first investment plan to retirement of the asset. Integral to PLM are features and functions for enterprise asset management. PLM supports the selection, purchase and installation of equipment based on performance, ease of maintenance, and manufacturer support. It also lets you manage equipment modifications, upgrades, and refurbishment. Tools for monitoring work-order backlogs keep you informed of the condition of assets and the status of maintenance work. PLM tracks the costs of individual assets and aggregates them to the level of an entire production line or plant. This supports decision-making and helps you achieve the lowest total cost of ownership. You can even use historical cost data to determine the optimal time to replace equipment.

In addition, you can access drawings, manuals, service bulletins, and parts information over the Internet. This includes the creation and maintenance of web-based illustrated parts catalogs.

Integrated e-procurement features make it easy to order supplies. Inventory management capabilities help to optimize the performance of key equipment.

Environment, Health, and Safety

PLM provides a solution for environment, health, and safety by aligning business processes to comply with government regulations. PLM addresses a range of environment, health, and safety issues. In addition to enabling you to manage risk and comply with government regulations, the solution integrates a variety of environment, health, and safety functions:

- Product safety
- Hazardous materials management
- Dangerous goods management
- Industrial hygiene and safety management
- Occupational health
- Waste management

PLM supports you throughout the life cycle of your products and assets across the entire supply chain, helping you to continuously improve business processes. The integrated architecture of the solution ensures the consistency of information exchanged between business and environmental, health, and safety processes. Current data is instantly available and redundant data maintenance is avoided. PLM streamlines and automates all activities necessary to let you implement business processes safely, effectively, and in accordance with laws and regulations. The result is reduced costs and minimized risks, as well as an enhanced image and improved market opportunities.

PLM'S SUPPORT FOR PRODUCT LIFE CYCLE PROCESSES

PLM supports crucial PLC processes in the following areas:

- Product development
- Development collaboration and strategic sourcing
- Prototyping and production ramp-up
- Sales, service, and maintenance handovers
- Quality engineering and improvement
- Product costing

Product Development

PLM includes the tools to manage all documents associated with product development—from specifications to CAD drawings, minutes of meetings, and test protocols. The solution supports both discrete and process manufacturing processes. Discrete manufacturers leverage a complete set of life cycle data management and product structure management functions that support engineering changes and configuration management. Process manufacturers can benefit from comprehensive support for creation and management of specifications and formulas, including recipes, equipment requirements, and process definitions.

Integration with authoring systems such as MCAD (Mechanical CAD) and ECAD (Electrical CAD) enables seamless data flow. Versioning, access controls, and document tracking by engineering change orders and requests help you manage and control document life cycles.

Development Collaboration and Strategic Sourcing

Successful partnering and outsourcing—keys to competitive advantage—are largely dependent upon your ability to collaborate effectively and securely with external parties. PLM provides superior collaborative functions that allow you to gather, organize, use and protect product information, and to share and exchange this information with both internal and external stakeholders. PLM lets you collaborate on technical documents, product structures, assets and project information during the product development process.

Prototyping and Production Ramp-Up

PLM supports the process of building prototypes based on product data and allows you to validate designs before starting production. During the product introduction phase, the solution also helps you to synchronize production ramp-up to avoid lost sales, as well as to produce just the right amount of new products to be in sync with both existing stock levels in the supply chain and customer demand.

Sales, Service, and Maintenance Handovers

PLM integrates seamlessly with other enterprise integration applications to make handovers to sales, service, and maintenance divisions easy and effective. For example, you can integrate PLM with the CRM solution to support and accelerate market launches. CRM automates delivery of collateral materials to sales representatives, sends pricing information to their mobile devices, provides an online and off-line order management system for fast, efficient order processing and uses integration with the SCM solution to support top-down and bottom-up demand planning for accurate forecasts.

PLM can also be integrated with the business intelligence systems whose data warehousing functions let you analyze data such as real-time sales of products being managed in PLM. Sales post analyses of actual versus planned data enable you to determine product success and make informed decisions regarding price changes, promotions, and production boosts.

Quality Engineering and Improvement

Today's customers demand more and better products. PLM provides you with powerful tools for a broad-based approach to total quality management, with a full menu of features and functions that enables you to control and maintain quality throughout the product life cycle.

Product Costing

PLM supports product costing in product development with enhanced estimating functions that help you better manage and influence the costs of product designs while they are still in the development phase. When costing information is available to your product engineers, they can design to cost and more accurately estimate costs before production begins.

BENEFITS OF PLM

PLM solutions enable companies to turn their innovation power into profit by addressing issues related to increased product individualization, successful launches, time-to-market demands, product quality, program management, and risk management practices. PLM solutions offer methods to speed engineering and product development processes and to get to market faster simultaneously reducing costs. These solutions provide an integrated set of methodologies, software, tools and services to address business requirements associated with product planning, concept development, design, engineering, analysis, testing, launch, and support. PLM can help you develop innovative

products more quickly, efficiently, and cost-effectively. It can help you in improving productivity, reducing the time to market a product, etc. With PLM you gain the following benefits:

- **Faster development and reduced costs**—The solution reduces time-to-market and time-to-volume through its integrated, collaborative approach to PLM
- **Seamless integration with enterprise systems**—Integrating PLM with other software such as CAD systems lets you align other core business functions for streamlined operations
- **Improved product quality**—PLM helps you effectively manage product quality throughout every phase of the product life cycle
- **Better business results**—With PLM you can explore new market opportunities, gain a larger market share, and increase customer satisfaction
- **Better business decision-making**—PLM supports decision-making regarding product design, development, pricing, quality, and other critical areas to ensure success

PLM IMPLEMENTATION

The implementation of PLM is more than just purchasing the software. An effective PLM implementation is the unique combination of people, processes, and products including technology that fits the needs of the enterprise. The issues that must be addressed with people to implement PLM are very similar to those that must be addressed to implement ERP. Some of the major issues that must be addressed are:

- A clearly articulated vision of how this technology will address the limitations of the business so that a positive return on investment is possible
- Teamwork
- An enterprise culture that embraces concurrent participative design
- Sufficient skills for the people who must use the tools
- Education to provide the understanding of what is to be achieved and why
- Effective communication to share this information throughout the extended enterprise

We will see more about ERP implementation in the next part—Part III—of this book. Nowadays, PLM is implemented as part of, or along with ERP systems. Thus, PLM implementation procedure is now part of many ERP implementations.

SUMMARY

The conditions a product is sold under will change over time. The PLC refers to the succession of stages a product goes through. PLM is a series of strategies used by management as a product goes through its life cycle.

The PLC goes through many phases, involves many professional disciplines and requires many skills, tools, and processes. PLC is the life of a product in the market with respect to business/commercial costs and sales measures, whereas PLM is more of managing descriptions and properties of a product through its development and life time, mainly from a business/engineering point of view.

You need an integrated PLM software solution for collaborative engineering, product development, and management of projects, product structures, documents, and quality. The PLM software should provide an information backbone to help you access relevant information anywhere, anytime. The PLM application should provide integrated PLM software—a single source of all product-related information needed for collaborating with business partners and supporting processes including

product innovation, design and engineering, quality and maintenance management, and control of environmental issues.

Product data management (PDM) is that category of computer software used to create and manage relations between sets of data that define a product and store those relationships in a database. The information being stored and managed (on one or more file servers) will include engineering data such as CAD models, drawings, and their associated documents. 'Associated documents' is a collective term for requirements, specifications, manufacturing plans, assembly plans, test plans, and test procedures. The package may also include product visualization data. The central database will also manage metadata such as owner of a file and release status of the components. The package will control check-in and check-out of the product data to multi-users, carry out engineering change management, and release control on all versions/issues of components in a product, build, and manipulate the product structure BOM for assemblies and assist in configurations management of product variants. This enables automatic reports on product costs, etc. Furthermore, PDM enables companies producing complex products to spread product data into the entire PLM launch process.

A product's life cycle (PLC) can be divided into several stages based on the revenue generated by the product. The PLC is based upon biological life cycle. For example, a seed is planted (introduction); it begins to sprout (growth), it shoots out leaves and spreads its roots as it becomes an adult (maturity), and livings its adult life shrinks and dies(decline). PLM solutions enable companies to turn their innovation power into profit by addressing issues related to increased product individualization, successful launches, time-to-market demands, product quality, program management, and risk management practices. PLM solutions offer methods to speed engineering and product development processes and to get to market faster simultaneously reducing costs.

The implementation of PLM is more than just purchasing the software. An effective PLM implementation is the unique combination of people, processes, and products including technology that fits the needs of the enterprise. The same issues that must involve people to implement PLM must involve issues addressed to implement ERP.

REVIEW QUESTIONS

1. What do you mean by product life cycle management?
2. Discuss the benefits of PLM.
3. Discuss product design and development.
4. What is product data management and what are its uses?
5. Discuss the benefits of PDM.
6. Discuss the product life cycle phases and the functions in each phase.
7. What are the limitations of the product life cycle concept?
8. Discuss PLM and its capabilities.
9. What are the uses of PLM?
10. What are the features and functions of PLM?
11. What is life cycle data management?
12. What is program and project management?
13. What do you mean by life cycle collaboration?
14. How does PLM help integrated quality management?
15. What is enterprise asset management and how PLM aid it?
16. How does PLM contribute to the environment, health, and safety?
17. Discuss PLM's support for product life cycle processes.
18. How does PLM support product development?

19. How does PLM help in development collaboration, strategic sourcing, prototyping, and production ramp-up?
20. How does PLM support sales, service, and maintenance handovers?
21. How does PLM help in quality engineering?
22. How does PLM help in quality improvement?
23. How does PLM help in product costing?
24. What are the benefits of PLM?
25. What are the steps of PLM implementation?

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Chapter 15

Supply Chain Management (SCM)

INTRODUCTION

Few concepts have revolutionized business more profoundly in recent years, SCM is one of them. The streamlining of communications and materials delivery from vendors to operations and on to customers can yield enormous business benefits—improved customer service, reduced inventory, shorter cycle times, increased agility, and higher asset utilization levels, to name a few. After establishing itself in the manufacturing and retail sectors, the principles of SCM are now catching up virtually every industry.

With shrinking product life cycles, shifting competitive landscapes and drastic changes to consumer buying patterns, SCM is no simple task. However, powerful new tools are helping to replace guesswork about planning, scheduling, and execution, with systematic and scientific insight. Earlier waves of enterprise resource planning (ERP) software that integrated financial and distribution functions with distribution requirements planning (DRP), master production scheduling (MPS), and manufacturing requirements planning (MRP) have automated those tasks for many companies. The newest generation, which incorporates advanced planning and scheduling (APS) goes beyond those discrete tasks by fine-tuning the entire supply flow for a company's unique needs.

EVOLUTION OF SUPPLY CHAIN MANAGEMENT (SCM)

MRP grew out of the need to know what to buy and when it is to be delivered. However, what to buy and when to deliver it, depends upon the customer. What does the customer want? When does he want it? Also customers can change their minds, make last minute modifications, cancel the order, or order a totally different item. If several customers behave like this, then trying to match material purchases with production geared to meet customer delivery dates becomes a juggling nightmare.

Variables to consider include production capacity, machine availability, supplier and production lead-times, bill of materials, available raw material stock, and available inventory stock. The goal was always to minimize the level of inventory held yet meet customer demand. MRP, MRPII, and ERP provided only limited solutions.

In order to balance supply with demand, various practices emerged during the 1980s. Sales and operations planning provided a high level overview of the match between supply and demand. Just-in-time (JIT) deliveries were based on a card/bin system. This indicated which items were required and triggered the 'call-off' of these items from the supplier, who held an agreement to have a stock of these items available for requirements. Product development adopted the idea of collaboration between customer and supplier at the design stage. Expertise shared at this stage enabled the design out of costs and the development of standardized parts in order to reduce the size of the component pool and to gain economies of scale when sourcing.

The fundamental task of dealing with the complexity of planning created an opportunity for vendors to develop specialized planning products. These integrate customer forecasts and demands with operational constraints, including capacity and availability, to generate production schedules and purchasing requirements. These powerful modeling tools are presented under the banners of supply chain planning (SCP) and advanced planning systems (APS). The distinction between the two is a moot point. Despite all this sophistication, these planning tools are limited in its forecasts. An optimistic or pessimistic forecast passed from a retailer to his distributor will be magnified as it is transmitted back up the supply chain and could have an undesirable effect upon inventory and availability.

Other functional developments have emerged. Maintenance, repair, and overhaul (MRO) can deal with the large number of part numbers, small quantities of each part, and a myriad of suppliers associated with equipment maintenance. Different inventory requirements can be managed, whether these are in hubs, multi-site warehouses, or different inventory accounts within one location. Replenishment systems can also be handled. Transport management includes transportation scheduling and real-time monitoring and the tracking of items and/or vehicles in transit. The Internet has fuelled the development of self-service malls and on-line auctions where buyers and sellers can engage in trade.

Collectively, the suite of functionality on offer provides fairly comprehensive supply chain focused support to the practices associated with the concept of SCM. However, one should beware of the interchangeable use of SCP and SCM in the literature. SCP is concerned with planning.

The concept of SCM encompasses all activities relating to the supply chain. SCM is the management of a network of interconnected businesses involved in the provision of product and service packages required by the end customers in a supply chain. SCM spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. SCM includes the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally. This includes vendor selection, negotiation, relations, and performance. It accommodates the planning, procurement and delivery processes, and personnel recruitment and training. It deals with vendor-owned buffer stocks, on-site inventory levels, off-site warehouse management, the efficient use of transportation, and the tracking of in-transit items. Other issues include duty, import documentation, and foreign currency management. A true supply chain application package will support all these activities.

Every dimension of business today demands greater efficiency, speed, and agility. Market pressures are forcing companies toward a demand-driven business model in which success is based on the ability to anticipate customer requirements and respond with high-quality, value-added products faster than the competition. To thrive, companies have little choice but to integrate innovation into core business processes so that the right products are produced for the right customers at the right time. To increase efficiencies, companies are also focusing on core competencies and filling the gaps with strategic outsourcing partnerships. But outsourcing success is not automatic. It requires the ability to share information, collaborate effectively, and expose internal processes. At the same time, companies are constantly challenged to increase process transparency. Such an environment requires an adaptive supply chain—one that helps you plan and execute with increased effectiveness while alerting you to sense and respond to real-time signals so that you seize opportunities when they emerge.

SCM enables collaboration, planning, execution, and coordination of the entire supply chain, empowering companies to adapt their supply chain processes to an ever-changing competitive environment. The SCM solutions transform traditional supply chains from linear, sequential steps into

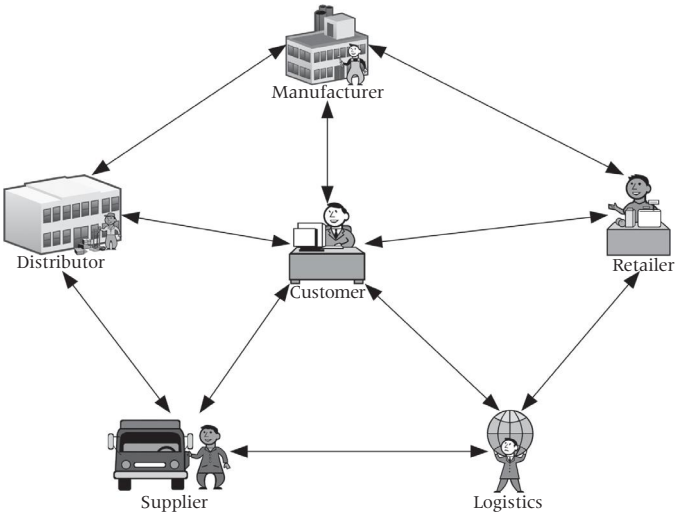

Figure 15.1 SCM processes and participants.

an adaptive supply chain network in which communities of customer-centric, demand-driven companies share knowledge intelligently adapt to changing market conditions and proactively respond to shorter, less predictable life cycles. The SCM processes and participants are shown in Fig. 15.1.

SHARING DATA AND GUT INSTINCTS ELECTRONICALLY

An electronics manufacturer may put a premium on minimizing fast-obsolescing parts inventory, while a pizza franchiser cares more about faster delivery of foodstuffs to its stores. To that end, APS tools monitor and optimize the supply chain from end to end—as a unified whole of plants, warehouses, and retail sites—instead of piece meal. Thanks to the Internet and electronic data interchange (EDI) networks producers can now share operational data and even gut instincts systematically and instantly with wholesalers and retailers, and vice versa, across time zones and geography. The result is more visibility throughout the supply chain, fewer surprises, and less need to stock back up raw materials or finished goods. With better synchronization across the entire supply chain, each member achieves major benefits:

- Lower inventories and therefore, lower financing costs
- Shorter receivables cycles
- Optimal use of production resources, costly work forces and transportation fleets
- Faster response to market changes
- Greater satisfaction and loyalty among customers
- Greater profitability

The most successful companies maximize those benefits by selecting SCM solutions not on the basis of mere bells and whistles, but on how well they improve critical business processes such as procurement-to-pay cycles, demand forecasting, and order-to-cash cycles. The secret to achieving improvement is a SCM system that ties all of the steps in the chain together, as well as into financial, production, and other critical systems. A standalone APS system, for example, is important but not sufficient to manage supply chain activities.

BATTLEFIELD TO BUSINESS

The military was one of the first organizations to recognize supply chains and management—during World War II. Strategists realized that delivering the right manpower and material on schedule to the right spot was the key to battlefield supremacy. The digital computer brought new methods for scheduling the loading and movement of ships, planes, and railcars. Thus was born modern SCM, and it was not long before automobile, chemical, and electronics manufacturers picked up the new techniques. To improve forecasting, speeding up material flows, and synchronizing production, they also found they needed to listen to the customers and work more closely with the suppliers. SCM as it turned out, was mainly a matter of building new communications paths and interlocking feedback loops that help business partners share information and ultimately, more fully trust each other to maximize the mutual benefit.

IMPROVEMENTS IN THE SUPPLY CHAIN MANAGEMENT

The supply chain discipline has taken a huge leap forward with APS' ability to simultaneously consider multiple constraints that affect production and delivery of goods. Making this possible is the tremendous increase in computer memory capacity now available at a reasonable cost from networked computers. It starts with constructing a detailed model of a given supply chain's elements—an enterprise's network of suppliers, distribution centers, and factories, for example—with data on what each one can supply, the costs and time to re-tool, transfer costs between facilities, and the inventories on hand at every stage. Next, it takes in details on current orders, forecasts of future demand, the costs and availability of every part and raw material, each customer's special requirements, and so forth.

Then comes the fun part; using specialized algorithms embodying artificial intelligence techniques, the APS software grinds through all of this data to come up with an enterprise-wide plan for production, distribution, or both tailored to the company's specific goals. For example, it may optimize production to make sure that orders from two customers get delivered on time at any cost, or that a specific plant of the company is kept as busy as possible. Or that inventory level at a particular distribution center does not fall dangerously low.

How does SCM apply to non-manufacturers? Think of hospitals, where purchase of enormous volumes of surgical supplies and other materials account for some 23% of their average annual budgets. Instead of blindly stocking a central storeroom and paying for inventory while it lies for weeks before getting used, an ERP system with APS can schedule and manage frequent delivery of supplies when and where they are needed. Leading healthcare companies are extending these efficiencies to entire networks of hospitals and clinics for even greater cost savings.

In fact, all businesses that involve complex flows of material can take advantage of this kind of global optimization and efficient execution. Communications and power utilities, squeezed by market de-regulation to manage assets more tightly than ever, deployed SCM to more efficiently purchase and schedule supplies for their network capital projects. Suppliers can deliver telephone poles or power transformers directly to construction sites and bypass intermediate storage depots, thus, eliminating inventory financing and re-shipment costs.

SUPPLY CHAIN MANAGEMENT AND RETAILERS

The retail industry is another prime contender for advancements in SCM. Its core is the ability to identify and then act upon fleeting fashion and other consumer trends. Be it single shop or a national

chain, it is a daunting challenge, since sometimes thousands of stocking units are delivered to multiple warehouses from hundreds of manufacturers. With better visibility across the entire supply chain, buyers can make more informed decisions about every aspect of their operations, from how to optimally allocate inventories among different stores and warehouses, to what goods to order and re-order, and how to price and stock them on the sales floor. Club it all into the retailer's financial accounting and human resources systems, and you have a model framework for optimum efficiency.

ADVANTAGES OF SUPPLY CHAIN MANAGEMENT

- Supply chain management enables
- Supply chain planning and collaboration
- Supply chain execution
- Supply chain visibility design and analytics
- Business benefits

Supply Chain Planning and Collaboration

With SCM, you can model your existing supply chain, set goals, and forecast, optimize, and schedule time, materials, and other resources. Supply chain planning functionality enables you to maximize return on assets and ensures a profitable match of supply and demand.

Supply Chain Execution

SCM enables you to carry out supply chain planning and generate high efficiency at the lowest possible cost. You can sense and respond to demands through an adaptive supply chain network in which distribution, transportation, and logistics are integrated into real-time planning processes.

Supply Chain Visibility Design and Analytics

SCM gives you network-wide visibility across your extended supply chain to perform strategic as well as day-to-day planning. The application also enables collaboration and analytics, so you can monitor and analyze the performance of your extended supply chain using pre-defined key performance indicators (KPIs).

Business Benefits

SCM can help you transform a traditional linear supply chain into an adaptive network with the following benefits.

- **Faster response to changes in supply and demand**—With increased visibility into the supply chain and adaptive supply chain networks, you can be more responsive. You can sense and respond quickly to changes and quickly capitalize on new opportunities.
- **Increased customer satisfaction**—By offering a common information framework that supports communication and collaboration, SAP SCM enables you to better adapt to and meet customer demands.
- **Compliance with regulatory requirements**—You can track and monitor compliance in areas such as environment, health, and safety.
- **Improved cash flow**—Information transparency and real-time business intelligence can lead to shorter cash-to-cash cycle times. Reduced inventory levels and increased inventory turns across the network can lower overall costs.

- **Higher margins**—With SCM, you can lower operational expenses with timelier planning for procurement, manufacturing, and transportation. Better order, product, and execution tracking can lead to improvements in performance and quality—and lower costs. You can also improve margins through better coordination with business partners.
- **Greater synchronization with business priorities**—Tight connections with trading partners keep your supply chain aligned with current business strategies and priorities, improving your organization's overall performance, and achievement of goals.

SUMMARY

Supply chain management is no longer a business school theory, but track-proven technology applicable to just about every company regardless of the sector. It is also not a magic. It is a series of complex calculations that optimize enterprise plans within a given set of constraints, backed by a fully integrated suite of financial, distribution, and human resources management systems.

REVIEW QUESTIONS

1. What do you mean by supply chain management?
2. Discuss the evolution of SCM.
3. How does SCM help to share data and gut instincts with business partners?
4. Discuss the transformation of SCM from battlefield to business.
5. Discuss the improvements that happened in the SCM.
6. How does supply chain management apply to non-manufacturers?
7. Why is SCM important to retailers?
8. What are the advantages of SCM?

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Chapter 16

Customer Relationship Management (CRM)

INTRODUCTION

The need to manage customer relationships is not a new concept. Around 1998, a phrase emerged, which attempted to encapsulate everything relating to this. It was called, *customer relationship management* (CRM). One significant feature of CRM was that it focused attention upon revenue-generating activities. This contrasts with the more traditional focus of ERP, which is on operations, with improvements and benefits having an impact upon the cost aspects of doing business.

Its emergence appears to be the outcome of several developments in the sales and marketing domains. On one hand, there were technological developments. It was increasingly recognized that MRPII and ERP systems, which focused on manufacturing and related activities had failed to meet the growing needs of the sales and marketing functions. Customer contact management, product and price lists, and direct mailing were among the first applications to be developed. Later on, campaign management, call centre services, and market intelligence management were included. One of the key technological issues has been the integration of the different technologies: databases, laptops, mobile phones, client/server, and computer-telephony integration. The Internet has spawned new channels such as e-mails and portals. With the removal of technological barriers it becomes possible for information to be immediately available at any location globally. However, one of the main concerns is security. Unsecured channels present a threat of interception and intrusion. One of the solutions being developed is encryption.

At the same time, there was a growing need to be more customer-orientated. Enabled by the technological developments, the search was for better practices and greater efficiencies. Data analysis allows better customer profiling and hence more efficient customer targeting. On-line data entry from remote locations improves information about customer interactions and enables the development of more efficient ways of approaching customers. The development of call centers enables 24-hour customer support. On-line data access enables customers to be informed about the current status of their accounts and orders. Developments in logistics technology enable better tracking of products and early awareness of delivery problems. The assumption is that by being better informed, the customer can be better satisfied.

WHAT IS CRM?

What is CRM? Gartner Inc. defines CRM as follows: "A business strategy, the outcomes of which optimize profitability, revenue, and customer satisfaction by organizing around customer segments, fostering customer-satisfying behaviors, and implementing customer-centric processes. By definition then CRM technologies enable greater customer insight, increased customer access, more effective interactions and integration throughout all customer channels and back-office enterprise functions" [1].

While Gartner Inc. distinguishes between CRM and the enabling technologies, popular usage suggests that CRM appears to be all encompassing to all people. CRM can be described as the development and implementation of a strategy for handling interactions with past, existing, or future customers. It covers all customer-oriented activities from potential market identification to customer loyalty retention. It is technology enabled and involves data capture and analysis, information

generation and distribution, and customer-orientated activity. CRM has a central database and integrates with an ERP system and different channels of interaction. CRM involves different participants and has the facility to manage these participants. Finally, it distinguishes different emphasis in dealing with the customer, including account management, and opportunity exploitation. CRM is about acquiring and retaining customers, improving customer loyalty, gaining customer insight, and implementing customer-focused strategies. A true customer-centric enterprise helps your company drive new growth, maintain competitive agility, and attain operational excellence.

Companies are increasingly waking up to the fact that they can create wealth (new value) by working creatively with business partners in the distribution chain and with consumers to reduce costs and cycle times of products, and to provide better order tracking information to customers. Customer delight is the key to enhancing revenue. Research has shown that only happy and satisfied customers are truly loyal, and loyal customers keep coming back. Using information technology (IT), nimble companies can strengthen customer relationships by integrating sales, product configuration, planning and design processes with customers through the existing and new channels. Typically, a company has a set of preferred customers but welcomes orders from any qualified buyer. Since the industrial revolution, companies have viewed orders as nothing more than a demand for their product or service. As the source of revenue, customers are treated with respect in hopes of getting repeat business.

With the rising popularity of the web and web-based business, companies operating in a mass production world were able to truly personalize relationships with customers. The ability to build strong relationships with customers is causing renewed efforts among businesses to achieve lifetime value from current customers and to put strategic plans in place to go after lifetime value for new customers in new markets. In the world of e-business, companies can replicate the personal customer relationship that existed prior to mass markets by using knowledge of the customer to personalize customer service while continuing to sell standard products.

CRM helps in streamlining processes and providing sales and service personnel with better, more complete customer information thus allowing organizations to identify, attract, engage, and retain its customers as shown in Fig. 16.1. Automating the sales process includes activities like implementing simple contact, account, and opportunity management to forecasting, territory management, and pipeline management. These tools allow organizations to shorten the cycle by having all relevant customer information at their fingertips—working smarter, not harder. Automating the marketing functions such as campaign design and management, e-mail marketing, and lead assignment and management, help organizations in increasing the efficiency of their marketing organization, and target their resources to the most effective programs.

Customer service department can use CRM to provide executives with the most up-to-date information on all customer service transactions. By automating service request management, knowledge bases, and call routing, customer care executives can become more productive by ensuring that all service requests are resolved to the satisfaction of the customer in a timely fashion. The CRM also provides enough data for business analytics that can be used by the management to:

- Identify new markets and opportunities
- Simplify marketing processes
- Improve productivity while lowering customer acquisition costs
- Enable higher cross-sell and up-sell rates
- Increase customer retention
- Reduce response times and request-resolution times
- Increase call center efficiency and lower costs

There are a number of potential benefits in following the CRM route. These are increased automation facilitates, better use of existing resources, better quality of information, faster response time,

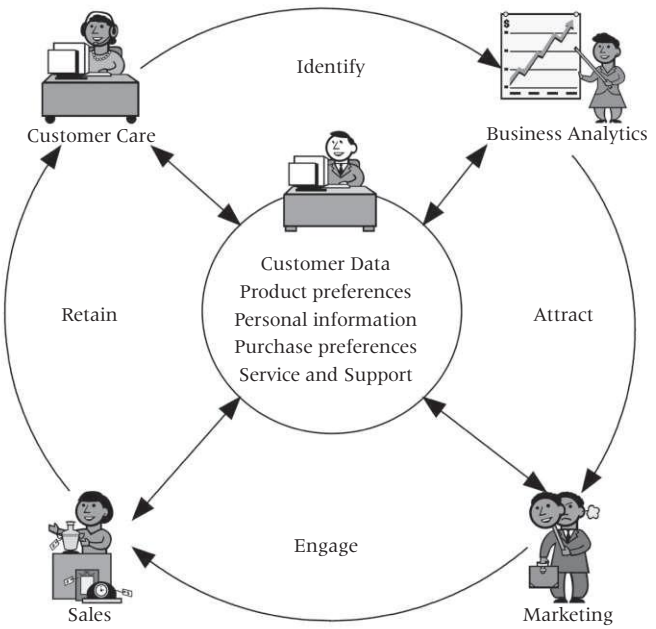

Figure 16.1 CRM lifecycle.

improved customer targeting, better customer retention, and increased sales. However, implementation of a CRM system has been described as 'not easy' with expectations often not being met. Reasons for failure include excessive expectations, lack of understanding of what CRM is, the misconception that CRM is a technical solution and not a business solution, poor requirements definition, required data not being captured or being inaccessible, lack of sponsorship, politics, and inadequate attention to employees. Nevertheless, whilst the technology enables the supplier to know all about the customer, it remains to be seen whether this is at the expense of the old adage 'know your customer.'

CRM helps companies achieve this objective. The CRM application enhances the company's 'front office,' focusing on sales, marketing, and customer service. However, in order to be truly successful, CRM must be seen as a combination of people, processes, and systems rather than as a narrowly defined IT application. CRM is one piece of the new wave of ERP that focuses on projecting the enterprise to the outside world and integrating them with the inside-the-enterprise transaction-processing engine of the original ERP systems.

FUNCTIONS OF CRM

CRM is a corporate level strategy, focusing on creating and maintaining relationships with customers. Several commercial CRM software packages are available which vary in their approach to CRM. However, CRM is not a technology by itself but rather a holistic approach to an organization's philosophy, placing the emphasis firmly before the customer.

CRM governs an organization's philosophy at all levels, including policies and processes, front-of-house customer service, employee training, marketing, systems, and information management. CRM systems are integrated end-to-end across marketing, sales, and customer service. A CRM system should:

- Identify factors important to clients
- Promote a customer-oriented philosophy

- Adopt customer-based measures
- Develop end-to-end processes to serve customers
- Provide successful customer support
- Handle customer complaints
- Track all aspects of sales
- Create a holistic view of customers' sales and services information

COMPONENTS OF A CRM SYSTEM

There are three fundamental components in CRM:

- **Operational**—automation of basic business processes (marketing, sales, service)
- **Analytical**—analysis of customer data and behavior using business intelligence
- **Collaborative**—communicating with clients

Operational CRM

Operational CRM provides automated support to 'front office' business processes (sales, marketing, and service). Each interaction with a customer is generally added to a customer's history and staff can retrieve information on customers from the database as necessary. According to Gartner Group, operational CRM typically involves three general areas.

- **Sales force automation (SFA)**—SFA automates some of a company's critical sales and sales force management tasks, such as forecasting, sales administration, tracking customer preferences and demographics, performance management, lead management, account management, contact management, and quote management.
- **Customer service and support (CSS)**—CSS automates certain service requests, complaints, product returns, and enquiries.
- **Enterprise marketing automation (EMA)**—EMA provides information about the business environment, including information on competitors, industry trends, and macro-environmental variables. EMA applications are used to improve marketing efficiency.

Integrated CRM software is often known as a 'front office solution', as it deals directly with customers. Many call centers use CRM software to store customer information. When there is an incoming call, the system displays the associated customer information (determined from the number of the caller). During and after the call, the call center agent dealing with the customer can add further information. Some customer services can be fully automated such as allowing customers to access their bank account details on-line or via a WAP phone.

Analytical CRM

Analytical CRM analyses data (gathered as part of operational CRM or from other sources) in an attempt to identify means to enhance a company's relationship with its clients. The results of an analysis can be used to design targeted marketing campaigns, for example:

- **Acquisition**—Cross-selling, up-selling
- **Retention**—Retaining existing customers
- **Information**—Providing timely and regular information to customers

Other examples of the applications of analyses include contact optimization, evaluating and improving customer satisfaction, optimizing sales coverage, fraud detection, financial forecasts, price

optimization, product development, program evaluation, risk assessment and management, strategic marketing, operational marketing, etc.

Data collection and analysis is viewed as a continuing and iterative process. Ideally, business decisions are refined over time, based on feedback from earlier analyses and decisions. Most analytical CRM projects use a data warehouse to manage data.

Collaborative CRM

Collaborative CRM focuses on the interaction with customers (personal interaction, letter, fax, phone, Internet, e-mail, etc.). Collaborative CRM includes:

- Providing efficient communication with customers across varied channels of communication
- Providing on-line services to reduce customer service costs
- Providing access to customer information while interacting with customers

USES OF CRM

CRM covers all interaction and business with customers. A good CRM program allows a business to acquire customers, provide customer services, and retain valued customers. Customer services can be improved by:

- Providing on-line access to product information and technical assistance around the clock
- Identifying what customers value and devising appropriate service strategies for each customer
- Providing mechanisms for managing and scheduling follow-up sales calls
- Tracking all contacts with a customer
- Identifying potential problems before they occur
- Providing a user-friendly mechanism for registering customer complaints
- Providing a mechanism for handling problems and complaints
- Providing a mechanism for correcting service deficiencies
- Storing customer interests in order to target customers selectively
- Providing mechanisms for managing and scheduling maintenance, repair, and ongoing support

CRM applications often track customer interests and requirements, as well as their buying habits. This information can be used to target customers selectively. Furthermore, the products a customer has purchased can be tracked throughout the product's life cycle, allowing customers to receive information concerning a product or to target customers with information on alternative products once a product begins to be phased out.

Repeat purchases rely on customer satisfaction, which in turn comes from a deeper understanding of each customer and their individual needs. CRM is an alternative to the 'one size fits all' approach. In industrial markets, the technology can be used to coordinate the conflicting and changing purchase criteria of the sector.

The business benefits of a CRM system is that it provides the insight and analysis you need to anticipate customer needs and build lasting, profitable customer relationships. With CRM you benefit from:

1. The ability to act immediately and grow strategically, without disruption
2. End-to-end processes within the industry value chain by helping you drive customer value, loyalty, and profitability across the entire value chain
3. Real-time visibility into customer value by working with other business critical software

4. Provision of a 360-degree view of customers, including all interactions with them and profitability at every point in the value chain
5. Ability to identify most profitable customers and build lasting, loyal, and profitable relationships with them

FEATURES AND FUNCTIONS OF A CRM SYSTEM

CRM enables you to maximize the efficiencies of marketing resources and empower marketers to acquire and develop long-term customer relationships. Marketers can analyze, plan, execute, and measure all marketing activities. With CRM, you gain a flexible application to power marketing success. CRM supports critical marketing processes, including the following:

- Sales Force automation
- Technology-enabled selling
- Marketing resource management
- Segment and list management
- Call center management
- Campaign management
- Internet telephony
- Field service management
- Trade promotion management
- Lead management
- Marketing analytics

Sales Force Automation

Sales force automation (SFA) involves using software to streamline all phases of the sales process, minimizing the time that sales representatives need to spend on each phase. This allows a business to use fewer sales representatives to manage their clients. At the core of SFA is a contact management system for tracking and recording every stage in the sales process for each prospective client, from initial contact to final disposition. Many SFA applications also include insights into opportunities, territories, sales forecasts, and workflow automation.

Technology-Enabled Selling

Technology-enabled selling (TES) goes beyond the blanket application of raw technology and deals with understanding the ways technology benefits the bottom line. The changing face of sales is speeding the drive for TES. In consumer markets, customers already expect a range of channels that offer consistent service. In the business-to-business (B2B) world the new focus on relationships and the rise of the consultant–salesperson have increased complexity and diversity.

TES has three sets of component building blocks. The first is a foundation of customer information located in company databases and manipulated either by legacy or ERP systems. The second is an infrastructure of systems that allow the company to communicate and transact business with customers; these employ telephones, faxes, personal computers, and other devices. The third is a set of advanced applications that are often specific to industries or sectors.

Marketing Resource Management

Analyze, plan, develop, implement, and measure all marketing activities to maximize the efficiencies of your available resources and gain visibility and control into your marketing processes. CRM helps

you control and manage your budget and marketing spend. The application also allows you to facilitate collaboration among team members and coordinate marketing activities across the enterprise, increasing the speed and effectiveness of your marketing processes.

Segment and List Management

Manage enterprise customer and prospect data without the need for IT support. With CRM you can create and capture customer profile data to better target and personalize marketing messages and you can view all relevant enterprise customer information from a central point. Using an interactive, drag-and-drop interface, the marketers can perform ad hoc, high speed customer segmentation and segment analysis, and quickly identify opportunities and gain insights into customer segments with data visualization features.

Call Center Management

Call centers are rapidly emerging as a means to provide service to customers, business partners, or employees. Increasingly, they are the main point of contact for customers. Call centers perform the following five functions:

1. Resolve issues or refer problems to the next level of service provider
2. Provide more information about products and services
3. Make recommendations to customers about the product or service that best suits the customer's needs
4. Take calls and monitor progress on customer requests and problems
5. Generate reports for root-cause analysis

The best call centers link voice, video, and data into a comprehensive system to provide cutting-edge 'customer care.' A call center system and process must be constructed with the customer in mind.

Campaign Management

Analyze, plan, execute, and measure marketing activities through all inbound and outbound interaction channels to build long-term profitable relationships. With CRM, you can make the most of dialog marketing by implementing inbound and outbound campaigns that are both multi-channel and multi-wave. You can develop and execute the best marketing strategy using constraint-based optimization techniques to determine the optimum marketing mix.

Internet Telephony

Frequently integrated into a pre-existing call center, Internet protocol (IP) telephony in Internet call centers allows customers to speak directly with call center agents while using the browser to access the company's web site. IP telephony can be used in call centers when, for example, a user is on a corporate web site and requests technical support. The user clicks on a call button displayed on the web page. The call button is a hypertext link that activates the IP telephony software, which then connects the user with a call center agent. If the customer enters his or her customer identification number, the call center agent can access the customer's history—the products the customer is using and the problems the customer has encountered previously. Based on the customer's purchasing history, this access also enables the agent to sell upgrades or new products. This is enabled by computer-telephone integration (CTI) technology, which is available as a feature of high-end CRM software.

Field Service Management

E-business customer service also enhances field service, which is the part of customer service in which qualified representatives of a company are sent to the customer's site to resolve problems. A call center can forward an unsolved problem to an internal or external field service organization. E-enabled field service helps sales representatives by providing them with up-to-date customer and product information (including design documents and repair manuals) via the Internet. Field service representatives can check on outstanding customer queries, view their active service calls, and even update the status of accounts while traveling.

Trade Promotion Management

Effectively manage trade promotions that increase brand equity and achieve sales objectives. With the CRM tools, you can gain complete visibility into trade programs at each stage of their life cycles—to reduce error, improve efficiency, and control trade spend.

Lead Management

Generate highly qualified, prioritized leads, and automate your lead distribution process to handle leads faster. CRM enables you to align marketing and sales organizations—and extend your lead management process to partner organizations—to increase conversion rates. The application provides full visibility into the lead management process enabling you to optimize all activities.

Marketing Analytics

Leverage a wide range of analytics such as customer values; and churn scores and satisfaction scores to make profitable decisions. Insights gained from CRM help you understand why marketing activities did or did not work. The application also helps you identify business challenges and opportunities, and predict customer behaviors, anticipate their needs, and create better relevant and targeted messages.

BENEFITS OF CRM

ERP systems in almost all organizations provide backbone support to build CRM systems. Where ERP itself with its focus on transaction processing, may have failed to deliver the anticipated benefits, CRM systems can provide tangible and measurable returns centered on customers sources of value creation.

Technology now exists that enables companies to conduct one-to-one marketing. These tools frequently available off the shelf are both powerful and inexpensive. They have transformed the selling and marketing landscape. Unlike some traditional forms of advertising, which are undirected and unspecified, CRM systems enable companies to communicate with customers on a personal level.

A company performing CRM provides a single corporate face to the customer wherever the customer may encounter the company: through different business units, regional offices, or operational organizations within the company. Customers expect integrated, seamless, multi-channel customer service that is transparent whether the service is being provided by the company or by a third-party service provider.

The 'new marketing' hinges on four key technologies: technology-enabled selling, call centers, e-business, and data warehousing/mining. In many instances, these technologies are combined to provide a seamless customer service experience. Recognizing these emerging products, ERP vendors are now investing a great deal of money to catch up. However, from the marketing world's

perspective they have a long way to go. As a result, in many areas, companies are using best-of-breed packages with bolt-on interfaces to their existing ERP systems.

CRM packages are available that bundle many existing sales and marketing functions, such as sales force automation, call center systems, and data mining with a robust technical architecture, resulting in integrated CRM with wide functionality.

SUMMARY

CRM covers methods and technologies used by companies to manage their relationships with clients. Information stored on existing customers (and potential customers) is analyzed and used to this end. Automated CRM processes are often used to generate automatic personalized marketing based on the customer information stored in the system.

One significant feature of CRM is that it focuses on revenue-generating activities. This contrasts with the more traditional focus of ERP, which is on operations, with improvements and benefits having an impact upon the cost aspects of doing business.

CRM is a corporate-level strategy focusing on creating and maintaining relationships with customers. Several commercial CRM software packages are available which vary in their approach to CRM. However, CRM is not a technology itself but rather a holistic approach to an organization's philosophy, placing the emphasis firmly on the customer.

There are three fundamental components in CRM—operational, analytical, and collaborative. CRM enables you to maximize the efficiencies of marketing resources and empower marketers to acquire and develop long-term customer relationships. Marketers can analyze, plan, execute, and measure all marketing activities. With CRM you gain a flexible application to power marketing success.

REVIEW QUESTIONS

1. Discuss the role and importance of customer relationship management in today's business environment.
2. What is CRM?
3. How does CRM help organizations in streamlining customer-oriented activities?
4. How does CRM integrate with ERP?
5. How does CRM help in personalizing customer service?
6. How does CRM help in automating sales functions?
7. How does CRM help customer care executives?
8. How does CRM integrate with BA?
9. Why CRM is called the 'front-office' software?
10. What are the functions of CRM?
11. What are the components of CRM? Explain each component in detail.
12. What are the uses of CRM?
13. What are the features and functions of a CRM system?
14. What is sales force automation?
15. What is technology-enabled selling?
16. What do you mean by marketing resource management?
17. What is segment and list management?
18. What do you mean by call center management?
19. How does CRM help in campaign management?
20. What is Internet telephony?
21. What is field service management?

22. How does CRM help trade promotion management?
23. What do you mean by lead management?
24. What is the use of marketing analytics?
25. Discuss the benefits of CRM.

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Chapter 17

Geographic Information System (GIS)

INTRODUCTION

A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth. GIS integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS technology also integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.

The major challenges we face in the world today—overpopulation, pollution, deforestation, and natural disasters—have a critical geographic dimension. Whether it is locating a suitable site for a new business or finding the best soil for growing apples or figuring out the best route for an emergency vehicle, most problems also have a geographical component. GIS will give you the power to create maps, integrate information, visualize scenarios, solve complicated problems, present powerful ideas, and develop effective solutions like never before. GIS is a tool used by individuals and organizations, schools, governments, and businesses seeking innovative ways to solve their problems. Mapmaking and geographic analysis are not new, but a GIS performs these tasks better and faster than the old manual methods. Before GIS technology came into existence, only a few people had the skills necessary to use geographic information to help with decision-making and problem solving. GIS technology can be integrated into any enterprise information system framework.

Today, GIS is a multibillion dollar industry employing hundreds of thousands of people worldwide. GIS is taught in schools, colleges, and universities throughout the world. Professionals in every field are increasingly aware of the advantages of thinking and working geographically. GIS technology can be integrated into any enterprise information system framework.

BENEFITS OF GIS

GIS benefits organizations of all sizes and in almost every industry. There is a growing awareness of the economic and strategic value of GIS. The benefits of GIS generally fall into five basic categories:

- **Cost savings and increased efficiency:** GIS is widely used to optimize maintenance schedules and daily fleet movements. Typical implementations can result in a savings of 10–30% in operational expenses through reduction in fuel use and staff time, improved customer service, and more efficient scheduling.
- **Better decision making:** GIS is the best technology for making better decisions about location. Common examples include real estate site selection, route/corridor selection,

evacuation planning, conservation, natural resource extraction, etc. Making correct decisions about location is critical to the success of an organization.

- **Improved communication:** GIS-based maps and visualizations greatly assist in understanding situations and in storytelling. They are a type of language that improves communication between different teams, departments, disciplines, professional fields, organizations, and the public.
- **Better recordkeeping:** The primary responsibility of most organizations is maintaining authoritative records about the status and change of geography. GIS provides a strong framework for managing these types of records with full transaction support and reporting tools.
- **Managing geographically:** GIS is becoming essential to understanding what is happening—and what will happen—in geographic space. Once we understand, we can prescribe action. This new approach to management—managing geographically—is transforming the way that organizations operate.

HOW DOES GIS WORK?

GIS stores information about the world as a collection of thematic layers that can be linked together by geography (see Fig. 17.1). This simple but extremely powerful and versatile concept has proven invaluable for solving many real-world problems from tracking delivery vehicles, to recording details of planning applications, to modeling global atmospheric circulation.

GEOGRAPHIC REFERENCES

Geographic information contains either an explicit geographic reference, such as a latitude and longitude or national grid coordinate, or an implicit reference such as an address, postal code, census tract name, forest stand identifier, or road name. An automated process called geocoding is used to create explicit geographic references (multiple locations) from implicit references (descriptions such as addresses). These geographic references allow you to locate features, such as a business or forest stand, and events, such as an earthquake, on the earth's surface for analysis.

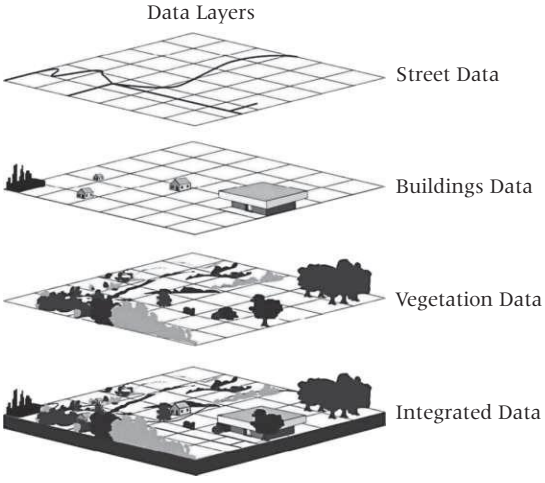

Figure 17.1 How does GIS work?

VECTOR AND RASTER MODELS

Geographic information systems work with two fundamentally different types of geographic models—the 'vector' model and the 'raster' model. In the vector model, information about points, lines, and polygons is encoded and stored as a collection of x, y coordinates. The location of a point feature, such as a bore hole, can be described by a single x, y coordinate. Linear features, such as roads and rivers, can be stored as a collection of point coordinates. Polygonal features, such as sales territories and river catchments, can be stored as a closed loop of coordinates.

The vector model is extremely useful for describing discrete features, but less useful for describing continuously varying features such as soil type or accessibility costs for hospitals. The raster model has evolved to provide such continuous features. A raster image comprises a collection of grid cells rather like a scanned map or picture. Both the vector and raster models for storing geographic data have unique advantages and disadvantages. Modern GISs are able to handle both models. Figure 17.2 shows the raster and vector models.

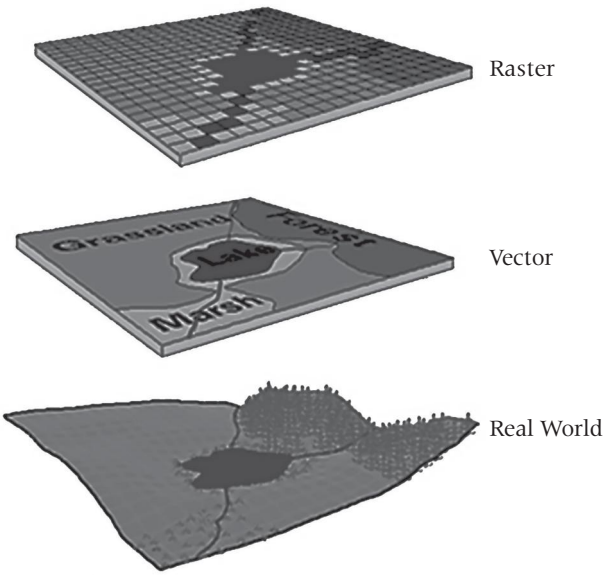

Figure 17.2 Raster and vector models.

COMPONENTS OF GIS

A working GIS integrates five key components: hardware, software, data, people, and methods.

- **Hardware**—Hardware is the computer on which a GIS operates. Today, GIS software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configurations.
- **Software**—GIS software provides the functions and tools needed to store, analyze, and display geographic information. Key software components are:
- Tools for the input and manipulation of geographic information
- A database management system (DBMS)
- Tools that support geographic query, analysis, and visualization
- A graphical user interface (GUI) for easy access to tools

- **Data**—Possibly, the most important component of a GIS is the data. Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider. A GIS will integrate spatial data with other data resources and can even use a DBMS, used by most organizations to organize and maintain their data, to manage spatial data.
- **People**—GIS technology is of limited value without the people who manage the system and develop plans for applying it to real-world problems. GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work.
- **Methods**—A successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to the organization.

DATA FOR GIS

If you are unfamiliar with map data, first decide about how to use map data. The following are some of the common map data types:

- **Base maps**—Include streets and highways; boundaries for census, postal, and political areas; rivers and lakes; parks and landmarks; place names; and geological survey raster maps.
- **Business maps and data**—Includes data related to census/demography, consumer products, financial services, health care, real estate, telecommunications, emergency preparedness, crime, advertising, business establishments, and transportation.
- **Environmental maps and data**—Includes data related to the environment, weather, environmental risk, satellite imagery, topography, and natural resources.
- **General reference maps**—World and country maps and data that can be a foundation for your database.

GLOBAL POSITIONING SYSTEM (GPS)

Global positioning system (GPS) is a U.S. owned utility that provides users with positioning, navigation, and timing (PNT) services. GPS provides accurate location and time information for an unlimited number of people in all weather, day and night, anywhere in the world. The GPS consists of three segments—the space segment, the control segment, and the user segment. The U.S. Air Force develops, maintains, and operates the space and controls the segment.

- The space segment consists of a nominal constellation of 24 operating satellites that transmit one-way signals that give the current GPS satellite position and time.
- The control segment consists of worldwide monitor and control stations that maintain the satellites in their proper orbits through occasional command maneuvers, and adjust the satellite clocks. It tracks the GPS satellites, uploads updated navigational data, and maintains health and status of the satellite constellation.
- The user segment consists of the GPS receiver equipment, which receives the signals from the GPS satellites and uses the transmitted information to calculate the user's three-dimensional position (latitude, longitude, and altitude) and time.

GPS satellites provide service to civilian and military users. The civilian service is freely available to all users on a continuous, worldwide basis. The military service is available to U.S. allied armed forces as well as approved government agencies. A variety of GPS augmentation systems and techniques are available to enhance system performance to meet specific user requirements. These improve signal availability, accuracy, and integrity, allowing even better performance than possible using the basic GPS civilian service. The outstanding performance of GPS over many years has earned the

Figure 17.3 GPS navigation system in a car.

confidence of millions of civil users worldwide. It has proven its dependability in the past and promises to be of benefit to users, throughout the world, far into the future.

Individuals may purchase GPS handsets that are readily available through commercial retailers. Equipped with these GPS receivers, users can accurately locate where they are and easily navigate to where they want to go, whether walking, driving, flying, or boating. GPS has become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations. Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions. Everyday activities such as banking, mobile phone operations, and even the control of power grids are facilitated by the accurate timing provided by GPS. Farmers, surveyors, geologists, and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals. Figure 17.3 shows the GPS navigation system in a car.

USES OF GIS

GIS can take care of lots of activities for you and your business. In today's global community, the more information you have at your fingertips, the easier it is to make an informed decision. In today's high-tech world, information comes in many different ways, from company reports and statistics, from down the hall to digital photos and multimedia from across the world. Information can be overwhelming and the need for timely decisions calls not only for innovative ways to access accurate, up-to-the minute information, but also tools to help present the information in useful ways. Some of the typical uses of GIS are given in Fig. 17.4.

A GIS allows you to bring all types of data together based on the geographic and location component of the data. But unlike a static paper map, GIS can display many layers of useful information. You will be able to integrate, visualize, manage, solve, and present the information in a new way. Relationships between the data will become more apparent and your data will become more valuable. GIS will give you the power to create maps, integrate information, visualize scenarios, solve complicated problems, present powerful ideas, and develop effective solutions like never before. GIS is a tool used by individuals and organizations, schools, governments, and businesses seeking innovative ways to solve their problems. Some of the areas in which GIS can help your organization are:

GIS solutions are helping organizations better manage, analyze, and leverage their spatial data. These organizations are improving network planning, controlling costs, enhancing customer service, and expanding their business by making more strategic decisions. With GIS, organizations can plan routes based on customer location, potential sales opportunities, and cargo transfer locations. GIS integrates information throughout all departments like market analysis (sales forecasting, business intelligence, revenue analysis, etc.), logistics (demand forecasting, capacity analysis, capital efficiency, etc.),

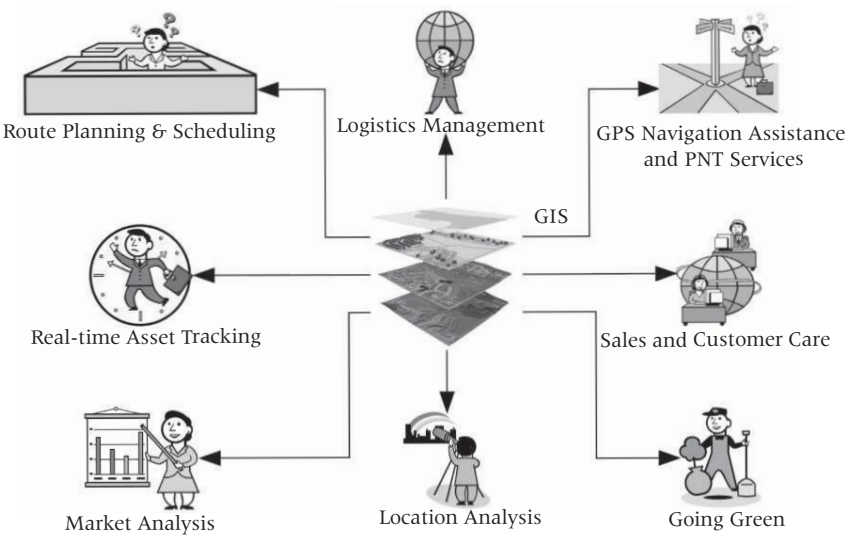

Figure 17.4 Uses of GIS.

sales and service delivery (workforce management, new client acquisition, routing optimization, etc.), customer care (on-time delivery, real-time asset tracking, up-to-date delivery reports, etc.), and so on.

Improve Organizational Integration

Many organizations that have implemented a GIS have found that one of its main benefits is improved management of their own organization and resources. Because GISs have the ability to link data sets together by geography, they facilitate interdepartmental information sharing and communication. By creating a shared database, one department can benefit from the work of another—data can be collected once and used many times. As communication increases among individuals and departments, redundancy is reduced, productivity is enhanced, and overall organizational efficiency is improved. Thus, in a utility-based company, the customer and infrastructure databases can be integrated so that when there is planned maintenance, affected customers can be sent a computer-generated letter.

Make Better Decisions

The old adage 'better information leads to better decisions' is as true for GIS as it is for other information systems. A GIS, however, is not an automated decision-making system but a tool to query, analyze, and map data in support of the decision-making process. GIS technology has been used to assist in tasks such as presenting information at planning inquiries, helping resolve territorial disputes, and siting pylons so as to minimize visual intrusion. GIS can be used to arrive at decision on the location of a new housing development that has minimal environmental impact, is located in a low-risk area, and is close to a population center. The information can be presented succinctly and clearly in the form of a map and accompanying report, allowing decision-makers to focus on the practical issues rather than trying to understand the data. As GIS products are produced quickly, multiple scenarios can be evaluated efficiently and effectively.

Market Analysis

One advantage of GIS is that it allows you to specify the geographic areas you want to analyze without the limitations of governmental boundaries such as county lines. It then fits the data to the

geography you have chosen. GIS is a tool that can improve the efficiency of business and economic development analysis. Some of the applications include:

- **Trade area analysis:** Incorporates drive-time, customer locations, and physical and cultural barriers into trade area models.
- **Market segment analysis:** Collect, store, retrieve, manipulate, and visually display a variety of social and demographic data by customer segment to understand market potential.
- **Other marketing applications:** Customer profiling, advertising planning, sales territory determination, business targeting, traffic audits, delivery routes, utility planning, economic development marketing, etc.

Logistics Management

The term *logistics management* is the part of SCM that plans, implements, and controls the efficient, effective, forward, and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer's requirements. GIS solutions can help you save 10–30% in operational expenses through reduction in mileage, overtime, and routing planning time. Mileage savings translate into reduced fuel use and a smaller carbon footprint, which will advance your goals for green operations. GIS also provides a platform for integrating data from existing workforce, fleet, and customer management systems so that you can get the most out of your IT investment. Customized Internet or intranet views give company executives, dispatchers, and customer representatives access to the most up-to-date information in a user-friendly format. GIS technology can help your organization to:

- Manage variable costs and routing and scheduling effectively
- Track your mobile assets in real time
- Implement fuel-saving green initiatives to minimize carbon emissions
- Meet customer expectations

Sales and Customer Care

The primary focus of the sales department is the customers—how to identify them, keep them, reach them, and find more like them. To accomplish these goals better than your competitors, you must focus on customer marketing applications such as acquisition, marketing, messaging, purchasing, and retention. Understanding the organization's customers' demographics, behaviors, and purchasing patterns increases your chances of retaining them and finding similar ones.

GIS combines demographic data, segmentation, software, technology, and web services for a complete marketing application that will give the organization the results you need. GIS systems can help the sales department to acquire and retain their most profitable customers, increase response rates, generate more revenue, and develop efficient marketing campaigns. These systems allow the sales personnel to analyze markets and customers, see trends and patterns on maps, and generate comprehensive demographic reports. As the data and analysis procedures are built into the system, the user can focus on results rather than the details of the underlying technology.

By integrating GIS, you can create websites that have real-time information that most customers require. This will enable anyone with Internet access and can find answers to his queries on his own. This 24×7 service is very useful for the customers as they can get the information when they want from wherever they want. This will also reduce the work load of the customer care executives and the number of queries they have to handle will be considerably reduced. The web services could be so configured that the customer gets alerts or e-mail notifications at specified intervals or

whenever the status changes. GIS also increases the customer care productivity and efficiency by giving real-time information at the executives' finger tips. Since the customer care executive knows exactly the status of an item or shipment, the answers can be precise and accurate, and by being in contact with the person on the field any problems that arise could be resolved to the satisfaction of the customer.

Route Planning and Scheduling

Optimized routing is more than just driving from point A to point B. Dispatchers need to consider every element that affects daily operations. GIS helps organizations to maximize the use of assets to create optimum routes based on specific variables including vehicle capabilities, driver specialties, street network restrictions, and customer time windows. It is possible to change and reroute vehicles in real-time to respond to situations like heavy traffic, road blocks, severe weather conditions, and other delays.

GIS also helps organizations more effectively schedule and manage the fleet by increasing the number of deliveries per route while decreasing excess capacity. Route planning with GIS technology is also a key element in reducing company expenses. Reducing fuel consumption, labor hours, and idle time are few of the ways that will help you save money.

Real-time Asset Tracking

GIS technology allows you to visually track equipment, personnel, and events and notifies you if there are problems during delivery. As assets are tracked and events are visually analyzed in real-time problem areas can be identified and corrected immediately. This real-time asset tracking will help in improving the efficiency and effectiveness of the customer service as they can inform the customers the status of their orders on a real-time basis. The customers could be informed of any unforeseen delays and the steps that are being taken to resolve the problem.

In addition, deficiencies identified during inspection can generate new work orders for maintenance and repair. Applied to asset management, GIS technology not only facilitates data collection but also integrates asset mapping with project management and budgeting tools, so operational and maintenance expenses can be centrally managed and accounted for.

GPS Navigation Assistance and PTN Services

GIS in-vehicle navigation helps drivers stay on route and on schedule. When in the field, drivers follow dispatched routes with turn-by-turn directions. Vehicles are automatically rerouted should they go off course and are directed to the originally scheduled route. This helps drivers follow the exact roads and streets needed to reach their destinations.

Positioning, navigation, and timing (PNT) allows users to accurately determine their location, as well as guide them from one location to another, based on a defined time standard. PTN services that use the GPS-enabled applications essential for safe and secure transportation of people and goods and ensures arrival or delivery on-time every time.

Location Analysis

Establishing the best location of logistics facilities relative to your distribution networks and customers is critical. GIS technology gives you the capability to analyze street and demographic data, business reports, and retail store locations to provide first-class service to current clients while developing future customer opportunities. Information can be shared throughout departments, which

reduce redundancy in marketing and sales efforts and increases employee efficiency. The three areas where GIS help in analyzing the location are:

- **Retail site selection:** Analyze competition and consumer demand to identify opportunities for locating a business as well as the potential impact of new competition on existing businesses.
- **Industrial site selection:** Identify location of suppliers, distribution points, transportation routes, utilities, and other factors critical in site selection.
- **Commercial real estate analysis:** Analyze locations of existing properties and their vacancies. Project the highest and best use of properties and their market value.

Productivity Improvement

The ability of GISs to search databases and perform geographic queries has saved many companies literally millions of dollars. GISs have helped reduce costs and improve productivity by:

- Streamlining customer service
- Reducing land acquisition costs through better analysis
- Reducing fleet maintenance costs through better logistics
- Analyzing data quickly

Making Maps

Maps have a special place in GIS. The process of making maps with GIS is much more flexible than the traditional manual or automated cartography approaches. It begins with database creation. Existing paper maps can be digitized and computer-compatible information can be translated into the GIS. The GIS-based cartographic database can be both continuous and scale free. Map products can then be created centered on any location, at any scale, and showing selected information symbolized effectively to highlight specific characteristics. The characteristics of atlases and map series can be encoded in computer programs and compared with the database at the final production time. Digital products for use in other GISs can also be derived by simply copying data from the database. In a large organization, topographic databases can be used as reference frameworks by other departments.

Going Green

Due to increasing government regulations calling for more environmental friendly fleets, organizations are looking for ways to cut fuel use and reduce carbon footprints. GIS products allow you to reach greener goals using your existing staff and vehicles through better planning, improved efficiency, and intelligent and precise routing.

SUMMARY

A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth. GIS integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS technology also integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

GIS benefits organizations of all sizes and in almost every industry. There is a growing awareness of the economic and strategic value of GIS. The benefits of GIS include cost savings and increased

efficiency, better decision-making, improved communication, better recordkeeping, geographical managing, etc.

GPS is a U.S. owned utility that provides users with positioning, navigation, and timing (PNT) services. GPS provides accurate location and time information for an unlimited number of people in all weather, day and night, anywhere in the world. GPS consists of three segments—the space segment, the control segment, and the user segment.

GIS helps to perform geographic queries and analysis, improve organizational integration, and make better maps. Some of the advantages of GIS for organizations are better logistics management, route planning and scheduling, real-time asset tracking, GPS navigation assistance, PTN services, location analysis, productivity improvement, etc.

REVIEW QUESTIONS

1. What is GIS?
2. What are the benefits of GIS?
3. How does GIS work?
4. What is geocoding?
5. What are vector and raster models?
6. What are the components of GIS?
7. What are the different map data types?
8. What is the function of GIS software?
9. What is GPS and how does it work?
10. What are the uses of GIS?
11. How can GIS be used to improve organizational integration?
12. How does GIS help in making better decisions?
13. How can GIS help in market analysis?
14. How can GIS be used in logistics management?
15. What are the applications of GIS in sales and customer care?
16. What do you mean by route planning and scheduling and what are the roles of GIS in this?
17. What is real-time asset tracking and how is it possible?
18. What are the advantages of GPS navigation assistance and PTN services?
19. How does GIS help in location analysis?
20. How does GIS help in productivity improvement?
21. How can GIS be used to make better maps?
22. How does GIS help in going green?

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Chapter 18

Advanced Technology and ERP Security

INTRODUCTION

The balance between providing data available to those users who need it and denying it to those who should not have access is not easy to achieve. To manage this risk, your company needs to implement an appropriate access strategy. An ERP system with insecure and uncontrolled access is unimaginable. More and more processes and data are integrated into the ERP systems and security needs are getting very demanding and overwhelming as the hackers are also upgrading their tactics and technology. In order to keep your organizations valuable and sensitive, make it accessible only to authorized users, thus you need to constantly upgrade your security systems and strategies and educate your users about the need for following the rules and guidelines provided. ERP implementations can create IT and business risk exposure through:

- Failure to implement application and IT controls into the new ERP system

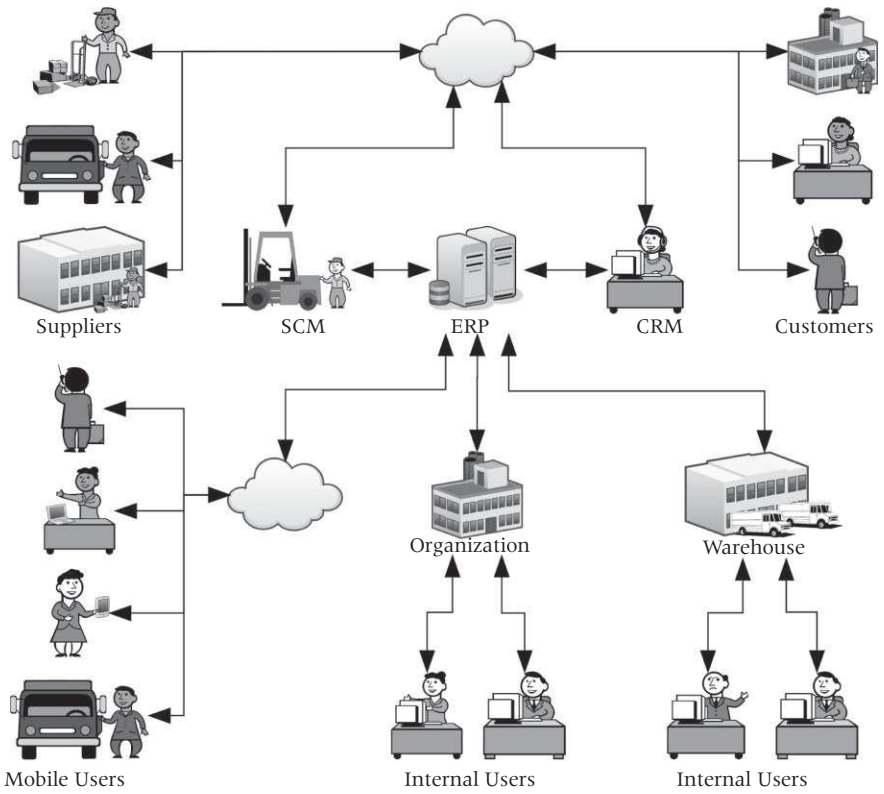

Figure 18.1 Current ERP environment.

- Lack of segregation of duties
- Audit risk—failure to comply with required regulations while implementing the system

The current ERP environment has undergone a drastic change from the security view point. The closed nature of the ERP systems is long gone. Now users can access ERP data from anywhere and at any time. This 24×7 access from around the globe has increased the security risks. Also with the integration of suppliers and customers and their systems to the organization's ERP system, the number of users and potential access points has exponentially increased. The current ERP environment is shown in Fig. 18.1.

Do not wait for an embarrassing—and potentially devastating—event to find out that security and controls in your ERP system are inadequate and vulnerable to exposure for your company. Consider the following security issues:

- Are you certain that sensitive information cannot be displayed to unintended users?
- Can only the right people in your organization perform critical functions?
- Does your ERP system give your users access to all the relevant information to make the optimum decisions?
- Do your e-commerce requirements have a security plan developed?
- Are you confident that you have appropriate security and control over your data?
- Will you comply with external and internal audit requirements?
- Will you eliminate the disclosure of confidential information?
- How reliable is your network and ERP system?

Managing the security of ERP information into and out of your organization has never been more critical or more challenging. As businesses grow, their information systems support whole communities of users: customers, suppliers, partners, and employees, who all count on the secure exchange of a wide variety of information to place orders, pay bills, and keep records up-to-date. Building the controls into the end-to-end lifecycle of the ERP system benefits both the end users and implementers of the systems. Identifying and incorporating required controls into ERP solutions results in reduced risk, clearer requirements, a stronger system design, better documentation, and an improved audit posture. The cost of designing and implementing an application control during the development will be significantly less than identifying the gap after the system is in production and implementing a maintenance change to resolve the control gap. The security of an enterprise system can be evaluated according to the following criteria:

- **Availability:** Information availability ensures continuous access to data even in the event of a natural or man-made disaster or events such as fires or power outages.
- **Access:** Information is accessible only to authorized users.
- **Confidentiality or selective access:** Confidentiality means that information is available or disclosed only to authorized individuals, entities, or IT processes based on their access privileges.
- **Accessibility:** Information should be securely accessible by authorized users from anywhere and from any device.
- **Data integrity:** Data integrity ensures that the data is maintained in its original state and has not been intentionally or accidentally altered. It also ensures that the data in the system is accurate and the information derived from it is relevant.
- **Traceability:** Traceability means that the data, transactions, communications, or documents are genuine and that both parties involved are who they claim to be. The access and attempted access are traced and that these traces are preserved and analyzed to improve security measures.

- **Network security:** Network security consists of the provisions and policies adopted by a network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs conducting transactions and communications among businesses, government agencies, and individuals.

Customers, vendors, partners, and employees all need access to the right ERP information at the right time and, increasingly, from anywhere. Yet these users work on many different systems and access data from multiple locations. All have different passwords and authorizations.

Initiatives like on-line order tracking to improve customer service, e-procurement to reduce costs or integrate supplier systems, and virtual private networks to provide information access anytime anywhere are additional factors that have increased the need for ERP security. Increased outsider access to ERP systems is another concern. You must not only manage the security issues of your own employees but also increasingly those of customers, suppliers, and other business partners.

The ERP security is an issue that should be addressed during the requirement phase itself. In order to effectively capture the security issues, the requirements definition team should include a security expert along with the functional experts.

TECHNOLOGICAL ADVANCEMENTS

Technological advancements are changing the way companies do business. Every day, new technologies emerge that will make things easier, faster, or possible to do things that were not possible with the existing technology. Organizations must keep their IT infrastructure updated to take advantage of the latest technological developments. Technology must be treated as a strategic weapon that will keep the company more competitive and ahead of the competition.

The Internet, WWW, mobile computing, wireless networking, etc. are some of the technologies that expand our ability to do many things. These technology tools have and will continue to affect ERP systems. The fundamental idea behind ERP systems was to integrate all business reporting systems within an organization.

Earlier ERP products were inherently secure as they were focused internally. Information flowed within the enterprise and the security measures kept the information secure inside the organization. The advancements in technology have made it apparent that there are many reasons to prefer open systems. This not only improves communication with suppliers and customers but also allows the use of more advanced technological tools.

Manetti [1] argued that ERP is on the verge of another major evolutionary advance with the following major changes occurring soon:

1. Broader use of web-enabled systems to support closer coordination, especially in supply chains
2. Greater artificial intelligence (AI) driven systems supporting more powerful advanced planning
3. Greater ERP presence in mid-range manufacturing, with more stable technology enabling less time and money for installation
4. More flexible, modular systems (the best-of-breed concept)
5. More third-party applications (bolt-ons) to perform specialty applications accessed by middleware

We have seen some of these ideas earlier in the book. Business intelligence was discussed in Chapter 9. Supply chain systems were discussed in Chapter 16. The ERP implementation and the various aspects of it are discussed in the next section—Part III. We will discuss the use of third-party applications—bolt-on products—in this chapter.

ERP BOLT-ONS

Bolt-on is ERP jargon for third-party applications. More specifically, a bolt-on is an artificially intelligent, comprehensive execution system providing very specific functionality or technology to complement ERP software [2]. Bolt-ons employ client-specific business rules to meet unique needs. There are many useful applications of this type. The usual means of connection to other organizations with ERP systems is through software components.

Most software has historically been delivered as inflexible code focusing on its originally intended application. A much easier approach is the idea of components where separate, encapsulated software code is written that is easier to manage, upgrade, and connect to host systems. Open systems can easily accept modifications, additions, or linkages to external software. Components make open systems possible.

Since the underlying philosophy in early ERP systems was internal integration, there was initially little apparent value in developing open systems. However, the ERP user market soon identified the benefits of best-of-breed selection of modules, sometimes across vendors. Vendors then realized the need to offer applications components. The focus shifted from internal design coherence to the ability to communicate with external software. Service-based architectures were created enabling business transactions and data transfer from outside the core application. Some examples where bolt-on software is used are product data management, product life cycle management, customer relations, e-procurement, order tracking, warehouse management, data mining systems, etc. These products enhance the capabilities of the ERP systems. Some of them focus on Internet and intranet communication (e.g. e-procurement, business-to-business products, on-line collaboration). Some others (like data warehouse management and data mining) enhance the business intelligence and decision-making capabilities.

MIDDLEWARE

External applications to ERP systems were initially accessed through application programming interfaces (APIs), which can access ERP data. APIs are pieces of computer code at low level, which is time consuming, costly, and difficult to maintain. A more recent trend is the development of software with the specific purpose of accessing application packages to ERP. Middleware is an enabling engine to tie applications together. Middleware removes the need for APIs. It can be divided into data-oriented products (supporting ERP integration through sharing data sources) and messaging-oriented vendors (supporting direct data sharing between programs without the need for data files or database) [3].

Data-oriented vendor products extract and transform data and then exchange data files between ERP packages and other applications. Middleware can transform data into standard formats readable by source and host systems. Most middleware products also avoid hub-and-spoke bottlenecks in single-server computer architectures by providing load balancing in their execution environments if multiple servers are present.

A major change in ERP systems has been the emergence of web delivered ERP. J.D. Edwards has designed an ERP product for that mode of delivery. SAP's mySAP.com also is oriented to web delivery and all vendors have moved that way. The data transformation features are now available for

multimedia documents including engineering drawings, scanned documents, and audiovisual products. Middleware can support many forms of data acquisition. This includes barcode data collection and radio frequency data collection. When web systems are used, the term *web portal* applies to software providing user-friendly access to data. Portals can act as middleware, giving organization users the ability to find technical information about engineering specifications, status information about promised shipments, and data about product prices and availability. Portals provide user-friendly access to data.

Portals enable ERP vendors to make their presence felt in a dynamic market. ERP vendor portals can focus attention on products. Portals are offered by third-party vendors too. Companies that are not ERP vendors provide portals to access information from files, data warehouses, e-mail systems, the Internet and many other applications.

Portals provide value to supply chain environments, feeding data across the entire supply chain, and tapping into the power of an ERP system. For instance, one portal allowed suppliers and customers to view forecasts and actual orders to monitor production target performance. A portal provides a unified interface to various data sources.

While initial ERP systems provide a competitive advantage, it also introduces concerns about security. Initial ERP systems were closed with limited numbers of organizational employees having access to the system. However, the strong trend toward more open ERP systems to gain advantages from supply chain connectivity and other features changes this circumstance dramatically.

COMPUTER CRIMES

Today the computer has replaced the gun and knife as the weapon of many criminals. Computer crime is often defined as any crime accomplished through the knowledge or use of computer technology. Nobody knows the true extent of computer crimes. Many computer crimes go undetected. Those that are detected often go unreported because businesses fear that they can lose more from the negative publicity than from the actual crimes. However, it is true that both businesses houses and governmental agencies lose huge amounts of money every year to computer criminals.

More than half the organizations reported attacks from employees and other insiders. Typically clerks, cashiers, programmers, computer operators, and managers who have no extraordinary technical ingenuity to commit these crimes. The typical computer criminal is a trusted employee with no criminal record who is tempted by an opportunity such as the discovery of a loophole in the security system. Greed, financial worries, and personal problems motivate these people to commit such crimes. Of course not all computer criminals fit this description. Some are former employees seeking revenge. Some are corporate or international spies seeking classified information. Organized crime syndicates are turning to computer technology to practice their trade with more efficiency. The explosive growth of the Internet is changing the demographics of computer crime. Now many organizations are reporting external attack through the Internet.

Types of Computer Crimes

There are many types of computer crimes ranging from pirating software and stealing information, to sabotaging systems. Piracy or the illegal duplication of copyrighted software is the most common computer crime. Another type of computer crime is sabotage of hardware or software. Modern computer saboteurs use software for their destructive activities. They use viruses, worms, logic bombs, and Trojan horses to destroy computer hardware and software. Hackers are another kind of computer criminals. They enter corporate and government computers using stolen passwords and security loopholes and steal information, transfer money to their accounts and do a lot of other criminal

activities. Sometimes they use modems to dial up the target computers directly; in other cases they 'travel' to their destinations through the Internet and other networks.

ERP AND SECURITY

Security is one of most important issues for an organization. Knowledge of enemy plans has been critical in influencing the course of human history. In classical business operations, just as in governmental and military operations, there have long been security issues concerned with physical protection. This physical protection could be of human access to buildings and information stored in critical rooms in much the same way as banks are secured. With the advent of computer systems, this security is expanded to data.

There has also always been a concern about the security of individuals. In a military context, patrols are sent out to capture enemies with critical information. Business firms have been known to hire away (poaching) individuals with key information from their competitors. Computer systems involve a new level of detailed complexity, providing many opportunities to obtain key competitive information. This is stored on computers and with the advent of networks, is in most cases accessible by networks. There are many threats to the security of information found on ERP systems. Threats across all three forms of access include theft, damage, copying, unauthorized access to information, natural disasters or accidents, sabotage, etc.

The traditional forms of physical spying can still be applied. This can include any form of unauthorized access to information. The most common forms of security threats to ERP are those made possible due to computer technology, including invasive electronic entry through some form of tapping or hacking. In addition to these security risks faced by all computer systems, two aspects of security are critical to ERP. One aspect concerns the quality of data generated and housed on the ERP. Data warehouses, discussed in Chapter 12, provide tools to ensure data quality.

The other aspect is control over who can access data. One major benefit of a web-delivered system is the flexibility afforded to users through the ability to log on to the ERP system from any terminal (not only throughout the company but also at airport terminals, hotels, or client offices). One difficulty is that providers use forms of caching to improve performance. There is a serious risk arising from the user walking away from the terminal before deleting the cache. This can be cured by software designed to turn off caches once the need for them has gone. Another form of control is a log-in page showing only those applications that the user is authorized to view. Some systems also provide access to HTML code that can reveal link information. The web page access system can preclude user access of this HTML code. While moving to the web may make tight control more difficult, this is not insurmountable. A digital certificate sign-on can act as one security measure with log-on to a directory protocol permitting access to authorized ERP applications. The ability to maintain ERP security in a web environment is mandatory, given that all ERP vendors are responding to demand to provide web products.

ERP Security Issues

During the development lifecycle of a new ERP system, it is critical to design and implement controls that assure data security and privacy. Many ERP implementations share common gaps that result in risks which are subsequently identified as audit findings. These include:

- The use of unmasked production data in development and/or test environments.
- Failure to identify business controls in the requirements and design resulting in later audit gaps and rework.
- Failure to identify and incorporate required IT controls. For example, PCI Security Standards Council (www.pcisecuritystandards.org) requirements for encryption of credit card data in transit and at rest.

- Failure to identify and manage segregation of duties risks and conflicts during the system design, test and implementation, as well as those implemented in the system. For example, an approver should not be able to endorse a purchase order that they have submitted.
- Inadvertent exposure of business sensitive information (e.g. exposure of user credit card or bank account information, or, even a report of personal data left on a desktop).
- Failure to manage privileged user access and default system user accounts.
- Lack of control over critical application programs, data files/tables, and automated system jobs.
- Failure to restrict direct changes to production data.

These common issues can impact an organization's:

- Reputation in the marketplace
- Compliance with federal laws and regulations
- Customer, partner, and dependent organizations trust relationships

The integration of ERP software to the existing IT infrastructure only increases the risk of both hackers who break through perimeter security and insiders who abuse system privileges to misappropriate assets—mainly cash—through acts of fraud. Security in the e-businesses (business whose ERP systems are integrated with that of their customers and suppliers) require a new way of thinking about security. It is not just about the network security and network traffic, but about business transactions that inflict financial losses from systems-based fraud, abuse, and errors.

While external threats from attacks and intrusions continue to rise, the opportunity for insider fraud and systems abuse has increased exponentially with increase of business process automation and access to enterprise-wide information. ERP vendors' focus on ERP security issues was very limited. The security measures were limited to internal controls that aimed to limit user behavior and

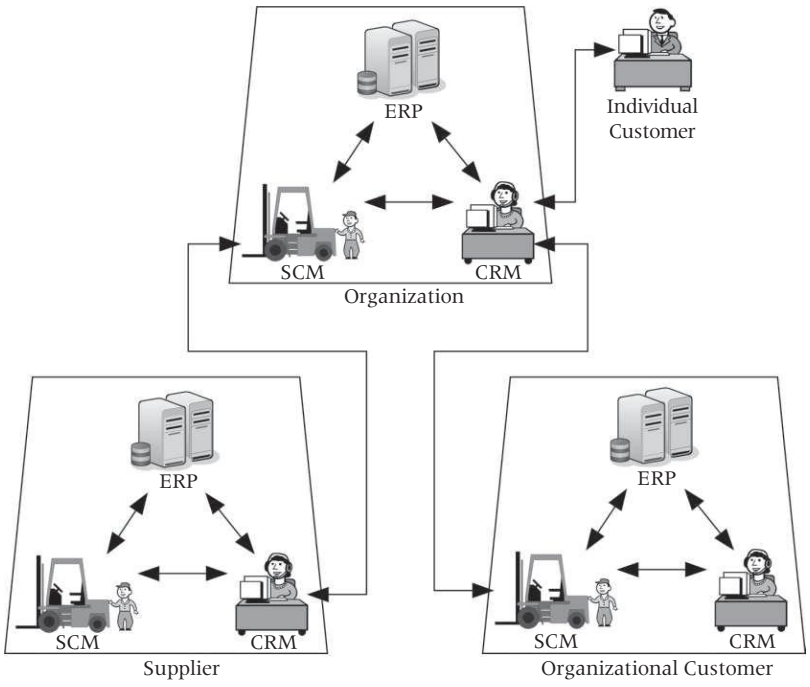

Figure 18.2 Integrating the suppliers and customers to the organization's ERP.

privileges while organizations relied on network perimeter defenses like firewalls, VPNs, intrusion detection, etc., to keep outsiders from accessing the ERP system. With the advent of ERP systems that were integrated to the systems of the business partners and the facility for the business partner to view the organizations data, the complexity of ERP security increased exponentially as the number of authorized users continue to grow. This effectively introduces new entry points to business systems from outside the traditional IT security perimeter as shown in Fig. 18.2. Enterprises now must not only trust the actions of employees but also trust partners' employees and their perimeter security measures. Thus, enterprises must rethink and revamp their security measures to take into account the new threats and take necessary actions including continuous monitoring, introduction of new alert mechanisms, etc., to keep their ERP systems secure.

COMPUTER SECURITY

With computer crimes on the rise, computer security has become an important concern for system administrators and computers alike. Computer security refers to protecting computer systems and the information they contain against unwanted access, damage, modification, or destruction. Computers have two inherent characteristics that leave them open to attack or operating error.

1. A computer will do exactly what it is programmed to do including revealing sensitive information. Any system than can be programmed can be re-programmed by anyone with sufficient knowledge.
2. Any computer can do only what it is programmed to do; it cannot protect itself from either malfunctions or deliberate attacks unless such events have been specifically anticipated and countered with appropriate programming.

We have seen that maintaining the security of the ERP system today is not an easy task as the number of people who have access to the system and the number of places from where users can access the system has become almost unlimited making the task of security professionals very difficult. Beyond physical and application-level design, proper policies, and procedures are required to maintain on-going security for 'anywhere-anytime access' services, completing the traceability component of the security design. Computer owners and administrators use a variety of security techniques to protect their systems ranging from everyday low-tech locks to high-tech software scrambling. We will see some of these methods.

Physical Access Restrictions

One way to reduce the risk of security breaches is to make sure that only authorized personnel have access to computer equipment. In those days when corporate computers were isolated in basements, physical restrictions were sufficient for keeping out intruders. However in the modern scenario, computers and data are almost everywhere and networks connect computers to the outside world. In a distributed and networked environment, security is much more problematic. It is not enough to restrict physical access to mainframes when the PCs and network connections are not restricted. Additional security techniques are needed to restrict access to remote computers.

Passwords

Passwords are the most common tool for restricting access to computer systems. Passwords are effective only if they are chosen carefully. Most computer users choose passwords that are easy to guess thus making the job of the unauthorized user easy. A growing number of security systems refuse

to allow users to choose any real words as passwords, so hackers cannot use dictionary software to guess them systematically. Even the best passwords should be changed frequently.

Firewalls and Encryption

Many data thieves do their work without breaking into computer systems; they intercept messages as they travel between computers on networks. Passwords are of little use for hiding e-mail messages while they are bouncing off from satellite dishes or traveling through Internet links. Still, Internet communication is far too important to sacrifice in the name of security. Many organizations use firewalls to keep their internal networks secure while allowing communication with the rest of the Internet. The technical details of firewalls vary considerably but they are all designed to serve the same function—to guard against unauthorized access to an internal network.

Of course, the firewall's digital drawbridge has to let some messages pass through; otherwise there could be no communication with the rest of the Internet. How can those messages be secured in transit? To protect transmitted information, many organizations use encryption software to scramble their transmissions. When a user encrypts a message by a secret numerical code called an encryption key, the message can be transmitted or stored as an indecipherable garble of characters. The message can be read only after it has been reconstructed with a matching key.

Audits

Audit control software is used to monitor and record computer transactions as they happen, so auditors can trace and identify suspicious computer activity. Effective audit control software forces every user, legitimate or otherwise, to leave a trail of electronic footprints. Of course, this kind of software is of little value unless someone in the organization monitors and interprets the output.

While data privacy addresses who can access data and what a user can do, a comprehensive auditing function is needed to track all transactions that occur in the system. Constantly monitoring the system and auditing the event logs is one of the best methods to enhance the security of the ERP system. Using the audit logs, security administrators can exclude events from auditing and define filters to manage information collected by the system. This information can be used to trace the source of selected changes to information in the system, as well as to detect unusual system activity.

Remote and Proactive Monitoring Systems

Remote and proactive monitoring systems are an extremely important part of the ERP security system. These monitoring systems enable early detection of potential incidents, ideally before they impact users. Monitoring is executed by a dedicated tool that permanently watches each node of the cloud infrastructure, along with access points at each customer's location and platforms at data centers.

These systems continuously monitor key application processes, systems, and wide area network between the service access point and the data center. An appropriate proactive monitoring infrastructure collects metrics from each device and automatically triggers alerts when a faulty condition is detected. Conditions that trigger an alert can range from a failure to back up data, to unauthorized attempts to access data. Depending on the severity of the incident detected, the monitoring system will send an e-mail to the support team or open a case file and display a visible alarm at the dashboard—allowing follow-up action to be performed by the incident-management team.

In addition to protecting data, monitoring activities also ensure that the systems achieve specified performance and uptime guarantees. Monitoring is conducted 24×7×365 and trained personnel investigate each incident thereby ensuring security of the ERP system and organizational data.

Backups

Even the tightest security system cannot guarantee absolute protection of data. Sabotage, human errors, power losses, machine failure, fire, flood, lightning, and earthquakes can damage or destroy computer data along with hardware. Any complete security system must include some kind of plan for recovering from disasters. For mainframes and PCs alike, the most widely used data recovery insurance is a system of making regular backups. For many systems, data and software are backed up automatically onto disks or tapes usually at the end of each working day. Most data processing shops keep several generations of backups so they can if necessary, go back several days, weeks, or years in order to reconstruct data files. For maximum security, many computer users keep copies of sensitive data in various locations.

Emerging Security Solutions

The migration from mainframes to personal computers is forcing experts to explore new security solutions. The PC's small size and physical accessibility can make it easy for criminals to steal the computer along with its data. Security experts are constantly developing new technologies and techniques for protecting computer systems from computer criminals. But at the same time, the criminals continue to refine their craft. In the ongoing competition between the law and the lawless, computer security generally lags behind.

Human Security Controls

Ultimately, computer security is a human problem that cannot be solved by technology alone. Security is a management issue, and a manager's actions and policies are critical to the success of a security program. An alarming number of companies are lax about computer security. Many managers do not understand the problems and do not think they are at risk. It is important for managers to understand where the real threats lie, make their employees aware of the problems, and build effective defenses against those threats.

CRIME AND SECURITY

We have seen that several types of computer crime scenarios exist. In some cases, the perpetrator has a legal right to operate the computer (such as an employee in a company), but uses it for unauthorized purposes. In other cases, the criminal gains unauthorized access to the computer either by appearing as if he belongs there or by breaking and entering. In a third type of crime, the criminal does not even have to be present; his programs find their way onto the victim's computer and do the damage.

Computer Crime by Authorized Users

There are several ways in which an authorized user of a computer, such as an employee using the company's computer, can accomplish unauthorized and illegal objectives. One such way involves altering data as it is entered into the computer. Another crime is removing a copy of data from the system without evidence of removal. An employee with access to the company's money management via computer has an opportunity for embezzlement. Disgruntled employees present a particular problem. An employee on his way out may sabotage the data on his computer, deleting customer records, bills owed, and so on, leaving a mess that could take months to straighten out.

Preventing Employee Crime

Some tips to help prevent the scenarios described are as follows.

- **Check references**—It is common to request three references when interviewing a potential employee; however, many employers never check these out. It is vital to call former employers and get their assessment of the candidate's honesty.
- **Do not give two weeks' notice**—When firing an employee, it is common practice to give him two weeks' notice so he can begin looking for another job. In a computer-related field though, this gives him two weeks to sabotage data, as well as copy data to sell to a competitor. If an employee is fired, have a security guard watch him clean out his desk and then escort him to the door. This may mean giving him two weeks' pay for doing nothing but this is better than letting him stay around the office and potentially cause millions of rupees in damage through sabotage.
- **Keep employee lists up-to-date**—Security guards get used to seeing the same faces every day and may let a former employee into an unauthorized (or formerly authorized) area because they think he still works there. It is important that security be kept up-to-date on this kind of personnel change.
- **Do not give more access than necessary**—Make sure that access to crucial data such as grades and payroll data is limited to those who must have it.

Computer Crime through Unauthorized Access

Someone who is not supposed to be using a computer network may gain access to it either by appearing that he/she belongs there, or by dialing or telnetting in and cracking a legitimate user's password.

Hackers are not only great at computer programming and analysis; they are pretty good at psychology too. The best hackers can walk into an office and gain the access they want without anyone suspecting them. This process of outwitting legitimate users to gain access is called social engineering. These criminals get the passwords from unsuspecting employees claiming that they are auditors, maintenance personnel, technical support staff, etc.

Another technique is cracking the password by using a variety of tools and techniques. They start with your personal data like pet name, date of birth, spouse's name, children's name, and so on. Then use a variety of programs that will try various number-letter combinations, words from the dictionary, and so on.

Tips for Defending Against Hackers

Given below are some guidelines to defend your system against hackers.

- Ask anyone who claims they are there to service the computers to show their identity card
- Make a policy that passwords are never to be spoken over the phone—a network administrator does not need a user's password to diagnose problems
- Make a policy that passwords are not to be left lying around near the computers
- Implement caller ID technology. Make a list of all employee phone numbers. When someone dials into the modem bank, hang up and compare the number that called in with the list of 'good' numbers. If the number is on the list, call it back and establish a connection
- Invest in a paper shredder to prevent snooping through the garbage

Potentially Malicious Computer Programs

This is the third type of computer crime where your systems can be sabotaged without anybody being physically present. Some types of computer programs (worms, Trojan horses, bombs, etc.) find their way onto your computer and carry out their instructions without your knowledge. These programs may be benign, simply printing a message on the screen, or they may be malicious, reformatting your hard disk at an inopportune moment.

A worm is a program which copies itself over and over, eventually causing the computer to crash when it runs out of RAM and/or hard disk space. A Trojan horse is a program, which appears to have a useful function but really has a secretly malicious one. A bomb is a virus, which waits a certain period of time before executing its code. It may wait for the user to access the computer a pre-determined number of times before being activated or it may wait for a particular date.

Defending Against Malicious Programs

You can buy or download anti-virus software, which will scan your disks and inform you of any programs it finds which looks like viruses or other malicious programs. In most cases, you will be able to remove the virus without harming your files (although it never hurts to have backups just in case.)

Some anti-virus programs can be trained to scan a disk before the computer reads any data from it—this way the virus never has a chance to infect your system. It is important to update your anti-virus software regularly. An anti-virus program written on March 4 will not know about a virus written on March 5. Most virus software producers maintain bulletin boards or Internet sites where you can download updates.

SUMMARY

The balance between providing data to the authorized users and denying it to unauthorized ones is not an easy job. To manage this risk, your company needs to implement an appropriate access strategy. We cannot imagine an ERP system with insecure and uncontrolled access. More and more processes and data are integrated into the ERP systems and security needs are getting very demanding and overwhelming as the hackers are also upgrading their tactics and technology. In order to keep your organizations valuable and sensitive, make data accessible only to those who are authorized. To ensure this, you need to constantly upgrade your security systems and strategies and educate your users about the need for following the rules and guidelines provided.

Managing the security of ERP information into and out of your organization has never been more critical or more challenging. As businesses grow, their information systems support whole communities of users: customers, suppliers, partners, and employees, who all count on the secure exchange of a wide variety of information to place orders, pay bills, and keep records up-to-date. Building the controls into the end-to-end lifecycle of the ERP system benefits both the end users and implementers of the systems. Identifying and incorporating required controls into ERP solutions results in reduced risk, clearer requirements, a stronger system design, better documentation, and an improved audit posture. The cost of designing and implementing an application control during the development will be significantly less than identifying the gap after the system is in production and implementing a maintenance change to resolve the control gap.

While external threats from attacks and intrusions continue to rise, the opportunity for insider fraud and systems abuse has increased exponentially with increase of business process automation and access to enterprise-wide information. ERP vendors' focus on ERP security issues was very limited earlier. The security measures were limited to internal controls that aimed to limit user behavior

and privileges while organizations relied on network perimeter defenses like firewalls, VPNs, intrusion detection, etc., to keep outsiders from accessing the ERP system.

With the advent of ERP systems that were integrated to the systems of the business partners and the facility for the business partner to view the organizations data the complexity of ERP security increased exponentially as the number of authorized users continues to grow. This effectively introduces new entry points to business systems from outside the traditional IT security perimeter. Enterprises now must not only trust the actions of employees but also trust partners' employees and their perimeter security measures. Thus, enterprises must rethink and revamp their security measures to take into account the new threats and take necessary actions including continuous monitoring, introduction of new alert mechanisms, etc., to keep their ERP systems secure.

REVIEW QUESTIONS

1. Discuss the data security risks of an organization.
2. What are the new security challenges due to the opening up of the ERP data?
3. List some of the security issues.
4. How can the security of an enterprise system be evaluated?
5. What are the technological advancements in the field of data security?
6. Discuss how the advancements in security features affect the functioning of the organizations.
7. What is the connection of ERP and data security? Discuss with examples.
8. What do you mean by bolt-ons and middleware?
9. Discuss computer crimes.
10. What are the different types of computer crimes?
11. Discuss the importance of security for ERP systems.
12. What do you mean by computer security?
13. What are the main ERP security issues?
14. What are the challenges caused by the integration of ERP software with those of the suppliers and customers?
15. Explain computer security and methods used to ensure security.
16. Explain computer crimes by authorized users and tips to prevent them.
17. Explain computer crimes through unauthorized access and tips to defend hackers.
18. Explain the details of potentially malicious computer programs.

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Part III

ERP Implementation

- To be or not to be…
- Implementation Challenges
- ERP Implementation (Transition) Strategies
- ERP Implementation Life Cycle
- Pre-implementation Tasks: Getting Ready
- Requirements Definition
- Implementation Methodologies
- ERP Deployment Methods
- Not All Packages are Created Equal—Package Selection
- ERP Project Teams
- Process Definition
- Vendors and Consultants

- Employees and Employee Resistance
- Contracts with Vendors, Consultants, and Employees
- Training and Education
- Data Migration
- Project Management and Monitoring
- Post-Implementation Activities
- Success and Failure Factors of an ERP Implementation

Chapter 19

To be or not to be...

INTRODUCTION

Information technology is revolutionizing the way, in which we live and work. It is changing all aspects of our life and lifestyle. The digital revolution has given mankind the ability to treat information with mathematical precision, to transmit it at very high accuracy, and to manipulate it at will. These capabilities are bringing into being a whole world within and around the physical world. The amount of computing power that is available to mankind is increasing at an exponential rate. Computers and communications are becoming integral parts of our lives.

To survive, thrive, and beat the competition in today's brutally competitive world, one has to manage the future. Managing the future means managing information. In order to manage information, deliver high quality information to the decision-makers at the right time and to automate the process of data collection, collation and refinement, organizations have to make information technology (IT) an ally and should harness its full potential and optimize it.

Almost all organizations are turning to some sort of ERP package as a solution to their information management problems. ERP packages if chosen correctly, implemented judiciously, and used efficiently will raise the productivity and profits of companies dramatically. However, many a company fails in this because of wrong product, incompetent and haphazard implementation, and inefficient or ineffective usage. To work successfully, ERP solutions need a lot of factors to click. There should be good people who know the business, the vendor should be good and his package should be the one best suited for the company's needs, the ERP consultants should be good, the implementation should be planned well and executed perfectly, and the end-user training should be done so that the people understand the system and the effect of their efforts on the overall success of the program.

Often the responsibility of implementing the ERP solution will be given to a person or a group of people who do not have much experience in implementing such systems. They might be good managers with excellent track records and they might have thorough knowledge of the functioning of the company. However, the number of options available in the ERP marketplace is simply overwhelming—SAP, Oracle, Microsoft, Oracle PeopleSoft, Infor, Oracle JD Edwards, etc.—to name a few. These are the major players but there are hundreds of small timers who enjoy considerable market shares in their own niche markets.

How to choose the right product? How to choose the right vendor? What options and modules to purchase? How to deal with the vendors and consultants? How to plan and execute the implementation? How to plan in advance so that the program can be rolled out in minimum time and with maximum effectiveness? What are the things that could go wrong? Who are the people who can be of help? The list of questions is endless. Every vendor will claim that their product is the ideal one and their support is the best. Thus, managers are faced with a tough proposition. They just cannot make a 'trial and error' decision. It is either a 'doing it right the first time' or 'going out of business' proposition. The huge costs involved in the ERP implementation allow no margin of error, re-work, or correction.

This book tries to answer the above questions and concerns. Some of the questions that I have tried to answer are given below. It is by no means an exhaustive list.

- Should we buy an ERP package? If yes, which package should it be?
- What will be the costs involved?
- What are the hidden costs?
- How to implement the package in the organization?
- What are the problems that are likely to crop up?
- What are the obstacles and hurdles that one should be prepared for?
- Who should be involved in the implementation?
- What is the role of consultants in implementation and how should they be dealt with so that the money is well spent?
- What changes should be made at the organizational level?
- How to overcome the resistance of the employees?
- When will the benefits start showing up?

In this chapter, we will discuss the issue of whether an ERP package is necessary or not. We have seen that in today's competitive business environment, the key resource of every organization is information. If the organization does not have an efficient and effective mechanism that enables it to give the decision-makers the right information at the right time, then the chances of that organization succeeding are very remote.

The three fundamental characteristics of information are accuracy, relevancy, and timeliness. The information has to be accurate, it must be relevant for the decision-maker and it must be available to the decision-maker when he needs it. Any organization that has the mechanism to collect, collate, analyze and present high quality information to its employees, thus enabling them to make better decisions will be always one step ahead of the competition. Today the time available for an organization to react to the changing market trends is very short. To survive, the organization must always be on its toes, gathering and analyzing the data—both internal and external. Any mechanism that will automate this information gathering and analysis process will enhance the chances of the organization to beat the competition.

TRADITIONAL INFORMATION MODEL

In the traditional method of data gathering and analysis—the one most companies were using till the advent of packaged software solutions (or ERP solutions)—the organizations used to develop computerized systems that was specifically made for them. Thus, the applications that were used in one company could not be used in another, because it was made specifically for that company and there was no in-built capability for customization. However this kind of software development is very costly and was in a way like re-inventing the wheel. The core or fundamental business practices are the same for all organizations, or at least to all organizations in the same business sector. Therefore, when companies developed their own information systems they were developing the same or similar systems—making and correcting the same mistakes—and spending huge amounts of money in that process.

Another drawback of these systems was that they did not have an integrated approach. There was an accounting system for the finance department, a production planning system for the manufacturing department, an inventory management system for the stores department, and so on. All

these systems performed in isolation. Thus, if a person wanted some information, which had to be derived from any of these two systems, he had to get the necessary reports from both systems and then correlate and combine the data. However, in reality no organization can function as islands of different departments. The production planning data is required for the purchasing department. The purchasing details are required for the finance department and so on. Thus, if all the information islands, which were functioning in isolation, were integrated into a single system, then the impact of that would be dramatic. For example, if the purchase department can see the production planning details, it can make the purchasing schedule. If the finance department can see the details of the purchase details as soon as it is entered in the system, they can plan for the cash flow that will be necessary for the purchases.

As the systems work in isolation, collecting and analyzing the data need for the functioning of their particular department, as mentioned earlier getting information about some aspect that is dependent on more than one department is a difficult task. However, no business executive or decision-maker can take right decisions with this isolated data that he can get from the various reports produced by each department. Even if he collates the data and produces the information that he requires, he must have lost valuable time that would have better spent in decision-making. The old information systems appeared as shown in Fig. 19.1.

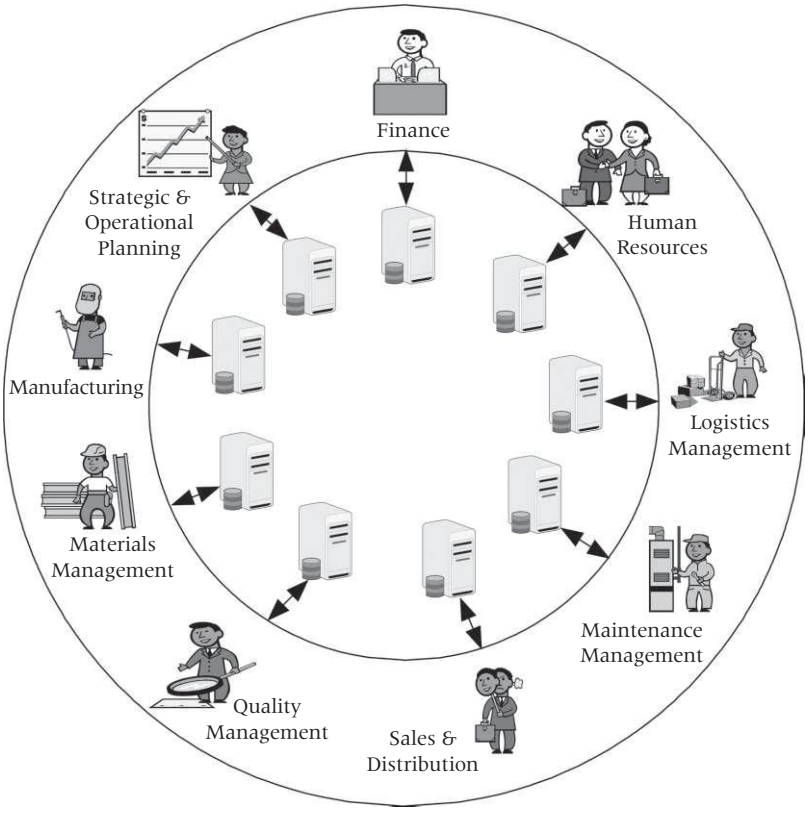

Figure 19.1 Isolated information systems—A pre-ERP scenario.

Therefore, what is needed is a system that treats the organization as a single entity and caters to the information needs of the whole organization. If this is possible and if the information that is generated is accurate, timely and relevant, then these systems will go a long way in helping the organization to realize its goals.

EVOLUTION OF ERP

When companies are small and all the different managerial functions are managed by a single person, the decisions that the person makes will be made keeping in mind the overall company objectives. However as companies grew, managing the entire operations became impossible for a single person. Thus, more and more people were brought in and the different business functions were given to different individuals. When the organization became larger each person in turn hired people to assist him/her and the various departments, as we see now, evolved. The size of the departments began to increase, as more and more people were required to do the job.

As the departments became large, they also became closed and watertight. Each had their own set of procedures and hierarchy. People at most levels within a department would just collect and pass information upward and information was thus shared between departments only at the top level.

Though IT provided the perfect answer, in the haste, most developers ended up developing need-based, isolated and piecemeal information systems that were non-compatible. It is no wonder then that IT implementations only automated existing applications and not the business functions.

Most of this happened because IT was not integrated into the corporate strategy. To draw real benefits from a technology as powerful as IT, one has to devise a system with a holistic view of the enterprise. Such a system has to work around the core activities of the organization and should facilitate seamless flow of information across departmental barriers. Such systems can optimally plan and manage all the resources of the organization and hence they can be called as enterprise resource planning (ERP) systems.

An enterprise is the group of people with a common goal, which has certain resources at its disposal to achieve this goal. The group has some key functions to perform in order to achieve the goal. Resources include money, manpower, materials, and all the other things that are required to run the enterprise. Planning is done to ensure that nothing goes wrong. Planning is putting necessary functions in place and more importantly, putting them together.

Therefore, enterprise-wide resource planning or ERP is a method of effective planning of all the resources in an organization. There are many misconceptions about ERP. First is that ERP is a computer system. Yes, computers and IT are integral parts of an ERP system; but ERP is primarily an enterprise-wide system, which encompasses corporate mission, objectives, attitudes, beliefs, values, operating style, and people who make the organization.

The second misconception is that ERP is for manufacturing organizations alone. This assumption is basically due to the way in which ERP has evolved from the methods of material requirement planning (MRP) and manufacturing resource planning (MRP II), which are relevant to manufacturing organizations. In the manufacturing industry, MRP became the fundamental concept of production management and control in the mid 1970s. At this stage, BOM (bill of materials), which is purchase order management that utilizes parts list management and parts development, was the prevailing trend. And this concept unfolded from order inventory management of materials to plant and personnel planning and distribution planning, which in turn became MRP-II. This incorporated financial accounting, human resource management functions, distribution management functions,

and management accounting functions, and came to globally cover all areas of enterprise mainstay business and eventually came to be called ERP. However in reality, the concept of enterprise-wide planning of resources is not limited to any particular segment of industry.

WHAT IS ERP?

ERP is an abbreviation for enterprise resource planning and means the techniques and concepts for integrated management of businesses as a whole from the viewpoint of the effective use of management resources to improve the efficiency of enterprise. ERP packages attempt to integrate all departments and functions across a company, onto a single computer system that can serve the particular needs of all the departments.

Originally, ERP packages were targeted at the manufacturing industry and consisted mainly of functions for generally planning and managing core businesses such as sales management, production management, accounting and financial affairs, etc. However, in recent years, adaptation not

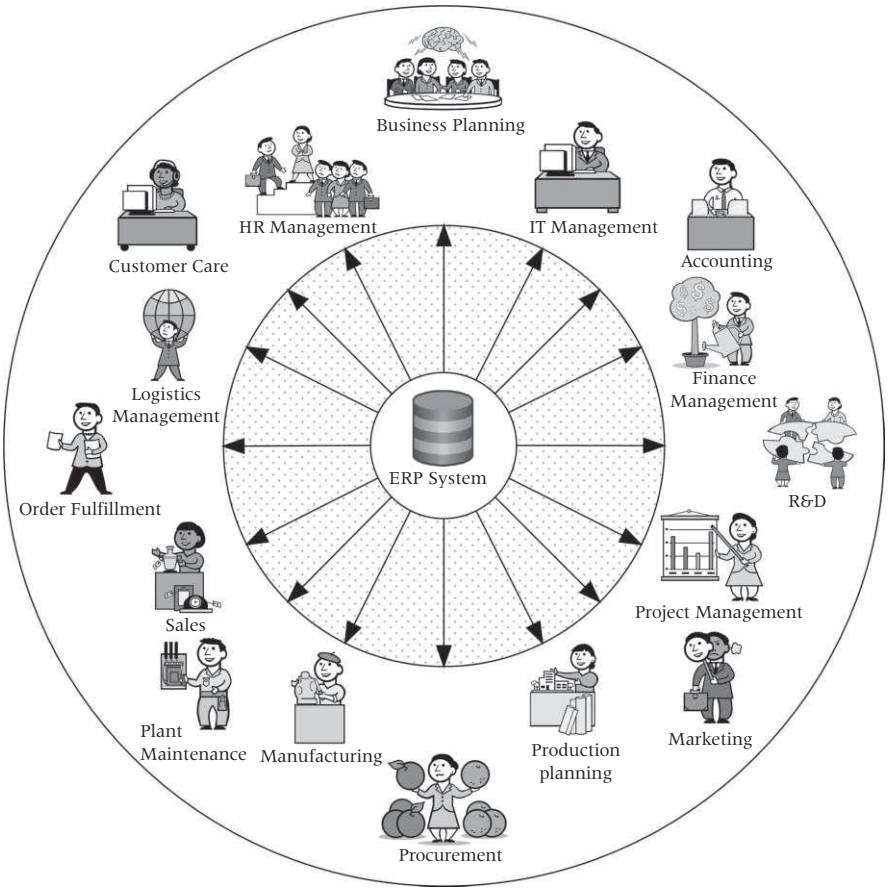

Figure 19.2 Information integration through ERP systems.

only to the manufacturing industry but also to diverse types of industry has become possible and the expansion of implementation and use has been progressing on a global level.

ERP software is designed to model and automate many of the basic processes of a company, from finance to the shop floor, with the goal of integrating information across the company and eliminating complex, expensive links between computer systems that were never meant to interact with each other.

Building a single software program that serves the needs of people in finance as well as it does the people in human resources and in the warehouse, is a tall order. Each of these departments typically has its own computer system optimized for the particular ways in which the department does its work. However, ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other as shown in Fig. 19.2. This integrated approach can have a tremendous payback if companies install the software correctly.

ERP software is a mirror image of the major business processes of an organization, such as customer order fulfillment and manufacturing. Its success depends upon reach—a circumscribed ERP system is not much better than the legacy system it replaces. In many cases, it is worse because the old code at least was written specifically for the company and the task. ERP systems' set of generic processes, produce the dramatic improvements that it is capable of, only when used to connect parts of an organization and integrate its various processes seamlessly. When a customer enters an order through the company's e-commerce website, for example, that data flows automatically to the departments within the company who need to see it—to the finance department at headquarters in Mumbai and to the warehouse in Chennai. The finance department will authorize the shipment once it has received the payment. If the payment is made while placing the order, it is automatically approved and the details of the order as well as the authorization to ship the items are sent to the warehouse. Thus within minutes after placing the order, the order processing is done and the order will shipped. This is possible because of the high level of automation of business processes across different functional departments and seamless information flow across the organization.

DO I HAVE TO CHANGE MY INFORMATION MODEL?

We have discussed that the traditional information model fails in creating the integrated information environment that is necessary for success in today's marketplace. Thus, if your company's information system is not incorporated into the way the company does business and is not linked to the operational management activities, then you are working with the traditional information model. If your company's system does not help in decision-making, but is only recording transactions and generating reports, it is time to change. If the data generated by your company's information systems is not relevant and timely, and if the data needs to be manually verified for its accuracy, then you need a new system. If the decision-makers are not getting the information they want but have to spend hours over the reports that are generated by the current information system, you need to change the system. If the various business processes of the company like finance, manufacturing, sales, etc., are not integrated, but functioning in isolation then it is time to change.

The above are some of the issues that necessitate a change from the traditional information model. There are other issues like cost of maintenance (of the different systems in the various departments), response time (time taken to retrieve information), scalability (ability of the system to grow with the growing information needs of the company), technology (whether the company is utilizing the latest technology or is the technological infrastructure obsolete), and so on. The management must

consider all these factors in order to make the decision whether to continue with the existing system or to embrace the enterprise-wide resource planning (ERP) systems (packaged solutions). Thus, the most important factors in making a decision on investing in ERP software are the quality of the information generated by the current system, the cost of maintaining the current system, the cost of implementing the new system, the advantages of the new system, the cost of maintenance of the new system, and so on.

EVOLUTION OF PACKAGED SOFTWARE SOLUTIONS

A majority of companies use information systems that were developed several decades ago—legacy systems. These systems were tailor-made for the company's needs (at that time) and were enhanced and modified many times during their life cycle. Therefore, most of these systems will be functioning far below the expected efficiency levels and would be using obsolete technologies. Maintenance of these systems is a difficult job as most of the employees who have done the design and programming will not be available (they must have left the company or retired). Also, since these systems were designed and developed during the time when software engineering and structured programming practices were still in their infancy, the software development procedures and practices that make the programs more maintainable were not followed. In many cases, there will not be any documentation and in some cases there will not even be the source code. Thus, it is difficult to understand what exactly a program or sub-system is doing. The Year 2000 problem created a situation in which the companies had no choice. They had to fix the programs before the entire information system crashed and brought the organization down with it.

Therefore, most of the companies are dissatisfied with the legacy systems that they have. This has many reasons. First, as mentioned earlier, most of these systems were developed during a time when IT played only a supportive role. But now IT has evolved from the supportive role and has become an integral part of the business. In fact, IT is supposed to be the most critical and important resource of an organization and the success and failure of any organization will depend on how well it manages its IT resources.

In this scenario, where user dissatisfaction over the existing systems is high and maintenance costs (due to problems like Y2K, Euro, etc.) are astronomical, most companies are thinking of moving away from their legacy systems. The reasoning behind such a decision is simple; why spend a lot of money and effort to extend the life of an already antiquated system when one can go in for the latest technology. Also the idea of developing a customized software solution for the organization is losing its appeal. Here again the rationale is obvious—why spend a huge amount of money when one can purchase a system that covers most of the functionality, and customize it to suit the needs of the company.

As a result of these trends, software organizations that were developing customized solutions for each organization shifted their focus slightly. They started developing sophisticated, all-encompassing, and integrated software packages. The companies who used to have systems built in-house also found these ideas appealing as they could focus their attention on their own chief activities, thus improving revenues and profits. However, there were hurdles for these ideas to gain acceptance. Many people did not believe that software organizations could develop solutions that could be used to solve complex business problems. However, the software companies were also thinking along the same lines. They recruited experts in fields like MRP, MRP II, supply chain, inventory control, production planning, preventive maintenance and spare parts management, logistics management, financial accounting, decision support systems, and so on. These experts brought in the functional

knowledge (about the business practices) into the software houses and played key roles in the system design. These experts were from the information services (IS) or EDP departments of various organizations and so they possessed the necessary knowledge—both functional and technical—to develop the sophisticated systems needed by the organizations.

Another factor that gained acceptance for the packaged solution was the increasing feeling by the business community that the development of software solutions should be done by experts. Many felt that developing software packages is not the main business of the companies and they argued that the company should be directing all their resources into improving their own products/services so that they can serve their customers better and continue to stay ahead of the competition. All agreed that IT was becoming a critical factor and that organizations need to develop a sound IT infrastructure but the actual job of developing the IT solutions should be left to the companies who are specialized in that business. Since designing and implementing integrated software packages is not the business (core competency) of most organizations, or a focus of their employees, the systems that a company's internal staff develops will never equal the quality, scope, or technology of those created by the software firms who are in the business of creating such applications. Companies should select a package that best suits their needs and then do the necessary customization to cover all the functionality that is required. With software package vendors improving their product to cover more and more business processes and functions, the 'gap' between 'what the company wants' and 'what the package has', is becoming less and less.

Thus, most organizations are implementing or planning to implement packaged software solutions or ERP packages. With more and more ERP vendors and many products, organizations have a better chance of identifying a package that will perfectly fit their business processes and functions.

WHY ERP?

An organization's growth is directed toward which all serious businesses strive as this gives a direct indication of their success and productivity. However, a company needs to consider implementing ERP in the emerging situation when this growth is fast and uncontrollable, leaving little or no ability to forecast and plan production requirements with any degree of accuracy.

A company needs to consider an ERP when their exact financial and operations performance is unknown, inaccurate customer expectations and job costs are predicted or even unknown, and promised delivery dates are regularly missed. An ERP needs further consideration when the inventories of a company do not meet or far exceed production requirements on a consistent basis.

With an ERP in place, a company can benefit considerably from all that it offers and is able to perform. By implementing an ERP, employee efficiency is no longer affected as it now only takes one simple step to capture vital data, with no duplication of the efforts needing to make this happen. Implementing an ERP further allows a company to overcome problems and issues, which lead to their devastating failure and are as such able to replace the systems currently in place, which are negatively impacting the ability of an organization to grow.

ERP's best hope for demonstrating value is in improving the way your company takes a customer order and processes that into an invoice and revenue—otherwise known as the order fulfillment process. That is why ERP is often referred to as back-office software. It does not handle the up-front selling process (although most ERP vendors have recently developed CRM software to do this); rather, ERP takes a customer order and provides a software roadmap for automating the different steps along the path to fulfilling the order. When a customer service representative enters a customer order into

an ERP system, he has all the information necessary to complete the order (the customer's credit rating and order history from the finance module, the company's inventory levels from the warehouse module and the shipping dock's trucking schedule from the logistics module, for example).

People from different departments will be able to view the same information and can update it. When one department finishes with the order it is automatically routed via the ERP system to the next department. To find out where the order is at any point, you need only log in to the ERP system to track it down. With luck, the order process moves like a bolt of lightning through the organization and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting. Some of the benefits that motivated organizations in implementing ERP systems are:

- Simplification of business processes
- Enhance productivity, flexibility, and customer responsiveness
- Compliance and control
- Efficiency improvements
- Enable new business and growth strategies
- Agility improvement
- Reduce costs and eliminate inefficiencies
- Continuous improvement
- Expand your knowledge of key business data
- Extend your business using the Internet

Simplification of Business Processes

Automating outdated business processes makes no sense when the nature of work itself is changing. With the Internet and mobile devices transforming the way we work, traditional business process need to make way for new ones. ERP systems introduce new and latest processes that make operations simpler, faster, more efficient, and more effective.

Enhance Productivity, Flexibility, and Customer Responsiveness

From quote to cash, an integrated business system helps you get product out the door faster. An ERP system gives you the tools to maximize the efficiency of business processes across the entire enterprise—forecast demand to suppliers, increase on-time delivery, automate the shop floor, decrease lead-times, increase order capacity, make commitments you know you can keep, etc.

Compliance and Control

Globalization, mergers and acquisitions, and regulatory burdens have created new demands for process consistency and transparency. By taking control of processes and enforcing business rules, ERP systems ensure compliance not only with policies and regulatory requirements but also with best practices tuned to performance objectives. ERP fosters re-use of process fragments enterprise-wide while allowing variations where needed.

Efficiency Improvements

ERP systems automate many business processes that deliver work to the appropriate people and systems, enforcing rules, and tracking completion against set deadlines. The resulting automation

noticeably cuts cycle times—from weeks to one or two days is common—and allows significant expansion in daily work volume without adding staff. Efficiency improvements are the most important source of ROI from the ERP implementation.

Enable New Business and Growth Strategies

Undertaking new business strategies requires an infrastructure that can handle the demands of an industry that is increasingly dependent on technology. Updating and integrating your business processes with an enterprise system enables you to take on more business and grow in new directions. ERP helps to connect multiple plants, take advantage of the Internet and wireless technology to connect to customers and partners, introduce new product lines, mobilize your sales force, etc.

Agility Improvement

The new IT revolution is service-oriented architecture. SOA exposes IT assets, both new and existing, for re-use and interconnection as component services. By standardizing the interfaces between components, SOA dramatically lowers the cost and effort of integrating business systems. Today's ERP systems make use of SOA to interconnect the various services and allow them to be modified quickly in response to changing demands.

Reduce Costs and Eliminate Inefficiencies

Using an enterprise system to standardize your business processes can dramatically improve your company's bottom-line. Better resource management results in more inventory turns. Management of your vendor relationships reduces costs for purchased items. More efficient scheduling on the shop floor reduces down time and overtime. Improved customer service leads to repeat business.

Continuous Improvement

The ultimate goal of ERP implementation is optimization of business performance. The same metrics and key performance indicators mapped out and simulated in a process model can be aggregated and displayed in real-time in performance management dashboards and reports. Like corporate performance management systems, ERP supports high-level strategic metrics, drill-down analytics, and alerts when results deviate from performance targets. By providing a platform for rule-triggered actions, ERP can turn alerts into automated escalation and remediation procedures, providing zero-latency response to business conditions. Parameters distilled from actual operations can be fed back into the process model to begin the next cycle of performance improvement.

Expand Your Knowledge of Key Business Data

An ERP system integrates all business management functions, eliminating contradictory information from disparate systems. Reports, graphs, and charts on key business data can be automatically generated to provide a higher level of business performance visibility, with the drill-down capability into details behind the data that the decision-makers always wanted. The organization of information in a hierarchical structure, where the decision-makers can drill-down to the very specific details from the highly summarized reports will help the decision-makers in identifying the problem areas and improve the quality of the decisions.

Extend Your Business using the Internet

Taking your business onto the Internet can give your company a competitive edge. Web-enabled technology allows you to access information, sell products, run business processes, and communicate with your customers and partners at any time and from anywhere in the world.

TECHNOLOGICAL, OPERATIONAL, AND BUSINESS REASONS FOR IMPLEMENTING ERP

The reasons for going in for ERP systems can be grouped into four different sets of categories: technology, business process, strategic, and competitive. Each of those rationales has different strengths and limitations. The choice of these rationales is important for at least three reasons.

Critical analysis is necessary to ensure that the firm makes the correct decision regarding ERP. Ultimately, that analysis can generate a number of different rationales or arguments used to substantiate ERP adaptation.

In some cases, the basis of choice can facilitate ERP design, providing design specificity. For example, if the goal is to improve a specific process then the extent of that improvement can be measured.

The basis of choice can facilitate evaluation of the success of the implementation, based on whether the business case rationale was successfully met. Different measurement approaches can provide a basis for determining success.

Organizations have used a number of technology rationales to justify the choice of an ERP system. A survey by Deloitte Consulting asked firms to specify why they decided to go with ERP. According to the study [1], the motivating factors stem from technological problems and operational issues.

After the inability of existing ERP systems to incorporate the latest technological developments like BI, SCM, CRM, etc., it is clear that companies hoped ERP-enabled systems would address a host of other technology problems, such as the confusion of disparate systems, poor quality of information, and overly complex business processes. Companies need systems and processes that offer a faster and more accurate picture of what is really happening across their business (see Fig. 19.3).

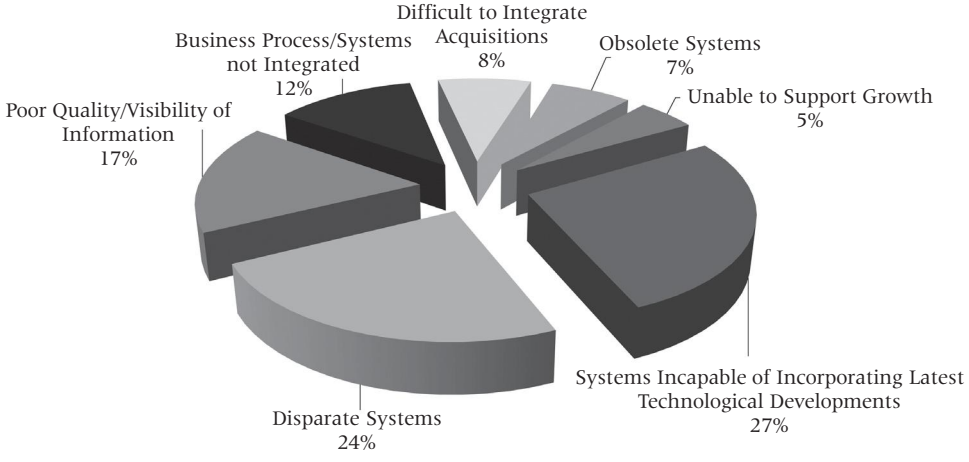

Figure 19.3 Technology motivations for an ERP program.

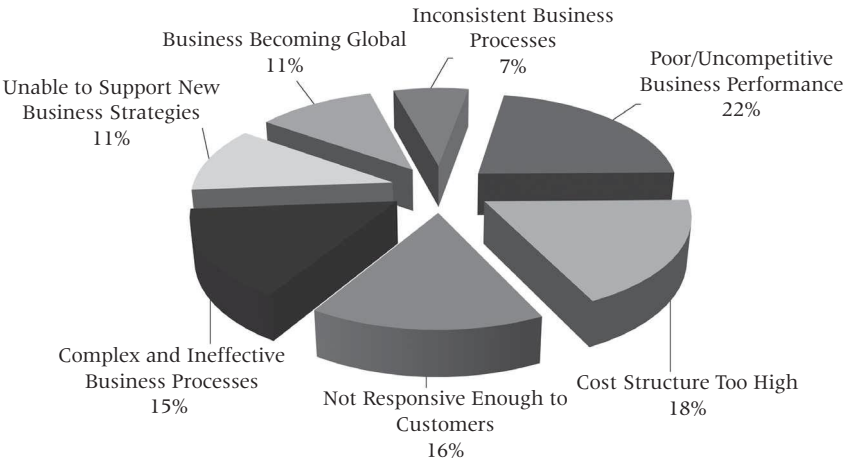

Figure 19.4 Operational motivations for an ERP program.

The study also revealed that the motivation for pursuing ERP-enabled processes goes much deeper than technology. Indeed, organizations were looking at solving some fundamental operational problems—problems that left alone, could have resulted in a tremendous strategic disadvantage (see Fig. 19.4).

Hallikainen, Laukkanen, and Sarpola [2], conducted a study on the reasons behind organizations going in for ERP. Based on the study, they ended up with two categories of reasons for ERP implementations—technological and business.

In the technological category, acquisition of an ERP system is motivated by the need for new IT and mainly aims to support the current way of doing business. This category also includes the IT investments mainly aimed for efficiency improvements, i.e. cost reductions. The specific technological drivers might be desired to outsource software maintenance and development when vendor support for the existing software has ended, the need for adopting a clean slate approach in order to achieve improved software systems to deal with, the need for a common technology platform, and increased standardization in technologies used across the organization, IT cost reduction, a desire to replace the ageing IT architecture or technology with a more advanced one, etc.

Sometimes the existing IT may be an obstacle prohibiting necessary and strategically important change in the enterprise. In these cases, new IT is acquired not simply to reduce costs but to facilitate change in the ways of doing business, and thus to improve effectiveness or to gain strategic advantage. Specific drivers to adopt ERP software based on business reasons can be desired in order to move to a standardized IT and organizational blueprint to deal with merger/acquisition or globalization, a desire to adopt best practice business models and new ways of doing business, and to conduct business process reengineering, need for increased flexibility and agility in doing business, data visibility and integration aiding managerial decision-making and operations, pressure from the value chain and need for electronic networking and collaboration with customers, suppliers, and other business partners, etc.

It should be noted that the different reasons and drivers for acquiring ERP systems partly overlap and are interdependent with each other both inside, as well as between, the two categories presented. These results are summarized in Table 19.1.

Table 19.1 Technological and business reasons reported for the acquisition of ERP

Technological Reasons	Business Reasons
Desire to outsource software maintenance and development • Support for old ERP software ended • Acquisition of ERP software that is actively developed by the vendor • New ERP software allows further development operations • Maintenance services **Need for adopting clean slate approach in order to achieve improved software system** • Need to acquire uncustomized standard ERP package • Problems with the maintenance of the old system • Old system not amenable to further development **Need for common technology platform and increased standardization in technologies used** • Acquisition of a common information system to the group • Need to integrate the ERP system with other systems • Need to link all the group's companies into same network • Holistic renewal of company's information systems • Old system did not operate in the required way **Resolution of year 2000 problems or Euro conversion problems** • Year 2000 problems • Euro conversion problems **IT cost reduction** • Need to improve efficiency • Need for more capacity and efficiency • Need to lower costs • Need to lower support and maintenance costs **Desire to replace the ageing IT architecture or technology** • Need to adopt a modern ERP system • Abandonment of old mainframe computer • Old system used obsolete technologies • Need to meet increased requirements	**Globalization and desire to move to a standardized IT and organizational blueprint to deal with merger/acquisition or globalization** • Globalization of the company's business • Current ERP system does not adequately support global operations • Current information systems are not transferable abroad • Standardization of company's policies and practices • Acquisition of unified global system for the whole company • Development objectives set by the group • Demands of the group **Desire to adopt best practice business models and new ways of doing business, and to conduct BPR** • Support for new processes • Improvement of the efficiency of existing processes • Changes in the company's business • Future development outlooks **Need for increased flexibility and agility in doing business** • Speeding up the availability of timely information • Improving the efficiency of reporting **Data visibility and integration aiding managerial decision-making and operations** • New requirements, e.g. integrated CRM • Possibilities for integration • Support for the improvement of operations • Support for the sales and marketing • Improvement of customer service • Improvement of process control • Improvement of project control • Improvement of managerial accounting and reporting • Unified reporting • Enhancement of information flow within the company • Improvement of data visibility • Increasing the reliability of information • Increasing the amount of information **Pressure from the value chain and need for electronic networking and collaboration** • Enablement of multi-company environment

• Need to renew an old system • Replacement investment • Old system had reached the end of its development lifecycle	• Electronic commerce • Expansion of the existing electronic commerce solutions • Growing demands of customers and other interest groups

THE OBSTACLES

In the last section, we have discussed the problems with legacy systems and the evolution of integrated software solutions or ERP systems. However, when it comes to implementing an ERP system, it is not an easy task. To work perfectly and in order to produce the results that it is supposed to, the ERP system should have the support and co-operation of all the users. If the system is implemented without support from all, the chances of failure are very high. This is not the same story as with isolated information systems. In those days, each department decided what system they needed to buy (or make) and went ahead accordingly. But the ERP system is for the entire organization. Thus, the system needs the support of all departments and users, in addition to strong commitment and support from the top management. Getting all the various departments to agree on a system is one of the most difficult tasks that the ERP coordinator is going to face.

It is human nature to resist change. When we are talking about implementing an ERP system we are talking about change on a very massive scale. Thus, there will be fear of the system replacing existing jobs, as many functions will be automated. Also, people will be afraid of the amount of training they have to undergo and learning they have to do in order to use the new system. Job profiles will change, job responsibilities will undergo drastic alterations, and people will be forced to develop new skill sets. If these fears are not addressed and the fears alleviated well in advance, then it will be asking for trouble.

It should be worth noting that while the ERP systems eliminate many existing jobs, they also create many new ones—ones with more responsibilities and value addition. It is easy to see that the automation of the business processes through technology can eliminate the jobs of many employees whose function is to record, control, calculate, analyze, file, or prepare reports. However, it must be pointed out to the employees that the same automation creates many more opportunities for employees because they can get away from the monotonous clerical work and transform themselves into highly valued individuals in a new and challenging working environment using the most advanced technology. If the company can succeed in making its employees accept this fact and assist in making the transformation (by giving them training), then the major (and most critical) obstacle in the path of an ERP implementation is solved.

COSTS AND BENEFITS

One of the most frequently asked questions when talking about ERP implementation is 'how much it is going to cost?' The answer to this is 'it depends.' It depends on a lot of factors like the package chosen, the technology used, whether the company is using the existing hardware/software infrastructure, how much training is needed, what are the resources available in-house for implementation, whether external consultants are required, and so on. But one thing is sure; the investment will be substantial—starting at several lakhs and running into crores of rupees depending on the size of the company and the scope of the implementation.

It is always a good idea to do a cost benefit analysis before actually going in for the implementation. The company can also conduct a feasibility study about the implementation and implementation strategies. All these can be done by a team of in-house executives or could be entrusted to external consultants. At the end of the study, the company will be in a better position to make a decision and also to set goals and deadlines for the implementation team. The fact that needs to be emphasized here is that the analysis should take into account the indirect benefits like availability of high quality information, faster response times, better customer service, customer goodwill, and so on.

One last word; if the company wants to survive, thrive, and succeed in today's highly competitive world, then it is imperative that the company's business processes and functions be integrated and automated using the latest tools in IT.

SUMMARY

This chapter examines the issue of whether an ERP package is necessary or not. We have seen that in today's competitive business environment, the key resource of every organization is information. If the organization does not have an efficient and effective mechanism that enables it to give the decision-makers the right information at the right time, then the chances of that organization succeeding are very remote.

Almost all organizations are turning to some sort of enterprise resource planning (ERP) package as a solution to their information management problems. ERP packages if chosen correctly, implemented judiciously, and used efficiently will raise the productivity and profits of companies dramatically. But many a company fails in this because of wrong product, incompetent and haphazard implementation, and inefficient or ineffective usage.

To work successfully, the ERP solutions need a lot of factors to click. There should be good people who know the business, the vendor should be good and his package should be the one best suited for the company's needs, the ERP consultants should be good, the implementation should be planned well and executed perfectly, and the end-user should be trained so that the people understand the system and the effect of their efforts on the overall success of the program.

REVIEW QUESTIONS

1. Discuss the advantages of ERP systems and how they will improve the competitiveness of your organization.
2. What are the obstacles for implementing ERP systems?
3. Describe the traditional information model. What are the problems with this model?
4. Discuss the evolution of ERP from an information point of view.
5. How does ERP improve the efficiency of the enterprise by integrating information?
6. Discuss whether an organization needs to change the information model in order to implement the ERP system.
7. Trace the evolution of packaged software solutions.
8. Discuss why ERP is the best solution for improving the efficiency and productivity of the organization.
9. Discuss the technological, operational, and business reasons for implementing ERP.
10. What are technological and business reasons reported for the acquisition of ERP?
11. What are the obstacles of ERP implementation?
12. What are the costs and benefits of ERP?

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Chapter 20

Implementation Challenges

INTRODUCTION

There are few information systems whose design and implementation challenge a company like enterprise resource planning. Done right, a new ERP implementation can dramatically improve business processes. However, when an implementation fails—or takes a prolonged and arduous course—huge amounts of money and effort could be misspent. In this chapter, we will see the challenges faced before, during, and after an ERP implementation.

Table 20.1 Challenges to successful ERP implementations

Implementation Challenge	Percent of Sample
Inadequate definition of requirements	46.5
Resistance to change (lack of buy-in)	43.9
Inadequate resources	43.1
Inadequate training and education	36.2
Lack of top management support	32.4
Unrealistic expectations of benefits and ROI	30.6
Miscalculation of time and effort	27.7
Poor communications	27.4
Software-business process incompatibility	23.1
Poor project design and management	16.8
Poor ERP package selection	6.4
Others	4

ITtoolbox [1] conducted an ERP implementation survey in 2004. Over 375 IT and business professionals from around the world participated in this on-line survey. One of the survey questions was 'what do you see are the main challenges to successful ERP implementations within your organization?' 46% of the participants indicated that the main challenge to successful ERP implementations was *inadequate definition of requirements* and *resistance to change*. The complete list of the challenges is given in Table 20.1 and is illustrated in Fig. 20.1.

Panorama Consulting Solutions [2] in 2011–2012 conducted a study on the completion times of ERP implementations and the reasons behind the extended durations. According to the study, while 61% of the projects were completed behind schedule 28% completed the project on-schedule and 11% completed implementation earlier than scheduled as shown in Fig. 20.2.

The key reason for delayed implementation noted in this analysis is the expansion of initial project scope (29%). This is a common issue suffered by organizations that rush into implementations without taking the time to properly plan or understand fully the impact and/or the organizational

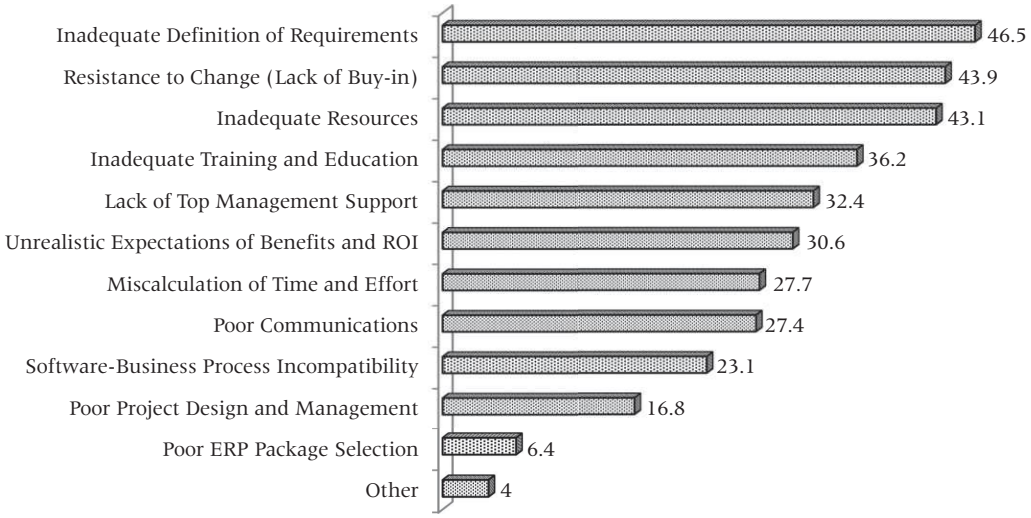

Figure 20.1 Main challenges to successful ERP implementations.

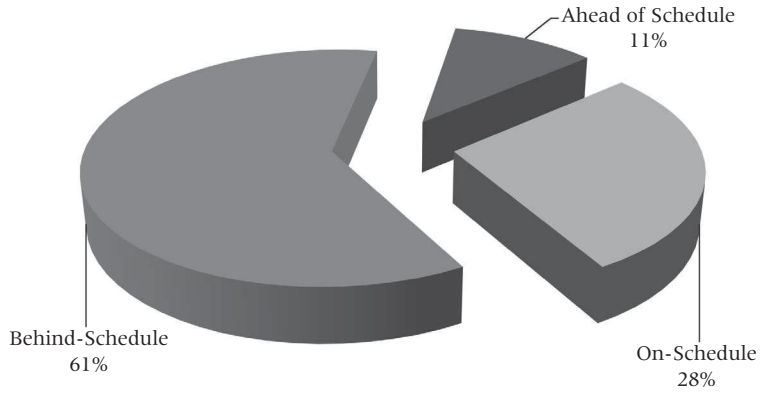

Figure 20.2 ERP implementation completion time.

change management tactics necessary to achieve a successful implementation. Organizational issues are a component that one-fifth of respondents (20%) indicate extended their durations while data issues and resource constraints accounted for 17%, training issues affected 15%, and technical issues accounted for 14%. The reasons for the extended durations are given in Table 20.2 and Fig. 20.3.

Table 20.2 Reasons behind extended implementation durations

Reasons Behind Extended Durations	2011	2012
Initial project scope was extended	17%	29%
Organizational issues	14%	20%
Data issues	14%	17%
Resource constraints	13%	17%
Training issues	10%	15%

Technical issues	7%	14%
Conflicts in priority of project	10%	12%
Unrealistic timeline	8%	11%
Vendor functionality issues	8%	4%

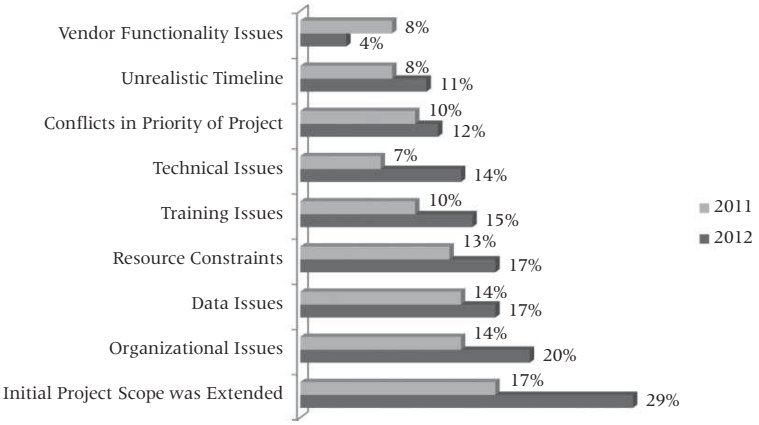

Figure 20.3 Reasons behind extended ERP implementation durations.

The frequency of the challenges increased in seven out of eight categories from 2011 to 2012, suggesting that companies are having increased difficulty implementing their ERP software. Regardless of the size or needs of an individual company, strong organizational risk mitigation and change management can address many of the issues cited above. Project planning, resource deployment, segmented communications, targeted training, strong data conversion plans, and so forth serve to minimize the negative effects of change, decrease the durations, and increase the success of implementations. Due to the resource and staffing constraints most small or medium-sized businesses face, it is critical that they recognize the great impact organizational change efforts—both in the executive suite and among end-users—have on implementation success. Regardless of which software package is chosen, a company that does not devote the time and effort to ensuring its staff is aligned and trained, and that its leaders are clear on the project priority, timeline, staffing needs, and so forth needed for ERP success, is apt to see an ERP project stretch well-past the initially projected timeframe.

THE IMPLEMENTATION CHALLENGES

We have seen an overview of the major implementation challenges. We will now look at them in a little detail. ERP implementations are more likely to fail, be delayed, cost more than forecast, or fail to deliver full functionality than they are to succeed. It is important to be aware of how ERP as a technology evolved, what its strengths and weaknesses are and the nature of important implementation challenges. Further, understanding of how ERP and legacy system metadata can be used to simplify implementation and help organizations best plan for this exciting new challenge. ERP solutions provide integrated applications that access standardized enterprise data—replacing the hodgepodge of legacy systems. While considering enterprise resource planning as a potential solution to specific organizational challenges, major considerations include solving the implementation challenges. We will now see the major implementation challenge in detail.

Inadequate Requirements Definition

Inadequate definition of requirements is one of the major challenges faced by the implementation team. The requirements definition should clearly specify the issues and problems that the ERP system is supposed to solve, the additional capabilities expected out of the system, and so on. If the requirements are properly specified then the implementation team can go about their job including selection of the ERP package that is best suited to meet these needs, the areas where customization is needed, functions where the organization's business processes needs modification, and so on. All these are important for the successful implementation and operation of the ERP system. Failing to provide these (which is the management's responsibility) could result in the selection of the wrong ERP package, unnecessary customization, lack of employee retraining, and so on, all of which can result in the failure of the ERP implementation.

Resistance to Change

Implementing an ERP system is a change, and it is human nature to resist change. Thus, any ERP implementation will face some amount of resistance. Users will be skeptical about the new system. However, for an ERP implementation to succeed, the co-operation of everyone involved is an absolute necessity. ERP is first an attitude, then a system. Thus, if employees are not convinced about the importance of ERP and the benefits of using an ERP tool or system they will not be fully co-operative, which can result in the failure of the system. It is very important, therefore, that users be won over before implementing the system. Forcing the system on unwilling people will only harden their resolve to revolt.

One main reason for the resistance is ignorance. People always have a lot of misconceptions about ERP—it will increase workload, it will hinder creative work, and so on. However, if the ERP implementation team backed by the management spends a little time and effort educating users about ERP and how it will help the company and the users, then user resistance can be reduced if not fully eliminated.

Another method of reducing resistance is by creating champions. One of the most competent ways to transition to new technology is to find a well-reputed potential user of the technology. Train the user on the process and the technology, have him evaluate the technology and encourage him to champion the merits of the technology to co-workers and management. The champion becomes the expert user, facilitator, and trainer of the tool. There will always be people who adapt to change slowly and maybe even begrudgingly; do not look to them to be your champions. Instead, look for people who are the first to embrace change, adopt new technology and are always looking for a way to do things better. That is the kind of person you want for a champion.

Inability to Achieve Organizational Understanding

The biggest ERP challenge faced by organizations is recognizing that the integration of previously un-integrated job functions requires that knowledge workers supporting different organizational functions will now be using the same software and they too will be entering information that affects the other. To do this accurately, these knowledge workers must have a much broader understanding than they did before the ERP solution, and learn how others in the organization perform their functions.

Understanding has a specific definition in an ERP context: 'Understanding the architecture,' indicates that the organizational legacy systems and the ERP are documented and articulated as a digital blueprint illustrating the commonalities and interconnections among the component metadata. Understanding in EAI is a shorthand reference for use of a data-centric technique to represent,

manage, and develop configurable system component models within a formally defined common metadata model.

Common metadata model components are represented using standardized notation and are sufficiently detailed to permit both business analysts and technical personnel to separately read the same mode, and come away with a common understanding, and yet they are developed effectively.

Inadequate Resources

ERP implementation is a very costly affair that requires a variety of resources—money, people, software, hardware, and so on. It is unlikely that the company management would support the idea of unlimited funding for the ERP implementation project. Instead, from a control stance a budget needs to be established. This will be based upon an estimate of the likely costs. There are many items that will be missed during the preparation of the budget, but will consume money during the implementation. The long implementation period (usually 8–20 months) will escalate many costs. Another resource that is always in short supply is skilled and motivated personnel from the organization. Getting the right people with the necessary skills, aptitude, and enthusiasm is one of the most difficult tasks faced by ERP implementation teams. These inadequacies in resources can create many a challenge to the ERP implementation.

Lack of Top Management Support

The commitment of the top management to the diffusion of innovations throughout an organization has been well documented. In particular, early in a project's life, no single factor is as predictive of its success as the support of top management. The roles of top management in IT implementations include developing an understanding of the capabilities and limitations of IT, establishing reasonable goals for IT systems, exhibiting strong commitment to the successful introduction of IT, and communicating the corporate IT strategy to all employees. Research on project failures show that project cancellations occur when senior management delegates progress monitoring and decisions at critical junctures of the project to technical experts. The importance of top management support was instrumental in the success of all ERP implementations. Thus, going ahead without solid backing from top management is a sure recipe for disaster.

Lack of Organizational Readiness

The main challenge in the successful implementation of ERP system is the readiness of the organization for a new system of functioning. The management should make sure that the organization, the work process, and the employees are amenable to adapt to the ERP system.

Inadequate Training and Education

The role of training to facilitate software implementation is well-documented in the MIS literature. Lack of user training and failure to completely understand how enterprise applications change business processes frequently appear to be responsible for problem ERP implementations and failures. ERP projects appear to have a six-month learning curve at the beginning of the project. At a minimum, everyone who uses ERP systems needs to be trained on how they work and how they relate to the business process early on in the implementation process. Although many companies use consultants to help during the implementation process, it is important that knowledge is transferred from the consultant to internal employees. Companies should provide opportunities to enhance the skills of the employees by providing training on a continuous basis to meet the changing needs of the business and employees.

Inaccurate Expectations

Information system failure has been defined as the inability of a system to meet a specific stakeholder group's expectations and successfully managing user expectations has been found to be related to successful systems implementation. The expectations of a company may exceed the capabilities of the system. ERP systems may fail to meet expectations despite positive contributions to the organization, if the systems are oversold by the vendor. Careful deliberation of success measurement as well as management of expectations by the implementation manager of ERP projects are important factors. Management of expectations has an impact through all stages of the implementation life cycle.

The first thing to realize when considering ERPs is that inaccurate expectations are the norm. Most ERP implementations today result in cost and schedule overruns. According to a study by the Standish Group [3], 10% of ERP implementations succeed with full functionality, within forecast cost and time frames while 55% are implemented with cost and time overruns, and the remaining 35% are cancelled before completion (see Fig. 20.4).

The same study found that the cost overruns average 189% (178% for large companies, 182% for medium companies, and 214% for small companies), while schedule overruns average 222% (230% for large companies, 202% for medium companies, and 239% for small companies). On an average

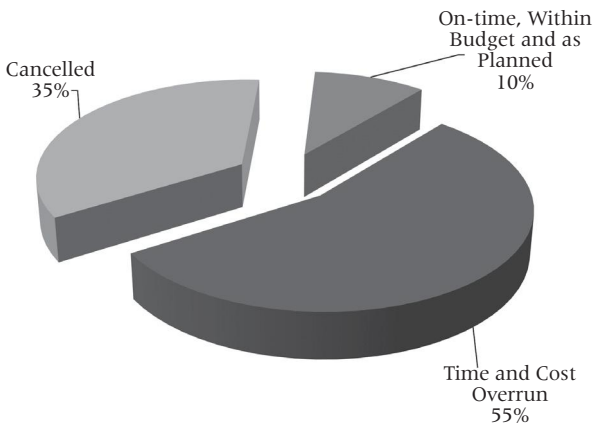

Figure 20.4 Implementation success rate.

the ERP systems are implemented with only 61% of the desired functionality (42% for large companies, 65% for medium companies, and 74% for small companies). This is shown in Figure 20.5.

A research paper by IT Cortex [4] found that 51% ERP implementers viewed their implementation as unsuccessful and 46% characterized their organizations as not understanding how to use the system to improve the way they conducted business. 34% of organizations were very satisfied with what they got, while 40% of the projects failed to achieve their business case within one year of going live.

These outcomes indicate lack of understanding of ERP implementation complexities. Routinely, the cost of implementing and the time required to implement are underestimated while the scope of what organizations are able to implement are routinely overestimated.

Poor Package Selection

Selecting a good ERP solution provider is another challenge. Analyze the capabilities of the ERP service provider and make sure the provider has the capabilities and the expertise to provide you with

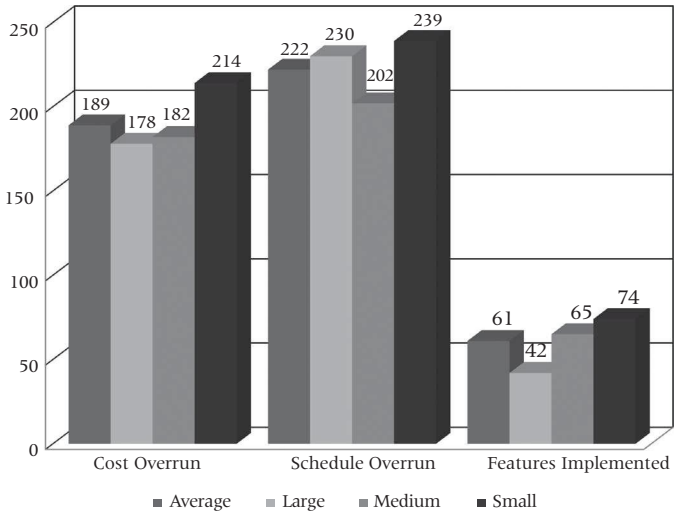

Figure 20.5 Implementation details—planned vs. actual.

a good solution. The choice of the package involves important decisions regarding budgets, timeframes, goals, and deliverables that will shape the entire project. Choosing the right ERP packaged software that best matches the organizational information needs and processes is critical to ensure minimal modification and successful implementation and use. Selecting the wrong software may mean a commitment to architecture and applications that do not fit the organization's strategic goal or business processes.

Poor Project Management

While many in the IS business consider project management an oxymoron, its importance in IT projects is well-documented and numerous methodologies and management tools exist. Project management activities span the life of the project from initiating the project to closing it. The contingency approach to project management suggests that project planning and control is a function of the project's characteristics such as project size, experiences with the technology, and project structure. The vast combination of hardware and software and the myriad of organizational, human, and political issues make many ERP projects huge and inherently complex, requiring new project management skills. Specifically, proper management of scope is critical to avoid schedule and cost overruns and necessitates having a plan and sticking to it. A project scope that is too broad or ambitious can cause severe problems. Customization increases the scope of an ERP project and adds time and cost to an implementation. The minimal customization strategy discussed later, which allows for little if any user suggested changes and customizations, is an important approach to managing the scope of an ERP project. The high implementation risks of ERP projects imply the need for multiple management tools such as external and internal integration devices and formal planning and results controls.

Customization Issues

As ERPs attempt to permit organizations to capitalize on planned information sharing cost avoidance, they make sense when existing organization procedures and data structures can be successfully adopted to match those implemented by the ERP. Most organizations discover how compatible

the new ERP is with their existing systems and processes when they turn on the new system. When it is realized that the ERP differs from the system it is replacing, the organization is faced with the possibility of either customization or tailoring the ERP. There are four basic choices to customization:

1. Modify the ERP to match the organizational processes and/or data structures
2. Modify the organizational processes and/or data structures to match the ERP
3. Perform some of choice 1 and choice 2
4. Ignore the problem

Choices 1 and 2 require understanding of the ERP and organizational processes and data structures. Most organizations approach the customization/tailoring decision without proper information required to reach a good decision.

Long Payback Period

Another statistic not well-understood is that the return on investment (ROI) for most organizations runs to almost three years. A Meta Group [5] study indicated that the median annual savings from the new ERP average $1.6 million/annually on a (roughly) $30 million investment one year after implementation is completed. A Deloitte [6] survey of Fortune 500 companies found that 25% of organizations suffered a drop in performance when their ERP system went live.

Poor Communication and Co-operation

Communication is the oil that keeps everything running smoothly. Communication is essential within the project team, between the team and the rest of the organization, and with the client. Poor communication between implementation team members and other organizational members caused many implementations to fail. A key factor for the successful implementation of ERP systems requires a corporate culture that emphasizes the value of sharing common goals over individual pursuits and the value of trust between partners, employees, managers, and corporations. As ERP systems are cross-functional and above departmental boundaries, co-operation and involvement of all involved is critical. ERP potential cannot be leveraged without strong coordination of efforts and goals across business and IT personnel.

Data Quality Costs

A data management study performed by Price Waterhouse Coopers survey [7] revealed the two troubling facts about organizational data quality:

1. Only 15% of companies are very confident of the data received from other organizations
2. Only one in three companies are very confident about the quality of their own data

Poor quality data input can be fatal to ERP projects. Just imagine the confidence that the new system engenders if they get bad data out of the system more easily than the legacy system.

Hidden Implementation Costs

There are many items that are missed or that will consume more money than that allotted while preparing the implementation budget. These cash shortages will hinder the smooth implementation and if the company does not have sufficient reserves to bear the additional expenditure, the implementation will have to be left half way. A very detailed discussion of the hidden cost of ERP implementation is given in Chapter 25.

Improper Integration

The benefits of an ERP application are limited unless it is seamlessly integrated with other information systems. Organizations face many challenges in ERP integration—the challenges of integrating various functional ERP modules, the challenge of integration with other e-business software applications, and the challenge of integration with legacy systems. The success of ERP implementation is the success of ERP integration. There are three areas where integration has to succeed—integration of ERP modules, integration of e-business applications, and integration with legacy systems.

Packaged ERP software consists of many functional modules (production planning, inventory control, financial, and HR). Organizations tend to install modules from the same ERP vendors in the initial ERP implementation. Not all companies will purchase all ERP modules from a single ERP vendor (SAP, Oracle, PeopleSoft, etc.). The implementation of ERP systems could last many years. The integration of ERP modules could be either integration of modules from different vendors or different versions of the modules from the same vendor.

E-business practice is the combination of strategies, technologies, and processes to electronically coordinate both internal and external business processes and manage enterprise-wide resources. E-business software systems generally fall into four categories: enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), and knowledge management (KM). To get the most out of ERP systems, ERP should be tightly integrated with other e-business software such as supply chain systems, CRM, knowledge management, B2B exchange, and e-commerce store front on the Internet.

Over the years, legacy systems have accumulated a vast amount of data vital to the survival, operations, and expansion of corporations and non-profit organizations. Integration of ERP systems with legacy systems is more complex than the integration of ERP modules and integration of e-business applications. It routinely requires the installation of third-party interface software for communication between ERP software systems and legacy systems. Second generation ERP systems use relational database management systems (RDBMS) to store enterprise data. Data conversion from legacy systems to RDBMS is often a time-consuming and tedious process. While most interface software provides API for ERP to access legacy systems, some vendors offer integration modules that automate or accelerate the transformation of legacy application logic and data into re-usable components with XML, SOAP, J2EE, and .NET interfaces.

Improper Operation/Use

The most crucial challenge is the optimal utilization of the ERP software solution. You can have the best ERP solution implemented but if its resources are not utilized to the fullest, the whole initiative goes for a toss. However, if it is deployed appropriately, ERP solutions can create dramatic changes in your business performance.

SUMMARY

There are few information systems whose design and implementation challenge a company like ERP. Done right, a new ERP implementation can dramatically improve business processes. However, when an implementation fails—or takes a prolonged and arduous course—huge amounts of money and effort could be misspent. In this chapter, we have seen the challenges faced before, during, and after an ERP implementation.

The main challenges of an ERP implementation are inadequate definition of requirements, resistance to change (lack of buy-in), inadequate resources, inadequate training and education, lack of top management support, unrealistic expectations of benefits and ROI, miscalculation of time and

effort, poor communications, software business process incompatibility, poor project design and management, poor ERP package selection, etc.

There are companies that have spent crores of rupees and more than two years on a suite of applications that ranged from finance to HR to SCM and had to abandon it because they did not function well or did not function as expected. In spite of the risks and challenges, companies are increasingly re-designing the infrastructure systems that run their business. In most cases, they have no choice. To stay competitive, these companies must leverage IT in new ways. ERP systems attempt to integrate all departments and functions across a company onto a single computer system that can serve the particular needs of all these departments.

Building a single software program that serves the needs of people in finance as well as of the people in human resources and in the warehouse is a tall order. Each of these departments typically has its own computer system optimized for the particular ways in which it does its work. However, ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other. This integrated approach can have a tremendous payback if companies install the software correctly.

REVIEW QUESTIONS

1. What are the typical ERP implementation challenges?
2. What are the reasons behind the extended implementation duration?
3. What is the main challenge to successful ERP implementation?
4. How does inadequate requirements definition affect ERP implementation?
5. How does resistance to change affect ERP implementation?
6. How does inability to achieve organizational understanding affect ERP implementation?
7. How do inadequate resources affect ERP implementation?
8. How does lack of top management support affect ERP implementation?
9. How does lack of organizational readiness affect ERP implementation?
10. How does inadequate training and education affect ERP implementation?
11. How do inaccurate expectations affect ERP implementation?
12. How does poor package selection affect ERP implementation?
13. How does poor project management affect ERP implementation?
14. How do customization issues affect ERP implementation?
15. How does long payback period affect ERP implementation?
16. How does poor communication and co-operation affect ERP implementation?
17. How do data quality costs affect ERP implementation?
18. How do hidden implementation costs affect ERP implementation?
19. How does improper integration affect ERP implementation?
20. How does improper operation or use affect ERP implementation?

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Chapter 21

ERP Implementation (Transition) Strategies

INTRODUCTION

Selecting and implementing a new ERP system and the process changes that go with it, is unquestionably a complex undertaking. Regardless of the size and perceived resources, an ERP implementation is not something that should be approached without a great deal of careful planning. Among companies that have been through a less than fully successful ERP implementation, five reasons for poor results show up consistently:

- The implementation or transition strategy chosen was not the one suited for the organization
- The implementation took much longer than expected
- Pre-implementation preparation activities were done poorly, if at all
- People were not well-prepared to accept and operate with the new system
- The cost to implement was much greater than anticipated

The most important factor that decides the success of an ERP implementation is the transition strategy. In this chapter, we will discuss the various transition strategies, their advantages and disadvantages, and the suitability of each of them.

TRANSITION STRATEGIES

An ERP implementation strategy determines how the ERP system will be installed. Different companies may install the same ERP software in totally different processes. The same company may implement different ERP software in the same approach. There are three commonly used methodologies for implementing ERP systems. There are several transition strategies but most of them are variants of the four basic types:

- Big bang
- Phased
- Parallel
- Process line
- Hybrid

These techniques focus on the strategy of how to make the transition from a legacy system to a new ERP system. ERP implementations all begin with the simple question—how do we make the transition from our legacy ERP system to the new ERP system? The selection of the transition strategy that is best suited for each organization is crucial as a wrong strategy can result in a failed or flawed implementation.

Three pillars—process, people, and technology—support any ERP implementation (see Fig. 21.1). Failure to use any one of these or failure to use them in the best possible manner can result in inappropriate implementation. Understanding the relationships of ERP transition strategies between the process, people, and technology will assist the ERP implementers to better understand what type

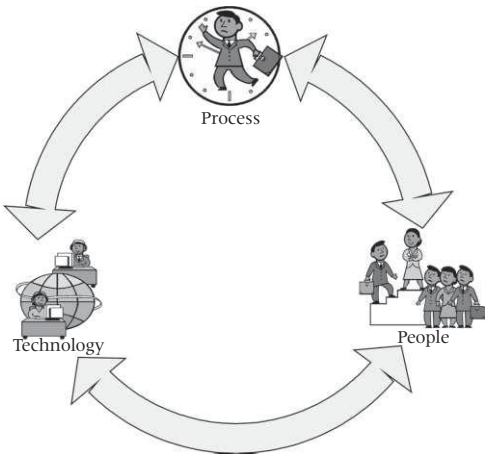

Figure 21.1 The three pillars of ERP implementation.

or combination of types of ERP transition strategy is best. We will now see each of these transition strategies in detail.

BIG BANG STRATEGY

In this strategy, companies layout a grand plan for their ERP implementation. The installation of ERP systems of all modules happens across the entire organization at once. The big bang approach promised to reduce the integration cost in conditions of thorough and careful execution. This method dominated early ERP implementations and it partially contributed to the higher rate of failure in its implementation.

Today, not many companies dare to attempt it. The premise of this implementation method is treating ERP implementation as a large-scale information system, which typically follows SDLC (systems development life cycle). However, an ERP system is much more than a traditional information system; in the fact that the implementation of ERP continuously calls for the realignment of business processes. Many parties involved in ERP software systems are not IT professionals. ERP more than automates existing business processes; it transforms the business processes.

In the big bang strategy, the company moves from the existing or legacy system to the new ERP system on a specific date (see Fig. 21.2). All the business functions performed in the legacy system across the entire enterprise are simultaneously transferred to the new legacy system during a period of one day or a weekend. The big bang strategy is seldom used and often not recommended by ERP vendors, systems integrators, and service providers. Many companies struggle in deciding whether the big bang approach is the right choice for their company.

One of the reasons given for not using the big bang approach is that it consumes too many resources to support the go-live of the ERP system. High failure rates have been found using the big bang approach, but high failure rates have also been found using other strategies. Success in using the big bang strategy comes with careful preparation and planning prior to using big bang. It is not a question of whether the big bang is a good approach for ERP systems. The success of the big bang strategy depends on how well an organization plans and prepares itself prior to implementation.

Large-scale scientific and technical projects requiring mass coordination are often successful as a result of careful preparation and sound planning. Large and complex projects such as building massive structures like bridges, skyscrapers, satellites, space shuttles, fighter planes, ships, etc.,

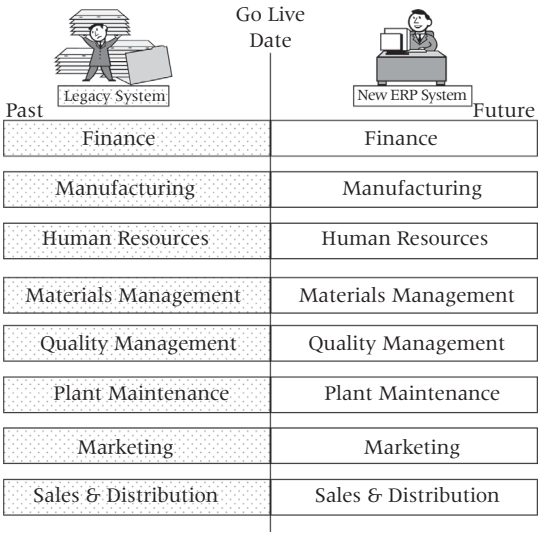

Figure 21.2 Big bang transition.

have been undertaken successfully in the past and also in the present. In all these projects, success depended on the amount of planning that went into the design and resource allocation. However, most of these projects are far more complex than implementing an ERP system in a company.

With careful planning and preparation, companies using the big bang strategy can be just as successful (if not more) as with any other approach. The big bang strategy offers advantages if properly used:

- The overall cost of implementation is less because no interface programs are required to communicate between the legacy system and the new ERP system
- Big bang eliminates all of the sequencing and decision-making of implementing one module at a time
- It is well-designed for rapid implementations
- It creates a strong central focus for all the ERP team members
- It can avoid complex integration issues

But there are disadvantages also. Some of the disadvantages of the big bang include:

- The amount of time and cost of careful planning and preparation for the go-live
- Bottleneck of critical resources, like lack of funds, non-availability of professionals, etc., during the implementation can result in failed implementations
- The recovery process, if something has gone wrong is more difficult in this approach; it is a do-it-right-the-first-time project
- The consequences of a failed implementation can range from anything such as a huge financial loss to the company going bankrupt

Big Bang Variants

There are several variants of the big bang strategy—mini big bang, mega big bang, multi big bang, etc. The *mini big bang strategy* (see Fig. 21.3) takes a single big bang approach and breaks it into

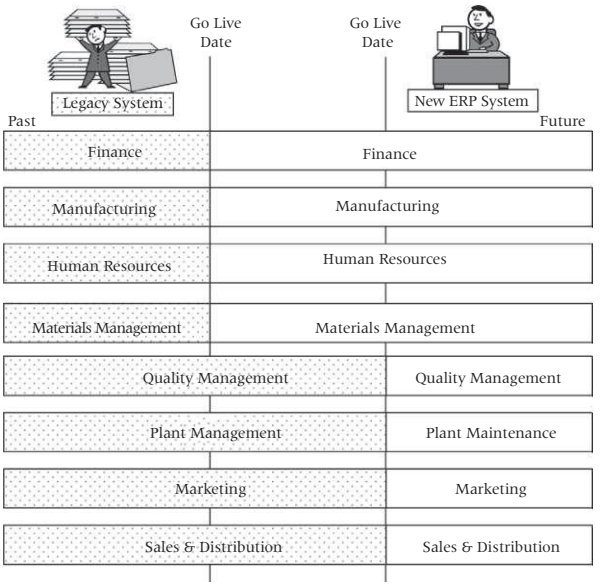

Figure 21.3 Mini big bang transition.

two or more sections. Each section consists of several software modules. Common sections, sometimes called suites, for a mini big bang strategy include financials, distribution, and manufacturing. For example, the distribution section would include purchasing, inventory, and sales. The mini big bang strategy contains some phasing but is still not considered a pure phased implementation. ERP providers, system integrators, and service providers often refer to the mini big bang strategy as a phased implementation. The mini big bang strategy tends to be quite popular with varying degrees of success.

The *mega big bang strategy* refers to a large company, with multiple sites, all going live at the same time using the big bang strategy. Some corporations have taken this approach as a 'do or die' motivator for lingering ERP projects. In situations like this, the senior management will issue a termination date for the legacy ERP in which all legacy ERP services will be terminated regardless of the readiness of any functional unit.

The *multi big bang strategy* uses multiple big bangs sequenced in order for different geographical facilities. This approach can be used for large corporations that have multiple facilities or divisions served by a centralized IT group. This group will help implement the new ERP system for one geographical location. After completion, they will move on to the next one and so on until they are all completed. In other cases, the multi big bang strategy will be used because different divisions of the corporation contain their own IT groups but still share the same software and hardware resources.

Big bang has application for several situations. It can be used in situations where an immediate ERP solution is needed, e.g. companies who need to go to the new ERP system immediately because their legacy ERP system has suffered a catastrophic malfunction such as physical destruction or database corruption. In general, the big bang approach seems to be better suited for smaller companies where all the critical resources of the project can fall within the immediate control of a project manager. The big bang strategy applies to any situation where a limited amount of time is available combined with an immovable go-live date. This was the situation faced by many companies just prior to the year 2000 as they raced to implement new ERP systems to replace their systems that were not Y2K complaint.

PHASED IMPLEMENTATION

The phased approach, shown in Fig. 21.4, implements one functional module at a time, in sequential order. The phased approach also goes by the names of modular, functional, and sequential. The method of modular implementation goes after one ERP module at a time. This limits the scope of implementation usually to one functional department. This approach suits companies that do not share many common processes across departments or business units.

Independent modules of ERP systems are installed in each unit while integration of ERP modules takes place at a later stage of the project. This has been the most commonly used methodology of ERP implementation. Each business unit may have their own 'instances' of ERP and databases. Modular implementation reduces the risk of installation, customization, and operation of ERP systems by reducing the scope of the implementation. The successful implementation of one module can benefit the overall success of an ERP project. The phased approach is shown in Fig. 21.4.

Interface programs are common in their use for the phased approach or any situation that contains phasing. These interface programs are required to bridge the gap between the legacy ERP system and the new ERP system until the new ERP system becomes fully functional. A good example is where the financial modules go live on the new ERP software, while the inventory module still remains active on the legacy ERP system. Through the use of interface and conversion programs, the financial activity that occurs in the inventory modules is exported to the new financial system in a format that can be understood by the new ERP system. Financial functions are usually implemented before distribution and manufacturing functions.

The phase approach is closely related to the big bang technique. The advantage of this approach is that:

- It allows companies to implement one functional module at a time before another is attempted
- Many companies feel more comfortable taking this stepping stone approach
- The total number of resources needed at any one given point in time may be less
- Additional flexibility may also be gained in the scheduling of people

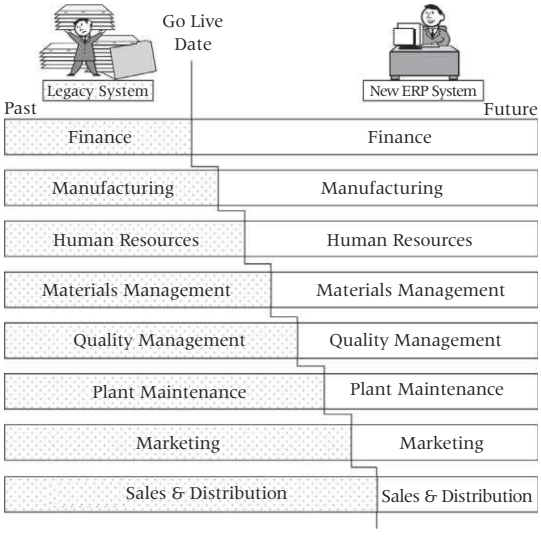

Figure 21.4 Phased ERP implementation.

There are disadvantages too. These are as follows.

- This approach needs a large amount of technical resources. Technical resources are usually needed in this kind of approach because of the conversion and interface programs that are required between the two ERP systems.
- The overall cost and time to implement is usually higher using this approach.
- Higher turnover rate can also be expected among key ERP team members because of the lengthy durations that usually accompany this approach.

The highly phased approach is often used in situations that lack strong centralized coordination in the ERP project. Without strong leadership and coordination in a project, the functional managers or assigned team leaders tend to take over the direction for their particular functional area. Because no one functional manager has more power than another, each is allowed to determine his or her own deadlines. The phased approach fits in well for this particular strategy; however, it does not necessarily generate higher success rates because of the good fit. Implementations that last a long time, greater than 18 months, usually use the phased approach. A variant of the phased approach includes the mini phased approach. In this case, two or more functional modules are combined into one sub-implementation for one single go-live date.

PARALLEL IMPLEMENTATION

The parallel approach keeps both the legacy system and the new ERP system active simultaneously for a length of time as shown in Fig. 21.5. The amount of time the systems are both in operation ranges from one day to several months. Portions of the same functional business areas (including software) such as finance, manufacturing, marketing, etc., are operating at the same time for both the legacy and ERP systems. The parallel approach can be thought of as another dimension to an ERP implementation strategy.

An advantage to the parallel approach is that it has good recovery options in case something goes wrong. Because both the legacy ERP system and the new ERP system operate at the same time for a particular module, the company's business processes will not get interrupted if the new ERP system malfunctions.

For any company a new ERP system represents a gigantic variable. Because of the high failure rates of ERP systems, the concept of running parallel to protect against implementation malfunction can provide a significant psychological cushion for the organization. The parallel approach also provides the most realistic number-to-number comparisons to validate that the new ERP system is performing the necessary business process flows. The parallel approach provides an exact number comparison in real-world conditions.

The parallel approach consumes considerably more resources than other techniques during the transition. All functional interaction with the legacy system must also be duplicated exactly in the new ERP system. Confusion often erupts when people do not interact with both systems in exactly the same way. This is often detected upon inspection of ending period balances when they are found to be different. Once errors are detected, the process of investigation begins to determine whether the differences resulted from the new ERP system not functioning properly or the users not interacting with the new system correctly. Of course, there is always the situation where people were interacting with the new ERP system correctly and not interacting with the old ERP system properly. This process of investigation to determine where the error occurred often exceeds an ERP team's resources during a go-live situation.

The parallel approach is ideally suited for mission critical situations that cannot survive a major malfunction of an ERP system. It also works well for business environments that require the utmost

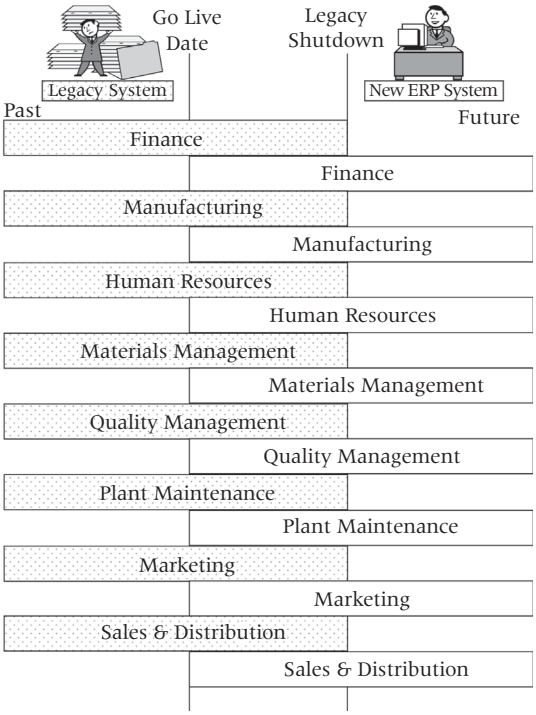

Figure 21.5 Parallel ERP transition strategy.

in stability of an ERP system such as financial (banking and insurance), pharmaceutical, or medical companies.

The parallel approach does not work well in situations where the legacy system has an expiration limitation that is within the needed amount of time for the system to operate in parallel mode. A classic example of this was the year 2000 situation. Because many legacy ERP systems had fatal year 2000 programming flaws, they could not continue beyond December 31, 1999, their expiration date. It would of course, be impossible to run in parallel mode beyond this date.

PROCESS LINE TRANSITION STRATEGY

The process line strategy (see Fig. 21.6) is conceptually similar to the mini big bang; however, it breaks the implementation strategy to manage parallel business process flows or product lines. An example includes a company making two products where both products are manufactured in the same plant and a few resources are shared between them.

The process-oriented implementation focuses on the support of one or a few critical business processes, which involves a few business units. The initial customization of the ERP system is limited to functionality closely related to the intended business processes. The process-oriented implementation may eventually grow into a full-blown implementation of the ERP system. This approach is utilized by many small to mid-sized companies, which tend to have less complex internal business processes.

Using the process line strategy, the first product line and all related resources go first in making the transition from the legacy system to the new ERP system. Once this transition is achieved successfully, the second product line is moved from the legacy system to the new ERP system.

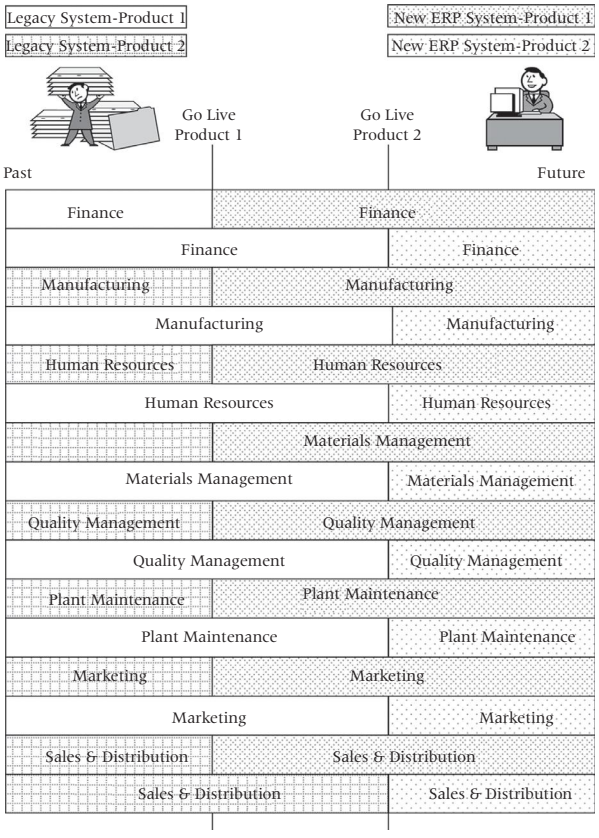

Figure 21.6 Process line transition strategy.

While using the process line strategy, the smaller process lines, which pose less risk and have a higher probability of success, usually go first. This initial success victory helps to build organizational trust in the new ERP system, increasing its overall probability of success. Upon completion of the first process line, resources are then loaned to the more difficult and challenging process lines. This same concept can be applied for service organizations except that it would be implemented along focused service lines instead of product lines.

HYBRID TRANSITION STRATEGY

The hybrid strategy is a combination of the process line, phasing, and parallel transition strategies. Hybrid strategies are seldom predicted precisely at the beginning of an ERP implementation. They tend to evolve into the needed configuration as ERP team members learn and analyze information. The complexity of a hybrid strategy varies tremendously depending upon the situation. Small single site ERP implementations tend to have simpler hybrid strategies than those used by large multinational corporations with different geographical locations.

The concept of a hybrid strategy is not necessarily fixed over the implementation of an ERP system. It can and often does, change as people learn more about the software and project scope changes. Many implementations use hybrid strategies because they are flexible in adapting to the specific needs of the situation. By using a hybrid strategy, organizations can fine-tune implementation for their needs.

ERP team members often find it difficult to learn to adjust to hybrid implementations. A great deal of communication is required, combined with strong leadership, for these to be effective. Without intensive communication, ERP team members can quickly become hopelessly lost in the project.

CHOOSING A STRATEGY

The factors that could cause a company to choose one ERP strategy over another are: technical resource availability, number of users, consultant availability, structure of ERP team, deadlines, reliability, and hardware resources.

If you are going to develop a global process model for your company, then a big bang approach is extremely beneficial. You can concentrate all needed expertise within one location and build a so-called competence center. Once you develop a roll out kit, containing work instructions, training material, plan of approach, detailed planning, templates, example deliverables, standard/customized software components, parameter setting, chart of accounts, hardware requirements, etc., you will see dramatic lower implementation costs, much quicker implementation, and stop local sites from re-inventing the wheel.

Panorama Consulting Solutions [1] conducted a study in 2102 on the ERP implementation approaches. According to the study, one factor that impacts employee buy-in is the determination of how exactly the ERP system will be implemented. The 'big-bang' approach implies all modules 'go-live' at the same time in all locations. This approach forces all employees to use the new system with no opportunity to fall back on the old one and often results in temporary business disruptions. The phased approach in which the companies implement modules across multiple locations or departments at different times can help avoid business disruptions but also may create some resistance to change within departments.

According to survey results, 34% of companies used a 'big bang' approach when implementing their ERP system, while 47% used some type of phased approach during their ERP implementation, and 20% used a hybrid approach (Fig. 21.7). Phased approaches are the most common and provide companies the opportunity to implement gradually across different locations and departments to minimize business disruption and address organizational changes one phase at a time instead of all at once.

Another factor to consider is the software cutover or changeover approach. A hard cutover approach provides means moving from the old system to the new system on the 'go-live' date with

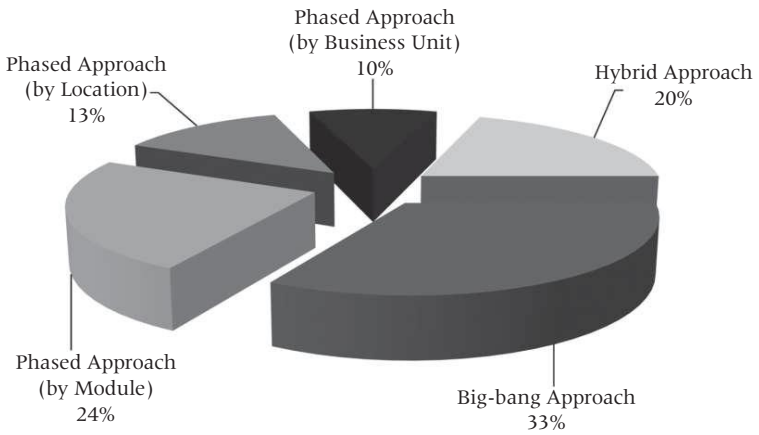

Figure 21.7 ERP implementation approach.

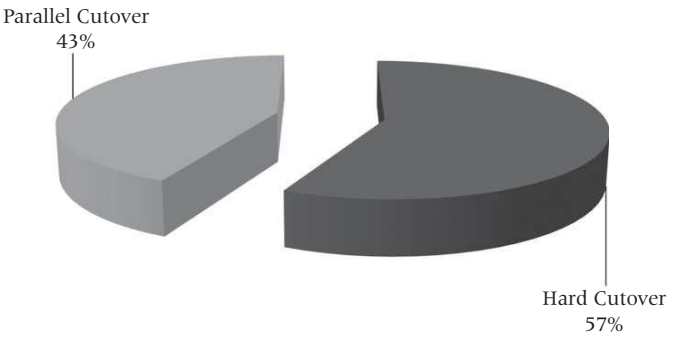

Figure 21.8 ERP cutover approaches.

no access to the old system thereafter. This approach pushes employees into acceptance of the new system, but can also create frustration within the organization if the end-user training and employee orientation is not done properly. A parallel cutover approach keeps both new and old systems for a certain period of time. The employees can access the old system after 'go-live' date for a certain duration when the old system will be shut down. This while providing reassurance to the resistant employees can also create problems if they continue to use the old system and refuse to use the new one. According to the Panorama survey, 57% of companies use a hard cutover approach, while 43% used a parallel cutover approach as shown in Fig. 21.8.

All approaches present change management challenges and require management to take specific actions like employee orientation, employee reassuring measures, and proper end-user training and constant monitoring to minimize disruption to the business, and facilitate a successful ERP implementation.

SUMMARY

An ERP transition strategy determines how the ERP system will be installed. There are several transition strategies, but most of them are variants of the four basic types—big bang, phased, parallel, process line, and hybrid.

In the big bang strategy, the company moves from the existing or legacy system to the new ERP system on a specific date. All the business functions performed in the legacy system across the entire enterprise are simultaneously transferred to the new legacy system during a period of one day or a weekend. The phased approach implements one functional module at a time in sequential order. The parallel approach keeps both the legacy system and the new ERP system active simultaneously for a length of time. The process line strategy is conceptually similar to the mini big bang; however, it breaks the implementation strategy to manage parallel business process flows or product lines. The hybrid strategy is a combination of the process line, phasing, and parallel transition strategies. Hybrid strategies are seldom predicted precisely at the beginning of an ERP implementation.

The factors that could cause a company to choose one ERP strategy over another are: technical resource availability, number of users, consultant availability, structure of ERP team, deadlines, reliability, and hardware resources.

REVIEW QUESTIONS

1. What are the reasons for the less than fully successful ERP implementations?
2. Why it is important to select the right implementation strategy?

3. What are the different implementation strategies?
4. What is the big bang approach? What are its advantages and disadvantages?
5. What are the variants of the big bang approach?
6. What is the phased approach? What are its advantages and disadvantages?
7. What is the parallel approach? What are its advantages and disadvantages?
8. What is the process line approach? What are its advantages and disadvantages?
9. What is the hybrid approach? What are its advantages and disadvantages?
10. Discuss how you will choose an implementation strategy.

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Chapter 22

ERP Implementation Life Cycle

INTRODUCTION

We have seen that the ERP system integrates all the departments of the organization thus allowing free and seamless flow of information across departmental boundaries. The top management should be convinced about the need and importance of having an ERP system. Also, the people who will be using the system—the managers, supervisors, employees, company management, and so on—should be made aware of the benefits of a good ERP system. The benefits of ERP as discussed in Chapter 7 could be used for this purpose.

ERP systems are capable of delivering dramatic productivity improvements and cost reductions. It can improve customer goodwill because the company will be able to provide customers with better quality products and better technical and after sales support. By educating employees on the benefits and values of ERP, the myths about ERP such as 'ERP will make your job redundant', 'ERP is additional work', etc.—are dispelled and the need for ERP would become obvious. Also, today's ERP tools are so sophisticated and advanced that they make the whole process of performing the organization's functions much easier than before.

There is a misconception that ERP is only for big companies. This author's experience is that companies, which use scientific methods for product development, automated tools for production planning and software packages for accounting and inventory management from the very beginning—that is, even when they are small—have a workforce and work culture that is more willing and able to learn new technologies and adapt to changes and implement new procedures. The employees and managers of these companies have become used to advanced production and engineering practices and procedures, and the work cultures of these companies evolve around these practices. New employees joining the company will also follow the procedures and methods because peer pressure will be high.

The advantage of this scenario is that the methodologies and procedures will produce dramatic results in such companies as people are doing things because they believe in them and not because they have to do it. For example, consider ERP. Everyone knows that ERP is not easy; it is difficult to keep a good ERP system (a system that is efficient and effective) up and running. However, the effort is worth it. However, if an ERP system is to become a success and deliver the promised results, the people who are involved have to be convinced of its worth. Just doing ERP for the sake of getting some certification or to impress the customers will not produce the results that it is capable of.

The purpose of this chapter is to explain the objectives and phases that make the life cycle of an ERP system from conception to retirement, and how these events may be sequenced. The organizational culture and the nature of projects will be different from company to company. Thus, two ERP implementations can never be identical; they will vary depending on the size, nature of projects, complexity of projects, development methodology, organizational culture, etc. The objectives, the different phases, the sequence of these phases, and other details of the ERP implementation will vary greatly from organization to organization.

It is important for the company management, project leaders, consultants, employees, ERP implementation team members, and other stakeholders to have a good understanding of the large-scale

conceptual picture of ERP and ERP implementation. Without the capability to understand the bigger picture, ERP practitioners can become lost. It is important to have a solid foundation for understanding the overall picture so that practitioners can understand the details of what they deal with on a day-to-day basis and how it relates to the rest of the project and impacts on the rest of the organization.

There are two basic characteristics common to all ERP implementation projects—objectives and phases (or events).

OBJECTIVES OF ERP IMPLEMENTATION

Objectives are the major high-level characteristics that can have a great impact upon the success of an ERP project. The objectives include characteristics such as:

- Speed
- Scope
- Resources
- Risk
- Complexity
- Benefits

Speed

The speed of a project is directly related to the amount of time that a company has before the completion of the ERP implementation or the amount of time that it would like to take for the implementation. The speed of the project in this context is how much time the company would like to take in implementing the system. The amount of time that the company actually takes may be dramatically different. The amount of time that the company would like to take should be the figure used when developing a project plan.

Scope

The scope of the project includes all of the functional and technical characteristics that the company wants to implement. A company installing a full-fledged ERP system would have a much greater scope than a company installing a few modules.

Resources

Resources are everything that is needed to support the project. This includes people, hardware systems, software systems, technical support, and consultants. All the resources of an implementation have one thing in common—money.

Risk

The risk of a project is a factor that impacts the overall success of the ERP implementation. Success is measured by factors such as overall user acceptance, return on investment (ROI), time to implement, etc. High-risk situations are less likely to possess these characteristics.

Complexity

Complexity is the degree of difficulty of implementing, operating, and maintaining the ERP system. Companies of different sizes, business environments, and organizational cultures have different

levels of complexity. A multinational corporation that has production facilities and teams spread across different parts of the world and working in different time zones is generally much more complex than a company with 50 employees occupying one geographical location.

Benefits

Benefits are the extent to which the company will utilize functionality of the ERP system for software development, maintenance, and other support activities. ERP tools automate almost all aspects of the organization's activities; they make the job of the employees, managers, and other stakeholders easy and improve the development productivity. To get the maximum benefit out of an ERP implementation, the system should be built around the product design, development, and production processes and organizational procedures followed by the organization. Better integration of the ERP system with the product design, development, and production will result in high-quality products, reduction in number of defects, faster problem resolution, quicker incorporation of enhancements, better customer service, etc. which leads to improved customer satisfaction and goodwill. This will result in satisfied customers and improved brand image, which will lead to an increase in market share and profits.

Each of these objectives can be rated on a scale from low to high. Interrelationships exist between the different objectives. For example, companies that attempt to install an ERP system with low resources, high complexity and at high speed would place themselves at high risk. Re-adjusting risk to a low value would cause other objectives to change their value, based on other factors such as complexity. In addition to the interrelationships there exist various dependencies between the objectives. A good example of such a dependency is between speed and risk of the ERP implementation. A quickly implemented ERP system tends to be at higher risk than one implemented at a slower pace, taking the necessary precautions. When deciding on an ERP implementation plan, the various objectives, their interrelationships, and dependencies should be taken into consideration.

DIFFERENT PHASES OF ERP IMPLEMENTATION

Like any other project, the ERP implementation project also has to go through different phases (see Fig. 22.1). There are no clear demarcating lines between these phases, and in many cases one phase will start before the previous one is completed. However, logical order is followed. Also, all the phases that we are discussing in this session may not be applicable in all cases. For example, in some cases, the organization must have already identified a particular package; then the pre-selection screening and package evaluation phases are not done. The different phases of the ERP implementation are given below:

- Pre-evaluation screening
- Package evaluation
- Project planning phase
- Gap analysis
- Reengineering
- Customization
- Implementation team training
- Testing
- Going live
- End-user training
- Post implementation

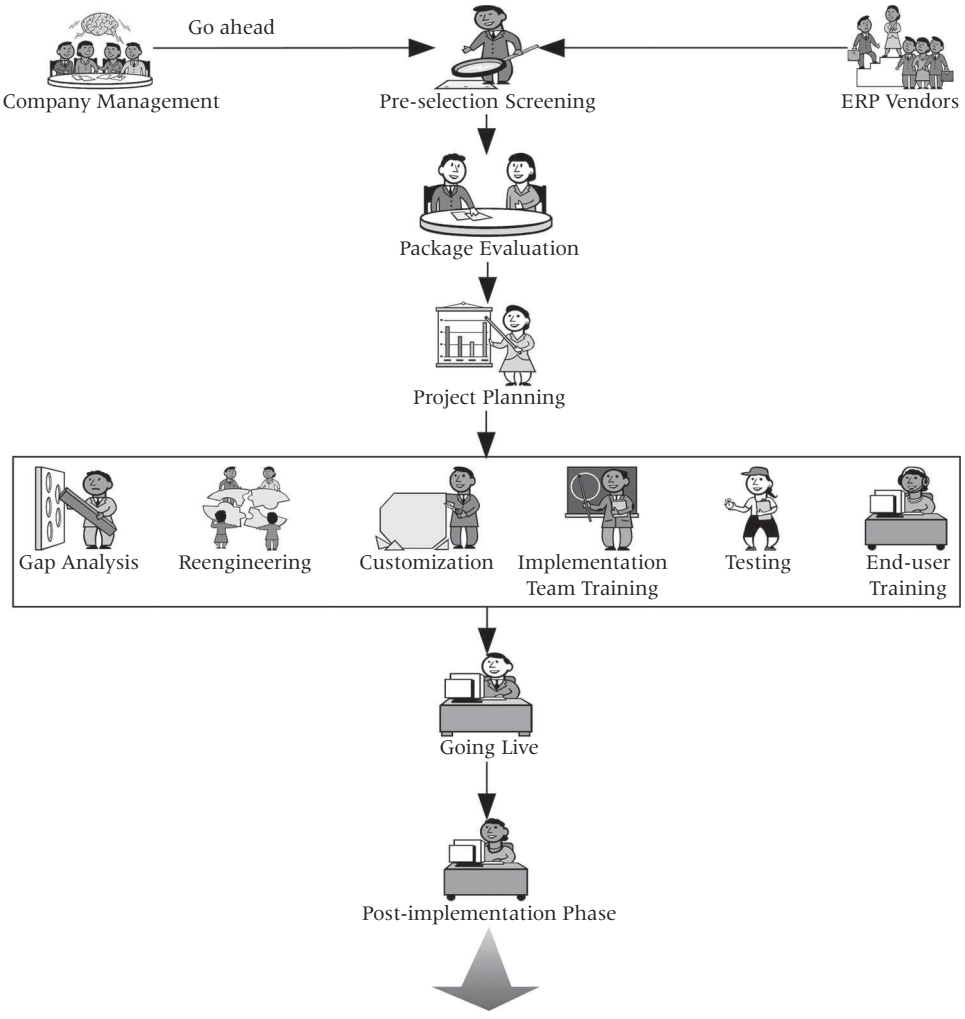

Figure 22.1 ERP implementation life cycle—different phases.

Although these phases may seem very linear and distinct from each other, in reality, the phases are in fact quite fluid throughout an actual implementation. In many cases, companies go through many implementations—in different business units, different modules, or manufacturing locations. Thus at any given time, more than one of the phases may be operational. Some companies opt for the one and only 'big bang', while other companies favor sequential rollouts—each company has different needs. However, whether it is the 'big bang' method or sequential rollout, the life cycle phases are the same.

Pre-evaluation Screening

Once the company has decided to go in for the ERP system, the search for the perfect package starts. However, there are hundreds of ERP vendors—of all sizes and shapes—all claiming to have the solution that is ideal for you. Analyzing all the packages before reaching a decision is not a viable solution. It is also a time-consuming process. Thus, it is better to limit the number of packages that

are evaluated to less than five. It is always better to do a thorough and detailed evaluation of a small number of packages, than to do a superficial analysis of dozens of packages. Therefore, the company should do a pre-evaluation screening to limit the number of packages that are to be evaluated by the committee.

Not all packages are equal—each has its own strengths and weakness. The pre-evaluation process should eliminate those packages that are not suitable for the company's business processes. One can zero in on the few best packages by looking at the product culture of the vendors, getting help from external consultants, and most importantly finding out what package is used by similar companies. It is always better to look around to find out how the different packages are performing in environments similar to yours.

If one studies the history of the ERP packages and finds out how each package evolved, then it soon becomes evident that every ERP package grew out of the experience or opportunity of a group of people working in a specific business who created systems that could deal with certain business segments. It is generally accepted that most ERP packages are stronger in certain areas than in others and each one is trying hard to add functionality in areas where they have been lacking. For example, PeopleSoft is strong in HR and less so in manufacturing; Baan, on the other hand, is historically stronger in manufacturing than in financial, and so on.

The ERP packages evolved over time as the companies grew. The experience gained from implementation, the feedback by users, the need to enter into new markets, and pressure from competitors forced most ERP vendors to re-define and expand the scope of the activities and functionality of their products. The concepts were expanded upon, new functions were introduced, good ideas were copied from others, and so on. However still, each package has a history (or origin) that determines the type of business it is best suited for.

Therefore while making the analysis it is a good idea to investigate the origins of the different packages. Now, almost all packages cater to all business and service sectors. It would be wrong to say that a system that was developed initially for manufacturing is not capable of catering to the needs of another business sector, e.g. software development. The system must have been thoroughly re-vamped and re-designed to meet the needs of the diverse business sectors that it is catering to. However, it should be remembered that many ERP packages are still very good in some areas, even though they are capable of catering to the needs of other sectors.

Once you select a few packages after the screening, you can start the detailed evaluation process.

Package Evaluation

The evaluation/selection process is one of the most important phases of the ERP implementation because the package that you select will decide the success or failure of the project. Since ERP systems involve huge investment, once a package is purchased it is not an easy task to switch to another. Thus, it is a 'do-it-right-the-first-time' proposition and there is no room for error.

The most important factor that should be kept in mind when analyzing the different packages is that none of them are perfect. The idea that there is no perfect package needs to be understood by everyone in the decision-making team. The objective of the selection process is not to identify a package that covers each and every requirement (a perfect fit). The objective is to find a package that is flexible enough to meet the needs of the company, or in other words, software that could be customized to obtain a 'good fit'.

Thus, once the packages to be evaluated are identified, the company needs to develop the selection criteria that will permit evaluation of all the available packages on the same scale. To choose the best system, the company should identify the one that meets the business needs, matches the business

profile, and identifies with the business practices of the company. It is impossible to get a system that will perform exactly as the company does business, but the aim should be to get the system that has the least number of differences. Some important points to be kept in mind while evaluating ERP software include:

- Functional fit with the company's business processes
- Degree of integration between the various components of the ERP system
- Flexibility and scalability
- Complexity
- User friendliness
- Quick implementation
- Ability to support multi-site planning and control
- Technology—client/server capabilities, database independence, security
- Availability of regular upgrades
- Amount of customization required
- Local support infrastructure
- Availability of reference sites
- Total costs including cost of license, training, implementation, maintenance, customization, and hardware requirements

It is always better to entrust on a selection or evaluation committee that will do the evaluation process. This committee should comprise of people from the various departments (the functional experts), top management (preferably the CIO or COO), and consultants (package experts). The selection committee should be entrusted with the task of choosing a package for the company. Since all business functions are represented and the management is involved, the package that is selected will have company-wide acceptance. The package experts or the consultants can act as mediators or play the role of explaining the pros and cons of each package.

Project Planning Phase

This is the phase that designs the implementation process. It is in this phase that the details of how to go about the implementation are decided. Time schedules, deadlines, etc., for the project are arrived at. The project plan is developed. Roles are identified and responsibilities are assigned. The organizational resources that will be used for the implementation effort are decided and the people who are supposed to head the implementation are identified. The implementation team members are selected and task allocation is done. This phase will decide when to begin the project, how to do it, and when the project is supposed to be completed. This is the phase which will plan what to do in case of contingencies; how to monitor the progress of the implementation, what control measures should be installed and what corrective actions should be done when things get out of control. A committee constituted by the team leaders of each implementation group usually does the project planning. The committee will be headed by the ERP in-charge (usually the CIO or COO). It will meet periodically (during the entire implementation life cycle) to review the progress and chart the future course of actions.

Gap Analysis

This is arguably the most crucial phase in the success of the ERP implementation. Put very simply, this is the process through which companies create a complete model of where they are now and

where they want to be headed. The trick is to design a model, which both anticipates and covers any functional gaps. It has been estimated that even the best ERP package, customized to a company's needs meets only 80% of the company's functional requirements.

The remaining 20% of these requirements present a problematic issue for the company's BPR. One of the most affordable, albeit painful, solutions entails altering the business to 'fit' the ERP package. Of course, a company can simply agree to live without a particular function (the cheap but annoying solution). Other solutions include:

- Pinning your hopes on an upgrade (low cost but risky)
- Identifying a third-party product that might fill the gap (hopefully it also partners with the ERP packages, keeping interfacing to a minimum)
- Designing a custom program
- Altering the ERP source code (the most expensive alternative; usually reserved for mission-critical installations)

Reengineering

It is in this phase that human factors are taken into account. In ERP implementation settings, reengineering has two different connotations. The first connotation is the controversial one, involving the use of ERP to aid in downsizing efforts. There have been occasions where high-level executives have invoked the reengineering slogan and purchased an ERP package with the aim of reducing significant numbers of employees. While every implementation is going to involve some change in job responsibilities, as processes become more automated and efficient, it is best to treat ERP as an investment as well as a cost-cutting measure, rather than as a downsizing tool. 'Downsizing' is a business practice that may have its place but it should not be cloaked within the glossier slogan of reengineering or justified by the purchase of an ERP package. ERP should engender business change but should not endanger the jobs of thousands of employees.

The second use of reengineering in the ERP field (or business process reengineering (BPR) as it is usually called), refers to an ERP implementation model initially designed and used with much success by the major ERP consulting firms. The BPR approach to an ERP implementation implies that there are really two separate but closely linked implementations involved on an ERP site: a technical implementation and a business process implementation. The BPR approach emphasizes the human element of necessary change within organizations. This approach is generally more time-consuming and has received its share of criticism for creating bloated budgets and extended projects. However, adherents of the BPR approach to ERP would argue that there is no way that you can ignore the human element to an implementation that involves significant changes in responsibilities. As the ERP market shifts to a mid-market focus and as all implementations are becoming more cost-sensitive, the BPR approach has come under some real scrutiny.

Customization

This is the main functional area of the ERP implementation. There is a bit of mystique around the customization process and for good reason; the Holy Grail of ERP implementation is synchronizing existing company practices with the ERP package. In order to do so, business processes have to be understood and mapped in such a way that the solutions arrived at match up with the overall goals of the company. However, companies cannot just shut down their operations while the mapping processes take place. Hence the prototype—a simulation of the actual business processes of the company—will be used. The prototype allows for thorough testing of the 'to be' model in a controlled

environment. As the ERP consultants configure and test the prototype, they attempt to solve any logistical problems inherent in the BPR before the actual go-live implementation.

Configuring a company's system reveals not only the strengths of a company's business process but also—and perhaps more importantly—its weaknesses. It is vital to the health of the company and to the success of the ERP implementation that those configuring the system are able to explain what will not fit into the package, where the gaps in functionality occur. For example, a company might have an accounting practice that cannot be configured into the system or some shipping process that will not conform to the package. The company obviously needs to know which processes have to change in the process of implementation. Finding out what will work and what won't requires a knowledge of the business process itself and an ability to work with people throughout the company. Thus, people with such skills should be assigned to these tasks. As a rule, in most large implementations, the functional customizations are split between the different areas within the company, thus some will attend to HR, some will be involved in financials, and so forth.

ERP vendors are constantly striving to lower customization costs. Strategies currently being pursued include automation and pre-customization. SAP, for instance, has pre-configured industry-specific templates that can be tweaked for each individual company (Accelerated SAP or ASAP Solutions). Sage MAS 500 ERP system provides a set of customization tools which includes a software development kit and a customizer. Similarly, almost all the ERP vendors offer some tools that automate at least some part of the customization process. Many third-party companies offer customization tools to make the task of customization as easy as possible.

The current ERP industry push toward developing the mid-range market in turn creates an added incentive to reduce costs, encouraging the sought after mid-range companies to feel they can afford to implement a top-of-the-line ERP package. By creating a custom pre-configured ERP module for a particular industry—say a shoe manufacturing software prototype created for a shoe manufacturer—the need for hands-on custom customization is reduced, thereby keeping the costs down. The hope is that a kind of 'question and answer' format can be used to find out the kinds of business process information hitherto addressed through the hands-on customization process. In theory, these pre-configured tools should save time and money but every business is unique and at least some customization is unique to each project.

Implementation Team training

Around the same time that the customization is taking place, the implementation team is being trained, not so much on how to use the system, but how to implement it. This is the phase where the company trains its employees to implement and later run the system. The ERP vendors and the hired consultants will leave after the implementation is over. However, for the company to be self-sufficient in running the ERP system, it should have a good in-house team that can handle the various situations. Therefore it is very vital that the company recognizes the importance of this phase and selects employees with the right attitude—people who are willing to change, learn new things, and are not afraid of technology—and good functional knowledge.

Testing

This is the phase where you try to break the system. You have reached a point where you are testing real case scenarios. The system is configured and now you must come up with extreme case scenarios—system overloads, multiple users logging on at the same time with the same query, users

entering invalid data, hackers trying to access restricted areas, and so on. The test cases must be designed specifically to find the weak links in the system and these bugs should be fixed before going live. Some of the different types of testing employed are:

- **Unit testing:** Testing the new and additional features in isolation to make sure that the subsystem or unit works as expected.
- **Integration testing:** Testing end-to-end business processes including customizations, enhancements, and interfaces to external systems.
- **Acceptance testing:** Testing done by the users working with real data to find out whether the system is functioning as expected and to find out any problems that the users of the system have about the systems functionality or usability.
- **Security testing:** Testing the user roles, access privileges, authorizations, and other security measures that are set up to ensure the security of the system. The objective of this testing is to find the loopholes or weaknesses in the system's security and fix if there are any.
- **Performance and stress testing:** Testing done to find out whether the system is able to perform as expected under normal business loads and also at huge increase in the transaction volumes—something that can happen in real life. The system should not fail when there is a spike in the transaction volume, and if that happens it must be fixed. Inability to handle occasional spike in transaction volumes (e.g. sudden increase in transactions due to holiday sales) can create a lot of problems including lost sales and customers. These situations, if occurs, should be fixed.

Going Live

This is the phase where ERP is made available to the entire organization. On the technical side, the work is almost complete: data conversion is done, databases are up and running; and on the functional side, the prototype is fully configured and tested and ready to go operational. The system is officially proclaimed operational even though the implementation team must have been testing it and running it successfully for some time. But once the system is 'live' the old system is removed and the new system is used for doing business.

End-user training

This is the phase where the actual users of the system will be given training on how to use the system. This phase starts much before the system goes live. The employees who are going to use the new system are identified. Their current skills are noted and they are divided into groups based on their current skill levels and based on this, training is imparted on the new system. This training is very important as the success of the ERP system is in the hands of the end-users. Therefore, these training sessions should give the participants an overall view of the system and how each person's actions affect the entire system. In addition to these general topics, each employee is trained on the job or task that he/she is supposed to perform once the system goes live. It is human nature to resist change. Also many people are afraid of computers and other new technologies. Hence, there will be resistance to change. Another factor is that not all people will be successful in making the changeover. The company management should address these concerns and should take necessary actions to avoid failure. End-user training is much more important and much more difficult (since most end-users are not thrilled at having to change) than the implementation team training. Companies are beginning to take this phase seriously as there is now statistical evidence, which shows that most implementations fail because of a lack of end-user training.

Post implementation (Operation and Maintenance)

Once the implementation is over, the organizations enter the operation and maintenance phase (O&M). O&M phase begins with a period of initial struggle until people become comfortable in their roles and tasks. The duration of this stage depends on how effective the training was. If the training given to the employees was efficient and effective, the initial teething problem will be overcome soon and the system becomes stable. According to many ERP experts and consultants, the period required for the stabilization varies between 3 and 9 months, and during this period one can expect a dip in performance due to the continued training needs and fine tuning of the processes.

One important factor that should be kept in mind is that the post-implementation phase is very critical. Once the implementation is over the vendors and the hired consultants will leave. To reap the full benefits of the ERP system, the system should get enterprise-wide acceptance. There should be enough employees who are trained to handle the problems that might crop up. There should be people within the company who have the technical prowess to make the necessary enhancements to the system as and when required.

The system must be upgraded as and when new versions or new technologies are introduced. Here, the organization should think in terms of the incremental benefits of the new enhancements because with any upgrade or enhancements, there will be a lot of other aspects like user training that have to be considered. Therefore, instead of going in for upgrade as and when a new version is announced by the vendor, the organization should first analyze the costs and benefits.

Maintenance activities also will start shortly after implementation and operation. The annual maintenance costs should be budgeted during the planning phase itself. The annual maintenance costs will come to about 20% of the ERP implementation costs. A system upgrade can cost as much as 25–33% of the implementation cost. The maintenance activities include preventive maintenance (regular maintenance to keep the system functioning properly), emergency or unscheduled maintenance (maintenance done to prevent some damage from occurring to the system or data), breakdown maintenance (maintenance performed to correct some problem that have caused the system to stop functioning), and system updates (applying the patches, bug fixes, etc., provided by the ERP vendor).

The post-ERP organization will need a different set of roles and skills than those with less integrated kinds of systems. At a minimum, everyone who uses these systems needs to be trained on how they work, how they relate to the business process, and how a transaction ripples through the entire company whenever they press a key. The training will never end; it is an ongoing process; new people will always be coming in and new functionality will always be entering the organization.

Just as courtships and honeymoons are different from marriages, living with ERP systems will be different from installing them. Projects for implementing the systems get a lot of resources and attention, but it is how the organization lives with ERP systems that have more to do with the value that one receives from them rather than the quick decisions made during installation.

WHY DO MANY ERP IMPLEMENTATIONS FAIL?

We have seen the different objectives, phases, and strategies for implementing an ERP system. Yet, many ERP implementations fail miserably during the initial stages of the operational phase itself or fail to deliver the promised benefits. Why does this happen? Given below are some of the most common reasons:

- Lack of top management buy-in, commitment, and support
- Improper planning and budgeting

- Use of wrong ERP tools
- Lack of training
- Work culture of the organization

Lack of Top Management Buy-in, Commitment, and Support

One of the most common reasons for a failed implementation is lack of top management support and backing. The top management must be clearly convinced about the importance of ERP and how ERP could be used as a competitive weapon and how the company can fail if an ERP system is not available to manage and control the business operations. If the management is aware of the potential benefits of ERP and dangers of not having an ERP system, it will give the full backing and necessary organizational resources to implement the best system possible. When the employees know that the ERP implementation has full management backing, they will also want the system to succeed. There will be a lot of issues like change of procedures, reassignment of employees, etc., when the ERP system is implemented. If the management can assure the employees that their jobs are secure, that assurance will go a long way in ensuring employee co-operation. The top managers should also talk to the employees regarding the benefits of the ERP system and how the company can get ahead of the competition by reaping the benefits of the system.

Improper Planning and Budgeting

Before starting the ERP implementation project, detailed planning involving all the major stakeholders is necessary for the success of the project. It is during this phase that the decisions regarding procedures to be followed, tool to be bought, the budget to be allocated for implementation and maintenance, etc., are decided. If this planning is not done properly, then there is every chance that many factors would be overlooked resulting in selecting the wrong tool, insufficient funds, inadequate team members, and so on. All these can lead to failure of the project. In order to avoid this, the planning phase should be taken very seriously and meticulous research should be done before taking any action. Also, there should be a provision in the plan to revise and update it as the implementation progresses.

Use of Wrong ERP Tool

We have seen that no two organizations are the same and each organization requires an ERP tool that is best suited for its organizational environment, work culture, and procedures. Thus, the ERP planning team should take into account all these factors before deciding on a tool. They should research the available tools, match them with the organization's requirements, visit companies where the tools are installed to see them in action, should discuss about end-user training, tool updates and upgrades, and so on. Only when all the members of the team are convinced that a specific tool is best suited for the organization, the purchasing decision must be taken. Never rush the purchasing decision; the time spent on researching and analyzing before the purchase is worth the effort.

Lack of Training

One of the main reasons ERP fails is due to the resistance of the users. This is often the result of ignorance and fear—ignorance about the tool and fear of additional work or unemployment. These factors can be corrected by giving proper training. Training should be given at different levels on different aspects of the ERP implementation. The top management should address the employees' fear of losing their jobs, as the tool automates many tasks. They should also pledge their allegiance to

the ERP system and should make it clear to the employees that the ERP system is essential for the success of the organization in this highly competitive business environment. The ERP implementation team members, tool vendors, and external consultants should explain the objectives and goals of the ERP system, the advantages on a day-to-day basis, how it reduces re-work and defects, and so on. Most users think of ERP as a system that creates more procedures and restrictions. Such myths about ERP should be de-bunked. The ERP tool vendors and external consultants along with the in-house experts should train the users in how to efficiently use the tool and should explain to them how the ERP tools make their lives easier and help them create high-quality products without chaos and confusion. Once the users are convinced about the potential of the ERP system, the system will succeed; without user buy-in, even the best ERP system will fail.

Work Culture of the Organization

The work culture of the organization is very important for the success of ERP. If the organization has a workforce that is willing to learn new things and change to new technologies, then there will be no problems for ERP implementation. However, if the employees resist change and see the introduction of formal methods as a means to assign accountability, they will perceive the new technology as something negative. Therefore the basic mindset of the workforce needs to be changed. This is important not only for the success of ERP but also for the success of any process improvement initiative. In changing the employee mindset, the two critical factors required are top management support and proper training.

SUMMARY

ERP implementation needs to change the way people have been doing things and lots of procedures are introduced for the functioning of ERP. Resistance to ERP implementation is natural because it is human nature to resist change. Making people accept ERP and implementing it is difficult because of the myths surrounding ERP, such as ERP causing additional work and elaborate documentations.

Most people are not aware of the potential benefits of ERP. For the ERP system to succeed and deliver those benefits, the organization has to design a good system, install procedures, and train the ERP team and project team. Once these tasks are done there is a natural tendency to feel satisfied or complacent—complacency about what has been achieved by the implementation team.

One important factor that should be kept in mind is that the post-implementation phase is very critical. ERP functions are continuous and should be performed throughout the life cycle of the project. To reap the full benefits of the ERP system, it should get project-wide/company-wide acceptance. To get project-wide acceptance for the ERP system, every member of the project should be made aware of the need, importance, and benefits of ERP.

Just as courtships and honeymoons are different from marriages, living with an ERP system is different from installing it. Implementing a good ERP system is not an easy job but it is how the projects mesh with the ERP system that determines the value that is received from it. It is how the ERP system is used in the project that makes the difference. Even a well-designed system can be a failure if the people using it are not co-operative.

REVIEW QUESTIONS

1. Discuss the main objectives of ERP implementation.
2. There is a misconception that ERP is meant only for big companies? Discuss.
3. What are the objectives of ERP implementation?

4. What is speed of the implementation project and how does it affect the implementation?
5. What is the scope of the implementation project?
6. What are the resources required for ERP implementation?
7. What do you mean by the risk of an ERP project?
8. What do you mean by complexity of implementation?
9. What do you mean by benefits of an implementation?
10. What are the different phases of ERP implementation?
11. What is pre-evaluation screening? Why is it done and what are the main activities in this phase?
12. What is the need for package evaluation? What are the points that should be used to evaluate the ERP packages?
13. What is the project planning phase and what are its main activities?
14. What is gap analysis and why is it done?
15. What is reengineering and why is it done?
16. What is customization and why is it important?
17. What are the objectives and main activities of the implementation team training phase?
18. What is testing? Why is it done and what are the different types?
19. What do you mean by going-live phase?
20. What is the need and importance of end-user training?
21. What are the activities of the post-implementation phase?
22. Discuss the reasons for the failure of ERP implementations.
23. Why is top management support important for the success of ERP implementation?
24. How do improper planning, budgeting, and choice of the wrong tool affect the implementation?
25. What are the implications of lack of training, poor training, and organizational culture on the ERP implementation?

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Chapter 23

Pre-implementation Tasks: Getting Ready

INTRODUCTION

There are at least two facts that fit most ERP projects: implementation will be painful and financial benefits realized in the first year will be minimal. Preparing your company for implementation is almost as important as the project itself. Too often, in justifying a project, we downplay the risks and pain of implementation, fearing that the truth will mean disapproval. However, brutal honesty at the onset is always better than giving team members false hopes. If employees believe that the project will progress painlessly they will only get discouraged when a problem does occur. If you tell them the truth they can anticipate pitfalls and prepare for them.

It is important to let everyone know that after many months of preparation for implementation, system operations may not go smoothly and the pain can last as long as three to four months or more, even if everything has been done correctly. If the implementation goes well, all the better; but if things go wrong as they sometimes will, everyone will be prepared. You can get to the same point with the same problems and be viewed with either approval or disdain depending on how well you have prepared your company. Often, project promoters claim new systems will impact the bottom-line immediately. However, experience shows that many systems benefits do not occur until the second year.

IMPORTANCE OF PREPARATION

Management too often plunges into ERP being less than fully informed or worse with very limited or no knowledge of what to expect. Often, there is a misconception that the skills necessary to select ERP software and then implement it already exist in the organization. Some skills may exist but rarely to the extent necessary to effectively implement ERP within a reasonable time frame. Enter the consulting 'experts' from a systems integration firm (often labeled as management consultants) who helped sell you the system, with a software business partner. Worse, when the implementation 'experts' arrive some of them are so inexperienced that it should make you quickly re-assess implementation risk. It is of paramount importance with such a high risk/reward ratio that you be absolutely certain the necessary knowledge and skills are present in your implementation team.

Another commonly overlooked and therefore not well prepared for, is the issue of information technology change. Often the IT infrastructure changes required to enable the implementation of a new ERP system are not given high priority that these technology issues deserve. Certainly, business issues and not those of technology should drive the implementation of ERP. However, it is the understanding and skills of the IT personnel that supports the technology that enables the business process issues to be improved. Disregarding the new IT is going to require preparation through education, in order to understand the new technology, is asking for trouble. For example, the IT staff of the organization is very knowledgeable about COBOL and HP-UX, but its new ERP will be programmed differently. IT personnel's understanding of the new technology is an absolute requirement for a successful ERP implementation. Furthermore, the IT personnel have to make the technology transition

fast. If the necessary technology adoption and infrastructure transition are not done well it will at the very least, delay the project.

One of the biggest problems that many have had with implementing ERP is misunderstanding what ERP is all about and underestimating what it takes to effectively implement it. Driving ERP preparation and implementation, senior operating management cannot relegate critical decisions to workers who may not have the background and/or the temperament for this type of decision-making.

Companies need a well-thought out and comprehensive process that will help plan, guide, and control the entire ERP implementation effort. Starting an implementation with an undocumented, skimpy, or untailored implementation methodology is an open invitation to disaster, and at the very least, a long drawn out implementation. Everyone from the boardroom to the stockroom needs to clearly understand their role and responsibilities for implementation, and above all, encourage dialogue that will get people focused on the business objectives as well as early identification and/or correction of any problems. In addition, and no small matter, the questions of how, when and who will be accountable for results must be an integral part of this understanding. An implementation that is going astray becomes recognizable when repeated schedule slippages surface. As time moves on the schedule, missed problems starts to compound the implementation quality, as the invariable response is to start taking short-cuts and by-passing critical business issues.

BEFORE YOU LEAP

An ERP system is a very powerful computer tool, and organizations can gain a lot of competitive advantage by implementing an ERP system. Unfortunately, it is observed that many ERP projects have not been effective and hence unable to achieve the results envisaged. As the cost of an ERP implementation project is very high, it is critical for an organization to make the project a success and start deriving benefits out of it as fast as possible. However, what is it that makes an ERP implementation project successful?

- A well-defined project organization structure that details the project planning, execution, and monitoring mechanism
- An attitude that stresses on business transformation instead of process automation
- An approach that brings about the proper integration of people, process, and technology through effective management of change

Companies need a well-thought out, comprehensive process to help plan, guide, and control the entire ERP implementation effort. Before the nitty-gritty of software selection begins, management should know how current strategy, processes, and supporting systems work and if any changes should be made before the new information system is introduced. The pre-implementation stage is the time to re-consider the way you do business and to make a detailed analysis of the requirements and the expectations of the new information system. Optimization of business processes rather than technical innovation should stand in the focus of an ERP implementation project. Start defining software needs by examining current processes that govern your flow of information and material throughout the order-to-delivery process and ultimately the entire supply chain. There is a common tendency to shortcut this very important activity but you will pay—sometimes dearly—in time and money for avoiding this essential step.

Take the time to evaluate your ERP plan before you commit to software acquisition and installation. Doing it right the first time is the only way to go. There are many people out there who wish they had taken a brief pause to evaluate their direction. The following questions do not cover every possible contingency but they should be used to stimulate thought and discussion and the right action.

- How do we want to run our business?
- What problems need to be resolved?
- Do we know and understand our priorities?
- Do we fully understand our 'as-is' condition versus our 'could-be' process?
- Have we defined an action plan for pre-implementation preparation activities?
- What tasks will be accomplished and by what dates?
- What are the 'missing links' in our software of choice?
- What are the real costs, benefits, and timetable going to be?
- Do you have an executive level ERP champion that provides the necessary link to top management?
- Who will implement ERP and make it work?

ERP implementation is a complex and lengthy project that requires a vast amount of resources (money, personnel, hardware, software, communications network, etc.) and that should result in huge losses, if failed. In the case of ERP implementation, failure is not an option. It is a 'do-it-right-the-first-time' kind of project because most organizations will not recover from a failed implementation. Careful and meticulous planning and preparation is required for the successful implementation of the ERP system in the organization. In this chapter, we will see the pre-implementation tasks that need to be taken care of to ensure a successful implementation. The pre-implementation planning session is a multi-functional event that recognizes the ERP project on a formal basis. One of its primary goals is to develop the project plan. A project is a solution that is scheduled for success. The project planning session is a meeting that usually lasts one or more days and consists of all the critical stakeholders of the ERP system from both internal and external sources. The project planning session will define the main problems with proposed solutions. In the planning session it will be determined what must be done, who will do it, how it will be done, when it will be done, cost of doing it, and the services and materials needed to do it. Output of the project planning session is the project plan, which will serve as a guide to implement the software and help to build ownership in the system. The main tasks that should be performed during this session are:

- Assembling the participants—stakeholders
- Feasibility study review
- Project mission and vision statements creation
- Determination of organizational structure
- Determination of the modules to be implemented
- Creating the core team
- Establishing the training needs
- Establishing the data conversion/migration strategy
- Establishing interfaces
- Determining work estimates
- Cost of consultants
- Calculation of implementation time
- Identifying constraints
- Establishing policies and guidelines

Assembling the Participants

One of the first steps of the project planning session is to assemble the critical stakeholders of the project. This should include all people who have a direct influence over the project in terms of how the resources should be allocated. It should also include any potential members of the company who may participate or

have an influence on the ERP core team. Participation in the project planning session is not an optional exercise. Because of the critical need for strong support in an ERP project, all members having a stake in the project need to participate. The full participation of senior management should not be overlooked. Any critical stakeholder who refuses participation in the project places the ERP implementation at risk, usually a high-risk. The project planning session and the ERP project, simply cannot take place successfully without the participation of the key stakeholders.

Feasibility Study Review

After the team is assembled, a review of the feasibility study and needs analysis should be conducted. The feasibility study document contains the results of the investigation as to the feasibility of the ERP system in the organization. It contains the factors that will affect the ERP implementation—the ones that will assist and the ones that will create problems. The needs analysis will essentially be the justification for the project. The needs analysis document contains the report of why the ERP system is needed, which functional areas need maximum focus, what are the areas that need to be improved, and so on.

Project Mission and Vision Statements Creation

In this step, the mission and vision of the project is determined and documented. The vision should be a global statement that is continuous and ongoing. The mission statements will consist of the major milestones of the project. Mission statements should have specific expiration dates and be measurable in nature so that they do not become vision statements. They can be broken down by functional module. The expected completion date for each module should be documented as expressed by the appropriate critical stakeholders. If they have not determined a critical completion date, then do the mission statements now and put the date on later. The projected completion date will be calculated in a later step of the project planning session.

Determination of Organizational Structure

The organizational structure is determined to decide how the implementation is to proceed. Some organizations will be clearly separated by geographic facilities. Others may be clearly separated by different business divisions controlled by separate management functions. The purpose of this exercise is to show the major areas of the business that may install the software independently or at different times.

Determination of the Modules to be Implemented

Using input from the needs analysis, vision/mission statements, and the organizational structure, the next step is to establish the modules to be implemented. Other independent software packages that may be interfaced may also be implemented with the rest of the ERP system. Include all possible sources that will integrate or affect the implementation of the ERP system. The modules of the ERP system may not correlate with the needs of the organization. It may be helpful or even necessary, to have an ERP system application consultant present to explain what functional need of the organization translates into the appropriate functional module of the ERP software. After the translation has been made, a complete list can be established.

Creating the Core Team

This session has several purposes. They include: (1) determining the structure of the ERP team, (2) assigning ERP core team members to modules and phases, (3) determining their percentage of

participation, (4) adjusting percentage equivalents, (5) and calculating full time equivalents. The type of ERP team structure to be used in the implementation should be decided. Other positions outside the core ERP team such as: steering committees, management consultant, technical consultant, and application consultant, can be applied and arranged to support any one of these four strategies. Before one is chosen over the other, the advantages and disadvantages should be clearly understood by all critical stakeholders. After the structure of the team is established, by input from participants of the project planning session, each member must be assigned a functional area and the percentage of time to be dedicated must be determined. The number of positions and the amount of time that ERP team core members will dedicate can vary considerably from the beginning of the project to the end. This can become quite evident when the project is broken up into phases and one person participates in more than one phase. Different phases may require different participation levels from different people. More about ERP project teams is given in Chapter 26.

Establishing the Training Needs

In this step, the educational and training needs are established. Education means the giving of information about ERP basics, best practices, need and benefits, different modules and how they function, and such general topics. The training imparts information specific for the company, in that they will teach the users how to use the ERP system specifically for the business. Each training class will be custom developed based on how the software is set up and used.

Determine how much education will be required, the type of education, and the number of participants. Educational classes will generally be pre-defined, standardized training packages. The focus of education should be the critical stakeholders, senior management, and ERP team core members. Some areas to consider for education include: fundamental ERP concepts, business management techniques, ERP functional modules, best practices, etc.

Make a listing of all the participants who will be attending in each category. ERP educational modules are generally available from ERP vendors and service providers. They are standardized educational programs to help students learn the functionality of the software. Make a complete listing of ERP functional modules with each team member who will be attending. It may be helpful and even necessary to have an ERP application consultant assist in the assignment of people to ERP functional educational training classes. Education for ERP functional modules should be further broken down by the phase in which the modules will take place.

While determining the total amount of educational needs, the end-users should not be included in these figures. Some ERP team members will have the need for both education and training. For ERP team members who will receive both education and training, the educational portion should be included in the educational section and the training portion should be included in the training section.

Establishing the Data Conversion/Migration Strategy

The goal in this step is to establish what needs to be converted/migrated and how it is going to be done. Almost every functional module will require information from the legacy system. The two primary methods of converting data are manual and electronic. While performing this step, it may be helpful to have an entity diagram and file structure specification of the ERP system. Application consultants can provide helpful insight into the critical files that require data for the successful use and implementation of the ERP system. In most cases, either electronic or manual methods may be used. However, before one is chosen over the other, the advantages and disadvantages of each approach should be clearly understood.

Some areas to consider for data conversion include open accounts receivable, open accounts payable, chart of accounts, accounts payable history, accounts receivable history, open sales orders, sales order history, open purchase orders, purchase order history, item master, item on hand balance, bills of material and routings, open engineering change orders, engineering change order history, open work orders, work order history, customer master, vendor master, fixed assets, project planning session, general ledger balances, employee master files, payroll history, payroll balances, etc.

Many other areas are also available for consideration. It is best to have experienced people from the legacy system working together with application consultants to fully understand the need.

Establishing Interfaces

The goal of this step is to identify any interfaces that require development. This section is for the required interface programs between systems for which none exist. If the ERP implementation strategy chosen is a big bang approach, it may then require few or no interfaces. Projects that are phased and have high degree process characteristics need a large number of interfaces. Other software packages that need to connect and communicate with the ERP system should be included here. Interface programs can be developed using electronic methods or ERP team members or clerical staff can perform them using manual methods. Before one is chosen over the other, the advantages and disadvantages of each approach should be clearly understood. It may be helpful to use application consultants or technical consultants to explain critical interface points for the new ERP system. It is best to have company employees with a strong knowledge base of the legacy ERP system working together with knowledgeable ERP application consultants to fully understand the critical interface points.

Determining Work Estimates

The work estimates for all the activities from planning sessions to training and maintenance after installation of the ERP project should be determined in advance. A wide variety of events are represented that will consume the majority of the resources dedicated to the project. Performing work estimates in ERP systems can be far from an exact science. However, if careful research was done prior to the purchase of the software, general estimates are possible with some degree of accuracy. Communication with outside references can provide estimates of how much work was performed and how long it took. Using these estimates from references combined with experienced honest application and technical consultants, reasonable numbers can be obtained. Estimates should be made for each activity for each phase or process section. The estimates for the work to be performed should be in days. The number of days is not based on how long someone thinks it will take from beginning to end, but rather on how long it will take based on a person working full time on that particular event. This is the equivalent of man-hours or in this case, man-days.

Cost of Consultants

It is better to establish the scope of the project or how much work needs to be done, in advance. With our previous section determining the available amount of resources, we can now move into our next section, which helps us determine the amount of time it will take. Most ERP projects benefit from some degree of consultation. This consultation can occur at management, functional, and technical levels. The amount of outside consultation that will be needed is dependent upon many different factors. Some factors that will increase the need for consultants include large complex installations, multi-language characteristics, complex business process flows, lack of ownership, lack of participation by ERP team members, sudden changes in leadership, etc. The amount of consultation assistance needed for an ERP project can vary tremendously. When and where a consultant may be needed is very difficult to predict in the early phases

of an ERP project. For purposes of increasing ownership and participation, it is better to limit the role of consultants and use them for critical areas.

Calculation of Implementation Time

Three characteristics working together—scope, resources, and time—will affect every ERP project. The scope of the project has already been defined in the previous steps. The available resources have been calculated through percentage equivalents into full time equivalents. The remaining step is to calculate the completion date. If a company increases the scope of its ERP implementation, then it will need to increase the time or available resources, or both. Similarly, when a company decreases the available resources used to work on the project, then the scope will need to be decreased or the available time will need to be increased, or both. By changing any one of the three characteristics, the other two are affected.

Once the scope, time, and resources have been calculated, a graphical timeline should be developed using a variety of project management software tools. The timeline will represent a high-level showing the major phases or processes, activities, sequence of activities, events that will operate in parallel, start dates and completion dates. A graphical timeline is an important part of the project planning session. The graphical representation of the elements of the project helps make it a valuable tool for discussion.

Identifying Constraints

All constraints of the project should be identified and documented. A constraint is any business activity or external factor that will inhibit or affect the outcome of the ERP implementation in some negative way. The source of information should come from all the critical stakeholders of the ERP implementation. One of the key factors on which to focus is identifying any activities that will potentially compete for the time of ERP team members. Some examples of business activities or problems include lack of people, data integrity problems, people unwilling to change, other implementations, change of personnel, new products or services, etc.

Establishing Policies and Guidelines

Project policies and guidelines form consistent methods for dealing with situations and events that occur in a project. Some areas to consider policies include problem resolution, software modifications, configuration settings, business process flows, meetings, budget changes, resource acquisitions, general communications, conversion strategies, contingency plans, project status meetings, training guides, user guides, etc.

SUMMARY

In this chapter, we discussed the tasks that should be performed before starting the ERP implementation. This is a very important aspect as the main reason for ERP failures is lack or poor planning. The amount of time spent in planning and organizing before the ERP implementation will make the implementation smooth and ensure success.

REVIEW QUESTIONS

1. What is the importance of preparation in an ERP implementation project?
2. Companies need a well-thought out and comprehensive process that will help plan, guide, and control the entire ERP implementation effort. Discuss.

3. What are the factors that make an ERP implementation project successful?
4. What are the questions that you should ask before you commit software acquisition and installation?
5. What are the main pre-implementation tasks that should be performed?
6. Why should the stakeholders of the ERP implementation be assembled during the pre-implementation stage?
7. What do you mean by feasibility analysis review?
8. What is the purpose of project mission and vision statements creation?
9. How will your determine the organizational structure?
10. Who will decide which modules are to be implemented?
11. How is the core team created?
12. How are the training needs established?
13. How will you establish the data conversion strategy?
14. How will you establish the data migration strategy?
15. How are the interfaces established?
16. Why is determining work estimates important?
17. Why is determining the cost of consultants important?
18. How is the calculation of implementation time done?
19. How are constraints identified?
20. Why is establishing policies and guidelines important?

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Chapter 24

Requirements Definition

INTRODUCTION

Requirements definition is the process of capturing and documenting the user requirements and specifications. One of the main tasks of requirements definition is to understand the current system (manual or computerized). The task should be undertaken with a view to examining its adequacy and identifying problem areas. The main tasks that are performed in this phase are to understand the current system by discussing this with the users and studying the documentation available. The main areas that are studied are organization objectives, activities, procedures, rules and standards, files and interfaces, and so on.

We cannot implement a system if we do not know what features are required by the organization. Thus, the first task is to gather requirements for the system that is to be implemented. Requirements express the needs and constraints that are placed upon a system that contribute to the satisfaction of some real-world application. The application may be to solve some business problem or exploit a business opportunity offered by a new market. One of the main objectives of requirements engineering is to discover how to partition the system; to identify which requirements should be given priority and which should be disregarded or deferred.

Every existing system, whether manual or computerized, will have some problems or inadequacies. That is why it is being re-designed or being replaced with a new ERP system. Even if the system is functioning smoothly, there could be areas that could be improved. These existing problems and constraints are identified. The existing system, problems, and constraints are documented for future reference and the findings are discussed with the client or user.

Defining requirements can be an involved and time-consuming affair where every detail is captured and presented in a voluminous document. This assumes that during the course of the definition, processes do not change and if they do change, the requirements are updated, assuming of course that you are aware that a change has occurred. However, it is unlikely that processes remain static. Instead, changes will be ongoing in response to demands from customers, efforts to resolve problems that occur, changes in personnel, efforts to improve the way things are done, or whatever. Change can occur for any number of reasons and can be small or large in detail and in effect. Furthermore, keeping track of all changes is very difficult.

The question then arises as to the value of such a detailed requirements definition, since by the time it is to be translated into an operational system, possibly nine months later; much of the detail may be irrelevant. From the perspective of a requirements definition, enough needs to be known about what is desired to ensure that this is contained as a requirement.

Another consideration is the scope of the requirements. Is the implementation to cover only selected parts of the organization or all parts? It is viewed that human resources and payroll have a perfectly adequate system. Similarly, marketing may have their database built upon a commonly available package. The quality department may have a sophisticated application whose functionality includes statistical process control support, the management of documentation, training records and non-conformances, and other specialist facilities. Other legacy applications may be viewed as

adequate. One issue to consider is the desirability of integration among all these standalone systems. This contrasts with the potential impossibility or exorbitant cost of integration. If certain modules are already provided within the ERP system, then the decision may be taken at a later date to review these specific requirements to assess the pros and cons of migrating from the legacy system.

ITtoolbox [1] conducted an ERP Implementation Survey in 2004. Over 375 IT and business professionals from around the world participated in this online survey. One of the survey questions was 'what do you see as the main challenges to successful ERP implementations within your organization?' 46% of the participants indicated that the main challenge to successful ERP implementations was inadequate definition of requirements (see Chapter 20 for more details).

WHAT IS A REQUIREMENT?

At the most basic, a requirement is a property that must be exhibited in order to solve some problem of the real world. The problem may be to automate part of a task of someone who will use the system, to support the business processes of the organization that has commissioned the system, to correct shortcomings of an existing system, to control a device, and many more. The functioning of users, business processes, and devices are typically complex. By extension therefore, the requirements on a system are typically a complex combination of requirements from different people at different levels of an organization and from the environment in which the system must operate.

Requirements definition is the statement of needs by a user that triggers the development of a program or a system. Requirement is a user need or a necessary feature, function, or attribute of a system that can be sensed from a position external to that system. Requirements are specifications of what should be implemented. They are descriptions of how the system should behave or of a system property or attribute.

All these definitions emphasize *what* will go into the product rather than *how* the product will be designed and constructed. Requirements definition means different things to different people. An executive's notion of 'requirements' might be a high-level product concept or business vision, while a developer's 'requirements' might look suspiciously like detailed user interface designs. Customer-provided requirements often are real solution ideas. There are several types of requirements, all legitimate and all necessary.

Requirements vary in intent and in the kinds of properties they represent. A distinction can be drawn between product parameters and process parameters. Product parameters are requirements on the system to be developed and can be further classified as functional requirements (capabilities) and non-functional requirements (constraints or quality requirements). Non-functional requirements can be further classified according to the performance requirements, maintainability requirements, safety requirements, reliability requirements, and many other types of requirements. A process parameter is essentially a constraint on the development of the system. These are sometimes known as process requirements.

Requirements must be stated clearly and unambiguously and where appropriate, quantitatively. It is important to avoid vague and unverifiable requirements that depend for their interpretation on subjective judgment (like 'the system shall be reliable', 'the system shall be user-friendly'). This is particularly important for non-functional requirements.

Some requirements are emergent properties. That is, requirements that cannot be addressed by a single component, but which depend for their satisfaction on how all the system components interoperate. The performance requirement for an ERP system would, for example, depend upon the capabilities of the software, hardware, and the communications network. Emergent properties are crucially dependent upon the system architecture.

An essential property of all requirements is that they should be verifiable. It may be difficult or costly to verify certain requirements. For example, verification of the production capacity of an

automated assembly line may necessitate the development of simulation software. The requirements engineering and V&V (verification & validation) personnel must ensure that the requirements can be verified within the available resource constraints.

Requirements can be classified into three distinct levels—business requirements, user requirements, and functional (and non-functional) requirements. Business requirements represent the high-level objectives of the organization or customer requesting the system or product. You can record business requirements in a product vision and scope document. User requirements describe the tasks that users must be able to perform using the new product. These are best captured in the form of use cases, which are stories or scenarios of typical interactions between the user and the system.

Functional requirements define the functionality the developers must build into the product to enable users to accomplish their tasks, thereby satisfying the business requirements. These are statements of services the system should provide, how the system should react to particular inputs, and the system should behave in particular situations. In some cases, the functional requirements may also explicitly state what the system should not do. A feature is a set of logically related functional requirements that provides a capability to the user and enables satisfaction of a business requirement. The functional requirements itemize the specific behaviors the software must exhibit. Figure 24.1 shows the different requirement levels.

Functional requirements are documented in a requirements definition document (RDD), which describes as fully as possible the expected external behavior of the software system. The non-functional requirements include standards, regulations, quality attribute goals, performance objectives, business rules, and external interface requirements. Quality attributes such as usability, efficiency,

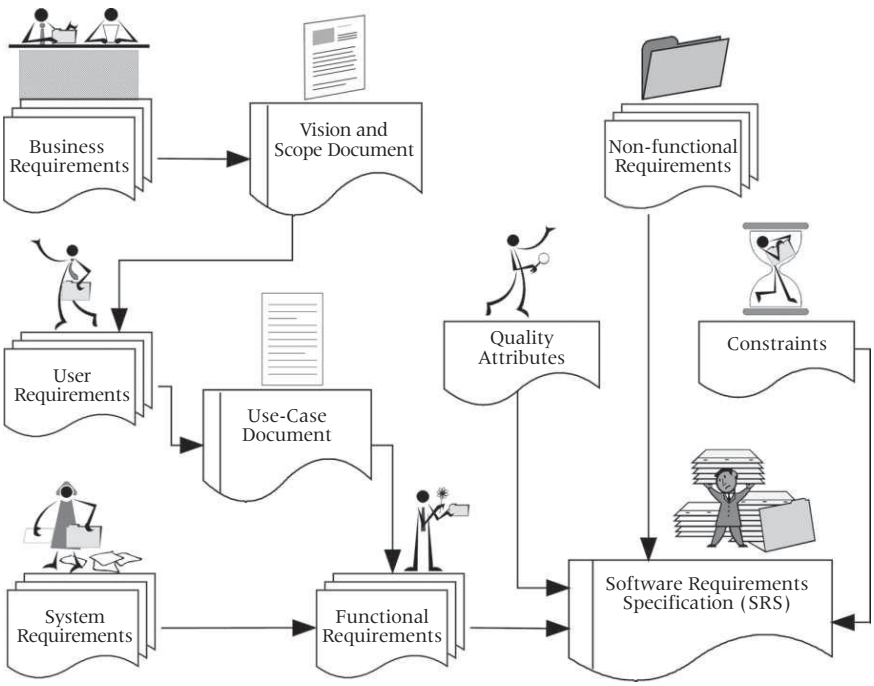

Figure 24.1 Different types of requirements.

portability, and maintainability need to be elicited from users, along with the use cases. Constraints are restrictions that are placed on the choices available to the developer for design and construction of the product. Quality attributes augment the description of the product's characteristics in various dimensions that are important either to users or developers.

As we have seen before, user requirements denote the requirements of the people who will be the system customers or end-users. System requirements by contrast, are inclusive of user requirements, requirements of other stakeholders (such as regulatory authorities), and requirements that do not have an identifiable human source. Typical examples of system stakeholders include (but are not restricted to) the following.

- **Users**—the people who will operate the system. Users are often a heterogeneous group comprising people with different roles and requirements.
- **Customers**—the people who have commissioned the system or who represent the target market of the system.
- **Market analysts**—a mass-market product will not have a commissioning customer. Thus, marketing personnel are often needed to establish what the market needs and to act as proxy customers.
- **Regulators**—many application domains such as banking and public transport are regulated. Systems in these domains must comply with the requirements of the regulatory authorities.
- **System developers**—these have a legitimate interest in profiting from developing the system by, for example, re-using components in different products. If, in this scenario, a customer of a particular product has specific requirements that compromise the potential for component re-use, the developer must carefully weigh their own stake against those of the customer. For mass-market products, the developer is often the primary stakeholder because they wish to maintain the product in as large a market as possible for as long as possible.

Requirements engineering is a collaborative activity. We will see the roles of the people who participate in the requirements engineering process. Requirements engineering is fundamentally interdisciplinary and the requirements engineer needs to mediate between the domains of the user and software engineering. There are often many people involved besides the requirements engineer, each of who have a stake in the system. The stakeholders will vary across different projects but always includes users/operators and customers (who need not be the same). These need not be homogeneous groups because there may be many users and many customers each with different concerns. There may also be other stakeholders who are external to the user's/customer's organization such as regulatory authorities, whose requirements need to be carefully analyzed. The system developers are also stakeholders because they have a legitimate interest in profiting from the system. Again, these may be a heterogeneous group in which (for example) the system architect has different concerns from the system tester. It will not be possible to perfectly satisfy the requirements of every stakeholder and the requirements engineer's job is to negotiate a compromise that is both acceptable to the principal stakeholders and within budgetary, technical, regulatory, and other constraints. A prerequisite for this is that all the stakeholders are identified, the nature of their 'stake' is analyzed, and their requirements are elicited. The requirements elicitation process is shown in Fig. 24.2.

In addition to these human sources of requirements, important system requirements often derive from other devices or systems in the environment, which require some services of the system or act to constrain the system, or even from fundamental characteristics of the application domain. For example, a business system may be required to inter-operate with a legacy database and many military systems have to be tolerant of high levels of electromagnetic radiation. We talk of 'eliciting' requirements but in practice the requirements engineer has to systematically extract and inventory

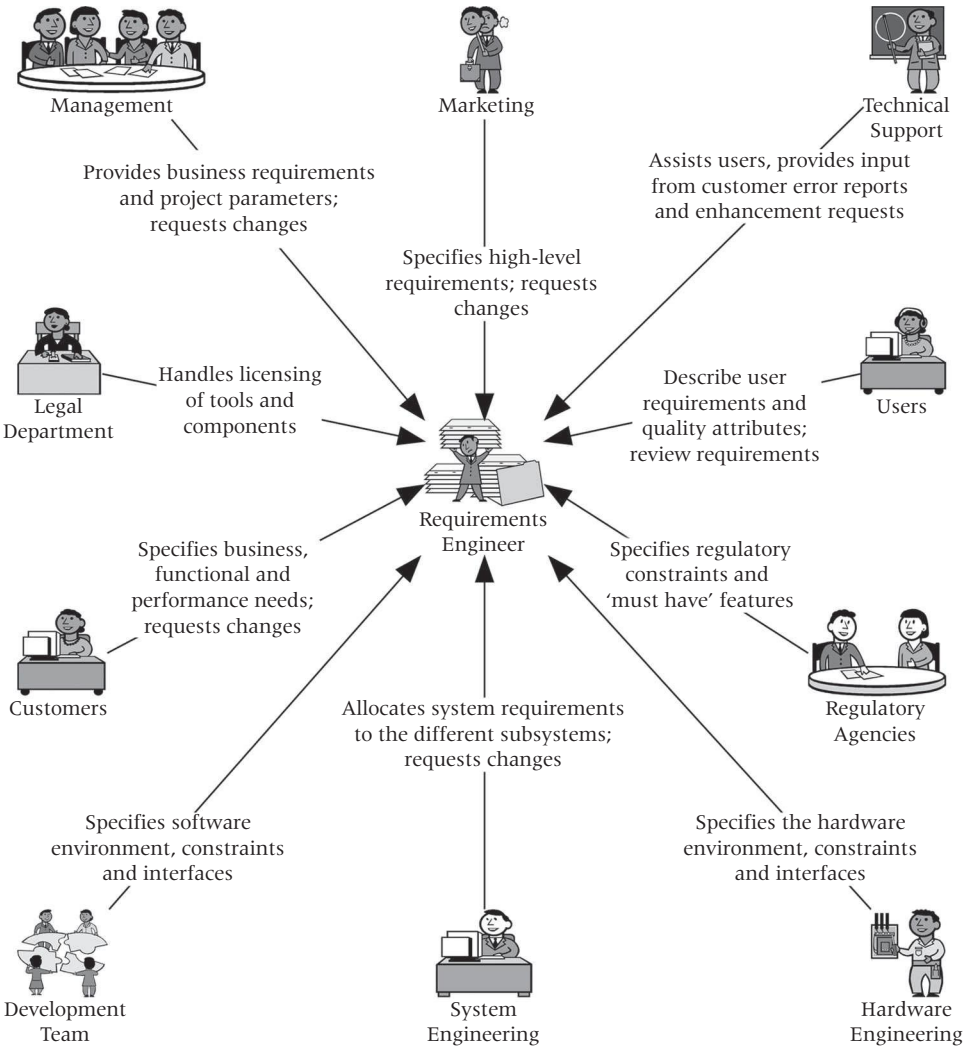

Figure 24.2 Requirements elicitation process.

the requirements from a combination of human stakeholders, the system's environment, feasibility studies, market analyses, business plans, analyses of competing products, and domain knowledge.

The elicitation and analysis of system requirements needs to be driven by the need to achieve the overall project aims. To provide this focus, a business case should be made which clearly defines the benefits that the investment must deliver. These should act as a 'reality check' that can be applied to the system requirements to ensure that project focus does not drift. Where there is any doubt about the technical, operational, or financial viability of the project, a feasibility analysis should be conducted. This is designed to identify project risks and assess the extent to which they threaten the system's viability. Risks should be documented in the project management plan.

Typical risks include the ability to satisfy non-functional requirements such as performance or the availability of off-the-shelf components. In some specialized domains, it may be necessary to design simulations to generate data to enable an assessment of the project risks to be made. In domains such as public transport where safety is an issue, a hazard analysis should be conducted from which safety requirements can be identified.

Requirements do not include design details, implementation details, or project planning or testing information. You should separate such items from the requirements, so that the requirements activities can focus on understanding what you intend to build. Projects can also have other kinds of requirements—development environment (hardware and software) requirements, requirements for releasing a product, compatibility requirements, and so on. We will see the various categories of requirements in the next section.

REQUIREMENTS DEFINITION PROCESS

One of the main tasks of this phase is to understand the current system (manual or computerized). This is not applicable for a new product development project where the task is to understand the functions that the software is supposed to perform. The task should be undertaken with a view to examining its adequacy and identifying problem areas. The main tasks that are performed in this phase are understanding the current system by discussing with the users and studying the documentation available. The main areas that are studied are organization objectives, activities, procedures, rules and standards, files and interfaces, etc.

Every existing system, whether manual or computerized, will have some problems or inadequacies. That is why it is being re-designed. Even if the system is functioning smoothly, there could be areas that could be improved in a computerized system. These existing problems and constraints are identified. The existing system, problems, and constraints are documented for future reference and the findings are discussed with the client or user.

There are different ways of establishing requirements. The aim is to identify the processes, establish what they do, and define the key issues that need to be addressed. The outcome is a list of issues that needs to be handled. There are formal tools and techniques available that are used by business analysts to define requirements. These include the use of data flow diagrams, entity relationship (ER) diagrams, etc. However, many companies do not have this type of expertise and resource in-house. Instead, they may decide to outsource this. Whilst this may be effective in producing a document detailing all the processes, its disadvantage is that the knowledge gained from this exercise is not resident within the company. Thus, it is not uncommon for this analysis to be carried out in-house. The value of analysis is two-fold. *First*, it provides a learning opportunity regarding the problems of capturing detail about processes, which will be useful while designing the new processes. Furthermore, the person conducting the analysis will develop a good understanding of the business and the issues affecting the business.

How are the requirements captured? One approach is to walk through all the processes, identifying who does what, what materials are used and generated, and who provides and receives them. These materials may be reports, documents to and from suppliers and/or customers, internal documents, plans, computer screens, etc. Each point where something is done is treated as a black box. The aim is to record these details, following a trail of successive customers so that a map emerges of all the processes. The problem with this approach is that it presents only a simplified view of what happens, with the danger that trails can be omitted due to oversight or ignorance of their existence. For the person doing this, it provides an administrative challenge in keeping track of events.

The next step in this phase is the definition of the user requirements. The main activities that are performed in this phase are diagnosing existing problems and defining the user requirements. To do this, the context of the problems has to be understood, the scope of the problems has to be assessed, and the user requirements, application requirements, and information requirements have to be determined. Once the user requirements have been defined, the next step in this phase is the preparation of the requirements definition document (RDD).

WHY REQUIREMENTS DEFINITION?

The aim is for one person to capture the detail of the processes on a series of large charts using samples of all the available documentation. This can then be used as the focus for discussion with those most knowledgeable about the processes revealing the key issues. It provides the opportunity to explore best practices and establish how things should be done.

This exercise may well reveal changes that can take effect immediately without much effort and give benefits. Each activity is then defined and the issues required are highlighted. Possibilities are discussed so that not only are the essential features of the process established but a wish list of desirable features is produced. The list of requirements are created and classified into various categories like vital, essential, and desirable. Special requirements can be highlighted, e.g. languages, currencies, decimal places. Statutory requirements that should not be overlooked are identified. Conflicting requirements are collated and set aside for determining what to do.

An overview map of the processes can be produced, supplemented by a list of all the activities and key issues that need to be addressed. This list becomes a useful device while discussing requirements with vendors. Again, there is the danger that areas will be overlooked but because the focus is upon all documentation and screens, there is less likelihood of this.

In both cases, the routine should be captured. What may be overlooked in both approaches is the deviation from the norm. The handling of such deviations may constitute an essential requirement for the new system. Thus, at each point in the process, the analyst should be alert to deviations and how they are handled. However, one should beware of the danger of re-defining undesirable legacy systems and practices. Similarly, consideration should be given to the stability of processes. Are they static and unchanging or are they forever evolving in accordance with requirements. If the process changes over time, then future requirements can be difficult to pin down. In this case, flexibility of the software solution needs to be sought. One should distinguish between essential requirements, which cannot be done without, and those that are desirable and may feature as a wish list—vital, essential, and desirable. This enables essential unique requirements to be revealed and will assist in filtering out unsuitable products. This may include the collection of specific data or the generation of specific reports. In carrying out this task, a balance has to be made between too much detail, which may become redundant if processes change, and not enough detail, whereby specific needs are overlooked. One factor that will affect this is the time available.

At the end of this exercise, the analyst should have a clear statement of requirements that can be given to the vendor at the appropriate time. The bonus is that the analysts will also have a good understanding of the business, which will help when viewing vendor products and holding discussions with the vendor.

MEETING THE REQUIREMENTS

Once the requirements have been defined, the next question is how to meet them. Sometimes a package provided by an ERP vendor will be able to meet all requirements. With some of the larger

vendors such as SAP and Oracle, this may well be the case but there are practical considerations such as time and cost. The time and costs of configuring the system to meet requirements may be beyond the budget of many small and medium companies.

Other vendors may provide modules or components to deal with specific functional requirements but the functionality provided may be very basic in comparison with specialist packages. The advantage of one integrated system is that it eliminates the need for repeated data entry and ensures that there is only one set of figures. Everyone is looking at the same data. The reality is that not all the data required is likely to be captured within the ERP system. Additional data will be recorded on other databases and spreadsheets. However, many applications offer the facility to specify particular fields for such data. The additional fields allow the client to customize the application without necessarily compromising the upgradeability of the system.

However, customization comes at additional implementation costs. Furthermore, for more sophisticated requirements, it can be questioned whether or not it would be better to go for a specialist or 'best-of-breed' package. Specialist packages tend to be the outcome of many years of development and expertise with focus on the specific application. They offer a high degree of functionality unlikely to be found in ERP packages. They may be expensive both to license and to implement. A key factor to be considered is their integration into the overall network of applications. A special link may need to be developed to ensure integration, which will involve additional cost. However, this is becoming less of an issue since vendors are, in starting to recognize the customers' need for integration, designing applications with integration as a feature.

SUMMARY

Requirements definition is the process of capturing and documenting the user requirements and specifications. One of the main tasks of requirements definition is to understand the current system (manual or computerized). According to a recent survey, inadequate definition of requirements was indicated as the main challenge to successful ERP implementations. A requirement is a property that must be exhibited in order to solve some real-world problems. Requirements are captured by walking through all the processes, identifying who does what, what materials are used and generated, and who provides and receives them. Once the requirements have been defined, the question arises as to how to meet them. Sometimes a package provided by an ERP vendor will be able to meet all requirements. Sometimes a module from a vendor may be suited for a particular application but the whole package will have many drawbacks. In most cases, in order to get the perfect match, some amount of customization will be required. However, with customization comes at additional implementation costs. Another key factor is the integration of the ERP system with other systems in the organization's supply chain. However, this is becoming less of an issue as vendors are designing applications with integration as a feature.

REVIEW QUESTIONS

1. Why is getting accurate requirement important for the success of the ERP implementation?
2. What is a requirement? Discuss with real-world examples.
3. What are the different types of requirements?
4. Who are the typical system stakeholders?
5. Why it is important to get the requirements from all the stakeholders of the project?
6. Explain the requirements elicitation process with the help of a diagram.
7. Discuss the requirements definition process.

8. How are requirements captured?
9. Why should one define the requirements?
10. How do we ensure that the requirements are met?

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Chapter 25

Implementation Methodologies

INTRODUCTION

At first glance all implementation methodologies look very much alike. For example, many terms and terminologies are common to all of them. However, the differences start appearing once you start discussing with the consultants about their implementation methodologies. Every consulting firm will try to impress upon the fact that their implementation methodology is the most foolproof and the one that will guarantee success. Their presentations will convince you (till you see the next one) that their way is the most appropriate one for developing a business solution. Thus, the contracting company must pay special attention when comparing the different methodologies. One important point to note is that selecting the consultants (and an implementation methodology) is as important as selecting the package.

Since almost all the methodologies look the same, the company should look into the minute details when comparing the different methodologies. In fact, the minor details will say whether the methodology is practical and successful. The minor details like the content of a particular slide, the write-up in a brochure, the conduct of the consultants during the presentation and most importantly, the practical demonstration that the consultants really have dealt with similar situations before should be considered before making the selection.

If the consulting firm has practical experience, the methodology for the implementation will have been adapted to include tasks or activities specifically tailored to the specific application being analyzed. This may be apparent in one or more of the following aspects of project—training, master files definition, business modeling, initial load plan and test plan, data migration strategies, definition of procedures, procedures for customization, development of interfaces, tuning of the processing environment (performance tuning), definition of accesses and permissions, and so on. The above list is by no means comprehensive, but contains the aspects that are most subject to comparison. If the differences between consultants are not evident during their presentations, then you should ask them questions. In fact, while dealing with the consultants you should prepare a detailed questionnaire and grill the consultants during their presentations. Also, the contracting company can ask for testimonials of successful implementations and check the consulting firm's reputation before signing on.

We have seen the different phases of the ERP life cycle in detail in Chapter 22. We will quickly summarize the most critical of phases of the ERP life cycle—adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement.

- **Adoption decision**—In this phase, managers must question the need of a new ERP system while selecting the general information system approach that will best address their critical business challenges and improve the organizational strategy. This decision phase includes the definition of system requirements, its goals and benefits and an analysis of the impact of adoption at a business and organizational level.
- **Acquisition**—This phase involves selecting the product that best fits the requirements of the organization to minimize the need for customization. A consulting company is also selected to help in the phases of the ERP life cycle that follow, especially in the implementation phase.

Factors such as functionality, price, training and maintenance services are analyzed and the contractual agreements are defined. In this phase, it is also important to analyze the return on investment of the product selected.

- **Implementation**—This phase deals with the customization or parameterization and adaptation of the ERP package acquired, to meet the needs of the organization. Usually this task is performed with the help of consultants who provide implementation methodologies, know-how, and training. Although training is required in all the phases, the largest training investment is made during the implementation phase.
- **Use and maintenance**—This phase consists of the use of the product in a way that returns expected benefits and minimizes disruption. During this phase, functionality, usability, and adequacy to the organizational and business processes are important. Once a system is implemented it must be maintained. Because malfunctions have to be corrected special optimization requests must be met and general systems improvements have to be implemented.
- **Evolution**—In this phase, additional capabilities are integrated into the ERP system to obtain additional benefits.
- **Retirement**—When new technologies appear or the ERP system or approach becomes inadequate to the needs of the business, managers decide if they will substitute another information system approach that is more adequate to the organizational needs of the moment. Some organizations may have already passed through this phase for reasons such as strategic changes, lack of trust in the ERP vendor or the implementation partner, or bad implementation experiences.

Each phase produces an intermediate result that can be evaluated, adjusted, and then approved, so that the project team can continue with the certainty that the work is evolving satisfactorily toward the project's defined objectives. Strengthening this approach is the determination of how the software and the business processes are to work together. This approach is carried out in a project environment, has a clear organizational structure, a team spirit, and a planned sequence of events and deliverables. There are variations to this approach. Some of the larger vendors offer a 'rapid implementation' approach aimed at speeding up the implementation. Whereas in a normal implementation, the software requires configuration, in 'rapid implementation' the software is pre-configured to a business model relevant to the client's sector . In this situation, the processes of the client are modified to match this business model. The rapid implementation does not mean taking short cuts. Shortcuts are potentially dangerous since they override project controls. The danger is that a shortcut taken by the unwary may lead to a situation that may require back tracking. This can have time and cost implications, affect project credibility and user acceptance, and also damage relations with customers and/or suppliers.

MANAGING THE IMPLEMENTATION

The nature of the ERP implementation is such that it is best handled within a project management context. The implementation involves a series of activities that do not fit naturally into the normal business cycle of events. These activities are of finite duration. They have an end point, after which any further work should become absorbed into the normal business activity. It also requires allocated resource and the development of specific skills. It is multidisciplinary and team orientated. The complexity is compounded by the need to involve an increasing number of people over time, distracting them from their normal activities. Thus, the way of working tends to contrast with the software development process businesses.

For project management to be effective, it needs to have the right environment. One of the main reasons for a failed project can be the wrong environment. This can take the form of a counterproductive organizational culture or inadequate corporate commitment or sponsorship or any number of other things.

ORGANIZATION OF THE ERP PROJECT TEAM

The organization of the project team that is best for managing the implementation takes the following format. The person who manages the implementation is the project manager. The project manager reports to a steering committee, who reviews progress and resolves any territorial, resource, or policy disputes. The CEO leads the steering committee and sponsors the project.

Working for the project manager are the members of the project team who develop the processes using the new software. They then roll the new processes out in readiness for go-live day, producing documentation, and training end-users. The vendor will appoint one of its consultants to provide support to the project manager, manage the client account, and coordinate other vendor resources. Vendor consultants provide advice about best working practices, software functionality, and assist with technical issues. Training is provided in the first instance by the vendor to the project team through either the consultants or specialist trainers. Once the project team have developed and proven the new way of doing things, they produce the procedural documentation and train the end-users. A detailed discussion of the functions and responsibilities of the project team and team members is given in Chapter 26.

IMPLEMENTATION STRATEGY

One of the key decisions is the scope of the implementation. One option is to undergo a complete switchover from any old systems to the new system, i.e. the 'big bang' approach. Another option is to introduce the software in stages, core functionality first, then rolling out additional functionality in successive stages. In both situations, the option of retaining both the old and new systems running parallel to each other is possible. Consideration should be given to a number of factors:

- Speed or urgency of implementation
- Availability of people for carrying out the implementation tasks
- Availability of time for training all users
- Cost
- Confidence in the new system
- Disruption to operations
- Total timescale

Whichever option is decided, it must be remembered that for those involved in the implementation there will be a lot of time spent on development work, time which would otherwise be spent on normal duties. The question arises about how these normal duties are to be fulfilled. One option is to recruit temporary staff to carry out the normal tasks. However, this assumes that the required skills can be acquired.

An additional option may be available for those organizations that are running multiple sites or plants—a pilot project. The organization would select one site, which could be representative of the others, hopefully a project that is not too large and implement ERP for that site—running the ERP pilot as a project unto itself.

The implementation plan should identify the implementation strategy, i.e. whether the incremental approach or the big-bang approach will be used and whether ERP will be implemented in all projects simultaneously or instead introduced in a pilot project.

When the incremental approach is used, all ERP modules are not implemented in one step. The different modules are introduced one by one. For example, the organization might choose to implement the financial module first and the other modules at a later date. The advantage of the incremental approach is that the company can get feedback on the implementation and how it is received and possibly fine tune the implementation strategy based on the feedback received. Another advantage is that it can spread the investment over a period of time.

The advantage of the big-bang approach is that the company can start reaping the full benefits of ERP immediately after implementation. The big-bang approach is effective if the organization is mature and conducive to ERP and the people are ready for the ERP. Here there is no room for error—it is a 'do it right the first time' proposition.

Implementing ERP in a pilot project is a good idea because it will give the implementation team a feel for the issues in an actual implementation, the peculiarities of the organization, its work environment, and so on. A successful pilot project can be used as an effective tool for convincing staff and alleviating any doubts and eliminating fears about ERP. However, the pilot project must be selected carefully—it should be a project where the team members are willing to face the challenge of doing something new, have an open mind, and can adapt to new systems. There is nothing like a successful pilot project implementation to convince others why they should also implement ERP.

ERP IMPLEMENTATION PLAN

Before implementing an ERP system in an organization or project, it is very crucial that the implementation process be planned. Implementation planning includes developing the implementation strategy and implementation schedule and organizing the implementation team.

The implementation plan documents the who, what, why, where, when, and how of the project. It is the outcome of discussions with affected people and involves negotiations over resources, timescales, and costs and their agreement. It should be realistic, otherwise if timescales are too short, potential disruption will be built into the plan and if timescales are too long, the momentum can be lost. The plan provides a guide to the project and is used to monitor progress. It enables people to carry out a set of interconnected tasks in a coordinated manner. Setbacks are highlighted and remedial action established. If necessary, dates are rescheduled. Importantly, the plan is communicated to all those who need to know about the project making them aware of progress and changes.

The implementation plan should address all concerns such as the existing procedures, the effect of the ERP implementation on the procedures, how it will affect the employees, the work environment of the organization, the ERP awareness of the employees, creation of ERP user manuals, and so on.

The most basic plan will identify all the activities, those doing them and the time frame. A project plan can be handwritten or produced using some computer application. A spreadsheet offers simplicity and is readily available. Furthermore, it can be easily distributed to others since a spreadsheet tends to be a standard tool on many PCs. Alternately, specialized packages are available such as Microsoft Project. These capture a lot of detail about the project, enable different views of the project, such as time-scale or critical path, and facilitate the reporting of many different issues, e.g. costs, resource usage, and overdue activities. The key concern is the amount of complexity to be organized, manipulated, and updated; a function of the amount of detail required. Therefore, it is necessary to

ask what detail is going to be useful. Another consideration is the distribution of the plan. With a specialized package, not all intended recipients may have the required software, raising the dilemma of what to distribute and how.

A project plan will enumerate the major tasks, the estimated duration (usually specified in months), resources required and people who will be doing the tasks. The high-level plan will give an overview of the project and can be used by the top management for monitoring the project. However, the person who is responsible for day-to-day activities of the project—the project manager—cannot use it. The project manager will develop a detailed project plan, where the high-level plan is broken down into a lot more detail with the time windows being weeks or days rather than months. Additional columns may be used to identify start dates, end dates, amount of work (hours), estimates of percentage completion, lateness, costs, and any other issues deemed relevant. Some tasks will be dependent upon the completion of others (interdependencies), while other tasks can run in parallel (concurrent engineering).

Time-scales should be realistic. If they are overly optimistic then the project will soon fall behind and is unlikely to catch up. This will have the effect of demoralizing the team. Likewise if the time-scales are too long, then the momentum may never build up and delays may result from inertia. Having devised a plan, it is important to maintain that plan against progress, revising it as and when necessary. When problems arise, so do the chances for delays. It can be argued that it is better to push out dates rather than not get it right, since a sloppy solution may re-emerge at a later date with a magnified impact.

RISK ASSESSMENT

Even the most detailed of project plans can go astray for events that could have been anticipated and prevented. It is prudent to carry out a risk assessment. The aim is to anticipate possible problems, assess their likelihood of occurrence and their intensity of impact and finally, to establish how they can be prevented or best handled if prevention is not possible, e.g. causal analysis.

There are various approaches to risk assessment. For many, the prerequisite for understanding what is involved in a risk assessment is denied by the virtue of never having been here before. To keep it simple, a basic approach is adopted. The starting point is to recognize if the project has the potential to fail. The first question that should spring to mind is—why?

The first task is to understand what is involved. Risk assessment should be done at the first possible opportunity and should be done by an individual or team of experienced professionals. An appreciation of what is involved will enable the potential risks to be determined. An insight into potential issues can be gained by reviewing the main problems experienced by others. Many tend to be people related. Technology and methodological issues tend to be of lesser prominence. The result may be an unwieldy and long list. In this case, it may be desirable to establish which risks are the most important and focus on those. Each risk is assessed for how severely it can impact the project and the business, and the likelihood that it will occur. This is a subjective process and the views of others can aid this. If a risk has a high severity and a high likelihood of occurrence, then this requires immediate attention. Likewise, risks rated with low severity and high likelihood of occurrence will require attention if they are not to be disruptive. Cases where there is a low likelihood of occurrence can be put to one side. Note that they are not discarded. This process prioritizes those issues that need attention. The result should be a reduction in the likelihood that things will go wrong. However, while it is proposed that this assessment is carried at the outset of the project, it should be regularly revisited. Process developments and changes in project conditions may raise the profile of risks that were previously viewed as insignificant.

BUDGET

With the costs identified (during the planning stage), a budget can be established. It should also be anticipated that problems and unforeseen issues are likely to result in additional expenditure. Whether an allowance is made for this is a policy decision by the finance management. Actual expenditure is monitored against the budget for the duration of the project. Variances to be aware of include high consultancy costs, particularly in the early stages of the project, and low training costs. Details of consultancy costs should be identified during the selection process and monitored to avoid overspend. Unless the project specification has changed between then and the implementation, this estimate should roughly reflect what is incurred. If there is a significant variance then the question has to be asked as to why this is so. The other major cost to monitor is training. When there is an indication that budgets are going to be overspent, then it tends to be the training budget that suffers. However, training is one area that tends to be reported as being inadequate.

COST

The total cost of ERP ownership includes the costs of packaged software, hardware, professional services (for ongoing maintenance, upgrades, and optimization), and internal costs. The cost of packaged ERP software depends on the scope of implementation (the number of ERP modules and the number of end-users), complexity of software and ERP vendors. ERP software that involves the integration with external business entities generally costs more. ERP vendors offer discounts to organizations that invest in a suite of ERP software systems. Mid-sized organizations typically commit a few million dollars to packaged ERP software.

Implementation of ERP systems routinely requires purchase of new computer hardware, systems software, network equipment, and security software. The costs of hardware vary widely depending upon the scope of implementation and platforms. The hardware typically costs about 25–50 lakh rupees for mid-sized organizations that implement ERP systems.

Implementing the ERP system requires the services of many professionals. These services cost money. The major costs under this category are customization, integration, data conversion, data migration, testing, and training.

It is unlikely that a financial director would support the idea of unlimited funding for the ERP implementation project. Instead, from a control stance, a budget needs to be established. This will be based upon an estimate of the likely costs. In identifying where the costs are likely to arise, consideration should be given to:

- Hardware
- Operating system
- Database license fee
- Core software license fee
- Additional module license fee
- Additional seat license fee
- Third-party software license fee
- Integration of third-party software
- Software customization
- Project management
- Consultancy
- Training

- Living and travel expenses (also travel time)
- Software maintenance or warranty renewal
- Upgrades

The vendor will provide much of this cost information. While it is likely that the vendor will provide a specific figure for each item, this may only be an estimate. Whilst the costs of the software can be precisely stated, where there is uncertainty about what is involved, the cost will only be an estimate. This is likely to be the case for such items as consultancy, which history suggests is an area for potential overspending. In this case, an upper and lower value, and the expected value should be sought to give a fairer reflection of the potential cost exposure.

While some of these costs will be one-off (e.g. hardware, consultancy, etc.), others will be ongoing (e.g. maintenance, training, etc.). To get a better picture of the cost exposure, a long-term perspective should be taken. A meaningful time horizon is five years. By the time that five years has passed it is quite possible that the application has been reviewed and a new budget established for additional work, such as an upgrade or additional functionality.

Not to be overlooked are the indirect costs, which are mainly internal costs. These can include:

- Time and consequent cost of employees involved in the project
- Cost of temporary personnel to replace those involved in the project
- Cost incurred due to other activities not being carried out costs related to off-site travel and sustenance, e.g. off-site training
- Costs related to the internal resources, such as the implementation team or work team, who administer and maintain the system and provide internal technical support

The annual maintenance fee may be surprising in terms of how significant a proportion of the total budget it is. Is it worth asking what is provided for this fee? Obviously each situation will be different depending on a host of variables including the complexity of the processes affected, the number of users, the amount of customization, and dependency upon consultants. It should be possible to pin down most of the costs, especially the main costs, to a lower and upper value and also a most likely cost. However, the unexpected can disturb this picture. Some costs will not be readily apparent and can be overlooked. Alternatively they can be underestimated. It is not uncommon for the yearly cost to be in the neighborhood of 10% of the initial cost outlay.

The danger arises when a budget is set, but costs during the project continue to escalate. This is particularly true with regard to consultancy and training costs. Overspend on consultancy is often compensated by a cut back in training. This is not helped by the fact that training costs tend to be under-estimated in the first place. The dilemma faced is that having started the project, so much has been invested in it that it must finish. But at what cost? This raises the need for cost control throughout the project. Project planning software may have the facility for attaching costs to resources used in activities planned. This can provide a means for determining indirect costs. Upon completion of the tasks, the plan is updated to reflect the actual resources used and the time taken. This gives an indication of the actual cost incurred. It is particularly useful for gauging the costs of internal personnel.

From a practical point of view, the one area where cost is most likely to get out of control is that related to the use of consultants. On-site attendance of vendor personnel can boost costs if uncontrolled or the unexpected occurs. Thus, it may be desirable to contrast the estimated costs of personnel on a 'time and materials' basis with a fixed cost implementation. While the latter may be more expensive at quotation stage, the reality may be the opposite. Typically, ERP package consultants (whether independent or the vendor's representative) will cost in excess of Rs. 8500 per day.

Cost-Benefit Analysis

Once the need has been defined and the costs identified, it is useful to determine what the benefits are and whether the benefits justify the cost. This justification can strengthen the argument about the need. However, the dilemma arises as to how to carry out this justification. The ERP implementation is by its very nature a complex activity. It involves many people who need to act over a long period of time in a coordinated manner in order to produce a coordinated way of working using a technology that may not function precisely as desired.

A similar case can be made for the determination of the benefits. While the tangible benefits of reduced stock holding may be readily quantified, the increased revenue resulting from more efficient operations will prove difficult. Furthermore, the quantification of any intangible benefits will prove difficult. However, from a practical viewpoint this exercise is not required to be and cannot be an exact science. The aim is to get a useful picture of the situation in terms of what to expect. Through the application of models, such as 'Six Sigma,' the company should see a considerable drop in software defects as a result of implementing ERP activities.

The identified costs are assessed within the context of what is understood about the future and the benefits likely to be gained. With a time horizon likely to be five years, much can happen in that time. Thus, the approach should be simple with assumptions clearly defined. This analysis can also be used to establish reference points or benchmarks. These can be used to assess progress and whether the anticipated benefits are achieved. Furthermore, it is prudent to be cautious about potential gains. History suggests that costs will overrun and benefits will fail to materialize. This is aside from the skill required of the project manager in controlling both the costs and the realization of the benefits.

Finally, consideration must be given to the context within which the justification is being used. Who is producing the justification? How will others use these benchmarks—now and in the future? If the situation changes in the future, then the relevance of a specific benchmark may change. All too often, forecast numbers are cast into stone, yet when the conditions change which make these numbers nonsense, this is ignored.

PERFORMANCE MEASUREMENT

The notion of performance is associated with the concepts of control and targets. We have already seen three performance-related measures—costs, time, and benefits. However, an ERP implementation has a notorious reputation for being overspent, late, and with benefits failing to be realized. Furthermore, with the timescale long, it is not practical to wait until the operation phase to find out if everything is functioning as intended.

The project plan identifies what tasks need to be done. The aim is then to carry out the tasks. It is desirable to have some indication that tasks are taking place as required and that they have accomplished what was intended from them. The assumption is that when a task is done it achieves an objective(s). Thus, the training of a user should result in a user being able to perform a set of tasks better or gain a better understanding of ERP concepts.

For each step or series of steps of the implementation, objectives can be defined which, if achieved, represent progress. By achieving these deliverables, there is less likelihood of problems arising at a later date as a result of an earlier event. Conversely, failure to achieve these deliverables and the subsequent progression to the next stage will increase the likelihood of potentially significant problems arising at a later stage. Furthermore, progress can be monitored in a methodical manner. Each task or set of tasks is evaluated as to its successful completion, e.g. has training been effective, are documents complete, are processes fit for the purpose?

Together, the four measurables (cost, time, benefits, and deliverables) present different dimensions for measuring the performance of an implementation. Often it is only the cost and time dimensions that are monitored. Understandably, these have a visible effect on the finances and operations of the business. Rarely are the benefits assessed. It can be argued that monitoring benefits is carried out after the event, so what is the value of this? However, by assessing whether benefits have been achieved or not (and the reasons), an opportunity is created to learn from what has happened. These lessons can then be applied to further phases in the implementation.

The use of deliverables provides the opportunity to assess the effectiveness of what is being done. However, potential conflict arises. To ensure that a task is properly completed may involve an unanticipated increase in the amount of work and lead to it being late. While the deliverable has been met, it is at the expense of two other measurables—time and cost. Therefore, when it comes to determining whether the project has been a success, it is important to consider which measurable is being used. This dilemma is magnified when targets are misused as a tool to blame someone or to score points over others. It is important to remember that while measurables provide a means to assess progress and attainment, they in themselves do not determine success. They merely provide reference points for further action. They are not a substitute for managing people in such a way that they give their best and more.

PROBLEM RESOLUTION

During the implementation, there will be many issues which are raised and which will require resolution. The danger is that some of these issues, having been identified are forgotten, only to surface at a later date, perhaps after the system is live. Thus, it is desirable that there is an agreed procedure for recording issues and their resolution. Whether this is by use of a flip chart or a more sophisticated process, it should be accepted practice that when an issue is raised it is recorded. When the issue has been resolved it can then be marked as closed. By adopting a simple approach, unresolved issues are highlighted. This may reveal that some issues have simply been ignored for the time being. Alternatively, it may reveal issues that need additional support, perhaps an executive decision or vendor support. By keeping track of problems, they can be systematically dealt with. The likelihood of something unpleasant manifesting at a later date is reduced.

SYSTEM ISSUES

Although much of the attention focuses upon the up-front activities of the implementation, in the background there is a lot of work dealing with the technical issues. Tasks include the installation and commissioning of both hardware and software. These tasks will be identified on the project plan but those involved will normally be the IT systems personnel. Technical support will be provided, as required, by the appropriate vendors. From an ERP perspective, there are a few questions that should not be overlooked.

- How does the system perform when the ERP application is under heavy use?
- How quickly will storage space be consumed when the system is live?
- What is the back-up procedure?
- Can the live domain be duplicated so that work can be done in the other domain such as new process development, without affecting the live domain?
- How many alternative domains can be created? How long will the transfer take?
- What happens when two people try to access the same data?
- Does the system lock and if so how is it unlocked?

- Do the locations of PCs and printers require to be changed?
- If the intention is to use pre-printed stationery on dedicated printers can this be done and if so what is involved and when is the time to do it?
- How secure is the system?
- How will user access be selectively restricted? Is it by screen or by field?
- How are passwords managed?
- What user menus need to be generated and how will this be handled?
- Is there an automatic log-out facility if an account is logged-in and not used for a period of time?
- What is the disaster recovery procedure?

This is not an exhaustive list but one that reveals the diversity of issues that need to be addressed. The earlier these issues are identified, the more time there is for dealing with them. A minor detail like a dedicated printer for pre-printed stationery may prevent purchase orders from being issued if the printer cannot be configured so that the required data prints correctly. In a live situation, the delay involved in finding a solution as to how purchase orders will be printed if the printer cannot be configured could result in operational stoppages due to materials not being available. Likewise, users need to be issued with passwords and trained in the log-on procedure. Issues like what happens if someone forgets his password should be addressed and solved.

ERP IMPLEMENTATION METHODOLOGIES BY VENDORS AND CONSULTING FIRMS

A methodology is a roadmap to an implementation. The purpose of a methodology is to deliver an implementation on time, according to specifications, and within budget. Most vendors, especially in the software industry, have developed their own methodologies. Consulting companies also developed their own methodologies in relation to a product. Vendors primarily use methodologies as a marketing tool in order to alleviate the fears of the top management when they are considering implementing a major software application (enterprise resource planning, supply chain management, customer relationship management, etc.).

Nowadays, ERP methodologies are beyond just marketing tools. They are now useful because vendors have gained from experience and these methodologies have lived through several generations. Methodologies are now applied and used by project managers and their teams. If we just look at the ERP methodologies: they range from vendor-specific methodologies, such as 'Accelerated SAP' (ASAP) from SAP to consulting firm products such as 'PERFECT Path' from Panorama Consulting Solutions, ERP Implementation Method by Fugo Consulting Pvt. Ltd., and the 'Offshore-onsite ERP implementation methodology' from Marlabs. We will take a closer look at the above-mentioned methodologies.

Accelerated SAP™ (ASAP)

The ASAP Roadmap is a detailed project plan by SAP that describes all activities in an implementation. It includes the entire technical area to support technical project management and address things like interfaces, data conversions, and authorizations earlier than in most traditional implementations. The ASAP roadmap consists of five phases:

1. Project preparation
2. Business blueprint
3. Realization

4. Final preparation
5. Go-live and support continuous change

ASAP provides examples, checklists, or templates as samples. They are used as a starting point to avoid re-inventing the wheel. ASAP calls these accelerators. We will now see the different phases in detail.

Project Preparation

Proper planning and organizational readiness assessment are essential and entails a determination of the following:

1. Full agreement that all company decision-makers are behind the project
2. Clear project objectives
3. An efficient decision-making process
4. A company culture that is willing to accept change

ASAP's uses something called project estimator to guide the project team through a series of pre-defined questions and drives interviews with senior executives and key operating managers about their expectations of SAP ERP and the speed of its deployment.

Business Blueprint

The engineer delivers a complete toolkit of pre-defined business processes. During the business blueprint phase, the broad scope of mySAP is narrowed to fit the industry-specific processes. Using questionnaires and the models from the business engineer, the business processes are documented to reflect the future vision of the business. Industry templates further accelerate the process by pre-defining industry best business practices. The result is a comprehensive blueprint of the business. During this phase, training begins on mySAP's integrated business systems. Level 2 hands-on training provides a step-by-step education of mySAP business process skills. The business blueprint is a visual model of your business' future state. It will allow the project team to clearly define the scope, and only focus on the mySAP processes needed to run the business.

Realization

Based on the business blueprint, a two-step process of configuring the mySAP system is begun. *First* the baseline system will be configured. *Second*, the system is fine tuned to meet all of the business process requirements. Since the initial configuration is based on the blueprint, the baseline system gives a real-world view of how the business transactions will actually run.

Final Preparation

In this phase, the mySAP system is fine-tuned. Necessary adjustments are made in order to prepare the system and the business for production start-up. Final system tests are conducted and end-user training is completed. Initial audit procedures are developed.

Go-live and Support

In this phase, procedures and measurements are developed to review the benefits of the mySAP investment on an ongoing basis. SAP support and services are provided to ensure that the system continues to run smoothly. The online service system (OSS) provides electronic support using a remote connection. The implementation assistant provides answers for most questions that may

arise. It is an easy-to-use repository of information defining what to do, who should do it, and how long it should take.

PERFECT Path

PERFECT Path is the ERP implementation methodology of Panorama Consulting Solutions (www.panorama-consulting.com). Their ERP implementation methodology and tools enable companies to do more with—and benefit more from—the ERP software systems. Rather than focus strictly on the functional or technical aspects of an implementation, Panorama's broad and independent experience allows clients to implement ERP more effectively than if they tried to do it themselves or with a software vendor, system integrator, or value-added reseller (VAR). Panorama serves the organization's single point of accountability during an ERP implementation by focusing on the following activities:

- Program management of vendor and internal client resources, project plan, and budget
- Comprehensive business process re-engineering and workflow definition
- Incorporation of lean manufacturing, Six Sigma, and other industry-specific skill sets into the overall business transformation
- Improvement of technical infrastructure
- Alignment of ERP implementation with business requirements
- Risk management and mitigation planning activities
- Organizational change management, communication, and training activities
- Integration between the core ERP system and business processes, systems, and stakeholders
- Definition of ERP measures of success
- Optimization of measurable business benefits
- Functional and technical development and support

Developed by Panorama consultants and based on years of ERP implementation experience, PERFECT Path uses a comprehensive, proprietary set of analytical tools, and guidelines to drive completion of ERP project milestones, deliverables, and results. Even though the solution is mainly developed for SAP, Oracle, and Microsoft Dynamics, it can be used for implementing any ERP package.

ERP Implementation Method

Fugo Consulting is an ERP vendor as well and ERP implementation consulting firm, mainly specializing in the implementation and maintenance of PeopleSoft solutions. Even though their ERP implementation methodology is used for PeopleSoft implementations, it is equally applicable to any ERP implementation.

Implementing an ERP system for any enterprise solution is not the end, but only a means. Realizing the benefits need not be a prolonged or an elusive pursuit. Fugo's effective implementation methodology identifies key success factors early on, thus sharpening focus on where it is most needed. Right from working with the executive management to identify business drivers to interacting with end-users to fine tune business processes, Fugo's implementation methodology is all-encompassing as shown in Fig. 25.1.

Offshore-onsite ERP Implementation Methodology

Marlabs Inc. (www. marlabs.com), has developed an ERP implementation methodology—Offshore-onsite ERP implementation methodology—that helps organizations combine the advantages of

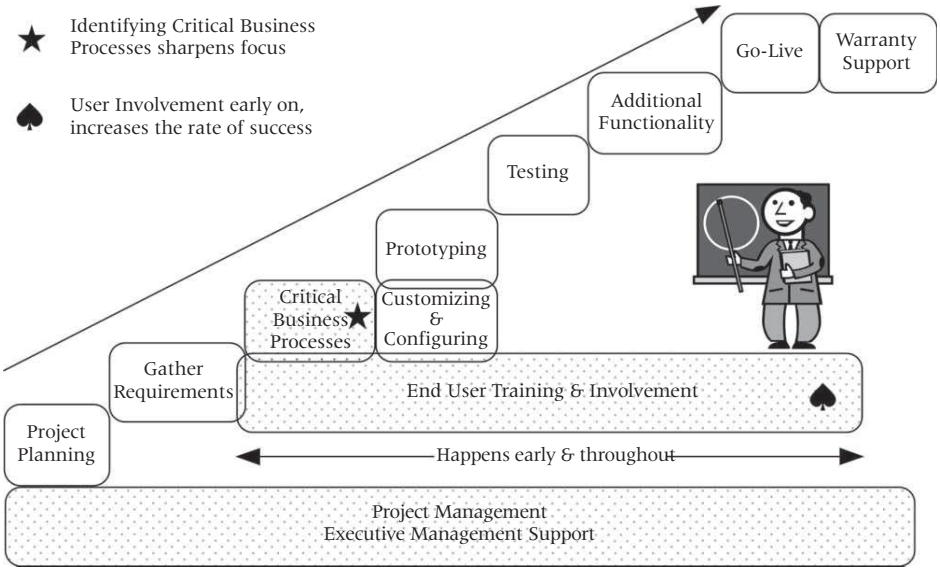

Figure 25.1 ERP implementation method by Fugo.

world-class delivery with robust ERP implementation and deployment skills. The Marlabs ERP implementation methodology is shown in Fig. 25.2 and has the following major phases:

Define

Definition is a client-facing activity and typically happens at the client site. The offshore team may support the documentation process including revisions to documentation, based on client interaction. The steps in this phase include:

- Project scope
- Work content definition
- Project plan
- Business requirements
- Conversions and interfaces
- User signoff

Design

Approved designs are used for performing system setup and configuration, as per user requirements. Any deviations from standard functionality or requirements that need customizations will be built with custom code. The steps include:

- Gap analysis
- Configuration of the base system
- Development of customizations or extensions
- Design of conversion
- Interface designs
- Solution footprint design signoff

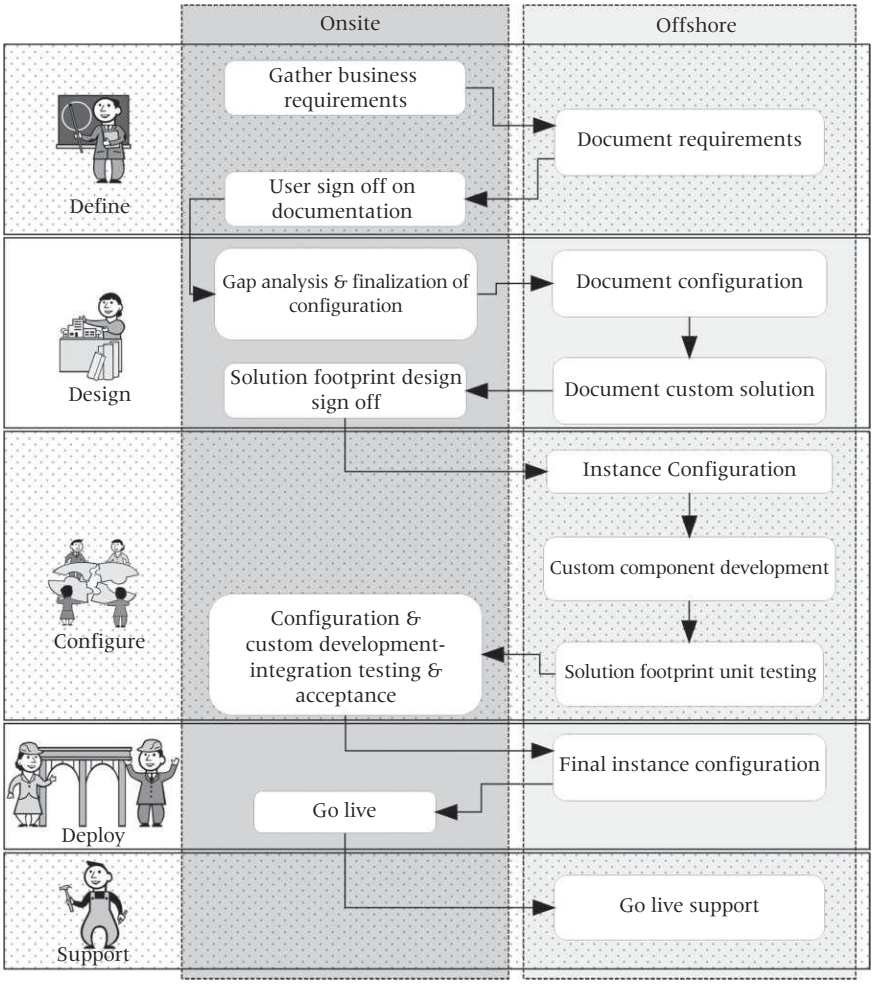

Figure 25.2 Marlab's ERP implementation methodology.

Configure

During this phase, the system is configured and built as per client requirements. The major steps in this phase are:

- Business process mapping to establish functional flows
- Development of custom code over and above base application functionality
- Solution footprint unit testing

Deploy

Once the base system is configured and the custom code is developed and tested, the system is ready for deployment. The business solution is deployed in phases or as a whole—on a given instance of the ERP. The steps in this phase include:

- Migration of tested code to the target instance for production

- Creation of base instance setups followed by conversions, interfaces, and customizations
- Ready for go-live

Support

This phase includes activities to support the live ERP instance for a pre-determined period. The important steps in this phase are:

- Helping the client to build the necessary skills to support the ERP instance, either internally or with the help of Marlabs
- Planning of transition for handover of the system to the client team

ERP IMPLEMENTATION—THE HIDDEN COSTS

ERP software packages promise great benefits. However, what are the costs involved? Exactly how much will one have to pay to get them? In most cases, the ERP implementation cost will exceed the budget? Why is this? Even the well-planned and thought out budget is exceeded. In this chapter, we will examine the areas that most managers miss to account for in their budgets. Or in other words, we will discuss the hidden costs of the ERP implementation.

Few companies buy enterprise resource planning or ERP software just to save money. The objective is the integration of company-wide information. A single, enterprise-wide computer system should be cheaper and easier to maintain than a hodge-podge of antiquated COBOL applications from a dozen different vendors. The move to ERP is a project of breathtaking scope and the price tags on the front end are enough to make the most stoic manager a little twitchy. In addition to budgeting for software costs, financial executives should plan for consulting, process re-work, integration testing, and a host of other expenses before the benefits of ERP start to appear. Underestimate the price of teaching users their new job processes? Fail to consider data warehouse integration requirements? Need extra software to duplicate the old report formats? A few oversights in the budgeting and planning stage can send ERP costs spiraling out of control faster than oversights in planning almost any other information system undertaking. Although different companies find different hurdles and traps in the budgeting process, those who have implemented ERP packages agree that some costs are more commonly overlooked or underestimated than others. Armed with insights from across the business, ERP implementation veterans agree that the one or all of the following eight areas are most likely to result in budget overruns:

- Training
- Customization
- Integration and testing
- Data conversion
- Data analysis
- Consultants
- Brain drain (employee turnover)
- Continuing maintenance

Training

Training is the unanimous choice of experienced ERP implementers as the most elusive budget item. It is not so much that this cost is completely overlooked, as it is consistently underestimated. Training expenses are high because workers almost invariably have to learn a new set of processes, not just a

new software interface. Take for instance, a receiving clerk who accepts shipments of raw materials. With an ERP package like SAP, that clerk now becomes an accountant because the clerk is keying new inventory directly into a live system. Mistakes have an immediate impact on the books. And once every receiving clerk has access to the system, the plant's accounting department can no longer simply look at their data in batches; now they need to be able to pinpoint the origin of each data entry to verify its accuracy, if necessary. Employees at all levels have to accept different responsibilities. ERP is not so much about technology implementation. While it is a lot of work to set up the software, it is not difficult. It does, however, force you to do a huge amount of change management. And change management appears in the budget on the training line.

Training is the first item that gets cut when budgets have to be squeezed—a major mistake, say most ERP implementers. A successful training will account for a minimum of 10–15% of the total project budget. Unwise companies that scrimp on training expenses pay the price later. However, there are still a few ways to keep its price tag under control. One way, is to train an initial batch of employees who can in turn train their colleagues. This solves two problems: *one* the huge training bills of the consultants are reduced, and *two*, since the training is done by their own colleagues there will be less resistance to changes and people will be more ready to accept the new system. In fact, it will be a good idea to identify these would-be trainers early on in the implementation and make them part of the implementation group, so that they will have a hands-on experience and will know the 'big picture'.

Customization

Customization of ERP happens when it cannot support one or more of your business processes and you decide to customize it to your requirements. You will have to do it all over again in the new version. The big chunk of costs of professional services is customization. The cost of customization can easily outrun the cost of packaged ERP software, but it is the customization of ERP software that makes an ERP a success or a failure.

Integration and Testing

ERP systems will not exhibit their full potential unless they are properly integrated with other enterprise software applications. There are three main areas that need integration:

1. The integration of the various functional ERP modules
2. The integration of ERP with other e-business software applications
3. The integration of ERP with legacy systems

Most ERP packages are very complex systems. Interfacing with those systems is not an easy task. Testing the links between ERP packages and other corporate software—links that have to be built on a case-by-case basis—is another essential cost easily overlooked. Most companies will have some system that will not fit into the ERP packages functionality and which will have to be interfaced with the ERP package. In most cases, such integration can be costly.

Unless and until the management and the IT experts feel that there will substantial and concrete payoff for modifying the software to match a key business process, do not modify the ERP products' core code. Once the code is modified, the cost of integrating, testing, and maintaining the system will grow exponentially. Therefore, if you decide to modify, you should have a solid reason to do that.

As with training, testing ERP integration has to be done from a process-oriented perspective. Instead of plugging in dummy data and moving it from one application to the next, veterans

recommend running a real purchase order through the system, from order entry through shipping and receipt of payment involving the employees who will eventually do those jobs.

Data Conversion

It costs money to move corporate information, including customer and supplier records, product design data and the like, from old systems to a new ERP system. A large part of data in most legacy systems is trash. However, most companies seem to deny their data is nonsense until they actually have to move it to the new client/server setups that popular ERP packages require. As a result, those companies are more likely to underestimate the cost of the move. However even clean data may demand some overhaul to match the process modifications necessitated or inspired by the ERP implementation.

Data Analysis

There is a misconception that ERP vendors spread; that you can do all the analysis you will want within their product. However, often the data from the ERP system must be combined with data from external systems for analysis purposes. Users with heavy analysis needs should include the cost of a data warehouse and a business analytics software in the ERP budget and should expect to do quite a bit of work to make it run smoothly.

ERP Consultants

The extravagant fee of ERP consultants is a well-known fact. Like training expenses, this cost is hard to circumvent. Choosing a lesser-known ERP package to avoid premium priced consultants will not necessarily help either. When users fail to plan for disengagement from the existing system, consulting fees will overshoot the budget. To avoid this, companies should identify objectives for which its consulting partners must aim when training internal staff. It is a good practice to include performance metrics and time schedules for the consultants. For example, a specific number of the company's staff should be trained to a certain level.

Brain Drain (Employee Turnover)

It is common knowledge that ERP success depends on staffing the project with the best and brightest brains from the business and IS. The software is too complex and the business changes too dramatic to trust the project to just anyone. The bad news is that a company must be prepared to replace many of those people when the project is over. Though the ERP market is not as intense as it once was, consulting firms and other companies that have lost their best people will be hounding yours with higher salaries and bonus offers than you can afford—or that your HR policies permit. Huddle with HR early on to develop a retention bonus program and to create new salary strata for ERP veterans. If you let them go, you will end up hiring them—or someone like them—back as consultants for twice what you paid them earlier.

Continuing Maintenance

Most companies intend to treat their ERP implementations as they would any other software project. Once the software is installed, they figure, the team will be scuttled and everyone will go back to his or her day job. However after ERP, the implementation team members should not be sent back to their previous jobs as they are too valuable. They have worked intimately with the ERP system, ERP vendors, and external consultants. They know more about the sales process than the sales people and more about the manufacturing process than the manufacturing people.

Companies cannot afford to send their implementation project team members back into the business because there is so much to do after the ERP software is installed. Simply writing reports to extract information out of the new ERP system will keep the project team busy for a year at least. And it is in this analysis and insight—that companies make their money back on an ERP implementation. Unfortunately, few IS departments plan for the frenzy of post-ERP installation activity and fewer still build it into their budgets when they start their ERP projects. Many are forced to plead for more money and staff immediately after the go-live date, long before the ERP project has demonstrated any benefit.

SUMMARY

We have discussed how to implement the ERP system in an organization. We have also discussed how to monitor the implementation project and the importance of monitoring. We discussed that one of the most critical factors in the success of an ERP implementation is the participation and cooperation of the users.

We also discussed the ERP project team, the implementation strategy, the implementation plan, etc. We also discussed how to perform risk assessment, prepare the budget, and what are the costs involved. We also saw performance measurement, problem resolution, and system issues. The key message is that an ERP implementation is characterized by its complexity. There are lots of issues that need to be recognized and handled. Many can be identified during the planning stage, but some issues will crop up during the implementation. Therefore the organization should have a plan to deal with these uncertainties.

We have seen three vendor and consultant-specific implementation methodologies—Accelerated SAP (ASAP) from SAP, PERFECT Path from Panorama Consulting Solutions, and Offshore-onsite ERP implementation methodology from Marlabs Inc. Every situation is unique. The complexity of the ERP implementation is such that one cannot anticipate the unexpected, particularly when people are involved. Thus, the project management team should monitor what is happening and pay close attention to the details, no matter how trivial they might appear.

We have seen the major hidden costs of ERP implementation. Although these five areas represent the biggest trouble spots for ERP budgeters, they are not the only source of hidden costs that a company could encounter. To avoid getting blindsided by unexpected expenses, veterans recommend assembling cross-functional teams to identify the costs up-front. These teams should include both senior executives and end-users who will have daily contact with ERP systems since lower level employees will be able to provide a level of detail that an executive alone would likely miss. Heeding advice from veterans and soliciting input from across different corporate functions will help beginners of ERP avoid overruns and make the software's payoff match its promises. Because even though most companies do not buy ERP just to save money, everyone is clearly happier when the costs arise when expected.

REVIEW QUESTIONS

1. What are the most critical phases of the ERP life cycle and why are they critical?
2. Why is it difficult to manage an ERP implementation?
3. How will you organize the ERP implementation team?
4. Discuss the ERP implementation strategy.
5. What are the factors that should be considered while creating the implementation strategy?
6. What are the pros and cons of choosing to implement on a pilot project?
7. What are the pros and cons of choosing to implement all projects simultaneously?

8. What is the importance of the ERP implementation plan?
9. What does the ERP implementation plan contain?
10. How do you assess the risk of an ERP implementation?
11. How is budget allocated to the various implementation activities?
12. What are the costs involved in an ERP implementation?
13. What are the direct and indirect costs of the ERP implementation?
14. Why is cost benefit analysis performed?
15. How is performance measurement done?
16. Why is performance measurement done?
17. How is problem resolution done during implementation?
18. What are the system issues of an ERP implementation?
19. What are implementation methodologies?
20. Explain the ASAP implementation methodology by SAP AG.
21. Explain the PERFEECT Path implementation methodology by Panorama Consulting solutions.
22. Explain the ERP implementation methodology by Fugo Consulting.
23. Explain the offshore-onsite implementation methodology by Marlabs Inc.
24. What are the hidden costs of an ERP implementation?

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Chapter 26

ERP Deployment Methods

INTRODUCTION

The different ERP deployment options available to an organization are traditional license or on-premises deployment, Saas or on-demand model, cloud or hosted deployment, etc. We will see these different options, their advantages, and disadvantages.

Traditional License or On-Premises

On-premises technology has the same meaning as owning your computer hardware and software (see Fig. 26.1). You own the equipment (hardware) and you own (or license from the publisher) your software. Most of the software you have used in the past is on premises and owned by you. It is just like buying an office building. You pay for your software once or finance it. Then you pay for the on-going maintenance and upkeep. In this arrangement, you are responsible for maintaining it, for fixing it when it breaks, for making sure it is meeting your needs and for keeping it up and running. Some organizations have internal IT departments to handle all of this and others use outside companies to help them. And, in many cases there are multiple helpers (people or organizations) either internal or external.

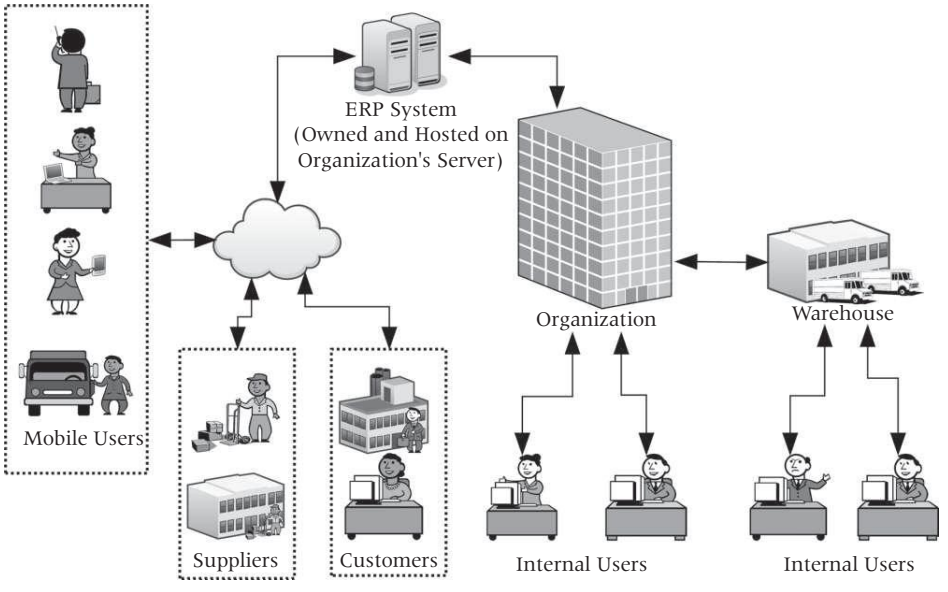

Figure 26.1 On-premises ERP system.

Advantages of On-Premises ERP System

- They give the user the greatest control and flexibility, just like owning your own office building.
- You do not have to check with anyone if you want to make modifications.
- You have control of your data and can manage it any way you wish.
- You can build your systems to your own specifications that meet the specific needs of your organization.
- A copy of the software runs on your computer equipment for your use and is not shared with anyone outside of your organization.
- You can leverage the existing investments and reduce costs by using the hardware and software you already own.
- With an on-premises solution you can easily connect with legacy systems. While some cloud solutions can connect with existing equipment, on-premises solutions can always do so.
- On-premises solutions are not subject to fluctuations in performance or availability due to the Internet (although on-premises solutions are not necessarily faster than hosted ones) and can guarantee predictable performance.
- You can ensure compliance with security and other policies that require on-premises solutions.
- You have complete control of who accesses your systems, your software and your data.

Disadvantages of On-Premises ERP System

- High initial costs.
- Long-term capital investment.
- Costly and complex software implementation, maintenance and upgrades.

Hosted ERP Systems

The traditional ERP solutions can be hosted off-site. The system has the capability to access real-time data from anywhere without using complicated and costly remote-access software. When you host your ERP on an ISPs server, then it becomes cloud or hosted ERP (see Fig. 26.2).

Two terms connected to the cloud and hosted environment are PaaS and IaaS. **Platform as a Service (PaaS)** refers to the virtual renting of servers, hardware, storage, operating systems and other data storage capacities. PaaS offers the hardware that would run your software package. **Infrastructure as a Service (IaaS)** is similar to PaaS, but deals more with the components such as Internet connectivity and virtual desktops.

When you want to run your ERP system on a hosted environment you use the PaaS and IaaS. In such cases you own (or license) your software and you allow someone else to provide the computer equipment to run it. The computer equipment resides at the hosting company's facility and you access your software over the internet. Just like an office or factory building lease, you can design the environment, you have exclusive access to it, the building is maintained by the property owner or manager but you are responsible for the use of your space and its contents. With a hosted computing arrangement, you specify and design the needed computer equipment (the environment), you have exclusive access to the equipment, the facility that houses the equipment is maintained by the hosting company but you are responsible for the software, the maintenance of your software and the related data.

In the above mentioned scenario it is possible to have different arrangements with regard to ownership of the computer equipment. In some cases, the hosting company will provide the computer equipment and all related maintenance. They will typically support the equipment and include the

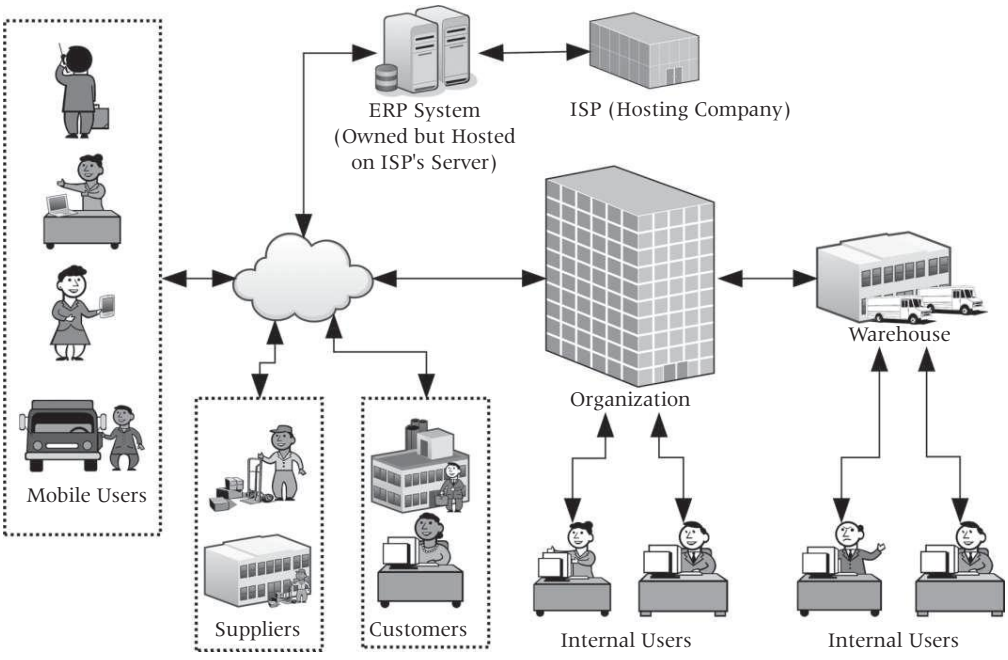

Figure 26.2 Hosted ERP system.

maintenance and support costs with your regular monthly fees. In other cases, you may purchase your computer equipment on your own and allow the hosting company to house it and maintain it for you.

Typically, software implementations, maintenance and upgrades are as costly and challenging in a hosted environment as they are in an on-premises environment. Depending on whether or not the hosting company provides the computer equipment or you buy it, the costs for housing and maintaining the equipment can be expensive, coupled with the upfront costs for purchasing software licenses and optionally computer equipment. In this model you will have an ongoing, recurring cost for your hosting fees.

Advantages of Hosted ERP System

- You 'own' the software and only pay once beyond the maintenance which is usually between 15% and 20% depending on software vendor. If you stop paying maintenance the software will continue to work at the version you are on.
- Your data is in a very secure data center which may also have/offer multi-site redundancy in case of disaster. Backups are being made reliably and you can connect from almost anywhere
- You can still bring your application back in-house if your want with little interruption. Most hosting centers use "Virtual" servers like VMWare or Microsoft Hyper-V. This enables you to take your 'server' and run it on your own physical hardware quickly.

Disadvantages of Hosted ERP System

- The monthly hosting cost may exceed in-house costs long term, depending variables such as other non-hosted solutions you have in house, etc.
- If your office Internet connection goes down, you have no access to your system. Redundant internet lines to your office can help alleviate this risk but will incur more costs.

- If you want to integrate other solutions to your ERP system, you usually have to have that solution supported and installed at the hosting center as it is difficult for local applications to real time integrate with hosted applications.
- You need a fair amount of bandwidth which will result in higher usage charges.

SaaS (Software-as-a-Service) or On-Demand

SaaS which stands for Software-as-a-Service is a concept in which you rent everything including your computing equipment and your software. SaaS specifically refers to software that is delivered on-demand over a network. The software itself is not licensed or owned by the end-user. It is provided as a service. SaaS model offerings are typically smaller. This is normally best for organizations with limited complexity, size and global presence. ERP system providers host SaaS model on their own infrastructures instead of locating the systems on-premise at the purchasing organization (see Fig. 26.3).

SaaS differ from traditional hosted services in three ways:

1. SaaS technology is purchased on demand, typically in per-minute or hourly increments.
2. SaaS is elastic, with dynamic provisioning that lets users buy only as many services as they need.
3. The provider completely manages the entire services, which means users typically only need a computer and Internet connection to access them.

In SaaS model, the vendor will have the full control of the application and not the customer where as in the case of hosted ERP system, your data and your application can be placed on server that you control. SaaS provides instant gratification, taking mere minutes to be up and running.

In this model, you pay a monthly, quarterly, or annual fee and simply use "the system." Just like in a furnished rental office. You only pay a monthly fee and there is nothing to own or maintain. You

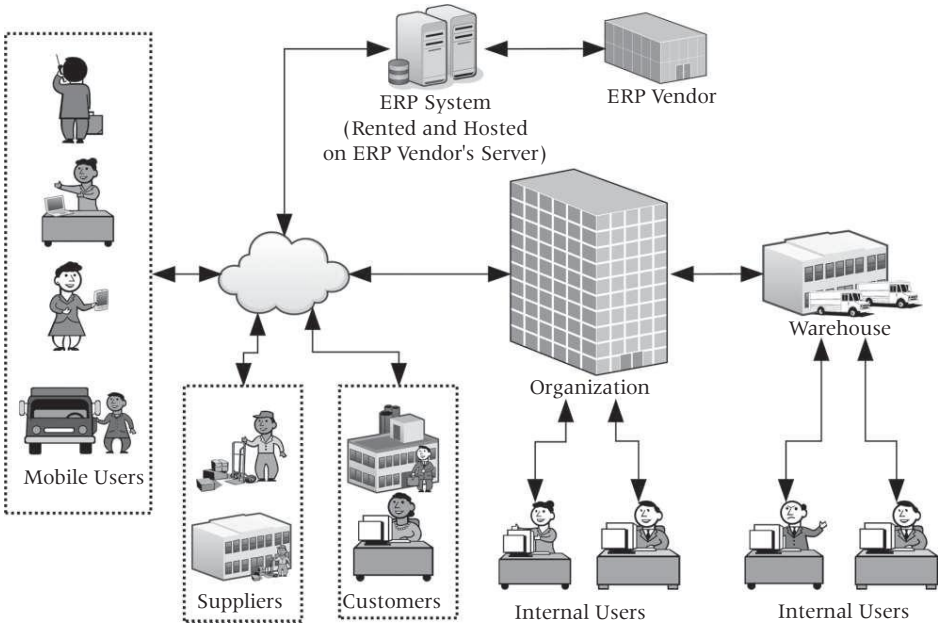

Figure 26.3 SaaS or On-demand ERP system.

access the system through the Internet and have no responsibility for the computing environment including any maintenance to your system. Your system provider is responsible for upgrading your software, your hardware, for making sure everything is working and for expanding your computing resources as your needs increase. In this case you simply sign-in to your system and go to work.

The costs with a SaaS or rental model are typically consistent and predictable over a period of time. Most SaaS companies will charge a monthly, quarterly or annual fee for access to the system and there are no other costs to incur. And, just like the hosting model, you will have an ongoing, recurring cost as long as you use and access the system but your up-front investment costs are minimal.

Advantages of SaaS

- SaaS solutions can be financially attractive. You typically have no upfront costs to start using and they are usually 'self provisioning.' *SAP Business ByDesign* or *Epicor Express* are examples of a true SaaS solution. With SAP, you can fill out some basic information and be in a test environment in less than 30 minutes.
- SaaS ERP solutions can be implemented with relative ease and integrated faster into the organization's day-to-day business than their onsite ERP counterparts. In fact, most SaaS ERP solutions can be up and running in mere weeks, rather than months or even years, as may be the case with traditional onsite ERP software.
- Often, the services component of implementation and future upgrades is bundled into the monthly fee. It may be easier to swallow $200/user/month than $150,000 for a new ERP solution. Even if the $150,000 is actually cheaper over 5-10 years, the savings of cash is very attractive to some companies.
- With traditional licensed ERP software, organizations typically must wait for the next release to benefit from the latest features, upgrades, or security patches. In addition, the cost, complexity, and potential disruption of moving to a new onsite software version often cause some organizations to defer upgrading to the newest release. This, in turn, prevents employees from taking advantage of the latest productivity enhancing tools consistently being added to the applications. SaaS ERP systems, however, eliminate this common problem. Under this delivery model, the provider continuously and unobtrusively adds latest features and upgrades, which means that users can be assured that they're actually using the latest technology.
- To be truly SaaS, it is likely the applications were recently developed. This gives many SaaS applications a 'fresher' look and feel and more modern technology than older applications that were moved into the cloud or are hosted.
- The integration between more than one SaaS application (such as ERP & CRM) can be done by the vendors, but is usually difficult for end-users. However, when done properly, it can look and work seamlessly, almost as if one solution.

Disadvantages of SaaS

- Although cheaper up front, the monthly fees, can add up over time to be substantially more than an 'on-premise' solution. SaaS vendors will typically over-inflate the cost of in house IT and upgrades, and on-premise vendors will typically underestimate those costs. Do your own realistic analysis of the whole picture and look at it over 10 years which seems to be the life of a major ERP system these days. SaaS can have additional fees for extra bandwidth and storage.
- There is nothing to keep a SaaS vendor from increasing the monthly fees a year or two down the road after you have invested time and money in implementing the system. With SaaS, if you

do not pay, you lose access to your system, period. With on-premise, if you stop paying maintenance, your software continues to operate at the current version level.

- Some SaaS vendors have contracts that do not even allow you to retrieve you own data until they are paid in full. This possession of your organization's sensitive data by the SaaS vendor is not at all advisable and it can take a long legal battle to reclaim the ownership of the data in case of a dispute.
- Organizations do not own the code in most SaaS models, have limited rights and control, and are at the full mercy of the vendor should the vendor decide to take a different product direction or find itself bankrupt.
- The total cost is still ambiguous. As more data and connections grow by the day with a deployment, changing SaaS vendors raises mounting complications with the advent of time. Migration plans across vendors or two on-premises solutions are unclear and complicated due to business processes latched onto vendor functionality and varying metadata and standards, and process flows.
- As SaaS model is still early in enterprise adoption maturity, most vendors still have customer-friendly policies. As more businesses move to the SaaS model, the deals favor the vendor. Unless rights are stated up front today, buyers will lose leverage over time.
- When the interface is HTML/Web only, many solutions are slower for 'heads down' data entry or are missing the richness of a traditional windows application such as right mouse click drill downs, etc. If you bring up a customer list, many systems will show you 20 records at a time and you hit a 'next' button to browse the next set whereas the on-premise application can scroll through thousands of records quickly.
- Since SaaS vendors are starting up quickly and many are only operating due to Venture Capital or other equity money, their long term survival is questionable as the inevitable consolidation occurs. If your SaaS vendor goes bankrupt, even if they give you a chance to get your data, it could take months to re-implement a new system. Can your business survive that interruption? With on-premise systems, if the software vendor goes out of business, you can move to a new solution at your own pace.
- SaaS can be challenging when expanding to multiple departments, plants, geographical locations, etc., in a large organization and there may not be much cost savings of SaaS model in complex deployments involving sophisticated business processes.
- Most SaaS solutions have only limited ability to customize and integration of SaaS solutions with existing legacy systems can be very challenging.
- Regarding data security the customers have to trust the vendor. So if the vendor's security infrastructure and policies are not sound and foolproof, then your organization's data is at risk.
- The operational transparency is less in the case of SaaS model as the customers do not have clear visibility into the system's health.
- ERP implementations are people projects and are difficult to manage. So the relative inflexibility of SaaS will force the organizations to change their business processes which can magnify the organizational change management challenges.

When an organization is implementing an on-premises ERP system, it can take effective measures to secure and safeguard the data, its security, privacy, etc. But in the case of a SaaS solution, these issues are handled by the solution provider or vendor. So, if you are considering a SaaS ERP solution, be sure to ask potential solution providers the following security-related questions:

- **What is your privacy policy?** – Your solution provider should have a well thought-out and documented privacy policy that is compatible and acceptable to your organization.

- **What level of security do you use to ensure the safety and integrity of critical data?** – To safeguard your data onsite, your prospective solution provider should use a combination of intrusion detection system (IDS) and intrusion prevention system (IPS) products and apply antivirus at various network layers. It should also utilize deep packet inspection (DPI) or an application-level firewall technology that scans all levels of packet transmission. Finally, it should also use secure socket layer (SSL) or https-encrypted transmission to ensure Internet security.
- **Is your production equipment housed in a state-of-the-art facility?** – Your prospective vendor's data center should be secure, strong and should be capable to withstand natural calamities.
- **Please describe your facility's physical security arrangements. Are they in place 24 hours a day, seven days a week, and 365 days a year?** – The solution provider should have well-defined and robust security arrangements that are in place at all times.
- **Do you contract with an independent, third-party organization to conduct periodic external and internal vulnerability scans?** – In addition to maintaining an intrusion response system and a prepared response plan, your prospective solution provider should frequently commission both routine and unannounced security audits.
- **How often do you back up data, and where are the backups stored?** – A rigorous program of data backup and offsite storage in a secure location remote from its main data center should be in place.
- **Do you offer full hardware redundancy to avoid the negative consequences of a power failure?** – The data center and backup location should have redundant power supplies, such as battery and diesel generator backups, to avoid the negative consequences associated with a power failure.
- **How do we ensure that our hosted ERP solution will remain affordable and viable as our business requirements and competitive environment evolve?** – As the demand for SaaS solutions become more, the solution provider will gain more leverage and will be in a position to dictate terms and conditions. So what assurances the vendor can give that they will not take you for a ride when situation favors them. The solution is to agree the rates, rate of increase in rates and other costs and get these things in writing.
- **Does your staff include a highly qualified operations team that monitors the site 24 hours a day, 365 days a year?** – Your prospective vendor should have on staff many certified security experts, including those with the preferred Certified Information Systems Security Professional (CISSP) designation.

We have seen the different methods for deploying ERP systems. The beauty of modern ERP packages is that you have options to choose from during your ERP software selection. You can either deploy a solution by hosting it internally on your own servers (traditional ERP), or if you would rather not deal with the software, you can have it hosted somewhere else (SaaS). So which model is best? In many cases, there is no one best answer on whether or not to move your business application to the "cloud". Your business circumstances, management reporting requirements, and operational needs all impact your decision. Changing business management systems is costly, time consuming, disruptive and not without risk. Having the ability to off-load much of the overhead and maintenance of on-premise computing provides businesses with more stable and reliable systems. However, there are some considerations that will help bring some clarity. They are availability of internal IT resources, ERP time horizon, and company size.

- **Simplicity** – In general, SaaS is simpler to deploy from a technical perspective. Because you do not need to purchase additional servers or physically install the software yourself. You can simply get started with a basic Internet connection

- **Flexibility** – Because traditional ERP is installed on your servers and you actually own the software, you can do with it as you please. You may decide to customize it, integrate it to other software, etc. Although any ERP software will allow you to configure and set up the software as you like, SaaS is generally less flexible than traditional ERP in that you cannot completely customize or rewrite the software. Besides, SaaS vendors are more likely to provide only one version, whether you need the upgrade functions or not, and since the software is delivered over the Web, you have no choice but to accept them.
- **Control** – Many companies find that they do not have control over SaaS software as they would like, relative to traditional ERP. This is especially true of midsized or large companies with well-defined business processes that cannot be changed to fit the software. Small companies can generally adapt their business processes to the software more easily than large organizations can.
- **Accessibility** – SaaS uses the Internet to access systems once deployed and maintained off-premises. Since SaaS is entirely accessed through the Web, you are in trouble if the Internet goes down. Traditional ERP does not require Internet reliability, provided your users are accessing the software from inside your company's network.
- **Cost** – In general, SaaS can be deployed at a much lower initial cost and lower total cost of ownership; companies can avoid costly licenses, complex hardware, software infrastructure and no technology maintain needed. This type of cost-effectiveness can be attractive to smaller businesses, but the ongoing annual payment or monthly fees can be higher for SaaS because you are paying to use the software on a subscription basis. It can become costly as you grow and add employees to the system.
- **Integration** – Companies that have implemented traditional ERP typically have applications that run on the same platform. They have avoided tough integration issues and improved visibility into operations. Integration is a major issue for SaaS companies, which need to provide on-premise integration for their customers to integrate cloud applications with existing legacy applications. A company with SaaS will find it very difficult to integrate hosted software from a variety of vendors using middleware from yet another vendor.
- **In-house IT expertise** – Use SaaS when you lack internal IT resources. Businesses benefit from SaaS when they do not have IT resources to dedicate to installing and managing applications.
- **ERP time horizon** – Another consideration is the length of time your organization plans to use the system. For short term deployments of small companies SaaS is a better choice as it can provide lower costs, but for longer duration hosted model will be less expensive.
- **Company size** – SaaS is normally best for organizations with limited complexity, size and global presence. For large organizations with worldwide presence and complex business models on-premises deployment is the best as they will have their own IT departments and would want the data security and flexibility of operation.

We have seen the different ERP deployment methods. The traditional on-premises ERP is still the *de facto* choice while other deployment options are being considered and are becoming popular. The advancements in the areas like data security, Internet access, etc. will help the growth of other deployment methods. Also ERP vendors are offering SaaS and web-based solutions and this will help in reducing the total cost of ownership and time to implement the system.

When deciding which method to choose, make sure you understand your costs, responsibilities, limitations, and future obligations of the different models and then choose a deployment method that is best suited for your organization. There is little doubt that SaaS ERP represents the wave of the future. SaaS offers some unmatched benefits like scalability, ease of upgrade, lower IT administration needs, etc. However, SaaS introduces inherent business continuity risks associated with the

relinquishment of data control. Unless businesses choose to outsource the hosting of their on-premise systems, they can avoid these risks. Table 26.1 summarizes the factors that should be considered and which model to choose based on that.

Table 26.1 SaaS vs. On-premise choice matrix

	SaaS	On-Premise
Business Process	Simple business process	Complex or unique business process
	Immature or undefined business processes	Well-established business processes
Employees	Low tenure	High tenure
Business model	Stable, little change	Volatile, constantly changing
Company size	Small to medium	Medium, large, or global
IT skills	Little to none	Sophisticated
IT infrastructure	Little to none	Well-established
Integration with other systems	Little to none	Need for integration to other applications
Control	Little need or desire	Require control

Source: Panorama Consulting Solutions

Deciding between SaaS and on-premise will inevitably be one of tradeoffs. The key to making an effective decision is to prioritize business requirements across an expected investment horizon. Only then will a company be in a position to make a value-maximizing ERP decision.

REVIEW QUESTIONS

1. What is on-premise ERP? Discuss their advantages and disadvantages.
2. What is a hosted system and what are its advantages and disadvantages?
3. What is SaaS? What are the benefits of SaaS ERP? What are its limitations?
4. How will you choose a deployment that is best suited for your organization?

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Chapter 27

Not All Packages are Created Equal—Package Selection

INTRODUCTION

There is no doubt that the market for ERP systems is very intense. Industry analysts are forecasting steady growth rates for the ERP market. Why have so many companies replaced their manual or semi-automated systems with ERP systems? Why are so many companies, which were using old systems or old ERP systems, changing to more sophisticated ERP packages? Here are some reasons.

- **Productivity improvement**—ERP systems improve the productivity and efficiency of organizations by eliminating data redundancy, streamlining processes, introducing best business practices, and so on.
- **Increased business agility**—Improved productivity and reduced development time means that less time is needed to get a product to market. This coupled with the ERP system's ability to manage and track problems, fix them, rebuild the systems easily, accurately and quickly, and release them faster results in improved customer satisfaction. Therefore, the company can be more agile and more responsive to the needs of the customer without compromising on the quality of products.
- **Error reduction**—ERP systems automate most of the monotonous and repetitive tasks that were done earlier by people. Thus, ERP systems have greatly reduced the opportunity for human error.
- **Information integration**—One of the major functions of ERP is to provide sufficient, relevant, and accurate information about the software system to the different people in the project—programmers, managers, analysts, auditors, and so on—allowing the functioning of the business processes to proceed smoothly. Earlier, people had to rely on reports provided by the legacy systems, which were never up-to-date, current, or accurate. These reports were not capable of answering ad hoc queries. However, today's ERP tools have all the information the user needs and can deliver them to the user in any format that he wants almost instantly. This information integration capability and flexibility is one of the most important advantages of ERP systems.
- **Automation**—ERP systems automate many processes. They also automate the workflow so that a single action like an entry into the order processing system triggers a number of related events and actions in different but related departments automatically. This level of automation reduces data entry, errors, data duplication, and helps the organization to react and respond faster. By automating the business processes and tasks, ERP systems have improved development productivity and given people more time for the system development process.

Aberdeen Group [1] conducted a survey in May–July 2011 to find out the reasons for implementing new ERP systems. It studied companies that had an existing ERP system and those who did not. The top reasons for replacing the existing system (ERP or other) are given in Table 27.1 and in Fig. 27.1.

Table 27.1 Top reasons for replacing existing ERP systems

Reason	Percent of Respondents (n = 387)
Lack of features	57
Obsolete technology or infrastructure	44
Cost of maintenance and support	39
Lack of available customization	19

Source: Aberdeen Group, July 2011

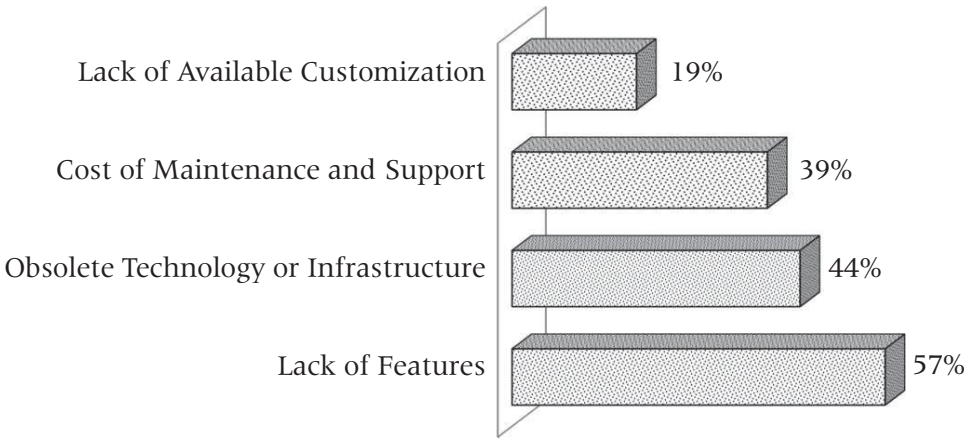

Figure 27.1 Reasons for implementing ERP systems.

These are some of the reasons for the increasing popularity of the ERP market. As more and more companies join the race, the competition is getting keener and ERP vendors are gearing up to meet this challenge by offering more features and better capabilities for their products. Thus, the future will see a fierce battle for market share and mergers and acquisitions aimed at gaining strategic and competitive advantage. The ultimate winner in this race will be the customer, who will get better products and improved services at affordable prices.

WHY MANY ERP PACKAGE IMPLEMENTATIONS FAIL?

In Chapter 22, we analyzed the reasons for the failure of ERP systems. In this section, we will see why many ERP implementations fail. ERP packages—if chosen correctly, implemented judiciously, and used efficiently—will raise productivity, shorten development times, improve responsiveness, and result in better customer satisfaction. To use the tool efficiently, it has to be the right tool (right in the sense that it integrates well with the organization's business processes), the people who use the tool have to be properly trained, and so on. However, many a projects/organizations fail in this because they use the wrong product, conduct an incompetent and haphazard implementation, and suffer inefficient or ineffective usage.

ERP is first an attitude; second, a process; and only third, a set of tools. Attitude refers to the feeling or mindset of the people in the organization toward ERP. Therefore, the users of the ERP

system have to be convinced about the real benefits of using the system. This can be done by educating people about its benefits and divulging the misconceptions about ERP. This is important because if people believe that ERP is unnecessary, they will try to bypass it.

To work successfully, the ERP implementations need a lot of factors to click. There should be good people who know the ERP system and the organizational business practices, the vendor should be good and the vendor's package should be the one best suited for the company's needs. The implementation should be planned well and executed perfectly and the end-user training should be done so that the people understand the system and the effect of their efforts on the overall success of the program.

ERP can be implemented in a variety of ways. It can be implemented in a *phased manner (the incremental approach)* or it can be implemented in *one shot (the big-bang approach)*. Irrespective of the implementation methodology chosen, the development process has to be mature and the development environment and the organizational culture must be conducive for the implementation of ERP and its tools. If the implementation is done in an environment where the people are not ready for ERP and the work culture is not suitable, then the implementation will fail. Thus, the first step in the ERP implementation process is to turn the organizational environment suitable for ERP.

Organizations exist in different levels of process maturity. The ease and correctness with which they can execute a process depends upon their maturity. As such, it is generally not fruitful to impose a very sophisticated process on an organization whose maturity is low. The maturity of an organization not only depends on the skill sets of the individuals, but also on the spirit of the team. This makes improvement an incremental process. The lessons, habits, and practices learned doing simple tasks provide the foundation to take the organization toward more sophisticated tasks. Thus, the maturity level of the organization is very critical in the success of an ERP implementation.

Also, many ERP system implementations fail because they try to implement ERP in the 'tool' way rather than in the 'process' way. As we saw earlier, ERP is first an attitude, then a process and lastly a set of tools. One can implement sophisticated, all-encompassing ERP packages, loaded with features, but if the people who are using them do not know why they are doing a particular task or what happens when they do something or the effect of their actions (or lack of it) on others, then the chances of such an implementation succeeding are slim.

Thus for an ERP system implementation to succeed, the implementation has to be planned well, the people must be ready for ERP, the development process must be in place, the selected tool should be well integrated with the process, and finally everybody involved in the project should understand the importance of having an ERP system and the role each one of them has to play to make the implementation a success.

ERP PACKAGE EVALUATION AND SELECTION

ERP systems have gained popularity and their usefulness has increased to a point where organizations without an ERP system are almost non-existent. ERP systems are now available in all sizes and shapes for all platforms and development environments. Evaluating the ERP systems available in the marketplace and then selecting one for your organization are critical parts of the process. This decision can make or break an organization. If the choice is not right then the organization will pay dearly for it.

Therefore, you think that all ERP packages are the same? Think again, because they are not. Out of the more than 50 ERP packages available, the features they offer vary, as do the technologies they support, the technologies they use, the architecture on which they are built, and the available platforms. Each tool has its own strengths and weaknesses. For example, some are better at human resources, whereas others have excellent production and production planning capabilities.

ERP packages have different architectures, concepts, and sets of functionalities and they are designed to address a variety of user requirements. Now of course, the marketing brochures from ERP vendors will no doubt give the impression that their tool is just as good as any other. Such document is valuable for giving the reader an overview of functionality and a glimpse at the differentiator for that vendor's offering. However, if you compare the literature or listen to a vendor's presentation, it would be very difficult to evaluate which package is the best or which would be most suitable for your organization.

Deciding which package is suited to your organization is a difficult task. Each piece of marketing literature of the tool vendors claims that their product is the best among the lot and has all of the features that you will ever need. Therefore, if you go by what is written in the product brochure or what the salespeople say, you will find it confusing and might end up with the wrong choice. Thus, package selection is something that should be done in a systematic and scientific manner. In this section, we examine how to select an ERP system that will suit your needs.

The most important factor to keep in mind when analyzing the different packages is that none of them are perfect. The idea that there is no perfect package needs to be understood by everyone in the decision-making team. The objective of the selection process is not to identify a package that covers each and every requirement (a perfect fit). The objective is to find a package that is flexible enough to meet the company's needs. Or in other words, to find a tool that can be customized to obtain a 'good fit.'

If one studies the history of ERP packages and finds out how each package evolved, then it soon becomes evident that every ERP package grew out of the experience or opportunity of a group of people working in a specific business who created systems that could deal with certain business segments. It is generally accepted that most ERP packages are stronger in certain areas than in others and each one is trying hard to add functionality in areas where they have been lacking. For example, PeopleSoft is strong in HR and less so in manufacturing; Baan, on the other hand, is historically stronger in manufacturing than in financial, and so on.

The ERP packages evolved over time as the companies grew. The experience gained from implementation, the feedback by the users, the need to enter into new markets, and the pressure from competitors forced most ERP vendors to re-define and expand the scope of the activities and functionality of their products. The concepts were expanded upon, new functions were introduced, good ideas were copied from others, and so on. Nevertheless, each package has a history (or origin) that determines the type of business it is best suited for.

Originally, ERP packages were targeted at the manufacturing industry and consisted mainly of functions for generally planning and managing the core businesses such as sales management, production management, accounting and financial matters, etc. However, in recent years, adaptation not only to the manufacturing industry, but also to diverse types of industry has become possible and the expansion of implementation and use has been progressing on a global level.

Thus, while making the analysis it is a good idea to investigate the origins of the different packages. Now, almost all packages cater to most business and service sectors. It would be wrong to say that a system that was developed initially for manufacturing is now not capable of catering to the needs of another business sector, e.g. software development. The system must have been thoroughly re-vamped and re-designed to meet the needs of the diverse business sectors that it is catering to. However, it should be remembered that many ERP packages are still very good in some areas, even though they are capable of catering to the needs of other sectors.

Thus, after finalizing on the decision, the company needs to develop the selection criteria that will evaluate all the available packages on the same scale. To choose the best system, the company should identify the system that meets the business needs, matches the business profile, and identifies with the business practices of the company. It is impossible to get a system that will perform, exactly as

the company does business, but the aim should be to get the system that has the least number of differences.

Focus Research [2] has developed a set of six best practices for selecting ERP software. The Inside-ERP [3] has 10 golden rules for choosing an ERP system. A summary of these are given below:

1. **Know your requirements:** You must make sure that you know what business problems you are trying to solve by introducing the ERP system. Only by understanding your need and then matching them against potential vendors' offerings, you can make a selection. Define and document the needs before deciding on the initial vendors or you might end up selecting an ERP system that addresses the wrong issues. The need assessment and requirements definition should be a multi-disciplined approach involving employees from all departments of the company.
2. **Make sure vendor competencies match your requirements:** Check and verify the vendor's experience, reputation, and the features of the ERP package, implementation support, and other details in advance. Ask them to demonstrate the functionality and the ability to scale up and a few examples where they have established themselves.
3. **Insist on demos:** Insist on demos—both in-house and also off-site (some other organizations where it is working). Insist that the representatives of all departments and your consultants attend all the in-house demos. Make sure that everyone agrees that the vendors are capable of doing what they are promising. Insist on seeing the system in real world. These demos can be attended by the project manager and a few key members of the implementation team as most companies will not be open to large groups going through their systems. Demonstrating capabilities on a set of test data and doing it in the real life are two different things. If the vendor cannot arrange a live demo, ask for references and check on them to verify the claims are true.
4. **Check vendors' training and support resources:** Make sure there are adequate vendor consultants in the implementation team during implementation and end-user training. Also ensure that the vendor has a training and certification program and is capable of training your employees. Also make sure that the vendor will provide additional training when there are major upgrades and changes. Check also about the support—both on-site and remote (by phone). Check what is their problem resolution time and whether they will have dedicated consultants till the system is stable.
5. **Treat your ERP project as a configuration-management project:** ERP projects are people-driven configuration or change management projects aimed at improving cross-functional business processes. In such projects, people are more important than technology. New software implementations need to include user engagement and knowledge transfer so users understand not only their own roles, but the roles of others, and what impact it will have on others in a given process chain.
6. **Enlist the aid of consultants:** Use external consultants and internal experts who have worked in many ERP implementation projects under different business scenarios. The people who have worked on both sides—functional as well as the software—are extremely valuable as they will be able to act as mediators between the two sections. It is critical, however, that this consultant be objective, equally knowledgeable about all the solutions on your short list, and have experience with ERP in your industry or for your type of organization. Employ these consultants well in advance and ensure that they are part of the requirements definition process now onwards. These people will be valuable during the selection process as they will be able to offer expert advice on the pros and cons of the different packages.

7. **Do not skimp when allocating resources:** Commit enough resources both financially and managerial time. When selecting an ERP package, do not choose one because it is cheap; choose a package that is best suited for your organization. This is a decision where cost is one of the last criterion, as an improperly chosen package can affect you adversely.
8. **Identify both industry-specific and general ERP packages:** Based on your business requirements and budgetary needs, you will probably eliminate most vendors. Ideally the final list should contain about six to eight vendors.
9. **Include a software-as-a-service solution (SaaS) in your assessments:** The ERP market was slower to adopt SaaS solutions than other types of business software, but it is now a viable alternative to premise-based solutions. SaaS offerings generally have a lower total cost of ownership, are easier to deploy than an on-premise solution, and can be implemented more quickly. On-premise solutions offer certain benefits, too, including greater security and control over your data, but for some organizations, SaaS is a perfect solution and hence it should be considered during the selection process.
10. **Plan for the future:** Choose an ERP solution that can grow with your company. Consider not only the features you need now, but the features you may need six months or a year from now. ERP is a long-term investment. You need a solution that is flexible enough to accommodate evolving business processes and new initiatives in your organization and is scalable enough to include additional users. You should also be able to phase in new ERP functionality as you need it.
11. **Buy only the modules you need:** ERP packages are sold as suites, but you do not necessarily have to buy them that way. You can purchase just the modules (or services) that your organization needs. The modules are integrated as you deploy them, depending on your initial installation or several months down the road.
12. **Calculate the true total cost of ownership (TCO) of each ERP offering:** Remember, the cost of the software or the monthly SaaS subscription is just the first line item on your list. The true TCO of any ERP solution also includes implementation, customization, and management services, training, additional hardware for an on-premise solution or ramped up bandwidth for a web-based product, and even additional IT staff.
13. **Insist on a thorough demonstration of the ERP solution:** Many companies offer online demos of their products, but they do not go deep enough. Meet with the vendor and get a hands-on demonstration that allows you to experience the usability of each module of the solution. Include employees from the various departments who will use ERP to evaluate how well the solution would support business processes.
14. **Take advantage of your peers' feedback on ERP:** Most of the companies that use the ERP are part of user groups to some extent. Use the peer group to get inputs during the selection process. One can find references and unbiased opinions about the vendors and packages in these groups. Make use of them.

THE SELECTION PROCESS

Once you have decided to implement the ERP system, you have to find a package that is best suited for you. The selection process is one of the most important phases of the ERP implementation because the package that you select will decide the success or failure of the project. Since ERP systems incur huge investment, once a package is purchased it is not an easy task to switch to another one. Therefore, it is a 'do it right the first time' proposition. The consequences of choosing a wrong package are catastrophic, often forcing the company to close shop.

Pre-evaluation Screening

As we have seen, there are many ERP packages available in the market. Analyzing all the packages before reaching a decision is not a viable solution. It is also a very time-consuming process. Thus, it is better to limit the number of packages that are evaluated to about six to eight. Once the list of six to eight vendors has been compiled, identify the key requirements that a package must have in order to make into the final list. These 'deal-breakers' should help you short list about three to four vendors. Typically, discussing business requirements with each of the vendors from the initial list (of 6–8 vendors) and getting an RFI (request for information) response will be the basis for moving to the final list. It is always better to do a thorough and detailed evaluation of a small number of packages, than to do a superficial analysis of dozens of packages. Therefore, the company should do the pre-evaluation screening to limit the number of packages that are to be evaluated by the committee. As we have seen earlier, not all packages are equal—each has some strengths and weakness. The pre-evaluation process should eliminate those packages that are not at all suitable for the company's business processes. One can zero in on the few best packages by looking at the product write-up of the vendors, getting help from the external consultants and most importantly finding out what package is used by similar companies. It is always better to look around to find out how the different packages are performing in environments similar to yours. Once you select a few packages after the screening, you can call the respective vendors for presentations/demos.

Selection Committee

It is always better to form a selection or evaluation committee that will do the evaluation process. This committee should comprise of people from the various departments (the functional experts), top management (preferably the CIO or COO), and consultants (package experts). The selection committee should be entrusted with the task of the choosing a package for the company. Since all business functions are represented and the management is involved, the package that is selected will have company-wide acceptance. The package experts or the consultants can act as mediators or play the role of explaining the pros and cons of each package.

The evaluation committee should be made up of various representatives of the user community. It can include managers, supervisors, clerical staff, QA people, technical leaders, and project managers. All can provide perspective and ensure that their needs are addressed, while providing their own experiences, skill set, and processes to address the three important areas apart from functionality requirements: usability, performance, and scalability requirements.

Handling the Vendors

Once you make a decision to go in for an ERP package, the marketing executives of the different vendors will swamp you. Each will have colorful and attractive brochures and presentations claiming that their product is the best one for you. They will use all the tricks to get you hooked. Therefore, it is better that you have a strategy for dealing with these vendors.

As mentioned earlier, it is always better to do a detailed evaluation of a few packages that meet your pre-selection criteria. Thus, when the vendors arrive for their presentations, you should be thoroughly prepared; otherwise they will drown you in their hi-fi presentations and you will not have time to clarify your doubts. This point is being stressed again and again because most vendors can make presentations that leave potential users dazzled and without proper consideration of all aspects. The selection may thus end up being based on a set of factors that are insufficient for arriving at a well-informed and judicious decision.

Thus, instead of just listening to presentations, you should be prepared with your questions. The questions should be prepared beforehand and should address all your concerns. The responses that you get for your questions will help you in either eliminating a vendor or strengthening his case. The questions if properly prepared and asked will expose the weak/problem areas, if any, that exists in the vendors' products. Also, when you are asking questions it means that you are not taking anything for granted. It is a good idea to prepare the minutes of the meeting and make the vendors sign it. This will prevent them from making false claims and you can make them accountable if they fail to deliver what they have promised.

The vendors should be asked to show testimonials and practical demonstrations of the system. The vendor should provide references for organizations where the system has been implemented successfully. However, vendors will also have customers where the tools have failed. In this author's opinion, getting those names and reasons for the failure is more important than the success stories. Also in this author's experience that while vendor representatives are well prepared for the success stories, the questions about failed implementations usually reveals points and issues that the vendor is trying to downplay. Thus, it is important to ask about failed implementations. Quite often, the vendor will send two representatives to visit you, a marketing agent, and a technical expert. Most of your questions should be directed to the technical expert. The marketing expert should be asked about warranties, licenses, cost, support, training, etc., whereas the technical expert should be asked about the functionality and capabilities of the system they are offering.

Role of Technology

The existing technology will play a very important role in the ERP selection process. Each organization will have its own technological environment: how the business is being done, what kind of hardware and software are in use, what is the database management system that is used for storing the operational and historical data, how is the data processing done, and so on. These factors can greatly influence the selection process, in the sense that they can limit the number of packages available for evaluation. Therefore, the management has to decide whether the ERP systems will be selected keeping in mind the existing infrastructure or if the existing systems will not be considered (in which case some of them will have to be scrapped). However, it is always a better idea to find a package that is compatible with the hardware, software, and technology that the company already has in place. Also, if the organization has the necessary infrastructure then it can think of buying the required components from the vendors and integrating them with the existing system.

For example, if an organization is using an HR management system and is quite satisfied with it, then it can go in for the other modules and not for the complete offering from the vendor. Later, if the organization wants to switch from the old HR management system it can then purchase that particular module of the ERP package. Thus, it is not imperative that all the components offered by the vendor be bought. The evaluation committee in association with the vendor can select the required components and then integrate them with the existing infrastructure. However, do not forget here to get the vendor's assurance (in writing) that the existing system will integrate smoothly and seamlessly with the purchased components.

The Selection Criteria

ERP packages come in all sizes and shapes, with all the frills, bells, and whistles, gizmos and gadgets that you can imagine. Hence, it is a good practice to specify selection criteria for evaluating the packages that survive the pre-evaluation screening. The criteria can be in the form of a questionnaire and a point system. This will help in making the selection process more objective.

The questions should address the company's business needs and concerns and each issue or question should be given credence based on the criticality of the function. For example, if the company has offices in different countries, then the capability of handling multiple languages and currencies becomes an important criterion. Likewise the selection criteria should be divided into categories—vital, essential, and desirable—and points should be given to each criterion. This point rating system will simplify the evaluation process; but remember the importance of human intuition (gut feeling) and judgment should never be underestimated.

The best method for preparing the selection criteria is to conduct a requirements analysis—find out what the company needs. The requirements must reflect those factors that the company considers indispensable for the successful running of the business according to the company's work culture and practices. Given below are some examples of the selection criteria.

- The package should have multi-language and multi-currency support.
- The package should be international and should have installations in specified countries (basically in countries where the company have offices). The vendor should also have a local presence in those countries.
- The package should have at least 'x' number of installations out of which at least 'y' should be in your business sector.
- The cost of the package with all the necessary modules should be less than 'x' Rupees.
- The package should have the facility to do an incremental module addition. For example, the company should have the facility to buy the core modules initially and then go in for the additional modules as and when desired.
- The vendor should provide pre-and post-implementation support.
- The vendor should give a commitment on training the company employees on the package.
- The package should have the capability of interfacing with other systems that the company is dealing with—banks, suppliers, customers, etc.
- The package should have scalability, ability to integrate with legacy systems, and openness of the architecture. These technical factors are as important as the functional business requirements.
- The package must be customizable and the customization process should be easy (something that could be done in-house)
- The vendor's policy and practices regarding updates, versions, etc., should be acceptable.

Thus, the issues, concerns, and expectations that the company has regarding the package can be consolidated and made into a list. Then the items in the list should be placed into the 'vital-essential-desirable' categories. Based on this list, each package should be evaluated. Many items in the list will have descriptive answers. The committee should sit together and analyze these issues and assign points to these items.

One important thing that should be kept in mind is that whenever a decision is made, the committee should discuss it and a consensus must be reached. In doing so, the chances of conflict between different departments are eliminated. It should be remembered that an ERP project belongs to all the functions and it is better that all the decisions are arrived at after discussions. This will create a notion that the project belongs to everyone and it furthers the idea that a commitment from everyone is needed to make it happen. Most importantly, since the functional experts and organization's experts (who know the business process well) and vendor representatives (who know the ERP package well) are involved, they can tell areas and issues that should be given more importance, the aspects that should be scrutinized more thoroughly and how the company's current business practices could be replaced with new ones or modified to suit the package.

Another source from which the evaluation committee can get information about the tools is independent research agencies and companies. These sources supply information, comprehensive analyses, and comparison reports about the leading tools. However these reports, although excellent sources of information and a single-point reference about the leading ERP systems, are not totally unbiased, completely accurate and totally objective and therefore, should not be taken as gospel truth. But these reports can provide valuable information about the tools. Thus, at least a few reports by these research groups should be studied along with the vendor's brochure so that you get a complete picture of the ERP system marketplace. These reports analyze and compare the tools and their features, predict market trends, forecast the position of the different players in the coming years, and so on.

A number of companies and consultants do this kind of analysis. Prominent among them are Aberdeen Group (www.aberdeen.com), FOCUS Research & Consulting (www.focusmr.com), Forrester Research (www.forrester.com), Gartner Group (www.gartner.com), The International Data Corporation (www.idc.com), Inside-ERP (www. inside-erp.com), Ovum (www.ovum.com), Nielsen (www.nielsen.com), Panorama Consulting Solutions (www.panorama-consulting.com), Ziff Davis Inc., (www.ziffdavis.com), etc. Sometimes trade magazines like *CIO, HBR, Forbes, Fortune,* etc., publish articles about ERP and its current state. This information is also worth looking into because it is independent and not biased.

Once the committee has evaluated all the packages that have cleared the pre-evaluation criteria, listen to the vendor presentations and demos, and clarify pending issues, a decision is reached on which package to buy.

Once the committee has reached a decision on a package, it is a good idea to visit a few companies that have installed the particular package and see it in action. Not many people will admit easily that they have made a mistake, so whatever the existing owners say about a package should be taken with a pinch of salt. But visiting four or five installations should give a good idea about the package. If the committee members feel that their decision is right and what they have thought is what they have seen, then the company can proceed with the purchasing and implementation.

If anybody is uneasy about some aspect or feels that the product is not up to the expected standard, then the committee members should sit and discuss this again and perhaps do the analysis once again. The package that has got the maximum score in the point rating system need not necessarily be the one that is best suited for the company. The extra time spent on analysis and evaluation is not a waste; it might save the company from a potential disaster.

One final word, the most critical factor that determines the success of any ERP implementation is the support of the people who use the system. Even the best ERP systems will fail if there is no user support. Therefore, the decision of the committee should be a consensus decision. If there are some people whose views are overridden by majority vote, then the management should take every effort to make them understand the reasons for the decisions and should spare no effort to win them over. Disagreements are common in any group discussion, but the success of the group lies in the fact that all the people in the group own the decisions that are made. Thus, as the group as a whole makes the choice, everybody emerges as a winner. This feeling is very important, as the company will need everyone's goodwill and support to achieve success during and after implementation.

ERP PACKAGES: MAKE OR BUY?

So far we have seen three possible scenarios for implementing an ERP system:

1. The manual system

2. The semi-automated system, in which some components like production planning or finance are automated
3. The integrated system where a computerized system is integrated into the business process

Except in the first case, the other implementation scenarios use some sort of computerized tools for managing the business. The question is whether to develop the ERP system in-house or to buy them. The rationale for buying software is compelling. The industry is forever comparing itself to more familiar trades, so how about this bit of hype: could you conceive of a machine parts company building its own lathe or a restaurant building its own grill?

Why can't companies develop their own ERP packages? Developing an ERP package is a very complex and time-consuming process that requires a lot of skilled manpower and other resources. Many companies have personnel on their payrolls who can absorb the necessary knowledge and who have experience in developing sophisticated systems. The problem is that ERP package development is not the main business of these companies. They should be directing all of their available resources into improving their own products or services so that they can remain competitive and better serve their customers and continue to grow.

ERP package vendors are people who have invested huge amounts of time and effort in research and development to create packaged solutions. ERP vendors spend billions of dollars in research and come up with innovations that make the packages more efficient, flexible, and easy to implement and use. Also with the evolution of new technologies, the vendors will be able to constantly upgrade their product to take advantage of the best and latest advancements in technology because their main focus is on improving the capabilities of their tools.

Since designing and implementing ERP systems is not the business of most companies, or a focus of their executives, the systems an in-house team comes up with will never equal in quality, scope, functionality, or technology with those created by software firms whose business this is. These software firms (ERP package vendors) can produce sophisticated packages and provide their clients with products that allow them to maintain a focus on their own chief activities, thus improving revenues, profits, and shareholder returns. During the 1960's, 70's, and 80's, there were not many vendors that were producing ERP packages; hence, quite often a company needing a specialized ERP system was left to their own devices and ingenuity to develop something that would suit their needs. In today's marketplace, there are many ERP package vendors and they are actively pursuing all the niches and circumstances where ERP systems can solve problems for development organizations.

Thus, it is always better to buy ERP packages. ERP systems are getting better, bigger, and have more features. Also, it is developed my experts in the field. Most of the tools could be customized to suit your needs. Therefore, unless and until your project or organization has a need that cannot be fulfilled by the available tools, it is better to buy the tools rather than develop them.

SUMMARY

ERP packages and their selection are discussed in this chapter. ERP systems can dramatically improve development productivity. This chapter also analyzed how to choose a tool that is right for an organization and how to deploy it. We also discussed on choosing between developing or buying the ERP package.

REVIEW QUESTIONS

1. Why are so many companies changing to ERP packages?
2. What are the top reasons for replacing the existing ERP systems?

3. Why many ERP implementations fail?
4. What are the different ways in which an ERP system can be implemented?
5. The most important factor to keep in mind when analyzing the different packages is that none of them are perfect. Discuss.
6. What are the guidelines and best practices for selecting ERP software?
7. What is the purpose and importance of the pre-evaluation screening?
8. What should be the composition of the ERP package selection committee?
9. How must the vendors be handled during the selection process?
10. How should the vendor presentations be conducted?
11. What is the role of technology in ERP selection?
12. Explain the importance of forming selection criteria for package selection process.
13. Explain the ERP package evaluation and selection process.
14. Give a few examples of the selection criteria.
15. What are the three possible scenarios for implementing an ERP system and explain each scenario?
16. Why it is said that it is better to go in for ERP packages from good companies rather than developing it in-house?
17. Discuss the pros and cons of making or buying the ERP package in the organization.
18. Name a few organizations that conduct and research and publish papers on the various aspects of ERP.
19. What are some of the sources other than vendor brochure that provide information about ERP systems?
20. Why should the ERP selection decision be made through consensus?

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Chapter 28

ERP Project Teams

INTRODUCTION

The success of an ERP implementation largely depends on how a company categorizes its ERP project team. ERP project teams are formed not just for implementing ERP software but also for the ongoing maintenance of an ERP system. Team structures vary tremendously from company to company and situation to situation.

Organizations usually do not give enough thought as to how to form ERP teams—pre-implementation, implementation, and post implementation. ERP consultants and vendors sometimes suggest the need and structure of the ERP teams, but since they do not know the organizational culture and specific strengths and weaknesses of the organization, their suggestion cannot be taken on its face value.

The top management should form the ERP team in consultation with the consultants and vendors. The ERP teams should contain the consultants and vendor representatives before, during, and after the implementation. The vendor representatives will come into the ERP team only after the selection of the ERP package, but the external consultants (the experts) should be there to help in the package selection and vendor negotiations, as discussed in Chapter 25.

The vendor representatives and the consultants will work hand-in-hand during the implementation and for some time after the implementation. They should be allowed to leave the organization only after the knowledge transfer and employee training and education has been completed and the in-house ERP experts are absolutely sure that they can manage the operation and maintenance of the ERP system on their own. We will see more about the ERP implementation, implementation team formation, and the working of ERP teams in this chapter.

ERP PACKAGE IMPLEMENTATION

Once the right ERP package has been selected, then the next step is implementation. Making a major change in a company, such as changing over to a new automated ERP system, is both a significant opportunity and a major responsibility. It is an opportunity because it enables a company to address its business problems and improve processes to result in better management of its data and its development and maintenance activities. However, changing over is a major responsibility because of the ramifications and the resources required to make the change. Many complicated technical, political, organizational, cultural, process-oriented, risk-related, and personnel issues need to be addressed in making the change and people need to be committed to the change.

To adopt an ERP system successfully or to make the changeover from one system to another, careful planning is a must. All possible aspects of the implementation should be addressed satisfactorily before starting the implementation/changeover. This includes the implementation of new procedures, automation of tasks, introduction of new business processes, the changing responsibilities of the users, etc. The users will have to be trained in the new technologies, which enable them to take full advantage of the various features of the ERP system.

Many people will need to be trained or re-trained on the new system. Many will have to be trained on the new business processes that are being introduced and on why they are replacing the existing

procedures. In this author's experience, it makes tremendous difference if people are explained the reason why a particular change is made, how the new business process or procedure will improve the productivity, and then given training on using the system. Thus, the employees can correlate what they are doing with the system to the actual business functions. If employees are just trained to use the ERP system without understanding the underlying reasons and concepts, then they will be doing their tasks without knowing how their actions affect others. Yes, it is possible to implement an ERP system and use it without actually knowing anything about the ERP concepts, in the long run it is better to do it the right way—that is, provide training in the ERP system along with training on the fundamental concepts and business processes and how these processes and functions are implemented in the ERP system.

The following issues need to be addressed before the ERP implementation/changeover begins: process, culture, roles, risk management, environment, application, requirements, management, and planning. The organization should address the current and new business process and how the ERP system will be different. The work environment and work culture of the organization and whether they have to be changed or adapted to meet the needs of the new ERP system need to be analyzed. This is important because a new ERP package will bring about changes in the roles of the users and give them more power, freedom, and responsibility. The people and the organization should be geared to handle this change.

The new roles of the staff need to be clearly defined. Because most processes are automated by the introduction of the ERP system, many existing jobs will no longer be needed and many job profiles will change. The implementation team should make the staff aware of the post-implementation scenario and what exactly will happen to their jobs after the package is implemented. This is important in order to secure the co-operation of the users, which is a critical success factor for the ERP package.

The organization should also identify and assess the potential risk factors in making the transition to the new package and try to reduce/resolve them. The ERP package implementation team should also consider which strategy is going to be used—big bang, phased, process line, and so on. If the phased or process line implementation strategy is being adopted, then the implementation team should identify which modules are going to be implemented or which production lines are chosen for ERP implementation.

The organization should also have a realistic knowledge of what they can expect from the system and what its limitations are. This information should also be given to the users of the system, because over expectations about the ERP system can turn into dissatisfaction, misuse, lack of use, or non-co-operation when the ERP package fails to deliver what the user expects it to deliver. The users should be educated accordingly on the capabilities and limitations of the system. Management support is essential for the success of the ERP system during and after the implementation. Therefore, management must take active interest in the ERP package and should designate a top executive who has the necessary authority and firepower as the leader of the package implementation team. Many bold decisions need to be taken and resources have to be used, schedules have to be altered, and so on, and for this one needs a senior person at the helm of the implementation affairs. Finally, all of these issues should be documented and plans, cost estimates, budgets, time schedules, etc. should be prepared before the implementation begins.

Once the planning stage is over, the implementation team in association with the vendor's representative can start the implementation. The system can be first implemented on the pilot process line. Selecting the pilot project is another critical factor, because failure in the pilot project can end the implementation process. Accordingly, the pilot project must be carefully chosen, considering the project members, the project environment, and other variables. The users in the pilot project have to be given thorough training on the system and the basic concepts, how it is going to affect the work environment, how the processes are going to be automated, and so on.

Choosing a high-profile project for the implementation is advantageous and at the same time dangerous—advantageous, in the sense that if the pilot project is an unqualified success, then winning over company wide acceptance is easy, and dangerous because if it fails, then everybody will know about it. If the implementation team is sure about making the pilot implementation a success, then in the author's opinion, it is better to choose a high-profile project. If the right package has been chosen, if the implementation is well planned, if the project team is well-prepared and well-trained, then there is no reason why the project should fail. Also with constant monitoring during the initial phases, any signs of a disaster can be easily detected and corrected. The pilot project will also show about the organization and its peculiarities that will be very useful when the company-wide implementation is done.

Finally, a caveat: the most critical factor that decides the success of any ERP system implementation is the support of the people who use the system. Even the best systems will fail if there is no user support. The decision of the package selection committee should be a consensus decision. Every member of the selection committee should feel that the decisions were made after careful consideration of the views of all members. This feeling is very important, because the company will need everyone's goodwill and support in order to achieve success during and after implementation.

PEOPLE INVOLVED IN THE ERP IMPLEMENTATION

The participation of people in an implementation can falls into several different positions—project sponsor, executive steering committee, project manager, functional manager, team leader, team member, functional participant, consultant, vendor representative, and end-user. Basic skill sets that are important to any ERP team position include communication skills, computer literacy, maturity, conceptual skills, and organizational knowledge.

Sponsor

Every ERP implementation project needs a **sponsor**. Ideally the project sponsor will be the CEO. The role of the project sponsor is to ensure that the ERP implementation gets all the assistance it needs from resources to management backing.

Executive Committee

The **executive committee** formulates the long-terms goals, objectives, and strategies regarding the implementation of the ERP system in the company. The executive committee is headed by the project sponsor and includes the CIO, CTO, CFO, and other senior level managers and department heads. It also includes a representative of the package vendor and external consultants.

Project Manager

The **project manager** is the most important person in the ERP implementation project. He is the person responsible for translating the vision and goals into reality. He reports to the executive committee and heads the project management team. The project management team consists of the head of the vendor representatives, the chief of the consultants, and the project team leaders.

Implementation Team or Project Team

The **implementation team** or the **project team** consists of selected employees from the company in addition to vendor representatives and consultants. These employees will perform the various tasks in implementing the ERP system from installing the hardware, software, customizing,

documenting, training, and so on. The positions of the functional managers are pre-existing positions that do not need to be filled.

Functional Managers

Functional managers oversee the day-to-day operations of their respective functional areas. Ideally, they should have strong conceptual skills in understanding the overall ERP project and how it relates to the business. The amount of time they spend on the ERP implementation is usually minimal. They play a significant role in the success of the ERP systems during its implementation (by maintaining a positive and open attitude toward ERP, and by releasing the resources necessary for the implementation) and after implementation (by ensuring that their team members are properly trained and are using the system in the best possible manner).

Functional participants

Functional participants have a limited role in the implementation of the project. Most of their time is spent carrying out the day-to-day activities of the functional area. Functional participants answer questions, and review the training programs and business process flows that are proposed in the new software. Through the feedback of the functional participants, other members of the ERP team can get a basic feel of how well the new ERP system may work. Functional participants usually have a significant amount of organizational and product knowledge. After the implementation of the ERP system, they become end-users.

Consultants

Consultants provide a wide variety of functions often filling in the gaps. Positions that consultants can fill include project manager, team leader, team member, service representative, and end-user. A consultant's success depends upon a number of factors including computer literacy, conceptual skills, software knowledge, industry knowledge, maturity, problem-solving capability, communication skills, and organizational skills. Consultants provide three general categories of services—management, application, and technical. *Management consultants* focus primarily on the function of management as it relates to the organization of resources and business process flows. Management consultants often participate in project management and will provide high-level direction for the overall successful implementation and use of an ERP system. *Application consultants* focus on the process of communicating, teaching, demonstrating, and configuring software for the business process flows. *Technical consultants* deal with technical issues such as database conversions, source code modifications, communication protocols, operating systems, software installation, hardware systems, and integration programs.

Package Vendors

Package vendors are people who have developed the ERP packages. They are the people who have invested huge amounts of time and effort in research and development to create the packaged solutions. The vendor representatives are responsible for fixing any problems in the software that the implementation team encounters. Another role the vendor representatives have to play is that of the trainer—to provide the initial training for the company's key users, people who will play lead roles in the implementation of the system. The vendor representatives also play an important project support function and must exercise the quality control with respect to how the product is implemented. The vendor is responsible for helping the implementation team in customizing the ERP package to suit the company's needs.

End-Users

End-users, who represent the largest group, are the general mass of people who will use the new ERP system. Tremendous variation in skill sets can be found among this group. They have the least control over the outcome of the ERP project. Documentation and training programs are often prepared specifically for this group of people. High end-user acceptance of the new ERP system is required for its success.

ERP IMPLEMENTATION TEAM

As we have seen, the ERP implementation project is a joint effort of many groups of people—the in-house implementation team, package vendor's team, outside consultants, end-users, and company management. In this section, we will discuss how to organize the internal resources of the company for an ERP implementation.

The most frequently asked question is, 'who within the company should participate in the project?' The natural response is everyone who is involved in the ERP process—developers, QA team, project leaders, support personnel, marketing team, and top management. As the ERP system is an integrated package, almost everyone in the company must participate in one way or another. The functionality of today's sophisticated ERP systems will extend to practically every sector of the company.

The usual organization of the implementation team takes the following format. The person who manages the implementation is the project manager. The project manager reports to an executive committee, who reviews progress and resolves any territorial, resource, or policy disputes. The CEO or MD leads the executive committee and sponsors the project.

The project manager heads the project management team. This team includes the head of the vendor representatives, the chief consultant, and the work team leaders. The work teams carry out the various tasks for implementing the system. They are the people who set up the infrastructure, prepare documentation, and train the employees. The package vendor will appoint one or more of its consultants to provide support to the project manager, manage the client account, and coordinate other vendor resources. Vendor consultants advise about best working practices, software functionality, and assist with technical issues. Training is provided in the first instance by the vendor to the project teams through either the consultants or specialist trainers. Once the teams have developed and proven the new way of doing things, they produce the procedural documentation and train other employees.

Just because everyone in the company should be involved in the project, it does not mean that everybody should stop their jobs and join in the ERP implementation effort, thus virtually stopping the company's day-to-day functioning. However, the company will need an owner or sponsor for the project—somebody who is going to lead the implementation. This should be a senior person who has knowledge of the ERP system and the organization and the necessary authority to make decisions and implement them. Then the company will need at least one professional from each major department to carry out a specific project function. Roles will vary in complexity and time involved, but all are equally important for the success of the implementation.

It is very important for all business functions having some relation to the ERP system to be represented adequately in the project team—from the top level to the lowest level of operation. This is important because these are the key people who will make the ERP system acceptable to everyone in their own departments. If the implementation team is comprised of people from all departments and from all levels, they can convey what they have learned about the ERP system and thus help overcome the initial resistance the system is bound to face.

The implementation of the ERP system demands that the managers and operational staff understand how the new information environment is going to work. They should be given a clear picture

about what is to be changed in the current setup and what additional facilities the new technology will give the end-user. This is important because the new technology and the additional responsibilities that arise when the new system is in place can overwhelm many people. Therefore, it is important to give everybody involved an idea of what to expect before the project starts.

For the right level of participation to occur, a group of representatives selected from various departments of the company will need to involve themselves in several levels. Some members of the project team will work on the project full-time—in tandem with the in-house experts, external consultants, and the vendor's team. Others will help coordinate the tasks of the different sections and make available all the resources required to the implementation team. Management representatives will monitor the progress of the project and make decisions and take corrective actions to keep the project on schedule and within budget. Other members will participate part-time during workshops and training.

One important thing to keep in mind is that the effective participation of the in-house personnel is not possible without the full commitment of top management. It is the responsibility of top management to see to it that the people who are designated to the implementation team on a full-time basis are not interrupted in any other way or with any other work.

COMPOSITION OF THE IMPLEMENTATION TEAM

Who should be assigned to the implementation team? This is a very important question because the success of the implementation and the continued functioning of the system depend on these people and their ability to grasp the new tasks and technologies.

Once the ERP system is implemented, new processes and procedures will replace the current ones. The job descriptions and responsibilities will undergo some changes. The information integration will happen and many a process will be automated. An action taken by an employee can trigger a lot of procedures and affect a lot of other functions—almost instantaneously. The technology will bring with it a series of new concepts and resources that must be mastered and used correctly in order to get the best out of the ERP system. The format, the speed, and the content of the management information systems will change. The decision-making process will change because the decision-makers will be able to get accurate information, in the form they want, and when they want it. The ERP packages will institute new development models and practices.

The company should accordingly assign its best and most efficient employees to the implementation team. The company should invest in these people and should create opportunities for them to excel within the company so that they can grow with it. These are the people who are actually running the business; these are the people who do not have time for anything else; these are the very same people everybody will turn to in a crisis. It is these people who should be assigned to the implementation team.

ERP implementation is a very complex and sophisticated project, involving technological as well as cultural changes. It is not the place for people without any initiative, dedication, and enthusiasm. It is not the place for people who do not have any team skills or who have communication problems. In fact, assigning some people just because they are the only ones available is one of the most crucial mistakes that management can make. They can jeopardize the entire project by taking such an action.

The ERP implementation project needs people who can grasp new ideas quickly, who have an open mind to new technologies and concepts, and who love challenges. These people should have a never-say-die attitude and should be capable of working as a team. These people will have a lot of demands placed upon them. They will need to develop a detailed understanding of how the software works, pick up new skills, e.g. process mapping, carry out totally unfamiliar tasks, e.g. prototyping

and training, and deal with problems that they normally would never encounter, e.g. establish which process path is the more acceptable. These men and women will be pioneers as they take their organizations through untested environments and uncharted waters, so their ability to think quickly, improvise effortlessly, innovate fast and act without hesitation is critical to the success of the project.

When faced with the decision of assigning members to the implementation team, management should be willing to send their best employees. Invariably, these people are those whose work cannot be interrupted and responsibilities cannot be delegated. But the company has to find a way. If the company decides early enough, whom they are going to send and if those people are informed, they might be able to train replacements to do their work until they return. But sending the best people is worth the effort.

Those selected—the pioneers—will have greater demands made upon their time. They are likely to work long hours for many months, including weekends, to cover their normal duties and also their project tasks. During this time, it may be necessary to restrict when they take their holidays, since this may coincide with a critical stage in the implementation. The continual intrusion into free time may affect family life and needs to be accommodated. For this reason, it would not be unreasonable to review remuneration or holiday entitlement for the team members. It should be acknowledged that people have their own learning styles and different rates of working, particularly when dealing with the unfamiliar. As time passes, the team members need to be watched for loss of interest, resentment, or burn out and handled with care. If team members leave the company, bringing replacements will cause delays.

ORGANIZATION OF THE IMPLEMENTATION TEAM

Figure 28.1 shows the organizational chart for a typical implementation team for medium to large companies. For a small company, there is not much difference in the organization except that the team size will be smaller, and the executive committee and the project management team might be merged. At the top of the chart is the executive committee headed by somebody from the top management. Then there is the project management team, followed by the technical and administrative support personnel. Then we have the work team. Let us look at the functions of each team in some detail.

Chief Executive Officer (CEO)

The most senior role is that of the CEO. This person has two key responsibilities. The first is to promote the vision of what can be achieved using the implementation as the opportunistic catalyst for change. How radical this vision is depends upon the individual and also senior colleagues, for these colleagues will share and make their own contribution toward this vision. The vision of what needs to be achieved must reflect what the organization is capable of. Irrespective of whether the organization has the capability to move mountains or only molehills, the focus is upon progress. However, the greater the ambition, the more is the commitment required. This is particularly true of the senior and middle management who, in a changing environment are traditionally the most resistant. It is the CEO's role to assess this capability and lead accordingly.

The other responsibility is sponsorship of the project. This means that support is given to the project in such a way that promotes its importance, supports the position of the project manager, brings into line dissenting middle/senior managers, acts as arbitrator and carries out any other activities that ensures that the project does not flag, including replacing the project manager if necessary. The CEO needs to ensure that the gap is bridged between the promise and action, if cynicism is to be avoided.

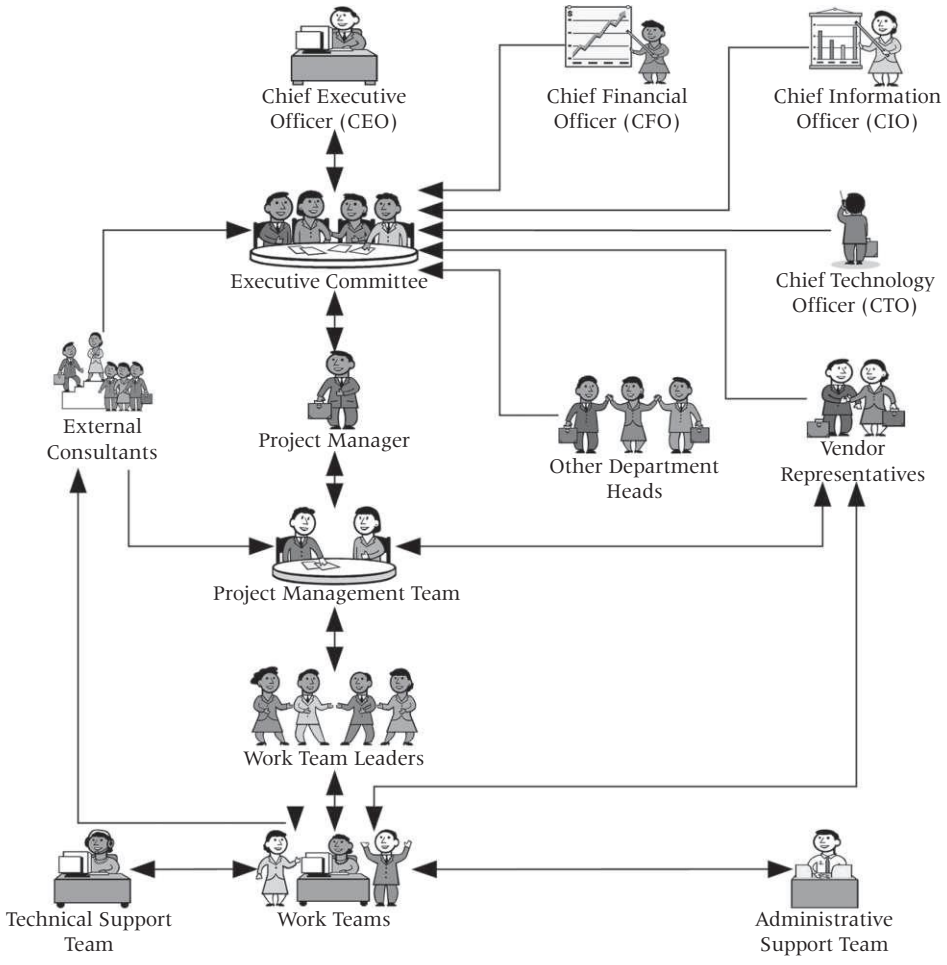

Figure 28.1 Organization of the ERP implementation project.

Executive Committee

The executive committee is a group of senior managers who represent the interests of the company management and is headed by the person who is in charge of the ERP project implementation (sponsor)—a person in whom the company places its highest confidence, someone who is considered a leader and someone who has the necessary authority and carries enough clout within the company. Usually the CEO or a very senior manager will be the sponsor for the ERP implementation. In the case of large corporations, the CEO or top management may not be members of the executive committee as they will be busy with strategic planning and decision-making. In such companies, the responsibility of ERP sponsorship will be entrusted to somebody in the top or middle management, usually to somebody who reports to the CTO (chief technology officer) or CIO (chief information officer).

The executive committee usually consists of the senior managers of the organization. The committee should also include the external consultant's representative. A consultant from the package

vendor should also be part of the committee. Their purpose is to establish the overall high-level strategy of the ERP system in relationship to their company and to establish visions and missions for the ERP system. The visions are perpetual while missions have a specific objective tied to a due date. The executive committee's interactions with other ERP team positions are generally very limited.

The responsibility of the project sponsor is to provide the full company backing for the ERP implementation project. The project sponsor does not represent any one particular functional area. He serves as a source of motivational, inspirational, and sometimes financial support for the overall ERP project. When there is more than one project sponsor (in the case of very large ERP implementation projects), the distinction between project sponsor and executive committee becomes clearer as the communication channels become split between the sponsors. In such cases, it is important that the project sponsors communicate with each other, coordinating and creating consistent uniform messages to the executive committee and others in the organization.

Irrespective of the title of the sponsor and the executive committee members, their primary function is to make sure that everybody knows that ERP has strong management backing and support. Also these people should have enough authority (or direct access to people who have authority) to make and implement decisions that are required for the smooth progress of the implementation.

Another scenario that should be anticipated and contingency plans developed is the case where the project sponsor has to leave or is unable to perform his duties. Contingency plans should be in place to ensure continuity in case the sponsor leaves the organization or is unable to perform his function. A second-in-command, who is part of the top management and has sufficient authority, must be elected and should be ready to take charge of things in the absence or non-availability of the sponsor.

The executive committee defines the objectives, monitors progress, and quickly resolves the issues that are brought to their attention. They ensure that the conditions are right for the implementation. This means that they eliminate any possible conflicts of interest, which the project team members may experience. This also means that the project manager is able to escalate concerns to the executive committee and the concerns will be acted upon and that the extra time and effort of those involved is recognized. The executive committee also ensures that corners are not cut for the sake of convenience and are committed to removing any barriers that may hinder both progress and the realization of benefits. The committee should be aware of, and adjust for possible discord between the discipline of project management and its own management style, particularly if project management is not a familiar practice within the organization.

The executive committee is responsible for the monitoring and evaluation of the project and its progress. The committee is the body that approves budgets and initiates corrective action when things are not going according to plan. Thus, the committee should establish a reporting and monitoring mechanism by which it will be kept abreast of the progress. The monitoring mechanism should have facilities to alert the committee about impending disasters and delays well in advance so that corrective and preventive measures are taken. The committee should meet at least once a week with a provision of emergency meetings, in case of emergencies. The project manager reports to the executive committee at the weekly business review meetings to enable the required discussions to take place.

External Consultants

The role of the external consultants in the implementation is to advise the project manager and the implementation team in all areas where there are no in-house experts. The cost of using the external

consultants is a huge drain on the implementation budget and hence should be kept to a minimum. If the company is already using an ERP system or has previous experience in implementing ERP systems or has employees who have the necessary expertise, then the number of external consultants could be limited to the minimum. In the case of companies who are doing the ERP implementation for the first time and whose employees do not have much experience, it is absolutely essential to get professional help, as otherwise the result can be failed implementations, poorly designed and implemented ERP system, and so on. Thus, the principle should be to use external experts when the company does not have in-house expertise, otherwise use the in-house experts.

Project Manager

The pivotal role in an ERP implementation project is that of the project manager. Perhaps the single most decisive element of ERP success or failure is the knowledge, skills, abilities, and experience of the project manager. The project manager is the catalyst—he makes things happen. A project manager profile has the following characteristics: can do attitude, communicator, knowledgeable about the business, credible within the company, diplomat and facilitator, impervious to criticism, and resilient. The project manager is also an administrator, keeping records about project progress, maintaining the project plan, handling correspondence, and checking invoices.

Project manager's responsibilities vary widely depending upon how the ERP team is formed. All project managers are capable of communicating and coordinating the resources. Communications and coordination may include taking ERP team meeting notes, issue resolution, developing budgets and timelines, performing updates for executive sponsors and steering committees and documentation.

An ERP project manager must understand both the business and the technology. To avoid customization, businesses frequently change their business processes to fit the new software. An ERP project manager must understand the impact of the ERP implementation on the business and work with business managers to ensure a smooth transition from the 'as is' to the 'to be' business operating environment.

Project managers are selected based on a variety of criteria including availability, technical expertise, product knowledge, organizational knowledge, political power, software knowledge, technology knowledge, cost, authority, availability, people skills, communication skills, maturity, computer literacy, and organizational respect.

Companies often do a poor job in selecting project managers from either internal or external sources. Too often companies select people based upon their availability without considering critical characteristics such as communication skills and computer literacy. Project managers are usually a full-time dedicated resource in all except small implementations.

Good project managers have an adequate blend of management and leadership skills. Too often companies look to project managers to perform basic management functions, such as scheduling and tracking issues related to an ERP project without providing the necessary leadership skills. Since ERP projects integrate deeply with business process flows overlapping onto functional managers' areas of responsibility, companies often will choose a weak project manager to prevent confrontational situations with functional managers. While this may protect political strongholds, it often leads to fierce confrontation with the ERP team.

A project manager must be flexible enough to roll with the changes as the project progresses, and not lose it when unpleasant surprises pop up as they always do during ERP implementations. He must be able to work with nearly every individual in the organization from the technically sound IT expert or plant engineer, to the mailroom and building maintenance staff. He must also possess

the ability to learn extremely fast because he will need to understand business issues in areas of the organization with which he is unfamiliar.

A strong project manager exercises authority and power over the people and resources in and around the project. Project managers use their authority and power in persuading others to enthusiastically pursue the visions and missions related to the ERP project. This is how a good ERP project manager carries out the function of leadership. A combination of education, technical expertise, and business knowledge allows the ERP project manager to carry out the function of management related to the project. These skill sets allow the ERP project manager to be more effective.

An ERP project manager must also be highly disciplined. He must be able to clearly envision the project end game and then hold the entire organization and leads it to its success. This means bringing other team members back on track when deviations occur or distractions arise. He must also be willing to make tough decisions, and understand that those decisions will upset some and please others. Table 28.1 shows the characteristics of a good project manager who has a high probability to succeed in implementing the ERP system.

Thus, a successful ERP project manager is flexible, disciplined, a quick learner, a good decision-maker, has ERP experience, business experience, and political clout, has a good formal education, is liked by all, and motivates staff and self. It will be very difficult to find such a person, but only such a person can make the complex and long ERP implementation a success.

The project manager can become ineffective if there is no demonstrable support from the top. The project manager may require people over whom he has no authority to do things. If the person is preferred by all, then this may influence people to co-operate. Problems will arise in the case where members of the project team split their time between their normal duties and those of the project. Operational demands will prevail when it comes to deciding which takes priority. Likewise, decisions about tasks may lead to the desire to shift work from one department to another. Whilst it may make sense to make this change, there may be objections from the departmental head. The department may already be overstretched and the question arises about head-count. The role of the sponsor is to deal with these and other predicaments. Thus, the roles of project manager and sponsor are complementary and essential for success. There are cases of projects that have progressed well and then

Table 28.1 Characteristics of good project managers

Leadership	Management
Builds goodwill	Copes with complexity and pressure
Promotes business changes	Maintains clear view of goals and objectives
Builds support systems	Design and executes schedules
Establishes project direction	Make tough decisions when situation demands
Motivates ERP team	Communicates effectively
Watches for problems	Controls and allocates resources efficiently
Does what is best for the organization	Monitors ERP team and project progress
Commands respect and trust of the team	Encourages clear communication
Commands political support	Develops individuals
Owns mistakes, admits them, and takes corrective action	Develops teams
Protects the team from external pressures	Does things correctly

stumble when the sponsor departs. Tasks that should take days, months because the project manager does not have the status to progress tasks like the sponsor. However, as we have seen before, if measures are taken to ensure continuity in the functioning of the executive committee, then such problems can be avoided.

Project Management Team

The project management team is headed by the project manager and is comprised of the technical leader (leader of the external consultant team), the vendors' project manager and the implementation team leaders. The project manager will report the project's progress, problems, and other issues to the executive committee.

The project management team is responsible for conducting the scheduled work, administering the project, communicating with the in-house team and the consultants. The team members should monitor the implementation teams' progress, assess the amount and quality of the contribution of the team members—both in-house and consultants—and resolve the issues that exist. Since the project management team has the project manager, the consultant team's head, the vendor team's head, and the project team leaders, most problems could be resolved at this level. If any problems cannot be resolved at this level, then the project manager will escalate it to the executive committee for resolution.

The project management team should also ensure that the company personnel and the consultants are working together as a team and that there is full co-operation between the two groups. They are also responsible for ensuring that the consultants are transferring their knowledge to the in-house team and the documentations are done properly. The project management team should make sure that even after the external consultants and vendor representatives leave, the system will run smoothly.

Project Teams or Implementation Teams

The project teams or implementation teams are composed of people who will actually perform the tasks set forth in the project plan. These tasks range from migrating the project information to the new system, to user training, to monitoring the start-up of the new system. The people on this team should be the best in the company and should dedicate their full time and attention to the ERP implementation project. The number of work teams in a project depends on the size and complexity of the project and can vary from one to a dozen.

In the case of projects with more than one work team, each work team will be allotted different areas of the ERP implementation. Each work team will have a team leader who will report to the project manager. The work team will perform all the day-to-day tasks of the ERP implementation from installing the hardware, software, performing customizations, if required, documenting the procedures, conduct end-user training, etc.

The project team normally includes hired consultants and the in-house team. These consultants should have a good understanding of the software that is being implemented. That is why they are hired in the first place. These consultants most certainly must have participated in the implementation of similar projects before.

Project team leaders carry out widely varied roles in terms of scope and the amount of time spent on the project. They serve as coordinators and communicators for their respective area. They work closely with application consultants in understanding how software features and functions can be used for business process flows of the company. They help configure the software and serve as ongoing support for the rest of the functional area.

The team's job requires knowledge of the company's work culture and environment, awareness of company policies and regulations, good analysis skills, team spirit, a co-operative attitude, good communication skills, patience, persistence, self-confidence, and above all sound common sense.

The company's in-house team (work team members) consists of the people with the knowledge of how the company works. They are the people who are going to use and run the system in the future. They and the consultants together decide on how the system should work. The in-house team members will be the first people to receive training on how to operate the software. They must know how the system works in order to evaluate the impact of the software on the company's current business processes. They will also discuss with the consultants and the package vendor the level of customization that the product will require in order to function effectively for the company. The projects teams will do the testing of the system once the system is installed. The project teams will also participate in the training of the end users of the system. The in-house team will contain people from the company's various functions/departments. The project teams will also have hardware engineers who will manage the technical requirements of hardware, network, and software.

The project team leaders should hold regular meetings with their team members in order to bring the team together so that they are updated of the happenings. This is an opportunity for progress to be reviewed, for issues to be highlighted, and for problems to be shared. They will also have regular meetings with the project manager to review the progress, resolve the problems, and decide how to proceed.

Consideration should be given to the teams' work environment. The ideal setup is a dedicated room where people can work undisturbed. This room, often called the war room, is a multifunctional dedicated area where team members can come to train, hold meetings, perform testing, and develop solutions.

War rooms are generally isolated from the other functional areas of the business. War rooms are ideal because of their flexibility and ability to allow team members to concentrate their resources. The need for a war room increases proportionally to the complexity of the project, the number of team members, and the speed with which the system will be installed. Extremely rapid and small installations generally go without a war room. Large and complex installations almost always have a war room.

The war room should have plenty of wall space so that charts can be hung on the walls. It should be equipped with networked PCs, tables, shelving for documentation and flip charts. Laptop links should be available so that consultants can link their equipment into the network. This room will serve as the nerve centre for the project. As well as a work environment, it will hold project meetings and serve as a training venue. This room should not be abandoned after the implementation is over. It can serve as an operations room for continuous improvement teams and also as a training venue for new recruits, those wishing to upgrade their skills or those wishing to test out refinements to processes.

Technical Support Team

The function of the technical support team is to create an environment that is suitable for the implementation of the software. The size of the technical support team is directly proportional to the size of the work team; usually the team size is 3–4. This team works very closely with the project team and takes care of issues like data migration, data backup and recovery, hardware infrastructure, and performance tuning of the databases.

In short, the technical support staff is responsible for ensuring that the machines will be up and running, the network is functional, and the hardware infrastructure is in good shape for the work team to implement the software package. These are the people who will be doing these activities

once the implementation is over and the system is live. Thus they should interact with the consultants and the package vendor to assess any special arrangements or hardware or maintenance and backup and recovery procedures that may be required for the system.

Administrative Support Team

The job of the administrative support team is to make the life of all others on the implementation team easier, so that they can concentrate on their tasks and be more productive and efficient. Here also the team size will be 3–4. The responsibilities of the support teams include making available the workspace, tables, conference rooms, telephones, stationery, filing cabinets (of course, refreshments), and any other resource required by the project team. Other duties include arranging the meetings and conferences, making photocopies of documents, circulating them to the right people, and any other administrative tasks that could make the life of the work team easier.

We have seen the organization of the ERP implementation project team. Each implementation project is different and will have its own characteristics. There will be some changes in the exact constitution of the teams, but these components should be there for the proper functioning of the implementation project.

FUNCTIONS OF THE IMPLEMENTATION TEAM

So far we have seen how the project implementation team is organized. At the top is the executive committee, and one of the main responsibilities of the executive committee is monitoring and evaluating the progress of the project. It was also specified that the executive committee should develop a management and reporting mechanism so that they know what is happening to the project on a regular basis. In this section, we discuss how this is done.

How can the company establish an information base to determine whether the work is progressing according to plan? How will the company decide that the present course is the correct one and will lead to the successful completion of the project?

One of the main roles of the members of the executive committee is to check and verify that the work that is being done is satisfactory and that the momentum, morale, and enthusiasm of the project team who are performing the tasks are maintained. During executive committee meetings, the members should receive reports and other information from the project manager as to how the work is progressing and whether everything is going according to schedule. The executive committee should receive data that induces them to maintain confidence in the implementation process.

Before the implementation starts, the external consultants and company representatives prepare a work plan. This plan details each and every activity that needs to be carried out and when they should be carried out. The consultants should lead the process of work plan preparation, because they have experience implementing the same package in similar conditions. The in-house team should point out the issues that are specific to the company and help the consultants create a realistic work plan.

The work plan or the project plan forms the basis for project tracking and monitoring. The project plan contains numerous activities, the person-hours required to complete them, and the resources needed to perform the tasks. The project plan is often built using a project management package (such as MS Project) that permits one to focus on planned activities from various perspectives—the chronological sequence or timetable, specific activities and who is responsible for them, the prerequisites for carrying out a specific task, or a PERT chart of the activities. Preparing the project plan using such a tool helps improve the quality of the plan and makes it easier to make changes and adjustments.

Once the project is under way the plan can be updated on a regular basis and the 'planned versus actual' reports can be produced in varying detail and in varying formats including graphical ones. The project management software can generate comparisons between the actual and planned completion dates, expenses, and so on. These software tools allow responsibilities to be assigned to different persons so that it is easy to find out who is lagging behind.

Keep in mind, however, that irrespective of whether the plan is created manually or by using a software package, all the parties involved—the executive committee, the vendor, the consultants and the in-house team—should be in agreement with the contents of the plan.

How often should the executive committee monitor the project? The answer is, 'it depends.' If the company has really assigned its best personnel to the job, then there will be a natural monitoring of the project's daily activities. The company professional assigned to serve as the project owner or sponsor is in an ideal position to evaluate how things are going. Because company-wide ERP implementation projects last for several weeks or months, it is quite adequate for the executive committee to meet once a week or once in two weeks (with a provision to hold emergency meetings when necessary).

Another choice is to set up milestones in the project plan and have a meeting when the milestone's planned completion date is over. There are no hard and fast rules regarding how frequent the executive committee should meet. During the final stages of the project, when the system is being tested, the committee might need to meet more frequently to discuss the various issues that could arise.

It is the task of the project management team to report to the executive committee and present the facts and figures. Because these meetings are managerial in nature, the project management team should prepare a presentation that describes the situation at a level of detail appropriate to the audience. Very technical topics should be condensed and excessive use of jargon should be avoided. It is a good idea for the material used in the presentation to serve also as documentation of the status of the project to that date. This is important because in order to track the progress at future meetings, it may become necessary to recall the issues presented in a previous meeting, so as to explain why the evolution of the work has taken a particular route.

Another objective of the executive committee meetings is to address the issues that involve decisions by top management. Such decisions will not be made at every meeting, but when they have to be made they need careful preparation. The project management team should circulate details about the issues well in advance so that the committee members can do their homework and come prepared for the discussions. It is the duty of the project management team to analyze alternative solutions and their advantages, disadvantages and consequences, and circulate them to the committee members well in advance of the meeting.

In an ERP implementation project, the work plan or the project plan is of paramount importance. Adherence to the plan, along with constant monitoring and the taking of appropriate corrective actions before the project gets out of control, will ensure the success of the project. The key players in project tracking and monitoring are the project management team and the executive committee.

To guarantee that a complex and sophisticated project that requires technological and cultural changes in the company will reach its conclusion successfully, it is not enough to sell it or approve it. The project team needs to re-sell it constantly, by demonstrating that it is evolving in an appropriate manner toward the stage at which benefits will be generated as anticipated.

SUMMARY

The success of an ERP implementation largely depends upon how the organization classifies its ERP project team. ERP project teams are formed not just for implementing the ERP software but also for the ongoing maintenance required of the system. Team structures vary tremendously from company

to company and situation-to-situation. Organizations usually do not give enough thought as to how to form ERP teams—pre-implementation, implementation, and post-implementation. ERP consultants and vendors sometimes suggest the need and structure of the ERP teams but since they do not know the organizational culture and specific strengths and weaknesses of the organization, their suggestion cannot be taken as such. The top management in consultation with the consultants and vendors should do the team formation. The ERP teams should contain the consultants and vendor representatives before, during, and after the implementation. In this chapter, we saw the details of ERP implementation, implementation team formation, and the working of ERP teams.

REVIEW QUESTIONS

1. Why changing over to a new automated ERP system is said to be a significant opportunity as well as a major responsibility?
2. What kind of planning should be done before changing over to the ERP system?
3. Why it is important to teach the employees the basics of ERP concepts and business processes?
4. Why it is important that the user be prepared for change and for their new roles?
5. Which is the best way to get the cooperation of the users?
6. How should the organization identify and assess the potential risk factors in making the transition to the ERP system?
7. Why it is important that the organization have a realistic knowledge of what they can expect from the system and what are its limitations?
8. How is a pilot project selected and why is the pilot project selection a very critical success factor?
9. Choosing a high-profile project for the implementation is advantageous and at the same time dangerous. Explain.
10. Who is the project sponsor and what are his responsibilities?
11. What is the composition of the executive committee?
12. What are the responsibilities of the executive committee?
13. What are the duties and responsibilities of the project manager?
14. What is the composition of implementation or work team and what are its duties and responsibilities?
15. What is the role of the functional managers in the ERP implementation project?
16. The amount of time the functional managers spend on the implementation is minimal, but they play a significant role in the success of the ERP system. Explain.
17. Who are functional participants and what are their duties and responsibilities?
18. What is the role of external consultants in the ERP implementation project?
19. Who are end-users of the system and why is their cooperation important?
20. Why it is imperative that everyone should participate in the ERP project?
21. What is the usual organization of the implementation team?
22. What are the responsibilities of the project manager and the project management team?
23. Explain the role of vendor and consultant representatives in the project management team?
24. What is the function of the project sponsor or owner?
25. Why is it important for all business functions having some relation to the ERP system to be represented adequately in the project team?
26. Who should be assigned to the implementation team?
27. What are the qualities required for the ERP implementation members?
28. What are the main problems faced by the ERP implementation team members and how can these problems be solved or mitigated?
29. Why it is important that the executive committee be headed by a person with excellent leadership qualities and quick decision-making authority?

30. Explain the constitution of the executive committee and its objectives?
31. What are the roles and responsibilities of the project manager?
32. What are the skills required by the project manager?
33. What are the qualities of a good project manager?
34. What are the objectives of the project management team?
35. What are work teams, how are they constituted, and what are their roles and responsibilities?
36. Explain the functioning of the work teams.
37. What are war rooms and what are they used for?
38. What are the main duties of the technical support team?
39. What are the duties of the administrative support team?
40. How is the implementation project monitored?

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Chapter 29

Process Definition

INTRODUCTION

A business process is a set of coordinated tasks and activities, conducted by both people and equipment, which will lead to accomplishing a specific organizational goal. *Business process management (BPM)* is a systematic approach to improving those processes. Defining the process is very important in the implementation of the ERP systems. This step ensures that the implementation will be consistent with the vision statement. It defines the new processes by which the company will be managed. It adds essential details to the vision statement and creates a detailed schedule necessary for effective management of project.

The process definition step consists of two elements—one is to define processes for demand management, planning, and scheduling, while the other element addresses the finance and accounting aspect. Their implementation is quite different, so we need to consider them separately. Let us start with the operational processes.

PROCESS DEFINITION

This is where people define the details of how the business will be run. It answers questions such as:

- Where do we meet the customer today and should we be doing it differently?
- Should we be design-to-order, make-to-order, finish-to-order, or make-to-stock?
- Would a change here make us more competitive in the marketplace?
- How are we going to promise customer orders?
- Will the people in sales have direct access to the available-to-promise information, and if not, how will they assign promised ship dates?
- How will we communicate and collaborate with our supply chain partners—customers, suppliers, and sister divisions—regarding their and our needs for product and material?
- What media will we use to send and receive schedules—the Internet, EDI, fax, phone, courier companies, or postal services?
- Less than half of our manufacturing processes are job shop and they are not very complex. Will we need to implement job plant-oriented tools such as capacity requirements planning and plant floor control?

The answers to question like these will give a clear picture of the business processes in the organization and how it can or should be modified and improved. Here the functional managers, external consultants, and the vendor representatives sit together and discuss these issues and come up with the process definitions which are then submitted to the executive committee. The executive committee will review and authorize these definitions.

PROJECT SCHEDULE CREATION

The ERP project schedule is the basic control tool used to manage the project to a timely and successful conclusion. For a company-wide implementation, it needs to be:

- Aggressive but attainable
- Expressed in days or weeks, for at least the short-to-medium term; months are too large a time frame for effective scheduling
- Complete, covering all the tasks through the end of supply chain integration
- In sufficient detail to manage the project effectively, but not so weighty that it overwhelms the people using it. For an average-sized company or business unit, a project schedule with between 300 and 600 tasks could serve as an effective project management tool
- Specific in assigning accountability. It should enlist names and not merely job titles or departments

The process definition and schedule creation is shown in Fig. 29.1.

There must be widespread buy-in to the project schedule, or it will be just another piece of paper. It so happens that the people who develop the project schedule need to be the same people who will be held accountable for adhering to it. They are primarily the project team leaders and are on the implementation project.

The project manager can help the project team leaders and the team members develop the project schedule. He or she cannot, however, do it for them or dictate to them what will be done and when. The project schedule should be developed based on a consensus and democratically. All the people involved in the ERP implementation should be part of the schedule preparation so that they will feel it is their own schedule and will take every effort to make it happen. Here is a good way to approach it (see Fig. 29.1).

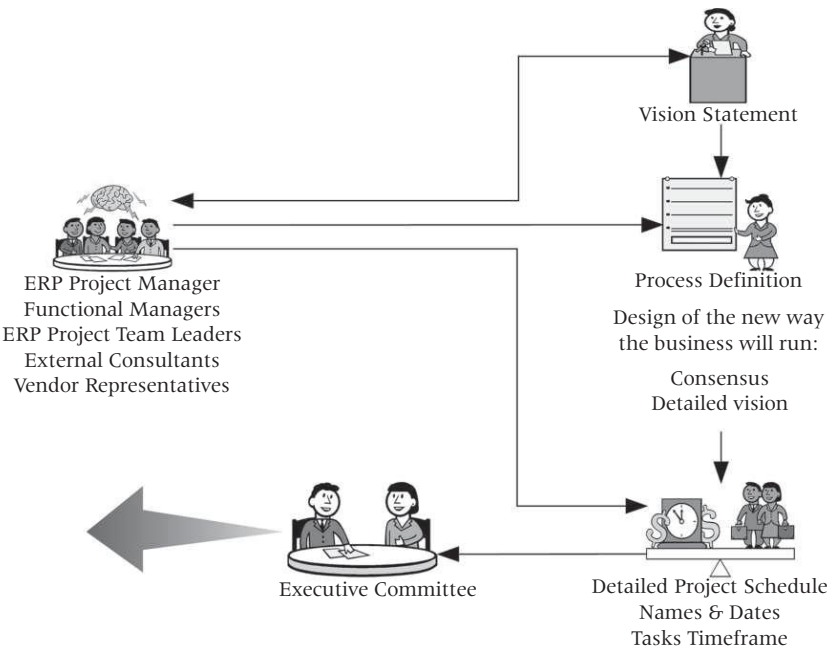

Figure 29.1 Process definition and schedule creation.

1. The project manager creates a first-cut schedule, containing the major tasks and milestones.
2. This first-cut schedule is given to the project teams and their leaders for their review and adjustment, as needed. During this process, they may wish to consult with the project manager regarding resource availability, infrastructure, and so on. The project manager will clarify issues, clear doubts, make suggestions, but will leave the final decision to the teams.
3. The project team finalizes the project schedule and submits it to the project manager.
4. The project manager presents the schedule to the executive committee for approval.

A process such as this helps to generate consensus, commitment, and willingness to work hard in order to meet the schedule. The potential problem is that with a 12–18 month project, one cannot anticipate all the things that have to be done to meet the major milestones. The best way is to set out the initial project schedule at the beginning of the project, focusing on the major milestones, and activities needed to reach those milestones. Create detailed schedules for the first milestone and once it is achieved or when it is nearing completion,prepare a detailed schedule for the second milestone, and so on. Here the feedback and lessons learned during the implementation can be used to take corrective actions and fine-tune the future schedules. As part of project management, it is essential that the 'near term' project plan be continually reviewed as time moves forward. The project team should not see the project plan as cast in concrete (except the major milestones). Tasks should be added and changed as more information is available and as designs are flushed out in other processes (initial education, task teamwork, etc.).

POLICIES

A few key policy statements are required for the successful operation of enterprise resource planning. Five bedrock policies are the ones that address sales and operations planning, demand management, master scheduling, material planning, and engineering change.

The sales and operations planning policy needs to spell out the objectives of the company's sales and operations planning process, the steps in the process, the participants in each step, and the actions to be taken at each step. The demand management policy focuses on the role of the demand manager and other key sales and marketing department people, their communications requirements to and from the master scheduler, ground rules for forecasting and promising customer orders, and performance measurements.

The master scheduling policy needs to define the roles of the master scheduler, time fence, who is authorized to change the schedule in time zones, allowable safety stock and/or hedges, feedback requirements, performance measurements, the fact that the master schedule must match the production plan and must fit within capacity constraints and others as appropriate. The material planning policy focuses on guidelines for allowable order quantities, use of safety stock and safety time, where to use scrap and shrinkage factors, ground rules for lead-time compression, feedback required from purchasing and plant, feedback to master scheduler, performance measurements, and so on.

The engineering change policy should define the various categories of engineering change. Further, for each category, it needs to spell out who is responsible for initiating changes, for establishing effective dates, and for implementing and monitoring the changes. Also included here should be guidelines on new product introduction, communications between engineering and planning, performance measurements, and the like.

These five are the basic policies that most companies need in order to operate ERP effectively, but others may be required for specific situations. Developing these policies is essential in the implementation process. The following checklist is an excellent source for points to be included in these policies. This is another case where both the project team and executive committee need to be involved.

The project team should:

1. Identify the required policies
2. Create spin-off task forces to develop them
3. Revise/approve the draft policies
4. Forward the approved drafts to the executive steering committee

The executive committee revises/approves the draft policy and the project sponsor signs it, to go into effect on a given date. Make certain the policy does go into effect and is used to run the business. Do not make the mistake of generating pieces of paper with signatures on them (policy statements), claim they are in effect, but continue to run the business the same old way. Also, as you create these policies and use them, do not feel they are carved in granite. Be prepared to fine-tune the policies as you gain experience. You will be getting better and better, and your policies will need to reflect this.

ACCOUNTING AND FINANCE

Accounting and finance personnel should be one of the biggest supporters of the ERP implementation. This process makes their jobs easier. Using sales and operations planning process, you can tie financial implications to the forecasts and determine where the organization should be headed financially for the period, year or even longer. This information can be used to insure that you meet bank forecasts, growth forecasts, and increase the value of the organization. For most firms, if you can achieve the sales targets, the departmental budgets generally fall in line so that profit goals are met. Use this process to plan for profits, growth, or to manage through difficult periods.

For many companies, it is easier to implement the accounting applications than those for resource planning. This is because less time is typically required for process definition and also because the implementation path is more straightforward. Most companies that have some sort of a computerized information system would also have computerized their finance and accounting processes. The reasons for this are based on the relative immaturity of effective formal resource planning and scheduling processes versus the high degree of maturity on the finance and accounting side.

Finance and accounting people have an important role to play in the ERP implementation projects. In addition to implementing their own new processes, they have roles to play on the ERP executive committee, the project team, and spin-off task forces. They will need to devote some time to getting educated on ERP system. It is necessary for them to understand the logical structure of ERP, the benefits to be achieved from running the business with only one set of numbers, and the competitive advantage that highly effective ERP can provide.

IMPLEMENTATION STRATEGY

In an ERP implementation, when should the new finance and accounting systems be implemented? Well, again, the answer is 'it depends.' Let us first look at the broad choices:

- Implement all or most of the new financial and accounting systems prior to beginning implementation of the new planning and scheduling processes
- Implement the new planning and scheduling processes first and let the accounting side follow
- Implement the new financial and accounting systems simultaneously with those for planning and scheduling

There are some downsides to each of these options. The primary choice, of implementing accounting first, will delay the planning and scheduling implementation and hence the benefits like being able to

close the books better, faster, and cheaper. However, it does not generate substantial competitive advantage. What can generate substantial competitive advantage is the ability to ship on time virtually all the time, using minimum inventories, and making possible maximum productivity at the company's plants and those of its suppliers. Because most of the benefits from ERP come from these areas and because the cost of a one-month delay can be quite large, this approach can be expensive.

The second alternative, i.e. do planning and scheduling first, solves that problem. However, it can be cumbersome, because it means that for some time the legacy accounting systems will be fed by the new ERP transactions. These legacy systems will need to be modified or temporary interfaces will have to be built.

The third option, also known as the big bang approach, is a very attractive one. It may create a workload problem, namely, too much load on the IS resources and also create more work than they can cope with for the implementation team. However, this option if planned meticulously, executed perfectly, and monitored constantly can be successful and deliver the maximum benefits and enable the company to reap the full benefits of the ERP system immediately after implementation.

SUMMARY

A business process is a set of coordinated tasks and activities, conducted by both people and equipment, which will lead to accomplishing a specific organizational goal. Defining the process is very important in the implementation of ERP systems. This step ensures that the implementation will be consistent with the vision statement. It defines the new processes by which the company will be managed. It adds essential details to the vision statement and creates the detailed schedule necessary for effective project management. The process definition step consists of two elements—one is to define processes for demand management, planning, and scheduling, while the other element addresses the finance and accounting aspect.

REVIEW QUESTIONS

1. What is a business process?
2. What is business process management?
3. What is process definition?
4. What is project schedule creation and why is it done?
5. Why is it important to develop a project schedule that is acceptable to all people involved in the implementation?
6. Why are policies important for the success of the ERP implementation project?
7. What are the five basic policies that most companies need in order to operate ERP effectively?
8. How are policies created for specific situations?
9. What is the role of finance and accounting personnel in ERP implementation?
10. What is the best ERP implementation strategy?

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Chapter 30

Vendors and Consultants

INTRODUCTION

Why can't companies develop their own ERP packages? Developing an ERP package is a very complex and time-consuming process, which needs a lot of skilled manpower and other resources. Many companies have personnel in their IT/IS departments who can absorb the necessary knowledge and have experience in developing sophisticated systems. The problem is that such specialized computer work is not the main business of these companies. They should be directing all their available resources into improving their own products or services so that they can remain competitive and better serve their customers and continue to grow.

Since designing and implementing integrated software packages is not the business of most companies, or a focus of their executives, the systems their in-house team come up with will never equal in quality, scope, functionality, or technology those created by software firms whose business this is. These software firms (ERP vendors) can produce sophisticated packages and provide their clients with products that allow them to maintain a focus on their own chief activities, thus improving revenues, profits, and shareholder returns.

IN-HOUSE IMPLEMENTATION: PROS AND CONS

Now, the next question that many people ask is why can't the company develop the ERP implementation by itself? To successfully set up and implement the ERP package, which will function perfectly, is not an easy task. One cannot go in for a trial and error method of implementation strategy due to the huge amount of investments involved. The consequences of a failed ERP implementation can be quite catastrophic. It might put the organization out of business. Also the ERP implementation process cannot go on for a long time. It has to be completed within a reasonable time period.

To successfully carry out the implementation within a reasonable time frame, the in-house people who are designated to do the job should possess certain knowledge and skills. To start with, the company should have many people who are experts with the ERP package and technical know-how. Implementing the ERP software means assigning optimum value to the various parameters and elements of the system. Experience has proven that a good professional needs at least one year to become reasonably good in operating an ERP system and this should involve hands-on practical experience. As you cannot become an expert by reading product brochures and on-line help files; you have to have practical implementation experience.

Many software vendors have their own team of consultants whose responsibility it is to implement the software package following a standard approach or methodology. Definitely, these people know the product and can be of great value during implementation. However, developing a good software package and successfully implementing it are two entirely different propositions. Thus, a good package vendor need not be good at implementing its product. Also each group of people in an implementation project (vendors, consultants, in-house team, users, and so on) has a definite role to play in the implementation. Thus if the same party is performing multiple roles, it can create problems when a conflict arises. For example, if the vendor is doing the implementation, the vendor's

consultants may not be as open to the ideas of the in-house team as third-party consultants, because the vendor's consultants will have a mindset, which will prevent them from seeing the other side's perspective.

Besides having a very good knowledge of the product, the people who are to implement the ERP system should possess the following skills:

- **Knowledge of how to organize and run a project of this magnitude.** This calls for good organization skills, project management skills, team management skills, and knowledge of scientific methods of software project management.
- **Should have enough experience in handling problems and issues that arise during the implementation.** No implementation will be a smooth process; there will be problems, cost overruns, time overruns, and so on. Knowing what to do in these situations is vital for the success of the project.
- **Good people skills.** Any ERP implementation will face resistance from the employees. The resistance could be due to ignorance about the product, fear of unemployment, fear of training, fear of technology, and so on. Therefore, it very important that the people in the implementation team are very good diplomats adept at diffusing crisis situations.
- **Good leadership skills.** ERP implementation will involve dealing with a lot of people, thus good leadership and communication skills are very effective.
- **Excellent training skills.** Every ERP project involves considerable amount of training at various levels and in various details. There will be familiarization programs for all the employees, executive programs for the top management, functional training for the implementation team members, and end-user training.

In today's business environment where the trend is to reduce manpower and focus more on the company's core competencies, it becomes even more difficult to take the total responsibility of the ERP implementation and get it done using in-house resources. If the company is planning to do the ERP implementation in-house, it might have to hire experts and have them on the company's rolls. This is an expensive proposition because once the implementation is complete, you will not need that many experts to keep the system running—the post-implementation phase. You will need, only a handful of people—perhaps just a few of them in each functional area—to effectively handle this post-implementation scenario. Therefore, if the company is planning to do the ERP implementation all by itself, then it will be adding a lot of resources and spending a lot of money on training, most of which will not be needed after the package implementation.

It is, therefore, always a better idea to leave the implementation—most part of it—to the people who are specializing in that and concentrate the company's efforts on preparing its personnel to administer the package after it is implemented. Once these employees have been trained—during the course of the implementation—they can help the company in its implementation efforts in other units of the company, or provide training to other employees in using the system, and so on. Therefore by getting the employees trained during the implementation, the company can save a lot of money it may otherwise have spent in hiring trainers.

In summary, it is better for companies to concentrate on their business and leave the job of ERP implementation to experts in that field. However, to get maximum benefit out of a packaged solution, the company personnel should participate fully during the implementation of the package. The company should plan the participation so that its people play an appropriate role in the implementation project and will have enough experts in-house, once the implementation is over. The company should bring in the know-how and experience that will guarantee the best possible use of the acquired package.

VENDORS

Vendors are the people who have developed the ERP packages. They are the people who have invested huge amounts of time and effort in research and development to create the packaged solutions. If one studies the history of ERP packages and finds out how each package evolved, then it soon becomes evident that every ERP package grew out of the experience or opportunity of a group of people working in a specific business who created systems that could deal with certain business segments. Now with the ERP marketplace becoming crowded with more and more players entering the market and the competition increasing, today's ERP packages have features and functionality to cater to the needs of businesses in almost all sectors. ERP vendors spend crores of rupees in research and come up with innovations that make the packages more efficient, flexible, and easy to implement and use. Also, with the evolution of new technologies, the vendors have to constantly upgrade their products to use the best and latest advancements in technology.

Choosing the right software vendor goes beyond evaluating software functionality. There has been a gradual movement among a handful of the largest software vendors to take a one-size-fits-all posture. Some vendors believe functionality ratings are no longer important since all software systems are beginning to look alike. While appearances may tend to support this theory, reality paints a different picture. Merely having a particular function does not guarantee that users will be able to capably work with it. If two vendors offer a function required in a specific industry segment, and one specializes in deploying it in that segment, while the other does not, the difference can be dramatic. The one-size-fits-all garment may fit everybody, but does it look good on everyone?

Vendor selection is not a popularity contest and bigger does not always mean better. While the financial stability, ensured longevity, and broad spectrum of offerings provided by the top vendors are good reasons for selecting them, size is not without its downside. Size breeds bureaucracy and bureaucracy hamper personal attention and agility. While smaller vendors that are not quite household names may carry increased risks in the area of long-term longevity, they may actually provide a better solution if they specialize in your industry segment rather than covering a broad spectrum of industries.

You have the greatest leverage with your vendor once you have made the decision to buy their software but have not yet issued the purchase order. Waiting for the end of their quarter can help you get the best price. Also view the financial stability of your future relationship as important—you will receive positive support from your vendor as long as it is profitable for them to do so. The relationship is a balancing act. Entrust your vendor to get the job done right, on time, and within budget, but watch out for penalties that may increase project pressure and sour the relationship.

It is important to remember that the vendor, as long as they provide working software and capable personnel, really has very little responsibility for your overall success. Responsibility for success or failure lies within the four walls of your business, and if you import failure in the form of a third party, it is still your responsibility.

Vendors and Vendor Management

Nowadays, most ERP implementation teams include vendor representatives. Since the vendors are the people who know the tool best, they definitely have a role to play in the implementation. The vendor should supply the product and its documentation as soon as the contract is signed. Once the contract has been exchanged the vendor will guide the company, in particular the project manager and his team through a series of events culminating in the use of the tool. The project manager, as with all the other resources, will need to manage the vendor so that everything progresses as intended.

One cautionary word concerns the power of the vendor. The vendor potentially has the upper hand in the client–vendor relationship. The client, having signed the contract and perhaps having

given a preliminary payment will be reluctant to terminate the relationship should the vendor fail to meet expectations. Consultants may not be available due to split commitments. Software bugs may not be fixed when required. Software links may simply not work. These all contribute to delay. It is the project manager's task to manage this.

The vendor will most likely appoint a single point of contact, the vendor's project manager. The role of this person will be to provide support to the project manager, advise upon and agree to the project plan, manage the client account, and coordinate vendor provided resources. A procedure should be agreed between the two managers about how work done by the vendor is to be authorized by the client. The vendor's project manager will be the first point of contact for resolution of problems whether they are technical, best practice related, or concerning vendor invoices. Within the contract, a be clause should be added signifying how problems are to be handled and the timescale allowed. If problems are not resolved then an escalation path should be included identifying the people to be contacted. Communication should be backed-up in writing. This reduces the likelihood of misunderstandings.

Only after the software is delivered can the company develop the training and testing environment for the implementation team. The vendor is responsible for fixing any problems that the implementation team encounters in the software. Therefore, the vendor should have a liaison officer who constantly interacts with the implementation team. Another role the vendor has to play is that of the trainer—to provide the initial training for the company's key users, and people who will play lead roles in the implementation of the system. These key users are the ones who will define, together with the consultants (external experts), how the software is to serve the company. These in-house experts will decide how the functionalities are to be implemented, as well as how to use or adapt the product to suit the company's specific requirements. Thus, it is very critical that these key users be given thorough training on the features of the package. Vendor training should target the goal of showing the key users how the package works, what the major components are, how the data and information flow across the system, what is flexible and what is not, what can be configured and what cannot, what can be customized and what should not, the limitations, the strengths and weaknesses, and so on.

The objective of vendor training is to show how the system works, not how it should be implemented. This means that the vendor demonstrates the product as it exists and highlights the available options. The company's employees who are participating in the vendor training should try to understand the characteristics of the package and the impact of the system on the company's business processes. The trainees should use these training sessions to question the vendor on all aspects of the system.

The external consultants (or the package/ERP experts) also have a role to play during this vendor training. They should participate in the training sessions to evaluate how the users react to the reality that is starting to take shape from the detailed presentations and demos. Consultants should also ask questions that the vendors are trying to avoid and the users are unaware of. This is the best way to present the real picture to the users and will also prevent the vendors from making false claims.

The project manager should monitor and control the costs incurred by the vendor. By monitoring the amount of time that the vendor's personnel are present on-site, it is possible to monitor consultancy costs, a potential area for overspend. Mistakes do happen and it is advisable that vendor's invoices are checked. Queries should be brought to the vendor's attention for resolution, for which there should be a provision within the contract regarding the withholding of payment. Finally, the project manager should ensure that the vendor is paid, and on-time.

Role of the Vendor

First and foremost, the vendor should supply the product and its documentation as soon as the contract is signed. Only after the software is delivered, can the company develop the training and testing

environment for the implementation team. The vendor is responsible for fixing any problems in the software that the implementation team encounters. Therefore, the vendor should have a liaison officer who should constantly interact with the implementation team.

Another role the vendor has to play is that of the trainer—to provide the initial training for the company's key users, people who will play lead roles in the implementation of the system. These key users are those who will define, together with the consultants, how the software is to serve the company. In other words, it is these in-house functional experts who will decide how the functionalities are to be implemented, as well as how to use or adapt the product to suit the company's unique requirements. Hence it is very critical that these key users are given a thorough training on the features of the package. Vendor's training should achieve the goal of showing the key users how the package works, what are the major components, how the data and information flows across the system, what is flexible and what is not, what can be configured and what cannot, what can be customized and what should not, what are the limitations, what are the strengths and weaknesses, and so on.

Now some of you might ask, 'we are hiring the consultants who are experts in the package; why can't we get training from the consultants?' This is true. Most of the consultants are capable of providing sound training for the packages. However, we are only hiring the consultants for implementing the system. The objective of the vendor training is to show how the system works, not to show how it should be implemented. This means that the vendor demonstrates the product as it exists, and will highlight what are the possible options available. The company's employees who are participating in the vendor training should try to understand the characteristics of the package and the impact of the system on their business processes. The trainees should use these training sessions to question the vendor on all aspects of the system.

The consultants also have a role to play during this vendor training. They should participate in the training sessions to evaluate how the users react to the reality that is starting to take shape from the detailed presentations and demos. Consultants should also ask questions that the vendors are trying to avoid and the users are unaware of. This is the best way to present the real picture to the users and will also prevent the vendors from making false claims.

The role of the package vendor does not end with the training. The vendor also plays an important project support function and must exercise quality control with respect to how the product is implemented. It is the vendor who understands the finer details and subtleties of the product and can make valuable suggestions and improvements that could improve the performance of the system. It is also in the best interests of the vendor that this participation continues because if the implementation fails, majority of the blame will fall on the vendor. Also a successful implementation means another satisfied client, improved goodwill and good referrals, and so on. Hence the vendor will continue to participate in all the phases of the implementation mostly in an advisory capacity, addressing specific technical questions about the product and technology.

The vendor has other responsibilities also. There will be 'gaps' between the package and the actual business processes. The software might have to be customized to suit the company's needs. Customizing means altering the product so that it serves the company's purposes. The choice of whether to customize or not is one that can have enormous impact on the project and it often constitutes a point of conflict between the consultants and users. However, if the decision to customize has been taken, it is the vendor's duty to carry out the necessary modifications. This is because only the vendor knows the product well enough to make the necessary changes without affecting the other parts. Moreover, the company must get a guarantee (in writing) from the vendor that despite the customization, it will benefit from the future software improvements introduced by the vendor.

CONSULTANTS

Business consultants are professionals who specialize in developing techniques and methodologies for dealing with the implementation and the various problems that will crop up during the implementation. They are experts in the administration, management, and control of these types of projects. Each of them will have many man-years of implementation experience with various industries and have knowledge of time-tested methodologies and business practices that will ensure successful implementation. They will be good at all phases of the implementation life cycle right from package evaluation to end-user training. The only problem is that they are expensive—very expensive.

There are many myths and ambiguities about the consultants and the role they play in an ERP implementation. Given below are few of them:

- **Employing a consultant or consulting firm can make the implementation successful.** This is not true as the success of the ERP implementation depends on top management support, appropriate planning, right package selection, excellent implantation team, and a host of other facts that we have seen. A consultant can help and educate you and point you in the right direction. However, the success of the ERP implementation project is within your hands, and employing a consultant cannot make an implementation successful.
- **Consultants should lead the project.** Consultants are hired for the expertise and they should function in an advisory capacity. The person leading the project should also be the project owner, one who will stay with the organization long after the implementation is complete. Making consultants, who will go to another company after implementation, the project leader is a recipe for disaster as he is an outsider.
- **Consultants know everything.** Yes, consultants are hired for their knowledge and expertise. But assuming that they know everything is wishful thinking. The consultants do not know how the company works and the business details. Also the experience and expertise and hence the knowledge of the consultants differ. Accordingly, make the employees learn from the consultants whatever they can—knowledge transfer. Once the employees' become knowledgeable the consultants become redundant.
- **Having more consultants will increases the chances of success.** In fact, having too many consultants is a sure recipe for failure. Too many consultants can contribute too many views and opinions and can slow down the decision-making and reaction times. Thus, limit the number of consultants, but make sure the ones you have are the best you can afford.
- **Consultants who are expensive and who have fancy degrees are better.** A consultant should be judged by his reputation in the field. How the person is regarded by other experts, how many projects has she consulted for, how varies is his experience, and so on. Consultancy fee and degrees is not at all a yardstick of excellence.

Consultants provide a wide variety of functions often filling in the gaps. Some of the positions that consultants can fill include project manager, team leader, team member, service representative, and end-user. A consultant's success depends upon a number of factors including computer literacy, conceptual skills, software knowledge, industry knowledge, maturity, problem-solving capability, communication skills, and organizational skills.

The success of any particular consultant can vary tremendously from company to company and from situation to situation. Surprisingly a consultant's industry and software knowledge does not correlate strongly with his or her success or capability to help a company. Case after case has identified consultants lacking in software and industry knowledge who were able to consistently outperform other consultants considered the most knowledgeable in software and industry. These

consultants showed strong interpersonal communication skills, were self-starters requiring little or no training, had good computer literacy, problem-solving capability, and conceptual skills.

Choosing a consultant or consultants is an important decision that can affect the success of the ERP implementation. It should be done with great care as the right consultants can steer the ERP implementation clear of the pitfalls and help it to completion on time. Before choosing a consultant, the project team should consider the following:

- **Experience**—Do they have experience in the organization's particular industry?
- **Success rate**—How many successful implementations have they completed?
- **Size and scope**—What are the sizes of the companies and number of users involved in the previous implementations? What was the scope of those implementations? Were they big-bang or phased?
- **Continuity**—Do the consultants provide ongoing service and support? What is their annual retainer for support after implementation? What are the terms and conditions for such an arrangement?
- **Training**—How good is the knowledge transfer? Will the consultants train the company employees so that they can implement the ERP system in other offices/branches of the organization? Do the consultants train the employees to operate and maintain the system independently?

Many of the big consulting firms, having forecasted the ERP boom, invested a great deal of money in developing a range of consulting services in this field and assigned many of their professionals to become specialists in the various aspects of ERP packages and their implementation. These firms researched the various products, developed an in-depth understanding of each product's strengths and weaknesses, worked by the side of the ERP vendors, confirmed that the vendor's package worked and learned the tricks and techniques of the trade, found out the pitfalls and mistakes that should be avoided, and thus created a pool of experts who could handle the ERP implementation without failure.

Thus, consultants are people who have made the business of ERP implementation their business and have invested huge amounts of money and manpower for that purpose. Hence, when you want to get the services of these consultants, the first question that will be asked is, 'are they going to be expensive?' The answer is a definite YES. The consultants will be expensive, so the company will have to formulate a plan as how to make the best use of the money spent on consultants. If we study the statistics, we can see that a well selected, integrated system that is successfully implemented and successfully working usually pays for itself in a relatively short period—between 10 and 30 months. If you analyze the cost break-up, you will find that the most expensive part of the implementation was the consultation charges. For a typical ERP implementation, the cost of consultants is 1.5–3 times for every rupee invested in the software product. Sounds amazing; but it is true and it is also true that the software will pay for itself—the software cost, the consultant's charges, and other expenses incurred during implementation—in the above-mentioned period (10–30 months). However, the catch is that the product has to be the right one and the implementation has to be successful. That is why the expertise of the consultants becomes invaluable and the money spent on good consultation is never wasted. Finding the right consultants—people who have necessary know-how and who will work well with the company personnel, those who will transfer their knowledge to the company's employees, and who are available in case their services are required again—are very important.

Consultants provide three general categories of services—management, application, and technical. The service provider will divide consultants into these three general categories. Some consultants can perform two of these categories, but it is rare to find consultants who can perform all three.

Management consultants focus primarily on the function of management as it relates to the organization of resources and business process flows. Management consultants often participate in project management and will provide high-level direction for the overall successful implementation and use of an ERP system.

Application consultants focus on the process of communicating, teaching, demonstrating, and configuring software for the business process flows. A management consultant may consult on how to perform a business process flow where an application consultant would show the company how to perform the business process flow in the new software.

Technical consultants deal with technical issues such as database conversions, source code modifications, communication protocols, operating systems, software installation, hardware systems, and integration programs. Technical consultants work closely with application and management consultants.

It can be difficult to estimate the proper ratio of management, application, and technical consultants required for a particular ERP project. Even slight changes in the ERP implementation strategy can affect the ratios. The ratios fluctuate between the beginning and the end of an implementation.

Role of the Consultants

The role of the consultants is very familiar to all of us because we have seen many of them in action. The company places its trust in the consultants for realizing its business objectives. In fact, it is a better practice that the contract between the company and the consultants should have all the performance clauses in place. The consultants should guarantee the success of the project and should be able to show results (quantifiable results like reduction in cycle time, increased response time, improved productivity, and so on) to the satisfaction of the company management.

Consultants are responsible for administering each of the phases of the implementation so that the required activities occur at the scheduled time and at the desired level of quality and with effective participation of all those who must participate. For keeping the promises that the consultants have made during the negotiations, they have to transform their approaches and methodologies into detailed work plans. The methodology will have to be converted into tasks and should be allocated to the right people. The time schedule for each phase and each task has to be determined and the project plan has to be finalized.

Consultants should add value to the project. They bring expertise about the package and about implementation—know-how that is not included in the standard documentation. This knowledge (also known as practical knowledge) is derived from their expertise, which stems from practical experience. Because the consultants have seen many projects and have made or seen many mistakes, they can avoid the phenomenon of 're-inventing the wheel.' They will know what will work and what will not. Thus, by eliminating the trial and error method of implementation and doing it right the first time the consultants help in saving huge amounts of money, time, and effort.

Consultants should also know how to remain impartial while questioning current company processes in an effort to promote better businesses practices and better implementation results. They should strive to improve the company's business processes so that the software package can be used as it was originally intended to, by its developers. Refining the company's processes can only optimize the performance of the system and maximize future user satisfaction. Consultants are also responsible for analyzing and clearly addressing the customization issues. They must be able to distinguish between the 'must have' and 'nice to have' items and decide on the level of customization. This is an area where the consultants have to use their diplomatic skills, as the company people might want to customize all the aspects. It is the duty of the consultants to present the advantages and drawbacks of each area and reach a consensus decision, which should also be the right one. Consultants need to position themselves such that their loyalty to the client and the project are

balanced, with that of defending the package vendor, when such defense is technically correct. This is indeed a very difficult job (like a tight-rope walk) and that is why consultants are paid such huge amounts for their services.

It is the duty of the consultant to understand the total context and scope of the envisioned work and to know when to alert the company management about actions and decisions that must be undertaken so that the job will not be compromised and the implementation will not be jeopardized. Maintaining technical documentation on the project also falls within the duty of the consultant. The consultants will leave once the project is complete, but the knowledge of the project cannot depart with them. The consultants should create a knowledge base accordingly and should train enough people so that the work they have started is continued.

SUMMARY

Developing an ERP package is a very complex and time-consuming process, which needs a lot of skilled manpower and other resources. Vendors are the people who have developed the ERP packages. They are the people who have invested huge amounts of time and effort in research and development to create the packaged solutions. The ERP vendors spend crores of rupees in research and come up with innovations that make the packages more efficient, flexible, and easy to implement and use. Also with the evolution of new technologies, the vendors have to constantly upgrade their product to use the best and latest advancement in technology. Therefore, it is better to leave the ERP package development to the vendors.

To successfully set up and implement the ERP package, which will function perfectly is not an easy task. One cannot go in for a trial and error method of implementation strategy due to the huge amount of investments incurred. The company might not have the necessary expertise to implement the package. As a result, it is better to get the help of experts—business consultants—to implement the ERP system. Business consultants are professionals who specialize in developing techniques and methodologies for dealing with the implementation and the various problems that will crop up during the implementation. They are experts in the administration, management, and control of these types of projects. Each of them will have many man-years of implementation experience with various industries and would have time-tested methodologies and business practices that will ensure successful implementation. They will be good at all phases of the implementation life cycle right from package evaluation to end-user training.

In this chapter, we had a detailed discussion about ERP vendors, vendor management and the role of vendors, consultants and their role in the ERP implementation.

REVIEW QUESTIONS

1. Why can't companies develop their own ERP packages?
2. Why can't the company carry out the ERP implementation by itself?
3. In addition to the product knowledge, what are the skills required by the people who implement the ERP system?
4. How does the in-house ERP implementation become costlier?
5. What are the advantages and disadvantages of the in-house ERP implementation?
6. What are ERP package vendors?
7. Choosing the right ERP vendor goes beyond evaluating the software functionality. Explain.
8. What are the factors that should be considered when selecting a vendor?
9. What are the tasks that the vendor must perform after signing the contract?
10. What is the goal of vendor training?

11. What are the strategies to get the best deal from the vendor?
12. What are the strategies to make the vendor to perform according to the organization's expectations?
13. What is the role of the vendor's project manager?
14. How will the organization make sure that the vendor does the bug fixing and training properly?
15. What are the roles and responsibilities of the vendor?
16. What are the objectives of vendor training?
17. Explain the vendor management process.
18. What is the role of the external consultant during vendor training?
19. What are the duties of the project manager in handling the vendors?
20. Why it is important that the vendor supply the ERP software and its documentation on time?
21. What are the duties of the vendor during implementation?
22. What are the duties of the vendor after the system is operational?
23. What are the myths and ambiguities about the consultants and the role they play in an ERP implementation?
24. What are the skills that the consultants should possess?
25. What is the main drawback of using consultants?
26. What are the main functions of the consultants?
27. What are the factors that decide the success of a consultant?
28. Why it is important to have consultants in the implementation team?
29. What are the services provided by the consultants?
30. Why it is important to have a performance clause in the contract with the consultants?
31. Who are business consultants?
32. Why consultants are better equipped and knowledgeable about the ERP system and its implementation than the company employees?
33. What is special about the services of the reputed consulting firms?
34. What are the three categories of service that the consultants provide?
35. What are the duties of management consultants?
36. What is the primary service offered by the application consultants?
37. What are the tasks performed by the technical consultants?
38. What are the main responsibilities of the consultants?
39. How do consultants add value to the implementation project?
40. Explain the role, duties, and responsibilities of the consultants.
41. Why it is important that the consultants remain impartial while performing their activities?
42. Why it is important that the consultants create a knowledge base and should train the employees?

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Chapter 31

Employees and Employee Resistance

INTRODUCTION

Primarily, ERP implementation is not a technology or process project—it is a people project. To succeed during and after implementation, the ERP system needs full and complete support of all the end-users of the system. The end-users are the people who will be using the ERP system once it is in place. These are the people who were doing the functions that are being automated or computerized by the ERP system. With the implementation of the ERP system, the old job descriptions will change and the nature of the job will undergo drastic transformation. It is human nature to resist change. When we are talking about implementing an ERP system we are talking about change on a very massive scale. Therefore, there will be fear of the system replacing existing jobs, as many functions will be automated. Also people will be afraid of the amount of training they have to undergo and learning they have to do in order to use the new system. Job profiles will change, job responsibilities will undergo drastic alterations, and people will be forced to develop new skill sets. If these fears are not addressed and are alleviated well in advance, then it will be asking for trouble.

It should be worth noting that while the ERP systems eliminate many existing jobs, it creates many new ones—ones with more responsibilities and value additions. It is easy to see that the automation of the business processes through technology can eliminate the job of many employees whose function is to record, control, calculate, analyze, file, or prepare reports. However, it must be pointed out to the employees that the same automation also creates many more opportunities for employees because they can grow from the monotonous clerical work and transform themselves into highly valued individuals in a new and challenging working environment using the most modern technology. If the company can succeed in making its employees accept this fact and assist in making the transformation (by giving them training), then the major (and most critical) obstacle in the path of an ERP implementation is solved.

REASONS FOR EMPLOYEE RESISTANCE

Change is happening faster that most people care to think about. What is more important, change is happening faster that most people care to accept. In fact, most people do not want change. The premise is that change is not always good—that somehow it will have a negative impact. Today, technology is advancing exponentially. It is very difficult to keep pace and stay abreast with these technological developments. We are in a constant state of change, and continuous change and improvements in the abilities of companies to do things better, faster, and cheaper is an absolute must for survival in this brutally competitive world.

The main reasons for the resistance toward change are fear of failure, fear of being redundant, and fear of the uncertain future. We will see these reasons in a little more detail.

Fear of being Redundant

The biggest fear shared by people in companies going in for ERP implementation is the loss of their job. As soon as the decision about the ERP implementation is announced, rumors about the new

system automating all the tasks and making people redundant will start floating around. When a company talks about ERP and automation, the immediate reaction is that computers will replace people. There is some truth in this fear. There are many instances where computers have made people redundant. However, what most people fail to hear and the gossipmongers forget to tell is that the people who were doing the manual jobs before computerization will be able to get better jobs with higher salaries once they learned the new system and how to use the computers. Thus, if a person is willing to adapt to the changes and is willing to learn the new systems and new way of doing business, then he or she does not have anything to fear. There is a very good chance of getting better jobs with higher salaries.

Fear of Failure

Another fear that must be addressed in the planning phase is how to handle people's fear of failure—the fear of not understanding or being able to work within an automated environment. Many companies make the serious mistake of not insisting on a very thorough training program that will insure the employees have the knowledge and a confidence level for adapting and using the new systems to the maximum benefit of the company.

Many view training as an expense to be cut. Beware of those that claim they can reduce this expense as the results have proven increases in hidden costs to the firm that often exceeds the perceived savings. Training is an item that should receive the most serious attention by professional implementers. Once it is determined in scope and budgeted for, it should become a holy cow, and be adjusted only by the implementer due to project scope changes.

Fear of the Future

Openly discussing and announcing the purpose of implementation and what it means to the employees of the firm can help to address the fear of the future. Normally ERP implementation investment is made so that the firm can compete and grow the business. It may be implemented to survive, thrive, and become competitive.

Whatever, the future expected from the implementation, it must be made openly clear to all who are expected to participate in making it successful. A feeling of excitement must be built from the ground up, in order for people to enthusiastically embrace the ERP system as the key to their futures. Without a feeling of confidence that things are going to be good, they may never try it at all. If they decide not to give the system their full support, you will not be successful in your implementation.

DEALING WITH EMPLOYEE RESISTANCE

Implementing an ERP system is a change and it is human nature to resist change. Thus, any ERP implementation will face some amount of resistance. The main reason for this resistance is fear—fear and uncertainty about what will happen. In the case of ERP implementations too, there will be fear among the employees. There will fear about what the new system is all about, what changes it will introduce, how it will change the job profiles, how many jobs will be made redundant and how many employees will lose their jobs, and so on.

It is quite natural that the end-users will be skeptical about the new system. Nevertheless for an ERP implementation to succeed, the co-operation of everyone involved is an absolute necessity. If employees are not convinced about the importance of the ERP system and the benefits of using it, they will not be fully co-operative. This can result in the failure of the system. It is very important, therefore, that users be won over before implementing the system. Forcing the system on unwilling people will only harden their resolve to revolt. The best way to deal with employee resistance is to

educate employees about the new system and assure them about their jobs. We will see some of the techniques used to deal with employee resistance in the following sections.

Training and Education

One main reason for the resistance is ignorance. People always have a lot of misconceptions about ERP—it will increase work load, it will make jobs redundant, it will change the way business is done, it will introduce limitations on the freedom of the employees, and so on. More problems have surfaced during implementation from all levels of a company because people were uncertain of their future upon completion of a successful implementation. Although if the ERP implementation team backed by the management spends a little time and effort educating users about ERP and how it will help both the company as well as the users, then user resistance can be reduced if not fully eliminated. Remove the uncertainty for all in the company by telling the people what is going to happen after the implementation of the ERP system.

Very few disagree that training is important. The problem, however, is that many projects tend to focus on training users on how to use the new system prior to go-live. While this is certainly important, it does not address other issues such as how key business processes will be affected by ERP. In addition, not enough companies take advantage of ongoing training tools such as on-line help, ongoing refresher training, etc.

Training is one of the most dangerous and expensive items to be compromised or circumvented. The lack of preparatory and reinforcement training or inadequate training can cause wrong and inefficient use of the system and result in many direct financial damages to the firm and even more dangerous indirect expenses.

Implement an Organizational Change Management Program

Organizational change management program is much more than just training. Organizations should ensure that they are holding regular workshops with end-users and management, involving them in process and organizational design workshops, and keep users informed of the purpose of the project, progress, why you are implementing ERP, etc. through formal and informal communications.

Creating ERP Champions

Another method of reducing resistance is by creating champions. One of the most efficient ways to transition to new technology is to find a well-respected potential user of the technology. This should be a person who knows the business well, embraces change, and is respected in the organization. Train the user on the process and the technology, get this user evaluate the technology, and encourage this user to champion the merits of the technology to co-workers and management.

The champion becomes the expert user, facilitator, and trainer of the tool. He or she will also be the key in helping other employees understand and learn the value of ERP and how it affects their jobs. Thus, all the members of the implementation team and the pilot project team are potential champions. There will always be people who adapt to change slowly and maybe even begrudgingly; do not look to them to be your champion. Instead, look for the people who are the first to embrace change, adopt new technology, and are always looking for a way to do things better. That is the kind of person you want for a champion.

Pilot Projects

Implementing the ERP system in a pilot project is a good idea because it minimizes the risk of failure. This is because the entire implementation team can concentrate on the pilot project. The ERP system can be tested before going in for company-wide deployment. Any issues that were not anticipated

during the planning stage that are encountered during the pilot implementation can be considered and the implementation plan can be refined and fine-tuned. During the pilot implementation, the existing data of the pilot project is migrated to the ERP system; team members are given training on the ERP concepts and how to use the ERP system (and tools, if tools are used). The implementation team monitors the various implementation issues such as how people find the system, their feedback, tricky issues in the implementation, the learning period, how long it takes for the users to get comfortable with the system, and whether the user manuals and other implementation documentation are satisfactory or need revisions/modifications.

Based on the experiences of the pilot project implementation, the implementation plan and the implementation guide will be revised and modified. The pilot project will warn the implementation team about what could go wrong, how the potential pitfalls could be avoided, and so on. Also a successful pilot project is a morale booster for the implementation team and a good marketing tool.

Involve Employees in ERP Process

The more involved employees are in the ERP decision and implementation, the more ownership and buy-in they will have into the project. This is not to say that every single employee should be involved. However, involving more employees than just senior management in the decision and implementation planning process will go a long way to make people feel more ownership, which inevitably results in less resistance in the future.

Address Issues of Fear, Uncertainty, and Self-esteem

Each and every one of the levels within an organization must be addressed in overcoming resistance to change. The first thought in anyone's mind when ERP implementation is discussed is, 'what's in it for me?' If the answer must be self-generated then it will probably be on the pessimistic side, yielding a negative perception. This critical issue should be addressed early in any project and at every level.

There is no such thing as communicating too much with employees. The more they know about why your organization is selecting ERP, how it will benefit the company, and what it means to them and their jobs, the less likely they will be to resist the changes when they are implemented.

Factual representations of what will happen to people within the organization, how the implementation will take place over what period, milestones during the project, and managing expectations of all (from the shop floor worker to senior manager) are absolutely necessary if a successful on-time and on-budget project is the goal.

Manage Expectations

Managing expectations of problems to be expected during the initial and final phases is the biggest challenge. Due to lack of top management commitment, spread of rumors, mistakes on the part of the implementation team, moves by the pessimists and skeptics, etc., your implementation efforts can be derailed. Never let this type of activity impact a project. It will result in failed implementations if allowed to go unchallenged. Thus, the project manager and the implementation team should monitor the mindset and attitude of the employees, their expectations, and concerns and take corrective action before problems get out of control.

In the planning stage, these elements must be addressed and well-documented for later fire fighting, if necessary. If planning is thoroughly completed prior to implementation, most of these elements will be insignificant to non-existent because they have been dealt with early on. And if expectations are openly adjusted and well-documented during changes in project scope or circumstances, you can avoid surprises and be ready to deal with any problem that arises. If you are not

prepared, then sudden and unexpected developments can surprise you and by the time you formulate a strategy and implement it, it will be too late and usually can result in the loss of confidence in the project or you or both.

SUMMARY

The real challenge in ERP implementation is meeting the fears, doubts, and anxieties of people head-on, addressing them in a very satisfactory manner, and eliminating them through planning, training, understanding, and obtaining 'buy-in' to the implementation effort in everyone's agendas. You can do it. It can be done if you pay real attention to these fears and take care of them in your design, planning, and implementation. If you do not, they may undo everything else you have done well. People's resistance to change can and will burn you, regardless of the level you are at in the process.

REVIEW QUESTIONS

1. Why ERP implementations are called people projects?
2. What are the misconceptions about ERP systems that make employees oppose it?
3. Will the ERP system eliminate existing jobs? How should the company tackle such a situation?
4. How should the company prepare its employees for the new system?
5. Why is training very important in dealing with employee resistance?
6. What are the reasons for employee resistance?
7. Why is change a must for survival in today's competitive world?
8. What do you mean by the fear of being redundant and how do you deal with it?
9. What do you mean by people's fear of failure and how do you deal with it?
10. Discuss the various methods of dealing with employee resistance.
11. Cutting the training costs is a bad strategy. Discuss.
12. Why are people afraid of the future?
13. What are the best ways to deal with employee resistance?
14. What is the role of training and education in dealing with employee resistance?
15. How do we create ERP champions and how will these champions help in winning the support of the employees?
16. What are the roles of the champion and who are best suited to become champions?
17. What are pilot projects and how do they help in countering employee resistance?
18. How will involving the employees in the ERP process help in dealing with their resistance toward the ERP system?
19. Why addressing issues of fear, uncertainty, and self-esteem are important in dealing with employee resistance?
20. How do you manage expectations during the ERP implementation?

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Chapter 32

Contracts with Vendors, Consultants, and Employees

INTRODUCTION

Webster's dictionary defines the term *contract* as an agreement between two or more people to do something, especially one formally set forth in writing and enforceable by law. Contracts are very important in an ERP implementation project—before, during, and after the implementation. If the contracts are not properly drafted or if it has a lot of loopholes, this will give the participants of the project—vendors, consultants, and employees—enough opportunities to leave the company stranded.

Who all are the parties with whom the company should sign a contract? The answer is, all those who are important for the success of the ERP project—both implementation and maintenance. This includes the package vendors, the hardware and peripheral vendors, the networking people, the consultants, the employees who are being trained in the ERP package implementation (not the end-user) or employees who are part of the implementation team.

CONTRACT WITH THE PACKAGE VENDOR

Most software vendors (for that matter all the people involved except the employees) will have standard contracts drafted by their legal department and have clauses to safeguard their interests. The contracting company's legal department should go through the contract, and if they find the terms and conditions agreeable, then sign the contract.

In reality, however, the contract signing process is not as smooth. Many a times it will require the legal departments from both the sides to sit together and iron out the differences. The package vendor will have copyright clauses in the contract. As the creator of the package, it is their intellectual property. Any abuse or misuse of the package by the contracting company will be a violation of the copyright. Sometimes the contracting company might want access to the source code and the design documents, so that they can make the required modifications—customization—to the source code. But the package vendor usually will not want this. The main reason for this reluctance is that once the package vendor gives the source code and design documents, it is very easy for anybody who has access to these documents to misuse it.

Also it is better to give the task of customizing the package—by modifying the source code—to the package vendors themselves. The vendor has developed the package and so they will have a better knowledge of the source code. They are the people who will have the complete knowledge of the impact of a change to the entire system. Another point that should be remembered is that the relationship between the ERP vendor and the contracting company is not a one-time affair. The vendor should be made a partner in the company's future plans. The vendor will be upgrading their product as the technology advances. They will be adding new modules and features. The company should get the benefit of these upgrades. The company should get preferential treatment as they are existing

customers. The contracting company should include clauses to make these things happen. One problem of the company modifying the source code is that this might prevent the contracting company from getting support on upgrades and future versions. Thus, it is best to leave the customization to the vendor. However, if the contracting company is not sure about the stability of the vendor and its continued existence, then the contract can include clauses to keep a copy of the source code and the design documents with a third party (like a bank) and release it if the vendor disappears from the scene or stops support for the product. This agreement will be agreeable to the vendors also.

The contract with the vendor should address—in addition to issues about source code and modifications—the following points:

- Value of the software and conditions of payment
- List of deliverables (software, documents, etc.)
- Mode of delivery and installation help
- Copyright and ownership issues
- Software license
- Third-party software compatibility, integration or interfacing, and integration support
- Operating system
- Hardware/liability
- Conditions and concessions for acquiring complementary modules in the future or for increasing the number of end-users
- Cost of implementation training
- Cost of end-user training
- Annual maintenance fee
- Warranty or guarantee terms
- Terms and conditions for the receipt of new versions, upgrades, etc.
- Details of technical support—on-site, telephonic, and so on
- Terms and conditions for customization
- The profile of the vendor's team who will be assisting the company in implementation
- Other specific responsibilities assigned to the vendor
- Cancellation of license

The above is by no means a comprehensive list. You will have to add clauses that are specific in your case. The objective is to protect the company's interests and whatever is needed for it should be in the contract. Obviously, the content should be rigorously checked and the requisite amendments and additions made. Particular attention should be paid to the meaning of the words used, in particular the subtle differences in specific words. The requirements definition and subsequent amendments should be included. The content should take into account all eventualities for the lifetime of both the software implementation and its license. Things to watch out for include:

- Payment profile: one possible consideration is to schedule payments in line with the attainment of targets and deadline
- License fee based on named users or number of concurrent users
- What happens if a software bug prevents the implementation of specific functionality and the bug fix will only be available in the new upgrade available at a later date?
- What is the process for controlling software modifications and their testing and the warranty period?
- Who owns software customizations and the associated intellectual rights?

- Who has responsibility for sourcing new hardware and what happens if it can be sourced cheaper elsewhere?
- Cost of transferring software from old to new hardware and who will bear them?
- Restrictions on who can use the software, e.g. satellite operations
- Entitlements for additional service
- Response procedure for problems including escalation route
- Escrow arrangements should the vendor go into receivership

These are just a few pointers. In view of the size of the investment, the safest recourse is to seek legal expertise. Indeed, it may be prudent not to dismiss the second choice of vendor should negotiations breakdown.

CONTRACT WITH THE CONSULTANTS

Consultants are another group of people who play a vital role in the ERP implementation project. Compared to the package, the consulting services are of a more subjective nature. It is difficult to measure whether the company is getting its money's worth from the consultants. The company's objective is to make the package work successfully as documented in the vendor's manuals. What the company expects from the consultants is that they will make the project a success, the implementation will be completed without time and cost overruns, that the user training will be done to everybody's satisfaction, and the consultants will train a group of people (and transfer their knowledge) so that when they leave there will be enough employees in the company who can carry on the work.

Even though the consulting services are subjective in nature, the company can include performance and penalty clauses in the contract. For example, the company and the consultants can agree upon the completion date and the implementation budget and the projected improvements (like x% increase in productivity, y% reduction in response times, and so on) and then include these in the contract. Thus, the consultants could be held accountable. The following are some of the points that should be included in the contract with the consultants:

- Profile of the consultant's team with resume of each member
- Consulting fee and payment conditions
- The time schedule and the implementation budget
- The projected improvements in quantifiable terms and the time required for showing the results
- Implementation methodology
- Terms and conditions of knowledge transfer and employee training
- List of deliverables (reports, manuals, knowledge bases, etc.)
- Other specific activities the consultants are supposed to do
- Reporting mechanism to the company management
- Project monitoring and status reporting systems

CONTRACT WITH THE EMPLOYEES

The employees who are on the implementation team are trained on the ERP package at the company's expense. Once they have acquired the knowledge, completed the training and participated in the implementation, their market value will improve exponentially. It is natural that they will find better and more lucrative job offers. In case the key employees leave the company without any warning or without making any alternative arrangements, then the company's performance will suffer. It is in

the best interests of the company to sign a contract with the employees before they are put on the implementation team and given training. The main clause of the contract with the employee should be that they should not put the company in a position where the smooth running of the ERP system is interrupted. If they want to leave they can leave; even the most stringent contract cannot hold them back; but before leaving they should give the company enough notice. They should also train another person to a level where he can handle his duties. The contract can also stipulate that no employee can leave the company in the middle of the implementation project, be it his first or fifth. The chances of an employee leaving during his first implementation are rare. It is once they have gained experience that they want to leave. Suppose the company has implemented the system in two divisions and is planning implementation in the third, and that the implementation is halfway. If at this point, a key employee leaves it will affect the implementation very badly. The contract with the employees should take such situations into consideration.

But one word of caution, if the company can retain the employees by other means like offering attractive salaries, stock options, challenging and comfortable work environment, etc., then adopting such a strategy is a much better option than enforcing a contract. The employees are the most important assets of any company and it is in the interest of the company to trust them and keep them happy and satisfied.

AUTOMATED CONTRACT MANAGEMENT SYSTEMS

Automated contract management systems are network-based software platforms that make contract terms accessible to every person within an organization who needs to know. Customers and suppliers also can be brought into the loop. Contract management function has two underlying goals. *First*, it should ensure the promises a company is making and the obligations it is taking on are always visible to the right people in the organization. *Second*, it should allow top management to see that what the sales staff is promising is acceptable. The fundamental purpose of contract management is to fully integrate the contract management process and the rest of the company's operations.

Automation will embed any contract within the company's operations using technologies such as e-mail, electronic document exchange, and instant messaging. The process of installing and implementing automated contract management systems is no more complicated than putting an enterprise resource planning (ERP) solution into place. The level of difficulty depends on the volume and complexity of a company's contracts and the variety of modules or functions the vendor offers and the client selects.

Automation forces companies to carefully analyze how they negotiate and implement contracts—a process that by itself can help the organization create better, more efficient procedures. Contract management systems tie executives and negotiators directly into the negotiating process and give them access to contract language the company considers standard and acceptable. Negotiators do not have to sit in the same room; they can prepare contract terms in an instant messaging environment. Afterwards, the system can initiate a series of notifications to ensure the terms of the deal are carried out according to the contract's timetable.

One of the goals of integrating the contract management process into a company's operations through automation is to eliminate human error. But these systems can just minimize errors by assuring that each person who needs to approve an aspect of a contract, or make sure one of its obligations is fulfilled, is kept in the loop.

For those who think the software can do everything, it is possible to build a workflow that is too elaborate. When automated contract management systems of companies do not run smoothly, it is usually not the software causing the problem but the workflow process it was built into. If a

company has no first-hand knowledge of how this kind of system works, a successful implementation will depend on how well the company prepared for it and tailored it for its internal use. That is the reason why bringing all the departments that will be affected by the new system into the implementation process is crucial.

If a company brings in an outside consultant to implement the system, the new person's understanding of the company's internal procedures will be critical as well. Otherwise, the company can end up having to re-tool the basic workflow that the automated system is supposed to follow or add modules that should have been installed in the first place. If the former situation occurs, the additional time and effort can mean re-fitting the system from top to bottom, at heavy additional costs.

Once an automated contract management system is in place, however, it becomes much like any other piece of software—an intellectual asset over which the company has only partial control. Companies that use them are vulnerable to the vendor's going out of business and no longer being able to support the software. Automation cuts costs and improves revenue. Savings can come from reducing pricing errors, mistaken payments, operating and processing costs, and personnel.

SUMMARY

Contracts are very important in an ERP implementation project—before, during, and after the implementation. If the contracts are not properly drafted, and if they have a lot of loopholes, this will give the participants of the project—vendors, consultants, and employees—enough opportunities to leave the company stranded. Who are all the parties with whom the company should sign a contract? The answer is all who are important for the success of the ERP project—both implementation and maintenance. This includes the package vendors, the hardware, and peripheral vendors, the networking people, the consultants, the employees who are being trained in the ERP package implementation (not the end-user) or employees who are part of the implementation team. We also saw the automated contract management system and its uses.

REVIEW QUESTIONS

1. Why are contracts very important in an ERP implementation project?
2. Why it is important to have well-drafted contracts with vendors, consultants, and employees?
3. Who all are the parties with whom the company should sign a contract?
4. What are the important aspects that the organization should be aware of when signing the contract with the package vendors?
5. Why it is better to give the task of customizing the package to the package vendor?
6. What are the strategies that should be used to protect the interests of the organization and should be part of the contract with the vendors?
7. What is the need for a contract with the consultants?
8. What is the need to have a contract with the employees?
9. What are the main topics to be included in the contract with the employees?
10. What are automated contract management systems?
11. What are the goals of the contract management function?
12. What are the advantages of the contract management systems?
13. What are the main points that the contract with the vendor should address in addition to issues about source code and modifications?
14. What are additional points that should be included in the contract to safeguard the interests of the organization?
15. List some of the points that should be part of the contract with the consultants.

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Chapter 33

Training and Education

INTRODUCTION

ERP implementation is primarily a people project. According to a survey conducted by Deloitte Consulting [1], respondents found that 69% of the reasons for failure of the ERP implementations were people-oriented (see Fig. 33.1). A majority of the people problems like employee resistance, non-cooperation, improper use of the ERP system, etc., are the result of ignorance, fear of failure, and fear of the future. Most experts and ERP implementation veterans agree that the best way to combat this issue is through comprehensive training and education of the users of the ERP system.

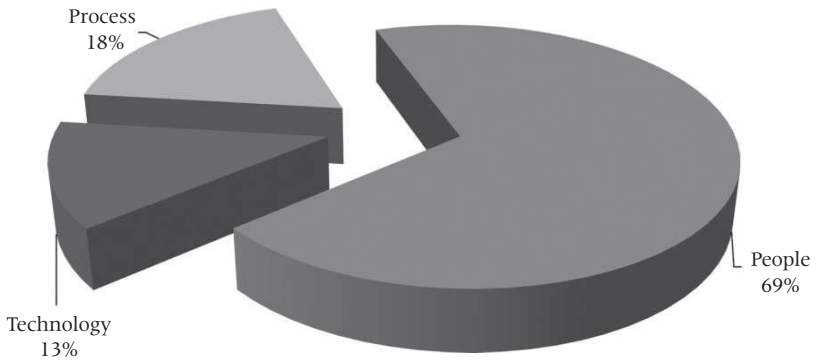

Figure 33.1 Obstacles for an ERP implementation.

Training is perhaps the most underestimated investment of the implementation life cycle. A major complaint is that not enough training is done. One of the most common mistakes of all ERP implementation is underestimating the time and cost of training end-users. Although training is a project-managed activity, it appears to be widely neglected or is inconsistent in application. Furthermore, since the greater part of training takes place toward the end of the implementation cycle, when it looks like overall costs will exceed budget, training is the first activity to be compromised.

According ISC Technology Inc. [2], the seven major pieces of the ERP training puzzle are:

1. **Planning**—Identifying the elements needed to structure the training direction.
2. **Budgeting**—Determining the investment required to create the infrastructure and impart the training.
3. **Staffing**—Determining resources (internal and external) and needed prerequisite skills.
4. **Partnering with the Business**—Developing a shared responsibility and success plan.
5. **Organizational Issues**—Looking out for red flags that could impact the plan and coping strategies.
6. **Curriculum Development**—Discussing best practices for ERP projects.
7. **Implementation**—Rolling out the training.

OVERVIEW OF TRAINING

This section provides an overview of the main issues to be considered when embarking upon the training activity. Although it may be convenient to take an informal approach to training whereby people 'pick up knowledge and skills as they go along', this is unpredictable in terms of a successful learning outcome. A more formal approach to training tends to involve the following stages:

- **Define learning objectives**—what will the learner be able to do as a result of the training?
- **Determine content**—what skills and knowledge are to be developed?
- **Plan**—when and how will the training be delivered? What resources, materials, facilities are required? How will the content be structured?
- **Deliver**—the experience of the learner
- **Assess learner**—has the learner met the objectives?
- **Review effectiveness of the training session**—what went wrong? What can be done better?

Those at the receiving end of the training are initially the project team members and the system administrators and then later in the project the developers, QA team, testers, etc., and the project leaders and managers. Each group of learners will have different requirements. Thus, the nature of the training is likely to be different for each different stream of learners.

Training that occurs too far in advance of the go-live date will likely be forgotten. Training that occurs too late will not be done in time and can lengthen the stabilization period. In order to fit training between the current time and the go-live date, the firm must consider the amount of time in that gap and the amount of time required by the users to learn.

The amount of training required is a function of the particular module for which users are being trained. In some cases, it can take up to six months for users to get comfortable and proficient with the ERP software.

Time spent on training is time not spent on day-to-day activities. Not surprisingly, there have been a number of different solutions used to ensure that workers get enough time off for training. Employees can put in extra hours in order to accommodate training hours. Still other firms have made use of temporary employees.

The hours assigned to training signal how important it is to the implementation. Training scheduled during working hours indicates its importance, whereas training scheduled outside of working hours suggests that training is not as important as day-to-day responsibilities.

The most pressing activities often get the most attention, to the detriment of other, less pressing activities. This means that productive work usually receives greater attention than training activities and so user ERP training might be pushed aside if firms do not ensure that users take it seriously. As a result, firms have introduced different penalties and incentives. In some companies, training is deemed mandatory for certain critical users.

Training end-users on how to use an ERP system is a mix of technology, processes, and domain-area content in order to provide a context for the system. Otherwise, training can become a useless exercise. It is always better to train on the concepts first and then show the end-users how to use the system. When the end-users have a good idea as why things are done, they will learn the tasks required to accomplish those processes faster.

Most training programs come from an analysis of what the company has in specific and what they need to accomplish. Almost all ERP approaches to training have an element of classroom training. However, other formats used include training over the Internet, computer-based training, and self-study. Based on interaction with consultants, one approach that is consistently well accepted involves designating a member (or group of members) of the client organization as 'super users or

champions,' who can then be responsible for training others. Training super users has a number of advantages. *First*, this approach has been found to facilitate buy-in from the users, because those who supply the training are people the users know. *Second*, the existence of super users shows the other users that learning about the system is important. *Third*, developing super users develops an important understanding at the user level.

Because ERP engagements are often behind schedule, firms may try to speed up their training. The ability of firms to speed up training depends on the firm's needs, personnel, and previous training. Some employees are likely to be quicker learners or able to spend more time on training than others. The training will likely be faster to the extent that the new system is similar to the old system. However, trying to speed up the training is potentially dangerous, with a high cost of failure.

TRAINING COSTS

Training costs will vary across ERP implementations. The training budget can be 15–20% of the total project budget. Training is one of the most important hidden costs of an ERP implementation. In most cases, there will always be training cost overruns. Thus, there should be a provision to allocate addition budgets for training when required. The organization can reduce the training costs by first training a batch of employees and then making them trainers so that they can train the colleagues. This training will be more effective as people will be more receptive to the ideas and more open about their ideas, fears, and concerns when the training is conducted by a person known to them or is one among them. Some of the items that contribute to the training costs are:

1. **Training planners and content developers**—For the training to be successful, it has to be planned well; and for this purpose, the training needs of the employees are to be identified. Once the needs are identified, the content that will address those needs have to be developed. The people who do this—external ERP training consultants and internal experts—have to be paid.
2. **Hardware infrastructure**—In order to create a training centre, the training team will have to spend money on infrastructure like computes, training aids, stationery, etc., and also on classrooms and labs to facilitate effective and uninterrupted training.
3. **Software**—This includes the demo or training versions of the ERP software that is being implemented, other software packages like word processors, spreadsheets, presentation software, e-mail programs, web browsers, etc., that are necessary to make the employees computer savvy and also proficient in the ERP package the organization is implementing. All the employees need not be given training in all the ERP modules; after an overview of how the different modules work and how they are interrelated, the employees can be given comprehensive training on the ERP module that he or she will be working and also on the necessary software package that he will have to use for effective communication.
4. **Trainers**—These include the salary of the trainers, both in-house experts and external consultants. One way to minimize the cost on trainers is to get a train a batch of the employees trained as trainers.
5. **Vendor consultants and training materials**—The vendor should provide the training materials and training consultants for the initial phases—until the in-house trainers are being trained and are capable of conducting training on their own. The vendor should also provide updated training materials and conduct refresher courses for the in-house trainers as and when upgrades and changes are made to the ERP system. These issues and associated costs should be negotiated during the package selection and should be part of the ERP budget.
6. **Support staff**—The cost of people who do the various administrative tasks should also be accounted for in the training budget. These people are important as they are the ones who

have to ensure that all the people are trained and the training goes on smoothly. Their tasks include scheduling employees into appropriate courses, tracking completion, scheduling make-up courses, adjusting training schedules, etc. They are the ones who should contact the vendor consultants and other ERP consultants when the need arises and when the in-house trainers need additional training.

The above list by no means is an exhaustive one. The training cost as we have seen earlier will depend on the organizational culture, current knowledge, existing infrastructure, etc. Therefore, the amount of money that needs to be spent on each of the above items and others that are specific to an organization will vary.

NEED AND IMPORTANCE OF TRAINING

We have seen that many ERP implementations fail and many more fail to deliver the promised results. What is the reason for ERP disasters? Most implementation experts have pointed out that the main culprit of failed ERP implementations is the end-user training. Experts say that the technical training of the core team of people who are installing the software is done properly and there is no problem in that aspect. It is the education of the broad user community of managers and employees who are supposed to actually run the business with it that is not done properly resulting in the wrong and improper usage of the system.

Many studies have revealed the fact that as few as 10–15% of ERP implementations have a smooth introduction that delivers the anticipated benefits. The remaining firms either experience teething problems or a significant shortfall in delivered benefits and the difference between the successful 10–15% and the rest is better training.

Everyone knows that training is important, especially the ERP software vendors. They earn handy revenues from 'design once, recycle many times' training courses. The third-party training firms, who conduct courses on how to operate an ERP vendor's system, also know the importance of training. The variety of training formats available is amazing—on-site training, web-based virtual classrooms, computer-based training, knowledge warehouses, video courses, self-study books, context sensitive help screens—an almost endless menu to suit almost every need and budget.

ERP training has become a giant business in its own right and the training business is expected to grow exponentially. The logic is inexorable—the better the training, the faster you will see the business metrics move in the direction you are looking for. However, the problem with such training is that it is not good enough. It is just a walkthrough of the system and teaching the users on what to do. This will not help the users to understand what they are doing and why.

The education should impart to the users the ability to figure out the underlying flow of information through the business itself. The program should explain the ERP basics, the business processes, how the ERP system functions, how it automates the business processes, how the action of a user affects the entire organization, and so on. The focus should shift from mere training to providing education and with greater emphasis on education. Education will tell the users why they are doing it and will help in winning support for the project as it will enlighten the users, whereas training will only tell them what to do and how to do it. There is a tendency for companies to fall into the trap of putting employees through training programs that are too software-specific. This kind of a training program will ignore the fact that ERP systems are designed to operate by codifying a set of business processes.

Another problem is that the training typically occurs at the end of the implementation cycle, when activities are often running late and being compressed. Training, too, gets squeezed in as a last-minute activity. It is important to start the training program so that it will be nearly over by the

time the system goes live and then continue for a few more sessions to clear the issues faced during the actual interaction with the ERP system. One of the results of not providing a proper training program is that users fail to appreciate the consequences of their actions, often with disastrous results. Informal practices that worked fine in the era of paper procedures or standalone legacy systems can have catastrophic effects on an integrated ERP environment.

Training in how to operate the system will not, however, help the middle manager see far enough down the road to decide to forgo the short-term benefit of shipping product come what may. Only a broader-based, holistic education in the company's ERP-mediated business processes will do that. If end-user and middle management training is so important, why it is not given more priority? Companies have begun to wake up to the fact that training is a key requirement.

TRAINING PHASES

The training strategy should include two phases of training—one before implementation and the other during and after implementation. The implementation of the project commences with the training of the project team so that they are able to carry out their tasks. During the implementation and after the implementation, the end-users are trained on ERP basics, process changes, and how to use the ERP system.

Pre-Implementation Training

Implementation of the first phase of the training strategy is the training activity that relates to the training of the project team and the system administrators. The focus of the training for the project team will be upon understanding the functionality of the software. Training on such subjects as best practices, process mapping, training skills, and documentation may be provided by the vendor, but this will vary from vendor to vendor. A local higher educational establishment or other training organization may be able to fulfill any gaps. The training of the system administrators will focus upon technical aspects of system installation, maintenance, report writing, and any other identified issues.

The objective of the training is to transfer knowledge and skills about the application, implementation practices, and operational best practices from the external trainers to designated internal personnel. Whilst most of this will be done in more formal proceedings, the transfer of knowledge about the software functionality tends to be done on a more informal basis. However, since this transfer of knowledge about the functionality need not be effectual, it is worth examining this specific area more closely.

Content

Team members' understanding of the application functionality is critical for the effective development and introduction of new processes. Without it, it becomes impossible to make the most of what is an expensive investment. While the pre-sales demonstrations will promote the merits of the functionality of the software, its drawbacks may be withheld.

The first true exposure to the software comes when it becomes necessary to make the functionality do what is required of it. There are various levels of knowledge and skills required by the project team in order for them to develop business processes that utilize the software. Each member requires knowledge about how to navigate around the system and the detail of the functionality of concern.

A content matrix is the most useful reference for training developers, and it will grow into a huge, complex document over the life of the project. Simply put, the matrix lists the skills that should be imparted and tasks that must be taught and information to be presented for each job role in the new

environment. In its final form, it will not only guide development, but also provide a complete checklist. Another useful document, using the curriculum matrix as its basis, is an employee-job map that will map the employees in each department to appropriate job roles and necessary training required, giving a departmental and end-user snapshot of the training needed.

The vendor's consultants should be the experts on how the software functions. It must be expected that these consultants will sit with team members, going though the screens and fields for the processes of interest. This training mode tends to be hands-on. This is an ideal opportunity for the team members to learn. In time, each person should build up a good understanding about specific parts of the application. Their aim is to be able to experiment with different ways of using the software and to transfer this knowledge to others. These key users are responsible for ensuring that they learn as much as they can about the functionality.

If there is concern about whether project team members are developing the required knowledge and skills, then it may be desirable to assess them. How this is done should be established in consultation with the vendor, as that is where the expertise resides. However, gaps in a person's knowledge and skills will become readily apparent as he starts to try and work with the application on his own. It is expected that this person will attempt to fill these gaps as they reveal themselves at the earliest opportunity.

Planning

Training planning normally begins during initial phases of the ERP implementation project, preferably during the project planning phase. As we have seen in Chapter 22, it is in this phase that the details of how to go about the implementation are decided. This is an excellent time to begin assessing organizational readiness and the current levels of end-user skill and knowledge in relation to those that will be needed in the new environment.

Many companies find that planning for ERP training is a multi-phased process. The extent and detail of the project plan grow over several months, as you uncover new facts and come to fully understand the scope of the initiative. There is no mystery to planning. All you really need to know is when to begin, the level of effort you need to apply, and the plan deliverables you need to develop. As the ERP project evolves, you can adjust and add detail to your plan and begin to schedule the work to be done.

The effort needed to perform the training assessment varies widely, depending upon project scope and how many people are affected. To do a thorough assessment of the training needs of an organization, it is better to form a team of an experienced ERP training consultant and an experienced and senior person from the HR department of the organization.

The organization must allocate the time and budget to conduct the assessment which will involve interviews with each end-user group and its manager, the executive team, selected ERP project team members, and support departments such as human resources, information technology, and training.

An ERP training consultant can help the organization in constructing the questions and strategies for conducting the training needs assessment. After the assessment, the organization will have the following information:

- **Training plan for the end-users**—A detailed analysis of what they know (current skill set) and what they need to know (required skill set) and a training program to impart the skills that are lacking.
- **Pre-training orientation plan**—This plan should contain details and plans of the business skills and knowledge end-users must obtain before ERP training begins, along with time schedule for completing this training.

- **ERP training team training plan**—This plan should define the talent mix and resources required for the ERP training team. It should also identify the resources committed and needed for analysis, design, development, delivery, and administration of training. The plan should also point out the gaps between requirements and available talent, and identify strategies for obtaining or developing resources.
- **Training delivery plan**—This plan should answer basic questions like how the curriculum is going to be developed and delivered. It should contain an overview of tools needed, logistical challenges, technical infrastructure requirements, training environment, and training delivery mechanisms. It should also provide an initial timeline for rollout of education and training.

Despite the informal nature of some of this training, it can all be planned. Dates can be established and people and locations organized. The emphasis of this phase is upon organizing and planning the training. External trainers carry out this delivery. The training is likely to comprise a mixture of formal workshops in a group environment and informal individual sessions. Most of the training will take place at the client's site in the project team room and will be delivered by the vendor.

More than one person should develop the necessary skills in each area as this reduces dependency upon that one person and prevents delays arising due to that person's other commitments. When completed, this training plan will become part of the project implementation plan and be monitored accordingly.

User Training (During and After Implementation)

The end-user and managers are trained during implementation and after the implementation. The aim is to disseminate throughout the organization the project team's knowledge and skills relating to the application and the new processes. The expected outcome is the trainees being able to use the system.

Content

For this phase, a program can be developed which covers all the areas required. It can be organized into different themes to reflect different topics and audiences. Whilst a general overview will appeal to everyone, the specialist areas will only be relevant to a limited number of people.

Some areas that will be relevant to everyone are ERP basics, business process, changed business procedures, automation of tasks by ERP, and fundamentals of computer usage like passwords, encryption, security, etc. Not to be overlooked is the fact that there may be new users who have no keyboard skills. If that is the case, a touch-typing (typing without looking at the keyboard and searching for the keys) course can be organized. A better option will be to install touch-typing training software and ask the employees to learn it and pass the course.

Two audiences can be distinguished—end-users and managers. While the former will be interested in how to use the system, the latter will be more interested in how to get information from the system. The users can be further differentiated into casual users, normal users, and reflective users. The interest of casual users is limited to being able to perform certain tasks when expected from them. Normal users are regular users of a specific suite of functions. Their main interest is using the system to do their job. Reflective users will want a deeper understanding of how the system works so that they can solve problems and make improvements. Thus, it may be appropriate to distinguish two levels of training: that essential to carry out tasks and a more detailed session on the finer points of the system.

The format of this training will tend to be structured into formal training workshops based around a PC. The data should ideally be that which they will be using when live so that real-life situations

can be simulated. This may require data setup preparation. While the training material should be task orientated, it will be explanatory in order to encourage an appreciation of why things are done in the way that they are. The project team room can be made available for trainees to practice on their own as a follow-up to the training courses. The trainers will be the new 'experts' on the system, the project team members.

The timing of the training should be such that there is not a long gap between receiving training and using the application. A refresher course may need to be considered as a contingency. The cost of the training should be monitored against the budget.

Planning

At the detailed level of each individual session, its preparation will be strengthened by its plan. The training plan should include the training objectives, trainer, trainer qualifications, audience, level and computer literacy of the audience, time, location, facilities required, content and content structure, method, resources/ materials, and cost.

Training, Assessment, and Review

The training is complemented by an assessment to ensure that it has been successful and the knowledge assimilation is satisfactory. During the training, the trainer will be confronted by a mixture of attitudes and expectations. While there will be those with a positive outlook, there will be others who have a negative view about the situation. Likewise, some may have high expectations about the quality of training and fail to appreciate the inexperience of the trainers. Thus, the trainers need to be aware that they may not be well received and be able to respond accordingly. This highlights the importance of the trainers being trained in the training process.

The training should result in the trainees developing the requisite skills being taught. To ensure that this is being done, some form of assessment should be carried out. The emphasis is upon assessing what level of skill or knowledge has been attained. However, it should be remembered that the trainees are less likely to retain this knowledge or skill for longer period of before they are required to use it. Thus, the assessment may only reveal what the person is capable of attaining rather than providing an indication that the person is competent at a specific task. It may be necessary to provide refresher courses closer to the go-live.

After each session has been completed, it should be reviewed in order to reflect upon the problems and assess what worked and what could have been done better. The issues raised may be concerned with the material being presented and highlight the need for its revision. Alternatively, it may highlight issues with people and the need to establish a strategy for handling them. Each situation will be different, but each will contribute to an accumulating wealth of experience, which when continuously fed into subsequent training sessions, should make these sessions more successful learning experiences for the trainees.

TRAINING STRATEGY

A training strategy can be developed defining the training policy and outlining the training program. Each stream will be identified and outlined in terms of the above stages. The strategy will provide an overview of the training objectives, identifying the people involved, the different streams, and the content of each stream, organized into courses and sessions. A plan will provide an overview of where, when, and how the training will be delivered. Preliminary consideration will be given to the assessment of the learners. How can their knowledge and skill competencies be assessed?

Furthermore, consideration is given to the effectiveness of the training and how this is assessed. Finally, the projected cost will be calculated. These costs can then be used to set a budget. The resultant strategy provides a framework within which to go about the training activity.

If the company accepts the strategy, it can be implemented. If the strategy is not accepted, then it needs to be reviewed. A core issue is the company's commitment to training. The right balance needs to be struck between getting the training right and the training being cost-effective.

The training strategy has two objectives—the transfer of knowledge from the vendor's personnel and external consultants to the organization's key personnel and the dissemination of this knowledge throughout the organization. More precisely, the learning objectives establish what the learner should be able to do as a result of the training. Knowledge may be sought, particularly if related to operational best practices. One then has to ask how this knowledge can be used within the company. However, it is likely that the main thrust of training is upon the development of skill competencies in the use of the software functionality.

The executive committee need to have sufficient understanding of what is involved in an implementation project so that they appreciate the potential problems and are able to give the commitment and support that is required. This is particularly true for the project sponsor. His lack of appreciation of the issues may result in him viewing the implementation as just another project and lead to his distancing himself from it. He may have a poor understanding of the roles and responsibilities of all the participants and when problems arise, may fail to appreciate that his involvement is required.

The members of the project team need to develop such knowledge and skills that will enable them to establish how to best use the functionality for the operation and maintenance phase. Since the members of the project team will become the trainers of other employees, they need to develop the skill to be able to formulate and deliver a training course. The users need to have the skill for using the functionality relevant to their roles. They should understand the basic concepts of ERP and also how to perform the day-to-day activities in the ERP system. Others who require training include managers, who should have at least an appreciation of what the system does. Ideally, the project manager should have a good understanding of all aspects of the system so that he can be available in dealing with any issues raised.

A select number of people will require more specific technical training so that they can design databases, write scripts, manage users, generate reports, and query the database for specific ad hoc requirements.

The system administrators need to be able to set up the system and then maintain it. They will require knowledge about how to handle system security and deal with technical problems. They will need to develop a level of understanding of the functionality so that, at some stage after implementation when the project team is disbanded, they are able to manage the system smoothly.

Additionally, over time it can be expected that the ERP tool will evolve to some degree along with the company and projects that it serves. From time to time it may be necessary to conduct additional training sessions to keep everyone abreast of the changes that have been implemented.

SUCCESS FACTORS

The biggest impact of ERP implementation is on the corporate culture, and the success of an ERP implementation depends on the people using it. In order to change the skills, habits, and attitude of the employees toward the ERP system and to make the employees see the potential benefits of the ERP system to individuals and the organization, the organization has to give them proper training, assurances that their jobs and careers are safe, and they will benefit from the changeover. Training has to play a critical role in the success of an ERP system—during its implementation and

operation. ISC Technology, Inc. [2], gives six steps to handle the cultural changes that arise from ERP implementation:

- **Start early**—Though the timeframe in which employees need to change work habits may be short, you can prepare them for the new system and reduce the emotional impact of the change by starting early with targeted information campaigns and good training.
- **Align the leadership team**—Make sure they not only understand the nature and benefits of the ERP system, but also the issues surrounding employee acceptance. The leadership should also constantly reassure the employees and promise that they will do that is possible to make the transition to the new system as smooth and painless as possible.
- **Set reasonable expectations**—Employees should understand that, in the short term, they are only expected to achieve a basic level of competency. Beyond this transition period, there will be many opportunities to excel and provide unique contributions. Setting high expectations will demoralize the employees if they fail to achieve them. It is always better to set realistic goals, provide the right environment for the employees to excel, and then reward their excellence. Also inform the employees that there is a settling down period for things to fall into the groove and only after the system has stabilized the true benefits of the new system could be seen.
- **Communicate specifically and continually**—Each level and area of the organization has its own needs and issues. Develop a plan that addresses the unique situation of specific groups but uses consistent and ongoing communication methods to keep staff updated on progress and involvement opportunities during the implementation period. Either it is good new or bad news, convey that to the employees and inform them about the steps the organization is taking to deals with the problems, if there are any.
- **Identify new work teams and roles early**—ERP systems bring large adjustments to work roles and responsibilities. Identify and communicate these changes early, so employees affected fully understand and mentally prepare for the new environment.
- **Develop competency**—Competency will provide comfort for most employees facing the new environment. Make sure everyone has a solid overall understanding of how work flows through the new system. Then allow weeks of hands-on practice performing new job tasks in the system after formal training.

Erick Eric Kimberling, President and Founder of Panorama Consulting Group [3], gives six keys elements to effective ERP implementation training for employees. They are:

- **Focus on business processes, not system transactions.** ERP training courses should focuses on imparting knowledge on the business process and explain the tasks the employees have to perform in the context of the business processes. For example, when an order entry clerk enters an order details into the order entry system, it triggers the order fulfillment business process. How the business process work, which departments are involved in that process and who are the other players (employees) of that process and what happens when each person performs his tasks, etc, should be explained so that the employees get the big picture and how his job fits in that. ERP training courses must deliver knowledge in the context of how employees perform their day-to-day jobs, not simply how to complete the new transactions in a system.
- **Relate new business processes to the existing environment.** When the organization is changing a process and is introducing a new one its place, the training should explain why the process is replaced, what were its drawbacks, how the new system will take the place of the discarded one, how it will improve efficiency and productivity, and what the employee should do to make the new process work seamlessly. Mapping the new processes to current ones and

explaining the new one in relation to the current ones will help the employees to migrate to the new environment more effectively. In addition, relating to as-is processes helps highlight the most significant changes affecting employees.

- **Leverage a multitude of tools for ERP training.** Different people learn in different ways, and it often takes repetition and multiple channels to transform understanding and behavior. So a multimedia approach with classroom learning, training manuals, hands-on simulations, discussions, etc., should be used to make the training more effective.
- **Train the trainer, i.e., train ERP end users.** All organizations will have employees who are adept and have an aptitude for teaching and training. These people should be identified and trained to train others. These trainers will have more credibility and acceptance among the employees as they are part of the workforce. As these people have worked with the company they would have hands-on experience and would be able to identify with the trainees and answer their questions better than the external consultants or trainers. In addition, these internal trainers can be leveraged to provide functional support during and after the go-live.
- **Allocate plenty of time for ERP implementation training.** Many companies do the employee training as an afterthought once the implementation is over. This is a sure recipe for disaster. Effective training is arguably the most important and critical part of the ERP implementation. Rushing the process and compromising on the quality or duration of the training program can result in costly failures.
- **Reinforce training with more comprehensive organizational change management activities.** Discussions surrounding employee changes should begin well before end-user training. As new business processes and changes are defined, employees should be kept in the loop so they are not blindsided during formal training—or worse yet, at go-live. Top management should address and resolve all issues like employee fears, uncertainties, and doubts about the new system well in advance so that the employees are fully supportive of the ERP implementation and participate in the training programs without any distractions.

ERP projects can go a long way toward making adoption easier when focused on effective training which ensures that employees are not overwhelmed, and deficient, at cutover. When properly prepared, most employees will support changes to the corporate culture, embrace the new ERP system, and adopt new values that ensure success.

SUMMARY

Training is perhaps the most underestimated activity of the implementation life cycle. A major complaint is that not enough training is done. One of the most common mistakes of all ERP implementation is underestimating the time and cost of training end-users. A good training program should define learning objectives, determine the content, plan, deliver, assess, and review.

Those at the receiving end of the training are initially the project team members and the system administrators and then later in the project the developers, QA team, testers, etc., and the project leaders and managers. Each group of learners will have different requirements. Thus, the nature of the training is likely to be different for different stream of learners.

The cause of the failure of many ERP systems is attributed to the training and education of the broad user community of managers and employees who are supposed to actually run the business. When these users are not properly trained, it will result in the wrong and improper usage of the system.

The training strategy should include two phases of training—one before implementation and the other during and after implementation. The implementation of the project commences with

the training of the project team so that they are able to carry out their tasks. During and after the implementation, the end-users are trained on ERP basics, process changes, and how to use the ERP system.

A training strategy can be developed, defining the training policy and outlining the training program. The training needs of the two sections—decision-makers and other users—should be identified and outlined and a training program should be developed to satisfy the needs of both. The strategy will provide an overview of the training objectives, identifying the people involved, the different streams, and the content of each stream, organized into courses and sessions. Training and education of all users of the ERP system is vital for the success of the ERP system and should be done properly. However, it is one area where budgets are cut and quality is compromised very often, leading to costly failures.

REVIEW QUESTIONS

1. What is the main cause of the major problems during the implementation of ERP projects?
2. What are the major pieces of the ERP training puzzle?
3. What are the stages of ERP training?
4. Give an overview of ERP training.
5. What are the main constituents of the ERP training costs?
6. What is the need and importance of training?
7. Why it is said that training is the key to successful ERP implementations?
8. What are the different phases of ERP training?
9. What is the purpose of pre-implementation training?
10. How will you decide the content of the training program?
11. Why it is important to plan the training program?
12. How are end-users trained during and after implementation?
13. How are the training program's effectiveness assessed and reviewed?
14. What is a training strategy?
15. What are the objectives of a training strategy?
16. What are the factors for developing a successful training program?
17. What are the steps to handle the cultural changes that arise from ERP implementation?
18. What are the key elements of ERP implementation training?

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Chapter 34

Data Migration

INTRODUCTION

Data migration is the process of translating data from one format to another. Data migration is essential when an organization decides to use a new computing system or database management system that is incompatible with the current system. Typically, data migration is performed by a set of customized programs or scripts that automatically transfer the data.

When implementing a new ERP system you need to start data migration from the existing legacy business systems as soon as possible. A real configuration of an ERP system can only happen when there is real data in the system. Data loading and data conversion is not a project that can be done after everything else is ready.

Extracting and cleansing the data from the existing system can be the single largest task in the project. Typically, mapping your existing data to the new ERP system schemas is a lesson in pain that must be experienced, to be believed.

How data is typically put into the ERP system? In early days, data had to be manually entered. This was a time-consuming, expensive, and error-prone process. However, today's data migration tools are designed to make this process as easy and simple as possible. The wizards in data migration tools make tasks like loading the data from the existing system, reviewing it for quality, accuracy, and completeness, and then importing the data directly into ERP database very easy. A good data migration tool will provide complete data understanding prior to conversion and migration. This ensures that the integrated data has the highest possible level of integrity and reliability. This reduces project risks with proactive assessment of diverse legacy data sources. This lets the organization create and complete consistent and accurate information from raw, chaotic source data.

DATA MIGRATION PROCESS

Data migration is the process of moving required (and most often very large) volumes of data from existing systems to new systems. Existing systems can be anything from custom-built IT infrastructures to spreadsheets and standalone databases. Data migration encompasses all the necessary steps to cleanse, correct and move data into the new system. Technological changes, change in providers, software updates or data warehousing/data mining projects make such delicate and critical operations necessary. An ideal data migration solution allows one to:

- **Reduce risk**—Data being an organization's most critical business asset, it is essential that any manipulation be carried out without any disruption
- **Lower operational expenses**—Data migration is a one-off activity triggered by certain circumstances. The data migration tool or solution reinforces the organization's resources which can remain focused on its ongoing continuous core activities
- **Improve data quality**—The cleansing and correction solutions ensure perfect data integrity after it has been migrated. From a user and development perspective, the migrated data results are completely optimized

From a user perspective, the data migration solutions should make sure that a strategy is put in place to achieve maximum flexibility and quality. This entails taking a number of measures and actions, including:

- **Iteration**—Data is iteratively identified and cleansed. The aim should be to give the users one or more 'iterative' opportunities to identify corrupt data and then rectify it either using the existing application functionality, or automatically cleanse the data within the data migration functionality. The different iterations of the data cleansing process would take place several weeks before the live data migration run
- **Weeding**—Data weeding within the data migration mechanism allows for better identifying candidates and non-candidates to migration
- **Inspection**—Users should be able to inspect data that has been archived, which is particularly important where users no longer have access to their source application and data following migration

From a development perspective, the organization should take necessary care to ensure that the data migration roadmap caters to maximum safety, avoiding risky big bangs, and allowing for phased migration activities. For example, organizations must make sure that:

- Each new application to which data is to be migrated has its own data migration strategy and roadmap document while using a unique, consistent, and generic template document that can be referenced by all projects
- A generic data migration mechanism that can be used across the majority of application migrations exists. This approach has the benefits of re-usability, and allows the development of generic modules for data migration for different types of 'source' and 'target' platforms

A source of application data to facilitate system test and user acceptance test of the new application is provided for. The most reliable method for acquiring a 'live volume' database to facilitate testing is to migrate 'live' data from the source application database into the new application 'test' database.

MIGRATION METHODS

Two primary methods are used for migrating data from the legacy systems to the new ERP database—manual and electronic. In the electronic method, some type of database conversion process is used. This process can range anywhere from true source code development to complex copy utilities. The manual approach does not seek to use an electronic method, but instead involves human intervention. The manual approach will use a non-technical human resource to examine the data on the legacy system and decide how to enter the information into the ERP system.

As we have seen, data can either be manually typed or electronically transferred. The former is obviously slower being labor intensive and more costly. Although the data can be checked for errors prior to entry, there is no guarantee that the manual input is error-free. Electronic transfer is in principle faster and cleaner, particularly for large amounts of data. However, there are various considerations. *First* is the assumption that the data can be produced on the old system in a format that is accessible. *Second*, having accessed the data, additional data may be required before it can be accepted by the new system. This may occur where there are additional data fields such as flags, to those downloaded. Alternatively, the data may require conversion or re-formatting. The time for cleaning the data may be at the intermediary stage after the data has been downloaded from the old system and prior to uploading on to the new system. The electronic input is likely to require the technical expertise of the software vendor.

Some of the factors that go into determining whether to use one approach or the other include: availability of technical resources, quality of legacy data, nature of operating systems and platforms, availability of human resources, database size, time constraints, budgets, user friendliness, etc. The process of choosing one approach over the other is seldom straightforward. Often the wrong choice is made. There is no universal rule in choosing one over the other; it depends on the situation.

Electronic Method

In this method (see Fig. 34.1), we start with raw data in a legacy system such as an inventory item master file. Using data migration tools and programs, we come up with a migration strategy to export data to the new ERP system. In some cases, a migration is relatively straightforward, with almost all relevant data coming from one file and going to another. In other cases, the situation becomes much more complex. Sometimes the information will come from one file and it will split into several different files in the new ERP system. Often special logic has to be applied to the process.

A typical example is when the legacy system uses an alpha field for part numbers and the new ERP system uses a numeric part number field. Special logic must be applied to convert from alpha to numeric. In this approach, implementation team members generally are not involved in the technical solution from getting the data from one system to another. Implementation team members often get involved in data review to check the quality to see that it came through successfully, at a later time.

Manual Method

In the manual data migration approach, the implementation team members and data entry personnel do the data migration. The number of people involved can range anywhere from one to dozens. The size of the database often plays a key role in using this strategy. If the database is very small, it can often be much quicker and less expensive to simply enter the data manually instead of trying to find an electronic solution. As with the electronic approach, we start with the legacy system. Using the manual data entry approach, the data is entered into the new ERP system.

The manual method has many disadvantages—it is slow, it is a monotonous and boring job, and it is error-prone as humans are involved in the migration process. Also this is not an option in cases involving large amounts of data.

There is often a misconception that an electronic approach will be a substitute for a manual one. In many cases, a manual editing and cleanup process must take place after an electronic migration. This is especially true when the quality of the data is very poor. Sometimes programmers and technical resources can use special logic to help clean up the database. In other cases, only direct human manual intervention can determine the proper coding for the database.

Data migrations whether they are electronic or manual, usually begin in the early to mid phases of the ERP implementation. There are several reasons why companies choose to perform database conversions early in the process.

Figure 34.1 Electronic data migration.

DATA MIGRATION ISSUES

Data migration is a complex process. Whichever approach is adopted, although it is likely that both modes will be involved, the migration of data onto the new system will need planning in detail and at an early enough point in the implementation to ensure that this process is completed on time. Questions that need to be addressed include:

- What data is required on the new system?
- Can this data be transferred from the old system?
- What data is required that is not on the old system?
- Does this data exist elsewhere and how can it be best input?
- How will the data be cleaned?
- What (static) data can be transferred prior to going live and what (dynamic) data can only be transferred after the last use of the old system?
- Who will check the data and when?
- Who will input the data and when?
- How will the data entry process be managed?
- How will the accuracy of the data entered be verified?

Static data can be entered over a period of time. The dynamic data, i.e. data that changes over time can only be transferred after the last transaction on the old system. Examples of dynamic data include purchase orders, sales orders, and stock details. The migration of the dynamic data may require several days, so it is not uncommon to plan the go-live date to coincide with a long weekend. This provides more time to ensure that the data migration is completed and reduces the likelihood of lost working days due to the absence of an information system.

CHOOSING A DATA MIGRATION METHOD

How will you choose a data migration method? Availability of time is one determining factor. The time consideration can be broken into two different types of time: long-term and short-term. Long-term time is defined as the time between the beginning of the implementation and the go-live of the ERP project or particular module. Short-term time is defined as a short period of time that exists between the closure of the legacy system and the go-live of the new ERP system. Typically, this time can range anywhere from an hour to several weeks. A weekend is often the choice to go-live on a new ERP system.

In the long-term time situation, either manual or electronic may be used. The probability of an electronic solution being used increases as the availability of time between the beginning of the implementation process and the go-live date decreases and the size of the database increases. A very large database and a very short period of time lend itself to an electronic solution. A very small database and a large amount of time lend itself well to a manual solution.

In the short-term time situation, either manual or electronic may be used. Some cases like when you have to migrate huge volumes of data in a short time, an electronic solution is the best choice. Although it may be theoretically possible to perform this process manually using teams of data entry clerks, it is not recommended. Human mistakes are the main reason for avoiding manual methods. Electronic methods are hardly foolproof as well. Even after painstaking prototyping and testing of an electronic conversion process, catastrophic mistakes can still occur and go undetected until long after the go-live date.

SUMMARY

Data migration is the process of moving required (and most often very large) volumes of data from existing systems to new systems. Existing systems can be anything from custom-built IT infrastructures to spreadsheets and standalone databases. Data migration encompasses all the steps necessary to cleanse, correct, and move the data into the new system. Two primary methods are used for migrating data from the legacy systems to the new ERP database—manual and electronic. In the electronic method, some type of database conversion process is used. The manual approach does not seek to use an electronic method but instead involves human intervention. Some of the factors that go into determining whether to use one approach or the other include: availability of technical resources, quality of legacy data, nature of operating systems and platforms, availability of human resources, database size, time constraints, budgets, user friendliness, etc.

REVIEW QUESTIONS

1. What is data migration?
2. How is data put into the ERP system?
3. Describe the data migration process.
4. What are signs of a good migration solution?
5. What are the measures used to ensure high quality data migration?
6. What are the data migration methods?
7. What is the manual migration method and what are its pros and cons?
8. What is the electronic migration method and what are its advantages and limitations?
9. What are the major data migration issues?
10. How will you choose a data migration method?

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Chapter 35

Project Management and Monitoring

INTRODUCTION

In Chapter 28, we saw how the project implementation team is organized. At the top of team is the executive committee, and one of its primary responsibilities is monitoring and evaluating the progress of the project. It was also specified that the executive committee should develop a management and reporting mechanism so that they know what is happening to the project on a regular basis. In this chapter, we will see how this is done. How can the enterprise establish an information base to determine whether the work is progressing according to the plan? How will the enterprise decide that the present course is the correct one and will lead to the successful completion of the project?

An ERP implementation project is complex in nature, involves a lot of people, requires the coordinated effort of a number of groups, involves a lot of money, and has a long completion period (typically 10–18 months). To successfully implement an ERP system is a very difficult task and requires huge efforts from all the stakeholders.

Enterprise resource planning (ERP) systems have fundamentally changed the work of IT organizations. The sheer size and complexity of ERP implementations makes managing these projects difficult. There are essentially two basic sides to ERP management, people and technology. An ERP package touches the entire organization and can affect nearly every employee. In some cases, an ERP project manager may not be able to know who will be affected, which can lead to some nasty surprises. One mismanaged ERP implementation left a southeastern electronics manufacturer unable to accept deliveries and nearly closed a plant.

It is also difficult to get a clear vision of the technological aspect of the implementation because of the vast combination of hardware and software involved. The project manager must cope with thousands of parts. Whether you are implementing one module or multiple modules, you must ensure consistency and full integration across the various sub-projects, which is an enormous effort even for an experienced system architect.

The major problem areas for the ERP implementation project are employee resistance and noncooperation, project size, employee turnover, risk management, unrealistic deadlines, inadequate funding and resources, organizational politics, organizational culture, scope creep, unexpected gaps, etc. We have seen most of these factors in Chapter 5 and have seen how to mitigate these risks.

IMPORTANCE OF ERP IMPLEMENTATION PROJECT MANAGER

In Chapter 28, we have seen the management and leadership skills that the project manager should have and the importance of the role he plays in the implementation. The one person who shoulders the maximum responsibility in an ERP implementation project is the project manager. The project manager should be chosen very carefully as choosing the wrong person can lead to project failure. We will see some of the characteristics common in identifying the difference between a good project manager and a poor one. A good project manager always stresses teamwork, recognizes individuals, inspires trust, and communicates vision. He has excellent technical expertise, computer skills, strong communication skills, and is a recognized leader. He has a positive attitude, is interested in

personal well-being and is an excellent role model. He foresees the future, accepts blame, knows how to get there, listens to subordinates, develops harmony, asks for input, does not place blame, leads by example, and has excellent organizational knowledge. A poor project manager lacks communications skills, is not people oriented and usually places blame on others. He is a poor listener, is focused on self-promotion and rejects creative thought and input. He does not have much technical expertise, is unable to translate vision into activities, and does not ask for help when required. He usually is argumentative, lacks diplomacy, and reacts without thought. He does not have any computer skills, is unpredictable and does not have the ability to win the trust and respect of the people.

Just by looking at the characteristics required for a good project manager, one can realize how difficult it is to find such a person. Therefore, the company should not spare any expenses in finding a good person to manage the ERP implementation project as it will take a person with great wisdom, excellent knowledge, exceptional communication skills and great diplomacy and discipline to lead a team of hundreds of people for almost two years, keeping their morale high, making the right decisions, taking correct actions in the face of adversities and unexpected events, and successfully completing the project.

The background of the project manager is crucial. After all, there is a difference between operations staff, i.e. the 'how' people, and the systems staff or the 'why' people. It is best to have a background spanning both but if that is not possible, someone from the operations side of the business is preferable—the 'why' can be accommodated by the steering committee, but 'how' knowledge must be on the frontline. The project manager's demeanor is equally important. The attitude spectrum runs from taskmaster to crowd-pleaser; the ideal candidate being somewhere in the middle. While the project should not resemble a forced march, a successful project manager understands that the job is not a popularity contest. Salesmanship is a trait often overlooked when selecting this position, yet it is one of the most powerful tools a project manager can carry.

Even the best and most experienced project managers have to start from scratch—project implementation is different from most managerial projects. While an effective manager may be able to organize a department to do the same routine on a day-in, day-out basis, implementation requires identifying and implementing the numerous steps that each occur only once. The project manager will need training and guidance for this kind of project or will need to look to an experienced project administrator to help.

Even a strong project manager cannot succeed if others believe the project can be stopped or delayed. Everyone involved must believe from the beginning that an on-time implementation is the only acceptable solution. The project manager also must have the authority to get things done without having to ask permission at each step of the way. The best project managers use the buy-in, fearlessly command the support and ruthlessly pursue the end date. But remember, if the end date is conservatively developed in the first place, ruthless may mean no more than light, but steady, pressure, and keep moving in the right direction.

DECISION-MAKING

Every company has decision-makers, the people who make things happen. Seek out those who impact operations the most—in an official capacity or not—and place them on the steering committee where the project manager can interact with them in a group. Limit the project manager from having to explain decisions time and time again. If a project manager's decision is to be overridden, it must be within a steering committee meeting, never from the outside.

Essentially, the project manager is the key decision-maker. There will be times throughout the project when this person will be called upon to make difficult choices, sometimes prioritizing tasks

and at other times resolving conflicts between people. The project manager must be capable of making, defending, and standing by every decision—backing down will only decrease the likelihood of a project being completed on time.

A project manager derives power from the commitment of corporate management to the project. Yet management is often held hostage to market conditions and ongoing financial problems. Not all companies have the resources to perform projects during down times, so commitment is a key factor. Commitment alone can keep a project going. Without the desire to see a project through, projects that begin as attempts to gain more control over operations or to replace old technology often fall by the wayside when management attention is drawn away.

Management attention usually has a time limit. Generally, it is advisable to finish any project with the original project team and a stable steering committee management team. New members will have goals and agendas that may disrupt the overall project and slow its completion. If implementation lasts longer than planned, break the project into year-long segments, and approve each section with renewed management commitment. For large companies, a year-long constraint seems unrealistic, but longer timelines often result in projects that are either grossly late or complete failures.

ERP PROJECT MANAGEMENT

Project management for ERP projects is little different from project management for any IS projects and traditional frameworks for project management have been applied to ERP projects. However, certain areas of traditional project management require a greater emphasis while others can be discarded. PMBOK [1] describes project management as the "application of knowledge, skills, tools and techniques to a broad range of activities in order to meet the requirements of a particular project." Project management is an aid to project managers because it helps them to standardize routine tasks and reduce the number of tasks that could potentially be forgotten. It also ensures that available resources are used in the most effective and efficient way. The application of project management principles allows senior managers to establish and use more appropriate measures of success, to quantify value commensurate with cost, and to optimize the use of organizational resources.

Project management as a discipline is only a recent concept, yet over the past 50 years a considerable body of knowledge has been built up around project management tools, skills, and techniques. The purpose of the PMBOK is to identify and describe best practices that are applicable to most projects most of the time. PMBOK identifies nine knowledge areas on which project management is based. The nine knowledge areas are:

1. Project integration management
2. Project scope management
3. Project time management
4. Project cost management
5. Project quality management
6. Project human resource management
7. Project communications management
8. Project risk management
9. Project procurement management

These nine areas, although presented as distinct features are usually integrated, as are their component processes. In the next sections, we will discuss how these nine areas are applied and applicable to the ERP implementation project.

Integration Management

Too many firms embark on ERP projects with a general lack of awareness of what is involved in their ranks. Top managers in particular, may not realize the level of efforts required from staff in areas that are going to be affected by the new systems and sometimes expect these staff members to carry on with their normal duties in addition to their role in the ERP project. Setting up a full-time team, back-filling the positions left vacant by team members, or having members on special training workshops so they understand what is expected of them, should all be taken into consideration at the outset. Preparedness is crucial but is often lacking.

Scope Management

Scope management of ERP projects pertains to how well companies are prepared when they embark in their implementations. 90% of ERP implementations end up over time and over budget, due to among other factors, changes in the project scope. These bad results go back to a lack of preparation before projects are undertaken. The single biggest reason that ERP projects fail is because companies are unable to reconcile the technological necessities of the system with their own business needs. An ERP system imposes its own logic on a company's strategy, organization and culture and if a definite scope statement is not articulated early in the project, the ERP system will drive the company toward full integration even though a certain degree of business unit segregation may be the optimal solution. This will result in generic processes even if customized processes were an original source for competitive advantage. A lack of understanding of the scope of the system may result in a conflict between the logic of the system and the logic of the business. The primary consideration when implementing an ERP system is that the ERP system will impose itself on the business and not vice-versa. The key to ERP scope management is to identify the areas requiring workarounds and to understand their implications for the long-term activity of the firm.

Time Management

Depending on the size of the organization and the scope of the project, implementing an ERP system may take years because of the need to be rolled out across multiple sites, lines of business and countries. Evidently, the length of implementation is greatly affected by the scope of the project, i.e. more activity regarding modules, sites, and functions means a longer process. A large proportion of the implementation time is consumed by customizing the package so the length of time could be substantially reduced by keeping the system 'plain vanilla' and reducing the number of packages that require customization in order to be bolted on to it, which has led software vendors and consultants to recommend a zero modification approach that has nowadays become a de facto standard. It seems that a proper balance must be found between being on time for the sake of it and keeping all areas of the project as tight as possible.

Cost Management

The total cost of implementing an ERP system includes the cost of licensing, training, implementation, maintenance, customization, and hardware requirements. ERP projects are characterized by a lot of hidden costs like training, consultants' fee, and so on.

Like most software, ERPs are priced on the functionality of the system and the number of users who will access it. ERP systems also require companies to invest in migrating data, modifying existing systems, and overhauling hardware and network infrastructure. Thus, costs quickly add up: 10–20% of the total project cost is spent on training the end-users. The problem with using external

trainers is that they are perfectly familiar with the ERP system but they are unable to answer questions regarding the business processes that underpin the system. Thus, buyers are designing and conducting their own training programs. One solution for reducing training costs is to train a select group of employees and then let these employees train the others.

Quality Management

An ERP system is not just an office automation software package that can be bought off the shelf and implemented with the aid of a step-by-step user manual. It is a serious transformation process that requires fundamental change in the way business processes are designed and conducted. Various methodologies have been put forward to ensure the package is implemented in a manner, which ensures the quality of the final system, i.e. that the system is implemented in an efficient manner and the objectives are met.

All these methodologies insist on proper and thorough preparation prior to acquiring or implementing any technologies, which is rarely the case in today's ERP market. Thus, all methodologies link the quality of the outcome of ERP projects to elements that must be put in place at the outset. The problem inherent in such ideas is that this is precisely the stage in a project where manager's awareness levels are at their lowest and when they are least able to make key choices, hence the recourse to external parties who unfortunately are rarely independent and unbiased.

Human Resource Management

An ERP implementation is a major undertaking, which requires management to assemble the best possible team to plan, execute, and control the project. Top management must be visible in their commitment to the project, clarifying the exact goals of the project. Responsibility for the implementation should be given to those individuals who have high degree of knowledge of the business and the way that its component parts interact. This implies re-assigning the few people who are most likely to be missed from their duties to the ERP project team on a full-time basis.

Frequently, companies do not fully comprehend the impact of choosing the internal employees with the correct skill set. The right employees for the team should not only be experts in the company's processes but also be knowledgeable about the best business practices in the industry. Ignorance of the project needs and an inability to provide leadership and guidance to the project by the company's team is a major reason for the failure of ERP projects. It is not rare to find functional areas reluctant to sacrifice their best resources to the project; this is a difficulty, which must be overcome.

ERP implementation teams are multidisciplinary, dedicated teams, comprised normally of information technology specialists, key users and operations personnel, as well as consultants with process re-design, and change management skills.

Team morale is a vital component for the success of the project. Team members are required to put in long hours (as much as 20 hours per day) and this stress coupled with their regular duties could diminish team morale quickly. Thus, support from top management and the project leader is key to maintaining a focused team.

Communications Management

Organizations find it very difficult to communicate internally, each department viewing its information as its own and being reluctant to share it. Indeed, implementation team members discovered that it was easier to learn and share experiences with people from outside their organization than within intra-organizational teams. This is where the primary benefit of using consultants to aid implementation is apparent. They add value to the project by facilitating meetings as open

discussions of requirements, preparing agendas, prioritizing issues, providing objectivity and avoiding bias, conflicts of interests, and possible confusion.

Thus, consultancy agencies are very important in ERP projects despite the possible lack of technical experience or knowledge because they facilitate open and productive communication. The higher the levels of communication and interaction in the implementation team, the greater are the performance of the team. The members of the team must be able to communicate between themselves, with clients, suppliers, and all other stakeholders.

Risk Management

There is ample empirical evidence of the risks involved in ERP implementations. It requires a radical change in the business processes of organizations. Radical change means risks, and risks mean more time and money. ERP systems are complex and they require reliance on many different types of expertise, which may also need to be sourced outside the organization. Suitable and experienced consultants are difficult to find, and employing a consultancy firm is no guarantee that the project will be a success. To succeed, the organization should have a risk mitigation plan. We have seen ERP risks and risk mitigation in Chapter 6.

Procurement Management

The different packages on the market have different strengths in different areas and it is important for the customer to recognize this and select the package with the strengths that are appropriate. Only when top management have reached consensus on what the business requires, should package vetting and selection begin. While selecting the package, it is critical to get vendors to state the extent to which their products will meet each requirement. We have seen how the ERP package is selected in Chapter 27.

Beyond the issues of package selection remain the legal matters that are involved in ERP implementations. Drawing up a contract for an ERP application requires specialized legal assistance and often many iterations, insofar as the standard contracts proposed by ERP vendors are overly protective of their interest and systematically neglect the rights of their clients. We have discussed vendor contracts in detail in Chapter 32.

RULES FOR SUCCESSFUL PROJECT MANAGEMENT

It is human nature to begin a project with dreams of success. With an implementation, project teams plan that each step taken will be successful, each attained goal building on preceding successful steps. However, this is only part of the total equation for a working system. Equally important is the plan to avoid failure. In order to avoid failure, the organization should:

- Have a clear, simple corporate vision and objective before you start, measure, and publicize successes as you proceed.
- Have a group dedicated to business process improvements. Also, rely on experienced project managers (possibly including internal or external managers who have been certified by the Project Management Institute).
- Have successful project managers who are capable of anticipating what can go wrong. While they cannot identify every possible failure and mis-step, it makes a great deal of difference if we can spot at least a few of them.

Avoiding failure is different from planning for success. In a world where only good things are welcome, you need only plans to move forward. In real life, however, most of our major flaws surprise

and shock us because we were looking forward to success and were not aware of potential traps and risks. Any large project is as much an exercise in failure management and avoidance as it is in task accomplishment.

Also, being prepared to react in cases of a crisis or spotting just a few reduces the risk of complete failure. Crisis management procedure should be planned and communicated to the implementation team. Organizations can avoid potential risks by incorporating the following into the company culture:

- Do not do things for the wrong reason. Identify the benefits that will result from your project, make sure every project-related action is directed toward achieving those benefits. Remember, benefits supersede company politics.
- Involve key stakeholders as early as possible. All stakeholders—managers, implementation team, consultants, employees, and so on—should own the project. They will be credited for its success or blamed for its failure.
- Failure is not an option. No one must believe that the project will be terminated. ERP implementation is a 'do it right the first time' kind of project. You either implement the system successfully or you will go out of business.
- Create a financial analyst position or team to track and analyze project costs and realized benefits.
- Warn off the disbelievers. If successful results are truly important to your company, naysayers must be silenced. Remove those who will not support the project or if that is not possible, make their future success with the company dependent on the success of the implementation.
- Cast implementation details in concrete. Set realistic and achievable dates and milestones and do not change them. Promote the implementation loudly, leaving no room for anyone to believe that the company will tolerate missing the deadline.
- Keep the project under control. The larger a project is and the longer it takes, the greater is the likelihood of failure. Hence, the ERP implementation should be finished as quickly as possible. Spending enough time on preparing, planning, and documenting for every contingency and starting the implementation after careful preparation can help overcome this.
- Designate a single leader. Shared leadership is divided leadership.
- When choosing a new vendor, put a premium on vertical industry expertise.
- Do not rub the wrong way with your vendor. All terms and conditions should be agreed upon and should be included in the vendor contract. The vendor should be made aware of what is expected and when. Never use your software vendor as a scapegoat. You will need his goodwill as well as his technical support for the long-term success.
- Keep functional managers accountable. An ERP implementation is not the sole responsibility of the ERP project manager and the implementation team. The functional managers have a very vital role to play. They should release people to the implementation team, support the new system, and help in spreading awareness about it and dispelling the myths. They should also encourage their group to completely co-operate with the implementation team and should lead by example. They can be of critical help in bringing about the cultural transformation in the organization that is required for the success of the implementation and operation of the ERP project.
- Make business objectives the primary drivers of the project. Investing in technology for the sake of technology does little more than drain company assets. Business objectives must be the primary drivers.
- Do not let technology and jargon intimidate the end-users. When end-users do not understand what is being explained about the system, they will lose their enthusiasm for making the system work.

- Avoid customization or demand that such requests meet rigorous criteria. Perfectionists try to customize the system down to the smallest detail; they will only succeed in building a fragile house of cards that is certain to crumble at the inopportune time.
- Make sure that data cleansing is addressed as part of the project.
- To keep the project in hand, periodically re-assess where it stands, especially with regard to potential problems. Also verify that the project team's attention is focused on the right goals. Remember the two important and mutually dependent goals: success and not failure.

PROJECT MONITORING

One of the primary roles of the members of the executive committee is to check and verify that the work that is being done is satisfactory and that the momentum, morale, and enthusiasm of the project team who are performing the tasks is maintained. During the executive committee meetings, the members should receive reports and other information from the project managers on how the work is progressing and whether everything is going according to schedule. The executive committee should receive data that induces them to maintain confidence in the implementation process.

Before implementation starts, the consultants and the company representatives will sit together and prepare a work plan. This plan details each and every activity that needs to be carried out and when they should be carried out. The consultants should lead the process of the work plan preparation, because they have the experience of implementing the same package in similar conditions. The in-house team should point out the issues that are specific to the company and help the consultants in creating a realistic work plan. The work plan or the project plan forms the basis for project tracking and monitoring. The project plan contains numerous activities, the man-hours required to complete them and the resources need to perform the tasks. Usually the project plan is built using a project management package (like MS Project) that permits one to focus on planned activities from various perspectives—the chronological sequence or timetable, specific activities and who is responsible for them, the pre-requisites for carrying out a specific task or a PERT chart of the activities. Preparing the project plan using such a tool helps in improving the quality of the plan and makes it easier for making changes and adjustments. Once the project is underway the plan can be updated on a regular basis and the 'planned vs. actual' reports can be produced in varying degree and in varying formats including graphical formats. The project management software can generate comparisons between the actual and planned completion dates, expenses, and so on. These software tools allow responsibilities to be assigned to different persons and so it is easy to find out who is lagging behind.

The one thing that should be kept in mind is that irrespective of whether the plan is created manually or using a software package, all the parties involved—the executive committee, the vendor, the consultants, and the in-house team—should be in agreement with the contents of the plan.

What should be the frequency of monitoring by the executive committee? The answer is, it depends. If the company has really assigned its best personnel to the job, then there will be a natural monitoring of the project's daily activities. The company professional assigned to serve as the project owner or sponsor is in an ideal position to evaluate how things are going. Since the ERP implementation projects run into months, it is quite adequate that the executive committee meets one in a week or once in two weeks (with a provision to hold emergency meetings when necessary). Another way is to set up milestones in the project plan and to have a meeting when the milestone's planned completion date is over. There are no hard and fast rules regarding how frequently the executive committee should meet. During the final stages of the project, when the system is being tested the committee might need to meet more frequently to discuss the various issues that could arise.

It is the task of the project management team (the team comprising of the project sponsor, the chief consultant, and the vendor representative) to report to the executive committee and present the facts and figures. Since these meetings will be of a managerial nature, the project management team should prepare a presentation that describes the situation at a level of detail appropriate to the audience. Very technical topics can be condensed and excessive use of jargon can be avoided. It is a good idea that the material used in the presentation should also serve to document the status of the project till that date. This is important because, in order to track the progress at future meetings, it may become necessary to recall the issues presented in a previous meeting, so as to explain why the evolution of the work has taken a particular route.

Another objective of the executive committee meetings is to address the issues that involve decisions from the top management. Such decisions will not be made at every meeting, but when they have to be made they need careful preparation. The project management team should circulate well in advance the issues, so that the committee members can do their homework and come prepared for the discussions. It is the duty of the project management team to analyze alternative solutions, their advantages and disadvantages and consequences, and circulate them to the committee members well in advance of the meeting.

Therefore, in an ERP implementation project, the work plan or the project plan is of paramount importance. Then the adherence to the plan, and constant monitoring taking appropriate corrective actions before the project gets out of control will ensure the success of the project. The key players in the project tracking and monitoring are the project management team and the executive committee.

SUMMARY

To guarantee that a lengthy, complex, and sophisticated project—which requires technological and cultural changes on a massive scale—reaches its conclusion successfully, it is not enough to sell it or approve it. The project team needs to re-sell it constantly, by demonstrating that it is evolving in an appropriate manner toward the stage at which benefits will be generated as initially anticipated.

REVIEW QUESTIONS

1. Why is ERP implementation project management difficult?
2. Why is the ERP implementation project manager important?
3. What are the qualities required for the ERP implementation project manager?
4. Why is project manager said to be the main decision-making authority?
5. How should the top management support the project manager in decision-making?
6. How is ERP project management different from IS project management?
7. What are the nine knowledge areas on which project management is based?
8. What is integration management?
9. What is scope management?
10. What is time management?
11. What is cost management?
12. What is quality management?
13. What is human resource management?
14. Explain communications management?
15. What is risk management?
16. What do you mean by procurement management?

17. What are the rules for successful project management?
18. What is project monitoring and how is it done?
19. Why is project monitoring important?
20. What is the role of the executive committee in project monitoring?

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Chapter 36

Post-Implementation Activities

INTRODUCTION

Treat the day your ERP project goes live as the start of the next phase of your journey. When the new system goes live, people will switch from their old practices to the new system. If everyone is properly trained, then they will know what he or she has to do on the go-live day. If the processes have been properly tested, then operations will progress smoothly. If the data migration has been properly handled, then the data will seem useful to the users. The success of the go-live day is measured by the lack of problems. The overwhelming feeling of anticlimax undermines the achievement of one of the most significant milestones in the implementation. However, the implementation is not finished. Work then begins on realizing the benefits of the new system. However, if problems are experienced on and after go-live, mechanisms need to be in-place to deal with them.

An ERP implementation represents much more than simply a project. Typically, your up-front investment is large, but the life expectancy of the application should lie somewhere between 10 and 20 years. You have already established your team and given it several months to bring the project to its launch date. Thus, why would you disband the team a month after the project goes live? By retaining a sub-set of your installation team, its members can enhance the ERP application, handle bottlenecks, tweak and improve the system, look for continual productivity gains—and learn. This sub-set should be made up of both business and technical experts.

AFTER GOING LIVE...

While going live may be a huge step in a long battle, it is by no means a final step. It seems that many project managers use the go-live date as their primary milestone and key measure of success. However, just getting to the go-live date on time and within budget is just one piece of the ERP benefits realization puzzle.

After going live with the ERP implementation, it is not time to forget about ERP because it is 'complete.' Instead, at that time the organization enters a stabilization period that typically drags down organizational performance. As a result, firms need to work to mitigate that negative effect. The firm also needs to build an organization to handle the day-to-day issues associated with the ERP system, and management needs to determine what else must be done and whether the implementation matches the system plan. Also, management must address what upgrades, extensions, or linkages can or should be made to the ERP system. Finally, the firm needs to evaluate the success of the project.

What about the effect the new system has on the organization? Are people using the system effectively? Is the software making the business more efficient? Is it adding value to the organization? These are many questions that go unanswered until well after go-live, which is why it is important to have a solid user support program in place to supplement your technical cutover activities.

Although pre-go-live end-user training can mitigate many of the risks that organizations face at the time of cutover, there needs to be additional reinforcement after go-live. For example, core

project team members (or super users) should be leveraged to provide general support and answer simple, process and system-focused questions. Immediately after go-live, about 80% of user issues are related to lack of understanding of, rather than a problem with, the system. Therefore, super users should be the first level of support.

Moreover, providing additional tools, such as flow charts and training documentation, will make employees more comfortable with the system faster. Refresher training should also be provided as needed on an ongoing basis.

By clearly defining your go-live and ongoing support processes as part of your overall ERP planning, you will better leverage your ERP technology to realize real business benefits and ROI from your ERP project. The following issues must be addressed in order to achieve the best results during the post-go-live period.

The Stabilization Period

After a system goes live there is what has been referred to as a 'stabilization period' that typically lasts from three to nine months. During that period, most companies should expect some dip in their business performance at the time they go live and should expect that they will need to manage through that dip. During the stabilization period, all those processes that once were just plans are now being used. New software and processes may be unfamiliar to the users. Hence, there may be problems with the quality and quantity of the work, and consequently the system may not operate as it was hoped. To avoid this, it is critical that users get the appropriate training at the right time. Training too early may not be remembered, but training too late may not be in time.

During the stabilization period, processing and network response times may not be adequate for the implemented system, forcing changes in bandwidth and processing capabilities. Where does support for these problems come from? Internally, the original project team can evolve to provide support for user needs, assist with additional training, and make necessary system changes.

Problem Resolution Mechanism

When problems arise there should be a problem response mechanism which deals with them and which everyone is aware of. This mechanism should be simple and provide a means for tracking progress in resolving the problem. When a problem is identified, it should be reported to the person assigned with responsibility for coordinating problem resolution. This person may be the project manager.

Initial investigation will reveal whether the problem is readily resolved, requires further investigation, or whether it is something that needs to be transferred to the vendor to deal with. Details about the problem are required. This will include a description of what was being done at the time the problem arose. Evidence should be collected about the problem in the form of screen dumps and any relevant documentation.

The problem coordinator will establish who is going to deal with the problem and keep track of progress in resolving it. Readily resolved problems can be closed off quickly. The rest need to be monitored to ensure that they are being addressed. This is particularly important for problems that affect critical tasks, for example those relating to month-end activities. When a problem is referred to the vendor, this tends to be through the vendor's user help-desk.

The User Help-Desk

The user help-desk is a call centre facility provided by the vendor, which allows the client to log problems that he cannot resolve. The hours of access tend to be normal office hours, although this

will vary according to the vendor. The availability of the user help-desk, the speed of response, the average, minimum and maximum down times, etc., should be clearly specified in the contract with the vendors. Also, for problems that are the result of the bugs in the ERP package, the vendor should not charge any fee.

While this service will be part of the maintenance agreement, there is a distinction between technical problems and those caused by user carelessness. The latter, if recurring, may incur a charge. From a problem coordination viewpoint, it is practical that the client has only designated people who access the user help-desk. Thus, when problems are reported, they are logged alongside the other problems. The key point is that all problems irrespective of who is resolving them need to be logged and monitored to ensure that they are resolved in an acceptable and timely manner and closed accordingly.

In-House Help Desk

When the system goes live, the implementation team needs to set up a help-desk to answer the queries of the users. Activities of the in-house help desk can include detecting and responding to system bugs and answering user questions (e.g. through a help-desk or training) pertaining to:

- Making changes in the system parameters as the organization changes
- Ensuring that consistent production versions of the software are available
- Managing different ERP input and output capabilities
- Maintaining and updating the documentation and training materials
- Maintaining and upgrading the software

Where do members of this support organization come from? Participants in the original ERP project team can be important players in the day-to-day operations. It is therefore important to retain project team members who have the (highly marketable) skills necessary for day-to-day ERP system operation.

Generally, members of the project team have valuable knowledge that needs to be preserved through their retention. Hence, firms need to advise project team members of career opportunities that will allow them to exploit their knowledge within the firm. A well-designed help desk is an ideal tool for capturing knowledge, storage, and dissemination.

POST-GO-LIVE ACTIVITIES

Determining what needs to be done (or re-done) regarding the system implementation can be accomplished by evaluating the data conversion, determining what new process bottlenecks have emerged since system implementation (e.g. during the stabilization period), and assessing whether the documentation and training has been sufficient.

Data Conversion

An important task required for the migration from legacy to ERP systems is that of data conversion. Old data needs to be placed into an appropriate format and sequenced for implementation. In many cases, the quality of the data conversion effort (and resulting problems) can only be observed over a period of time. Cumulative data needs to be examined for 'sense.' For example, it may appear that inventories are building up, collections are down, and part shortages are occurring. These are symptoms of inadequate data conversion—wrong part numbers, vendor numbers, or inventory numbers.

Mitigating potential data conversion problems typically requires a number of actions, including the following. *First*, reconcile the data in the legacy and the ERP data sources wherever possible. *Second*, perform a mapping from one database to the other to make sure that all data is included. The mapping may reveal new and omitted product numbers as well as new and omitted vendors and clients. Inventories should be equivalent. Without these actions there is no guarantee that the data conversion did not mix different kinds of data or that all data is accounted for.

Bottleneck Resolution

No matter how much effort has been made or how good the ERP implementation and planning was, it is still likely that process bottlenecks and non-value-added activities remain. As a result, firms should establish systematic approaches for identifying such bottlenecks and activities.

Where are those bottlenecks likely to occur? *First*, their location is likely to be different for different firms. *Second*, the cross-functional nature of ERP process design is likely to generate bottlenecks, particularly where different departments have different resources. *Third*, for those settings where data gathering has been transferred from accounting to where the data is actually generated, there may be process bottlenecks because of the change in data input. *Fourth*, linkages to legacy systems and processes may drag down system performance. How do you locate the bottlenecks? One approach is to listen to the customers and partners. What are they complaining about? Follow up on those complaints. Unfortunately, the complaint road can take a while to manifest. Another approach is to sit back and wait at the help desk for the questions and resource requests to come flooding in. This approach may also be too late.

Two other approaches can be used to detect bottlenecks—an internal ERP data analysis and an organizational analysis. Internal ERP analysis is based on an examination of ERP data; exception reports and transaction data can be analyzed for emerging and repeating problems. Alternatively, going into the organization and talking with those who use the system can cool down up issues before they become major problems.

Documentation and Training

System and process knowledge is required in order for the system to work. As a result, adequate training and documentation are required prior to going live. Since virtually all organizations either underestimate or under-allocate for the necessary training, this is likely to be a problem area. However, until the system goes live, the adequacy of training and documentation cannot be truly assessed. Thus, when the system goes live, a review of changes in documentation and additional training begins and resources can be allocated where they are needed.

Comparison of Planned vs. Actual Results

Another source of information about what still needs to be done is the comparison between plans and reality. For ERP systems, this comparison has at least three dimensions: systems design and implementation, planned and actual use, and expected versus actual system capabilities. The basic nature of this comparison roughly equates the comparative analysis to an audit, possibly by different personnel or even an outside source. These comparisons are critical. If there are marked differences between plans and reality for any of the dimensions, engagement success may be compromised.

As an example, the ERP decision may have been made assuming certain changes in best practices, which were expected to lead to organizational improvements in efficiency and effectiveness. However, if the ERP was not implemented as planned then those benefits will not be attained. As a result, the basic reason(s) for choosing the ERP may not have been addressed. Why would there be differences? Perhaps the biggest source of problems is implementation compromises.

Implementation Compromises

Implementation compromises are deviations from a planned implementation—generally to save time or money. Often, in the rush to have the system installed a number of compromises are made. After the system is implemented it is important to examine what needs to be done or re-done as a result of these compromises.

What is the impact of implementation compromises? The ERP installation saves time and money over what would have been the cost if there had been no compromises. However, because the full scope has not been implemented, the system and processes will not operate entirely as anticipated. Implementation compromises will therefore affect evaluation. In some cases, implementation compromises may ultimately result in engagement compromises, as in those settings where the move to ERP was done in order to change key processes or make key changes and those changes were compromised.

How do firms identify implementation compromises? There are at least three approaches. *First*, there can be a comparison of the implementation to the plan to ensure that all was done. *Second*, the firm can set up lines of communication so that they can effectively listen to their own employees and their problems with the system. *Third*, firms often bring in consultants to review the implementation to detect such compromises, particularly in such areas as security.

System Design and Implementation

The system design is not always what is implemented. Processes and procedures ultimately implemented may not match the original plan. In order to find differences, planned implementation should be compared to actuals. When differences are found between the plan and actual realization, those differences should be investigated to make sure they were authorized.

The way a system is used may not conform to its planned use. A system audit can be performed in order to find out how the system is actually being used. For example, reports made available to some users may also be available to other users; should that second set of users receive the reports or not, may be an issue of concern.

Firms get a reality check from top management after the system goes live. At this point, the ERP installation of the vision is now real enough to be seen and compared to what was expected. A comparison between key parts of that vision and the ensuing reality are necessary to ensure that the system is working as expected.

Interfaces, Upgrades, and Extensions

After stabilization, resources devoted to implementation can now be used to facilitate interfaces to other systems and to extensions of the ERP system that have been identified. Throughout this process, the importance of different interfaces, upgrades, and extensions should be prioritized so that (a) maximum benefit can be generated from expenditures and (b) priorities are consistent with the firm's overall vision.

- **Upgrades**—In some situations, upgrades to different system versions must be made so that additional features can be implemented.
- **Interfaces**—Although ERP systems are designed to function independently of other systems; they still can be interfaced to a range of such other systems. In order to ensure that the ERP system goes live at the planned time, those interfaces are sometimes not made until after the 'go-live' date; such interfaces can be pursued after the implementation.
- **Extensions (new features and functions)**—Enterprise resource planning systems have become the information system 'backbone' in many firms, providing processing capabilities for

virtually all of a firm's transactions. Over time, ERP systems have been extended in a number of different directions. For example, ERP vendors have moved to provide supply chain integration and sales force automation support. In some cases, these extensions were known when the software was chosen and may even have influenced the final choice of software. In other cases, there may be new extensions to the ERP software that the firm needs to go back and examine in order to determine whether or not the options should be considered and implemented.

EVALUATING SUCCESS

After the stabilization period, the firm can begin the process of evaluating success. This requires determining just when the evaluation should be made and exactly how success is to be measured—for example, using cost-benefit analysis, some approach based on the criteria used for deciding to go ERP, or a 'balanced scorecard' approach. We will see more about this in Chapter 40.

Timing

Timing is a critical issue when evaluating a new system. Rarely would benefits be fully realized immediately after implementation, nor would much information be available. As a result, evaluation needs to be scheduled at a time when benefits could be realized and measurable. Accordingly, firms typically evaluate the ERP implementation during the first or second year after the system goes live. At that point, many system bugs will be ironed out. Further, the system will have generated a year of data and that can be used as part of the basis of evaluation, e.g. did inventory turnover improve?

Project management requires monitoring the project duration, costs, and benefits of the ERP implementation (i.e. business benefits). There have been a number of reports of problems with implementing ERP systems in a timely and cost-effective manner. ERP project benefits are usually more often short of expectations while costs more often exceeded expectations. A possible explanation for this finding is that costs may have been systematically underestimated and benefits overestimated in order to sell the system to top management.

Balanced Scorecard

This approach for evaluating performance in organizations was promulgated by Kaplan, Norton, and Atkinson. The balanced scorecard communicates a firm's multiple objectives from multiple perspectives, including financial, customer, learning and growth, and internal business processes. Rather than depending on a single measure or a single type of measure, multiple measures are used as part of the evaluation process.

The multiple perspectives and multiple measures approach can be translated to ERP implementation. A balanced scorecard for ERP systems could employ each of the four basic business case rationales (technology, business process, strategic, and competitive) used for deciding whether to go ERP and so generate a portfolio of perspectives and measures that would depend on the particular company and its reasons for adopting ERP.

Post-Implementation Audit and Review

It is easy to forget that successful ERP implementations do not end at go-live. If anything, it is after the system is implemented that makes or breaks the success of the system. However, most companies fail to conduct a post-implementation audit to see how their ERP systems are fitting in with the business. Inevitably, there are going to be ongoing changes and adjustments to optimize the way the system is operating and to improve the way it supports your business. At some point following

the go-live, it is useful to reflect upon the implementation and consider how the implementation has progressed. Two months is an appropriate period as it allows the system to settle down and also permits at least one accounting month-end to have taken place. The review provides an opportunity to learn from the implementation:

- Does the software do what is expected of it?
- What are the outstanding or emergent issues?
- What can be learnt from the implementation?
- What could have been done better? How can this be used in future?
- What timescale/budget is required to deal with the remaining issues?
- Has the project been a success?
- Have performance factors like employee productivity, order fulfillment time, reduction in financial close cycles, etc., improved?
- Are there any areas where the employees are under trained?
- Do the employees feel that training was not adequate in certain areas? Are there any areas where employees have to be retrained?
- Are there any business processes that need to be improved? Are there any redundant and wasted procedures that can be eliminated?

The answers to the above questions will help in improving the ERP system that has been successfully implemented. No system is 100% foolproof; there will always be areas that need modification and processes that could be improved. The answers to the questions should be collected by interviewing the actual users and managers. This feedback may reveal issues that can be readily addressed such as the provision of extra training. The post implementation or post go-live audit and reviews should help in finding out these issues and help the organization becoming more efficient. This exercise is particularly invaluable if there are successive phases involving the introduction of additional functionality or more implementations to follow the pilot implementation.

SUMMARY

Treat the day your ERP project goes live as the start of the next phase of your journey. When the new system goes live, people switch from their old practices to the new system. If everyone is properly trained, then they will know what he or she has to do on the go-live day. If the processes have been properly tested, then operations will progress smoothly. If the data migration has been properly handled then the data will make sense to those using it. The success of the go-live day is measured by the lack of problems. The overwhelming feeling of anticlimax undermines the achievement of one of the most significant milestones in the implementation. However, the implementation is not finished. Work then begins on realizing the benefits of the new system. However, if problems are experienced on and after go-live, mechanisms need to be in-place to deal with them. In this chapter, we have discussed the various post-implementation activities.

REVIEW QUESTIONS

1. What are post-implementation activities?
2. What happens after going live?
3. What is stabilization period?
4. Why should there be a problem resolution mechanism?

5. What is the importance of the user help desk?
6. Why should there be an in-house help desk once the system goes live?
7. What are the post-go-live activities?
8. What is data conversion and migration?
9. Why should there be a system for bottleneck resolution?
10. What is the importance of documentation and training after go-live?
11. Why should you compare the planned and actual results?
12. What are implementation compromises and why they should be made?
13. What are interfaces, upgrades, and extensions?
14. How do you evaluate success?
15. What is balanced scorecard?
16. What is post-implementation audit and review and why is it important?

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Chapter 37

Success and Failure Factors of an ERP Implementation

INTRODUCTION

Implementation of an ERP system is a major investment and commitment for any organizations. The size and complexity of ERP projects are the major factors that impact the cost of ERP implementations. Different companies may implement the same ERP software in totally different approaches and the same company may integrate different ERP software applications by following the same procedures. However, there are factors common to the success or failure of ERP implementation regardless of the ERP systems they implement and the methodologies they use.

It is important to understand exactly what you are as an organization now and what you want to be in the future. This includes everything from understanding your strengths, weaknesses, and core competencies to the areas you would like to improve. Making these decisions in the midst of an ERP implementation can be a very rushed decision, and making key strategic decisions like these in a sloppy fashion will create significant loss and confusion in the future.

The key takeaway is that ERP cannot be implemented successfully without clear requirements, which are critical to ERP success. By the same token, clear requirements cannot be defined until business processes are well defined. And business processes cannot be defined until organizations establish a clear sense of strategic direction. Organizations should ensure that these areas are taken into consideration during their ERP assessment and software selection processes.

In this chapter, we will discuss the various success and failure factors of an ERP implementation. These factors are lessons learned from successful and failed implementations across the world and shared by many ERP implementation specialists.

This chapter also summarizes what we have discussed in the previous chapters. Thus, when you are trying to implement the ERP system in your company, try to follow as many success factors as possible and avoid the failure factors.

SUCCESS FACTORS

1. **Make sure you understand why you are implementing ERP**—This is arguably the most important one. It is easy to see that many big companies are running SAP or Oracle and maybe you should too, but it is harder to consider that maybe you do not need an ERP system at all. Perhaps process improvement, organizational redesign, or targeted best-of-breed technology will meet your business objectives at a lower cost. By clearly understanding your business objectives and what you are trying to accomplish with an ERP system, you will be able to make a more appropriate decision on which route to take, and that may or may not involve ERP.
2. **Project Planning**—ERP implementation starts with project planning—setting project goals, identifying high-level business requirements, establishing project teams, and estimating the project costs. Project planning offers the opportunity to re-evaluate the project in great detail.

If the ERP project is not justified at the planning phase, organizations should not hesitate to cancel the project. For every successful ERP project there are projects that are canceled before implementation.

3. **Plan upfront**—An ERP vendor's motive is to close a deal as soon as possible. Your responsibility should be to make sure it gets done right. Too often, companies jump right in to a project without validating the software vendor's understanding of business requirements or its project plan. The more time you spend ensuring that these things are done right at the beginning of the project, the less time you will spend fixing problems later on.
4. **Focus first on business processes and requirements**—Too often, companies get tied up in the technical capabilities or platforms that a particular software application supports. None of this really matters. What does matter is how you want your business operations to run and what your key business requirements are. Once you have this defined, you can more easily choose the software that fits your unique business needs.
5. **Align the organization on the true destination**—You should make sure that everyone in the organization has the same vision about the original motivations for implementing ERP-enabled processes: what the targeted capabilities were, as well as the targeted benefits. Only then can an organization really know how close its ERP program is to being complete. This alignment needs special focus on people: communicating, managing expectations, education, and top management support.
6. **Architectural design**—While high-level architectural decision is made in the process of ERP vendor selection, it remains a critical successful factor in integrating ERP with other e-business applications, e-commerce applications, or legacy systems. Choice of middleware, interface software, or programming languages drastically impact the implementation cost and release date.
7. **Transition project roles to a way of life**—Information technology people, ERP experts, process experts, site leaders, the project manager, and the steering committee—going live can involve hundreds of people, in dozens of roles. But at go-live, once the program is operational, the ways roles change and the way such change is orchestrated can be an even larger undertaking. Companies successful in the post-implementation phase are simply better at mobilizing and guiding such efforts. They are also better at preparing people for the critical shift, moving from being team members to champions.
8. **Data requirements**—Unlike in-house e-business applications, much of the packaged ERP implementation involves the integration of ERP systems with existing e-business software (CRM, SCM, and SFA) and legacy information systems. Appropriate level of data requirements is critical for an ERP to interact with other applications. Data requirements usually reflect details of business requirements. It costs ten times to correct a mistake at later phase of ERP implementation than the effort to correctly define requirements at analysis and design phase.
9. **Apply planning and program management practices throughout the program life cycle**—If there is one thing that companies should master by the time they go-live, it is program management and planning. Companies that will succeed are those that accept the fact that if they are to achieve their benefits, the operation and maintenance phase demands at least as much planning as the implementation phase did.
10. **Strong project management and resource commitment**—At the end of the day, your company owns the success or failure of a large ERP project, so you should manage it accordingly. This includes ensuring that you have a strong project manager and top players from the business to support and participate in the project.

11. **Achieve balanced people, process, and technology changes across all areas**—Companies undertaking the ERP journey must make changes and take action in all areas of the modern enterprise. They need the best-of-breed technology tools, the most effective work processes using world-class practices, and people who are trained and motivated. They will also need strategies that fully leverage these new organizational abilities. Far from being a one-dimensional project, the ERP journey must keep changing play and in balance, in all these areas—a fact that successful companies never forget.
12. **ERP must be driven by a business case**—In other words, the work must be directed toward improving specific business metrics: improved cash flow, faster hiring, reduced costs, and accelerated shipments. Both line and IT managers must identify the processes that need improvement. Focusing on business process improvement is the only way to know whether you have got your money's worth.
13. **Commitment from company executives**—Any project without support from its top management will fail. Support from a CIO or IT director is fine, but it is not enough. No matter how well-run a project is, problems arise (such as conflicting business needs), so the CEO and your entire top management needs to be on board to deal with some of these.
14. **Active executive direction**—Executive direction in this case means more than just oversight or support. People do not adapt to doing work in new ways without some inspiration from the top. ERP systems are huge, influencing thousands of people, processes, practices, and policies. There are thousands of decisions to be made—both large and small. Someone at the top of the organization has to make the call.
15. **Focus on capabilities and benefits, not just going live**—The ERP implementation was initiated because of its benefits. Thus, it will not matter much if a schedule is missed by a few days or even weeks. However, if you miss out on an expected feature or benefit, then it is going to hurt. Therefore, make sure that all the features that were planned are implemented.
16. **Make ERP-related decisions quickly**—How about a rule that all decisions must be made within three days? This may seem arbitrary, but setting a fast and deliberate implementation pace is critical. Experience has shown that when an ERP project stretches more than 10–12 months, it is at risk—mostly because key team members move on.
17. **Put the very best people on the implementation team**—The natural tendency is to source projects with employees who are the most available. These people may not have the skills or process knowledge required to get the job done. This is complex stuff. An ERP project will require the best talent that you have. And if you assign only part-time talent, then work gets prolonged and the project is at risk. ERP work is not just a project. It is the beginning of a continuous improvement process. There are at least five years of benefits to get out of any ERP implementation.
18. **Phased approach**—It is important to break an ERP project down to manageable pieces by setting up pilot programs and short-term milestones. Depending on the IT experience, some organizations choose the easiest piece as the pilot project, while others may implement a mission-critical application first. The pilot project can both demonstrate the benefits of ERP and help gain hands-on ERP implementation experience.
19. **Data conversion**—Second generation ERP systems use relational database management systems (RDBMS) to store enterprise data. If large amounts of data are stored in other database systems or in different data formats, data conversion is a daunting task, which is often underestimated in ERP implementations. A two-hour data conversion task could be turned into a two-month effort as a result of the DBA group's lack of technical experience and the management's incompetence or ignorance.

20. **Organization commitments**—The involvement of ERP implementation goes far beyond the IT department to many other functional departments. The commitment and smooth coordination from all parties is the key to the success of ERP project. The commitments come from the understanding of how ERP can benefit each functional department. For example, if the warehouse staff is not completely sold on the benefits of the inventory control module, they may not input the kind of usage data that is essential to the project's success.
21. **Create a partnership between your software vendor (and implementation partners) and your stakeholders**—While this concept may seem obvious, it has been found that the vendor–client relationship is often contentious and sometimes outright hostile. This fact is particularly true if the organization is severely divided regarding the choice of vendor software. As problems arise during implementation, and they will arise, the blame game often begins. Before long, the project evolves into a standoff with neither vendor nor client willing to admit fault. A third-party project director or manager is often the best solution for this dilemma. This person can usually serve as an objective mediator to bring the parties together, finding solutions, rather than allowing the project to slow down to a crawl.
22. **Sell, sell, and continue to sell the ERP to your stakeholders**—Implementing ERP systems are extremely complex and take months or even years to implement. If your stakeholders understand the long-term benefits of the system, they are much more willing to accept any perceived temporary steps backward.
23. **Build and leverage process expertise**—Process focus is if anything, more important after going live since the company now has an even greater core of process expertise. Successful companies fully capitalize on this expertise and the power of ERP-enabled processes. One way is by sending process experts from the implementation team back into the organization, or by having some serve at centers of excellence, some as key process performers, and some as business managers. Successful companies never forget the point of the integrated enterprise—that it is not about ERP so much as it is about people involved in ERP-enabled processes.
24. **Adequately resource your project (especially in the functional areas)**—Ensure that replacements are in place to release key team participants. The people who do the daily work of running functional departments are the same people who will be essential to implementing an ERP system. No surprise. The people with the most knowledge will be needed for the majority of the project. Priorities will conflict between the demands of the office and the demands of the project. The most effective solution we have seen is hiring or contracting with additional resources to serve as backfill for key office personnel. Admittedly, a new resource cannot do everything that an experienced resource normally does; however, the replacement can handle routine work and coordinate with the experienced person for critical decisions.
25. **Define metrics and manage them**—Successful companies set targets, establish budgets, and make it happen—especially after going live. On the other hand, after seeing head counts fall and inventory shrink to more efficient levels, less successful companies can see these gains reversed if they do not continue to define metrics and stick to them.
26. **Communicate and manage expectations at go-live**—Many stakeholders in the organization expect the ERP to be an 'everything for everybody' solution. Even in the best-case scenario, this is rarely true. And inevitably, some functionality must often be re-scheduled into a post 'go-live' phase. All of this combined could create disillusionment with the new system. If the project teams are struggling to meet deadlines, they may have to make decisions on the functionality that needs to be delayed in order to meet the original 'go-live' date and

avoid delays. These decisions must be communicated and 'sold' to the stakeholders to ensure expectations are effectively managed. The organization needs to know what will be in place at 'go-live' and when they can expect the additional functionality.

27. **Extend capabilities beyond the ERP foundation**—As a backbone technology, ERP delivers more powerful benefits when companies do their utmost to build on that platform. In doing so, successful companies turn to a host of complementary applications that generate ROI, from advanced planning and scheduling to warehouse management to sales force automation. Successful companies also pay closer attention to the constant stream of innovative new solutions developed by today's software developers like CRM, SCM, BI, etc.
28. **Ensure the project has sufficient budget**—What project teams feel they have enough money budgeted for their projects? The perception of not enough funds is likely to be even greater in a project with the complexity of an ERP. Careful planning during the budgeting process helps project teams make better decisions on timing and allocation of resources. If budgets are not sufficient to support the deadlines, project resources find themselves working extensive overtime and under constant pressure. Ultimately, morale disintegrates along with the quality of work. If counter measures are not implemented, the image of the entire ERP system could suffer not only during implementation, but also long after go-live.
29. **Encourage functional ownership of the project**—Doing project work is a way of life for most IT departments, while functional departments typically have little, or no experience with projects the size of ERP implementations. Thus, many organizations choose to let IT lead the ERP implementation. Rarely is this decision successful. In the long term, the functional departments with own the ERP. Hence, they must establish the rules that govern system functionality; learn how the system will handle business processes within their departments and be able to obtain information by on-line inquiry or by creating their own reporting. This ownership should be in place at the start of the implementation project.
30. **Develop dependency-driven project schedules that can be tracked and managed to provide early warnings and help avoid crises**—Successful ERP project implementations have well-planned project schedules. These schedules are not built from a desired end date. Instead, they are built with a realistic view of the amount of time needed for the various tasks. These tasks are linked with clear dependencies—what must happen before a task can begin. With a schedule, you can track and manage your progress throughout the project. Most importantly, a well-designed project schedule can provide early warnings of problems.
31. **Implement pre-project readiness assessment and overall project planning**—Most organizations have never been involved in a project as complex and cross-functional as an ERP implementation. Additionally, an ERP project requires near full-time participation. A readiness assessment conducted prior to the project kick-off can help identify areas of strength and potential problem areas in need of improvement. This information is extremely helpful when planning the project budget and the project tasks.
32. **Implement aggressive project management processes**—The magnitude of an ERP implementation requires aggressive and structured project management processes. An ERP implementation is complex and touches virtually everyone in the organization. Without the structure of project management processes and without a project manager who understands this methodology, the project runs significant risks in time, quality, and costs. 'Go-live' dates could be missed and the credibility of the project team and the ERP software itself could suffer dramatically.
33. **Create a project organization structure to provide planning and quick response for decision-making and issues management**—The toughest problems with any project

implementation involve people issues. Pre-project planning must include the creation of clearly defined roles and responsibilities. The following critical roles need to be filled by qualified people: project sponsor, project director and/or project manager, functional team leaders, technical team leaders, project coordinator/scheduler, etc. These people must have dedicated time to the project and they must be willing to be accountable for dealing with issues and making timely decisions. Many ERP implementations become paralyzed when issues are put on hold and are not dealt with quickly.

34. **Make the best use of the external consultants and experts**—These people are paid huge amounts of money for helping you in implementing the ERP system. Thus, you must make the best use of their knowledge and skills and ensure that the knowledge transfer is complete before they leave the project.
35. **Ensure adequate training and change management**—ERP systems involve big change for people, and the system will not do you any good if people do not understand how to use it effectively. Therefore, spending time and money on training, change management, and job design is crucial to any ERP project.
36. **Teach the organization to use new capabilities**—The natural progression from building capabilities is actually using them. While this may sound obvious, many organizations are far better at building new capabilities than at teaching (and motivating) people to use them. Successful companies avoid this fundamental imbalance. For them, teaching goes hand-in-hand with building new capabilities, from defining roles to developing skills to culture shifts.
37. **Implementation review**—This review must be performed after users are competent with the system. The goal is to ask the software vendor to suggest better ways to use the system.
38. **Assign clear ownership of benefits**—During implementation, it is usually clear that the responsibility for going live—on time and on budget—ultimately belongs to one person, the project leader. But after going live, who owns the benefits that are being targeted? In many companies, that is a difficult question to answer—no one is been identified as the owner. But in successful companies, accountability for results is no mystery. The owner may be the business unit leader, a project sponsor, a process owner, or someone else. What is important is that there be somebody whose responsibility is realizing the benefits.
39. **Focus on achieving a healthy ERP ROI (return on investment), including post-implementation performance measurement**—This requires doing more than just developing a high-level business case to get approval from top management or your board of directors. It also entails establishing key performance measures, setting baselines and targets for those measures, and tracking performance after go-live. This is the only way to truly realize the benefit potential of ERP.

FAILURE FACTORS

1. **ERP implementation is, at its core, a people project**—The biggest challenge before and after implementation is not the technology; the biggest issues are related to people. At every stage, companies must work harder to manage change, secure buy-in, communicate better, and educate their employees. Top human resources issues are related to changing management, training, and internal staff adequacy.
2. **Employee resistance**—If the employees are not educated and informed about the benefits of the ERP system and assured about the security of their jobs by the top management, they will start believing in the rumors that float around and will either resist or sabotage the ERP implementation.

3. **Lack of top management commitment**—The top management should pledge and demonstrate that the ERP implementation has its full support. They should assure the employees about their jobs, clear any doubts and explain why the ERP system is a necessity for the organization. The CEO or some senior level manager should sponsor the ERP project in order to demonstrate the management commitment.
4. **Inadequate training and education**—All users of the ERP system should be trained properly in using the system to its fullest. Different groups of people in the company will have different training needs. Managers need more focus on the decision-making and analysis features of the system while the clerical staff need more focus on how to perform their jobs. Nevertheless, all the users must be trained in the ERP basics, overview of the system and its working, how an action by an employee triggers a host of events throughout the organization, how automation will help, what processes are changed, and so on. Educate everyone so that they understand what is going to be achieved with the new system. Additional education should include total quality management and change management strategies. Also the training sessions should be used to gain acceptance for the ERP systems by dispelling the myths about ERP. When the employees do not understand what the new system is and what it is supposed to do and how to operate it, they will not use it or use it incorrectly. This can lead to failure of the system. Train process owners (department managers) in how to use the system. Have them train the users.
5. **Inadequate requirements definition**—If the requirements of the new system or what is expected from a new system are not adequately defined, then the implementation team will find it very difficult to plan the project. Only if the requirements are specified correctly, can the ERP package that is best suited be selected.
6. **Inadequate resources**—ERP implementation is a complex, costly, and lengthy project. The initial budgets are very often exceeded and there are still many hidden costs in an ERP implementation. Therefore, while preparing the budget and allocating resources for the ERP implementation care should be taken to consider all the factors that could affect the costs, manpower requirements, infrastructure needs, and then reserve a reasonable amount of buffer for any contingencies that might occur during implementation.
7. **A poor fit between the software and users procedures**—If the selected package is a poor choice then either the organization has to change its business processes or the package has to be customized to follow the organization's processes. If the company's processes are efficient and cannot be changed, the only option is to customize. This is a time-consuming, costly, and error-prone process. Hence, while selecting the ERP package care should be taken to select a package that offers the best suits the company processes.
8. **Unrealistic expectations of the benefits and the ROI**—ERP systems are capable of producing dramatic productivity improvements if successfully implemented and properly operated. However, expecting ERP to perform miracles will be asking for trouble. The management and employees should be made aware of the benefit so that there are no over expectations. If ERP is touted as a panacea, then there will be dissatisfaction and disappointment about it, which can lead to failure of the system.
9. **Poor ERP package selection**—If the right package—the one that is best suited for the company—is not selected, it will create a lot of problems for the implementation and customization teams as well as the end-users and will result in failure. Choosing an ERP package that is not suited for the company or one that will require huge amounts of customization is one of the major factors that contribute to the failure of the ERP project. Accordingly, the package selected should be one that addresses the basic business functions of the organization.

10. **Extensive customization**—Be prepared for people to argue that they need to customize a report or tell you that your new software does not accommodate the way your company pays invoices. However, you should always challenge those arguments aggressively. Most companies can live with standard business processes. When you over-customize an ERP installation, you not only add time and costs, you also make installing the next release of the ERP software increasingly difficult and costly.
11. **Change management**—Long and expensive customization efforts often result in the lapse of the release deadline and budget overrun. Customizations make the software more fragile and harder to maintain when it finally goes to production. Major changes may be required in the later stage of the implementation as a result of incomplete requirements and power struggles within organizations.
12. **Failure of accommodating evolution of business processes**—Business processes fall into three levels—strategic planning, management control, and operational control. Organizations continuously re-align their business processes at all levels in response to the ever-changing market environment. Many ERP systems are not flexible enough to accommodate evolution of business processes. An ERP system that worked well last year may need major overhaul.
13. **User acceptance**—The users of ERP systems are employees of the organizations at all levels. ERP projects usually modify the company's business processes, which create extra workload for employees who use them initially. They may not think that the workflows embedded in the software are better than the ones they currently use. Ongoing end-user involvement and training may ease the difficulty in the organization's adaptation of new systems and new processes.
14. **Going live is not the end of the ERP journey**—ERP process is a never-ending process. ERP implementation and operation is a continuous learning process and needs constant review and course corrections. The organization should realize that the benefits of ERP go far beyond cost reduction, touching virtually every aspect of the integrated enterprise. Meanwhile, with a growing body of experience and best practices to draw on, organizations already past the go-live stage can still harvest the full benefits of their ERP investment.
15. **Companies should anticipate a temporary dip in performance after going live**—It takes time and focus to realize the full benefits of an ERP implementation. There is also the sheer magnitude of the change. After going live, this change can be dramatic, especially in relation to how people do their jobs. Managing the dip begins with a plan that addresses the organization's unique circumstances—starting with training and change initiatives for those who use the system. On a broader level, what the dip really shows is an organization stabilizing after doing something new. In that sense, the dip is a sure sign of growth and new capabilities—a bounce that then raises to new performance levels.

SUMMARY

Implementation of an ERP system is a major investment and commitment for any organizations. The size and complexity of ERP projects are the major factors that impact the cost of ERP implementations. Different companies may implement the same ERP software in totally different approaches and the same company may integrate different ERP software applications by following the same procedures. However, there are factors common to the success or failure of ERP implementation regardless the ERP systems they implement and the methodologies they use. We have seen the various success and failure factors of ERP implementations in this chapter.

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Part IV

ERP in Action

- After ERP Implementation …
- Operation and Maintenance of the ERP System
- Measuring the Performance of the ERP System
- Maximizing the ERP System

Chapter 38

After ERP Implementation ...

INTRODUCTION

ERP implementation is just the beginning. It is only the start of a journey. A successfully implemented ERP system does not mean spontaneous results. It needs constant monitoring and management. An ERP is an ongoing project. As technology advances, new software with more features and capabilities will emerge. To stay competitive, the organization has to adapt to new environments and adopt new technologies. This requires continuous improvement, continuous learning, and an ongoing implementation.

The realization of a life-long commitment has begun to dawn upon several companies. Some of the early adopters of SAP who initially implemented the mainframe version SAP R/2 and who has now implemented SAP ERP are now faced with an expensive, time-consuming conversion to SAP ERP. One presumes that there will eventually be another version; then many more companies will be faced with the same prospect.

Non-technical employees and managers who served as functional experts, during the implementation just cannot return to their previous jobs just because their help may be needed in support roles. Also many of them might not be with the company, having left for greener pastures or retired.

Another dilemma faced by companies that justified an ERP project on the basis of reduced IT manpower is that they are unable to lay off anybody; people no longer needed for implementation are now needed for support and maintenance. The permanent nature of the ERP system has numerous implications. The following section discusses some of them. ERP implementation is just the beginning. For any organization to succeed and reap the benefits of the ERP system, it has to take necessary action keeping in mind the permanent nature of ERP systems.

ORGANIZATIONAL STRUCTURE

Most organizations create implementation project offices and appoint project managers with the assumption that the project will end and life will go back to normal. But it will not. However, what the organizations need is not a project office, but a new organizational structure that reflects the ongoing need for ERP-related activity. 'Sponsorship' is one example of the need. Many companies appoint senior executive sponsors—often the chief information officer (CIO) or chief operating officer (COO)—for implementation projects. Their expectations are probably because the CIO/COO could own the systems once the installation is over. However, many companies are postponing business change until after they put a basic system into place. Who is going to oversee those changes and ensure that they fit in with the rest of the business? If the executive sponsor is temporary, who will ensure that the system and the business evolve hand-in-hand?

One solution is to create a hybrid role that oversees change in processes, systems, and information. There are not many of these around, but they are not unprecedented. Another solution is that CIOs can oversee long-term ERP change, but the problem here is that the CIO should be ready to take responsibilities that are far beyond his normal technology-related issues.

Of course, there are other organizational implications of these systems. A substantial support capability will have to be created; injecting more people into the existing EDP/IS/IT departments can do this. More importantly, the long-term use of ERP could change the broader organization in terms of its structure and function. For example, employees who are involved in the business of recording, analyzing, and producing reports may no longer be needed or the number of mangers needed may go down, after the ERP implementation or the organization can become flatter. The organizational re-structuring at that level is anyway the responsibility of the top management and not that of the ERP chief.

ROLES AND SKILLS

The post-ERP organization will need a different set of roles and skills than those with less integrated kinds of systems. At a minimum, everyone who uses these systems needs to be trained on how they work, how they relate to the business process and how a transaction ripples through the entire company whenever they press a key. The training will never end; it is an ongoing process so new people will always be coming in, and new functionality will always be entering the organization.

Most companies use consultants to help with the implementation process. This in itself is not a bad idea, but the problem is how most companies use consultants in ERP implementations. They do not transfer knowledge from consultants to internal employees. Since these systems are going to be around for quite some time it is very important that the company employees have a good knowledge (as good as the consultants) about how these systems work and how they can be configured to fit the organization. The CIO or whoever is in-charge of the implementation must make sure that the consultants allow the employees to work side by side with them on the implementation project, and before they leave tap the most knowledgeable consultants on long-term system evolution issues.

In every business function and department that is affected by ERP you will need one or more people who know the system and its relationship to the departmental processes. It is these people who have to save the system in the early days after you turn the system on. It is these people who have to guide, motivate, and help their colleagues by working along with them. They will answer questions, find needed workarounds and let you know what is working and what is not. These people will be the ERP team representatives in each department. It is a positive aspect that these people have a dual reporting relationship; with their managers and with the ERP in-charge. It will also be useful to convene meetings of these people once in awhile, so that they can share knowledge and compare notes.

KNOWLEDGE MANAGEMENT

It is imperative that the knowledge and experience that is gained during the implementation and after the implementation is captured on an ongoing basis and made available to all. Thus, when somebody encounters a problem, he/she can look up the knowledge base to see if such a problem has occurred before. When new problems are identified and solved, it should be added to the knowledge base. Thus, over a period of time the knowledge base will be able to provide answers to most of the problems. Therefore, even if an employee leaves the company the knowledge will remain with the company.

APPLICATION MANAGEMENT

Several vendors are bringing out ERP application management tools. This provides further evidence that living with ERP systems is an important issue. Several companies have announced capabilities to monitor ERP systems and pass on any troubles/problems they discover to humans or service

management systems. There are many companies, which offer pre-packaged ERP support knowledge bases for help-desks. It is a good sign that the attention is shifting from putting ERP systems in place to living with them comfortably for a long time.

Living with ERP systems (operating and maintaining them) is totally different from installing them. Projects for implementing the systems get a lot of resources and attention, but it is how the organization lives with ERPs that has more to do with the value that one receives from them than the quick decisions made during installation.

ONGOING IMPLEMENTATION EFFORTS

The implementation should never really stop. The benefits anticipated at the outset may not arise without further attention to the processes, as the prototyping process is unlikely to yield optimum solutions. Once a particular process has gone live and has had time to settle down, issues emerge which, if dealt with can lead to the improvement of the processes. Furthermore, it is worth remembering that the ERP system is merely a tool to facilitate activities within the business. Thus, when improvements occur, they need not be directly concerned with the ERP system. Improvements in the use of the ERP system are an outcome of improvements in the process. These improvements can take place informally as the need arises or in an environment in which improvements are part of the culture. Where improvements are part of the culture, they tend to take place within a framework, under a banner of say total quality management or continuous improvement program. Furthermore, a key aspect of the culture can be described by an expression that has emerged in the 1990s—The Learning Organization. Together, they provide a means for maintaining change as a strategic weapon for establishing and maintaining a competitive edge.

When the point in time is reached where the tool—the ERP system—is viewed as more a hindrance than an enabler, then the implementation cycle completes the circle and the system is ready for retirement. The question whether to upgrade or replace with a new system arises. Irrespective of the decision, the outcome is to start the cycle again.

Kaizen

Kaizen or continuous improvement has been the subject of much interest, particularly during the 1980s when it first rose to prominence. The underlying principle is that there is a continuing search for better ways of doing things. When adopted as a company philosophy, it involves everyone. The approach tends to be organized around a company-wide program of activities. This program often takes place under the banner of total quality and is regarded as the domain of quality.

The objectives of a continuous improvement program are to become more competitive, to lower costs, and to improve customer satisfaction. This is achieved by means of a company-wide continuous improvement program to reduce non-conformance in all activities. This requires understanding of the business, the process making up the business, and the implications of the change, focus, planning, implementation, and control, and education and training of the workforce, including management. The participants of the program are people within the organization. To be successful, it requires individual understanding and awareness (by effective communication) and responsibility (for action) recognition for success management commitment and leadership (especially from top management), etc.

There are strong similarities between Kaizen and an ERP implementation, which is perhaps not surprising, as the focus of both is upon the management of change. The differences are more revealing. The ERP implementation tends to be project focused, with a beginning and an end. Continuous improvement is part of the day-to-day work activity for which time is made available. The team

approach within ERP tends to be primarily orientated around the project team. This reflects the fact that much of the work is carried out by individuals who work in consultation with others. Continuous improvement teams form in order to deal with a specific issue or set of issues and disband when that issue has been dealt with. Alternatively, the team may have a process focus whereby they are looking at a specific process and ways that it can be improved. At any one time there are numerous teams whose membership is comprised of those with an immediate interest in the topic. It may well be that everyone belongs to at least one team.

Continuous improvement is the logical extension of the implementation project. It enables the rough practices that were developed in the artificial situation of the project team environment to be refined and tuned within the reality of day-to-day operations by those who are in the best position to effect the change: those doing the work. As a company-wide practice it can be inaugurated at any time, though it does require organization, commitment, and planning. The transition from the project team to continuous improvement team should be planned well in advance. The outcome of continuous improvement is the transition from the potential to realize the benefits of the ERP application to the likelihood that these benefits are realized.

The organizational culture is an important factor in the success of both the ERP implementation and continuous improvement. A culture where everyone works together is likely to effect change more successively than one that is characterized by infighting. Some cultures are more conducive to change than others.

Successful efforts to affect a culture involve a variety of activities. Top management must promote a vision of how they would like things to happen. This is backed up by events that reinforce the message. The focus is upon the entire workforce. Events can take many guises. They deal with both the symbolism associated with practices as well as the practices themselves. This symbolism is illustrated in a few examples: consider the meaning conveyed by management car-park allocations, open-plan offices, good housekeeping discipline, poor reward/pay systems, or uniforms. Those symbols that are at odds with the vision are removed or replaced with symbols that are in line with the vision. Care must be taken to ensure that events are in line with the message. The company that espouses a no-blame culture but engages in witch-hunts to find out who is responsible for misdemeanors is unlikely to be taken seriously by its workforce. Culture change can be fraught with problems. Well-entrenched habits can be difficult to change. Long established traditions can resist efforts to abandon. Unintended and undesirable side effects may result. Good intentions can lead to bad feelings among those affected. Cultural change can be difficult to create. There does not appear to be a formula for effecting cultural change. Instead, cultural change appears to be an almost invisible gradual process involving a combination of events that act in a manner unique to that particular organization.

This concept of culture is an important issue that should be both appreciated and addressed. From an ERP perspective, a culture that embraces change is desirable for a successful implementation. It forms part of the conditions conducive for change. Nevertheless, it can be argued that a project management approach to an ERP implementation, supported by a strong senior management, can force through the implementation. New practices can be imposed upon the workforce. However, these practices will be mechanically carried out and the impetus for doing things better will be absent. The continuous improvement phase of the implementation is highly unlikely to happen. Once the system is up and running, things return to ‘normal’.

Learning Organization

For most people involved in an ERP implementation, the whole cycle is a learning experience. The project team members are gaining new knowledge. The end-users are learning new skills. The

managers are learning new approaches for understanding what is happening. The fact that so many people within the organization are involved raises the notion of communal learning, more commonly referred to as organizational learning.

Despite its recent widespread use, the concept of organizational learning is not new. Organizational learning is different from an individual's learning. It is the participation and sharing of knowledge and expertise among the employees. Systems to support learning range from informal networks to formal mechanisms. In learning organizations, learning becomes a part of life.

ERP is about change and if this change is to ensue successfully then it requires the collective ability of people to understand their environment, learn about possibilities for the future, and then make them happen. To this end, an organization that embarks upon an ERP implementation may benefit by considering itself as a learning organization and adopting practices relating to the different aspects of learning presented in this very cursory overview of the subject. Their adoption may in turn have an impact upon the organizational culture in so as to enhance the conditions conducive to a successful ERP implementation.

UPGRADING VERSUS NEW SOFTWARE

There comes a point in time when the existing system is deemed to have served its purpose and is viewed more as a hindrance to progress than an enabler. With the passage of time, a decision about what to do may be continually put off. The opportunity to seek the benefits of a new or upgraded system is offset by the distraction of the potential cost and effort. This delay may postpone the incidence of changeover costs, but this is offset by the costs incurred through missed opportunities associated with the enhanced functionality.

When the decision is finally taken to do something there are three options: upgrade, refurbish, or replace. One should consider the advantages offered by each option and how issues such as cost, disruption, or risk of new, untested, bug-ridden software offset each of them.

Upgrade has the advantage that people are familiar with both the software and the vendor. Also an upgrade may be more quickly implemented than a replacement. The vendor should have experience of upgrade, so that he can facilitate a smooth transition. However, this is offset by whether the upgraded technology really offers any advantages. Involvement with a user group may allow the vendor to be influenced about the development path of its functionality, resulting in individual modules that meet specific requirements, and provide identifiable benefits. If the gap between the existing licensed version and the latest release is great, there may be significant differences in the software. The look and feel may be totally different. The underlying code may have been totally rewritten using a 4GL rather than a 3GL. It may just not be possible to simply substitute the existing version for an upgrade and then phase in use of the additional functionality. A full implementation may be required. Interestingly, this outlook may become outdated with the componentization of packages. The concept is that a required component is downloaded from the vendor's portal and 'plugged in'. Attention focuses only upon the activities relating to that component. Thus, the upgrade process is simpler and more manageable and done on a need basis. However, the reality may be different. One component may require other components to function. Thus, the upgrade may require the downloading of a set of components and involve as much work as the traditional upgrade. Some of the reasons for upgrade are competitive advantage, multi-language, multi-currency, and global support, newer technology, cost reduction, etc. Despite the potential benefits of upgrading there are many practical reasons to delay or defer the upgrading. Some of them are insufficient features, too many customizations, lack of budget, etc.

The refurbishment of the existing application involves its customization to meet the new requirements. If the application has already had a lot of investment made in its customization this may be

an acceptable option. However, a variety of issues should be considered: the age of the host software, scale of the additional requirements, who has access to the code, what are the contractual issues regarding the code, who is doing the modification, how familiar are they with the code, how quickly is a solution required, how does the modification affect vendor support, is the functionality required unique to your application, etc. There are a host of issues, and this exercise is likely to appeal only to the larger organizations.

Finally, there is the option to replace the legacy system with a new system with its associated challenges and opportunities.

Whichever option is decided upon, the implementation cycle has returned to its starting point. The cycle begins again with the need and how this need is to be fulfilled.

SUMMARY

The key message is that an ERP implementation is just the beginning. It is only the start of a journey. A successfully implemented ERP system will not automatically produce results. This needs constant monitoring and management. An ERP is an ongoing project. As technology advances, new software with more features and capabilities will emerge. To stay competitive, the organization has to adapt to new environments and adopt new technologies. This requires continuous improvement, continuous learning, and an ongoing implementation.

Operating and maintaining the ERP systems is totally different from installing them. The realization of a life-long commitment has begun to dawn upon several companies. One presumes that there will eventually be another version; then many more companies will be faced with the same prospect. Non-technical employees and managers who served as functional experts, during the implementation just cannot return to their previous jobs just because their help is needed in support roles. Also many of them might not be with the company, having left for greener pastures or retired.

Another dilemma faced by companies that justified an ERP project on the basis of reduced IT manpower is that they are unable to lay off anybody; people no longer needed for implementation are now needed for support and maintenance. The permanent nature of the ERP system has numerous implications.

The post-ERP organization will need a different set of roles and skills than those with less integrated kinds of systems. At a minimum, everyone who uses these systems needs to be trained on how they work, how they relate to the business process, and how a transaction ripples through the entire company whenever they press a key. The training will never end; it is an ongoing process; new people will always be coming in, and new functionality will always be entering the organization. It is imperative that the knowledge and experience that is gained during the implementation and after the implementation is captured on an ongoing basis and made available to all.

REVIEW QUESTIONS

1. Why it is said that ERP implementation is just the beginning?
2. What are the things the organization has to do to remain competitive?
3. Is the position of the executive sponsor a temporary one? If yes, who will ensure that the system and the business evolve hand in hand?
4. What are the problems faced by companies after implementation?
5. Explain the organizational structure after the successful ERP implementation.
6. What are the roles and skills required after successful ERP implementation?
7. Why is ERP considered as an on-going project?

8. Why is ERP system said to be a way of life?
9. ERP implementation requires a lifelong commitment by the company management and users of the system. Explain.
10. What are the problems faced by the companies after going live?
11. What are the implications of the permanent nature of the ERP system?
12. What are the solutions for having a permanent executive sponsor?
13. How does the organization ensure that the consultants transfer their knowledge to the employees?
14. What is knowledge management?
15. What do you mean by application management?
16. What are application management tools?
17. How do ERP systems help in total quality management and continuous improvement programs?
18. What are the ongoing implementation efforts and why are they important?
19. What is Kaizen and how it is related to ERP implementation?
20. From an ERP perspective, a culture that embraces change is desirable for a successful implementation. Discuss.
21. What is the advantage of a learning organization in implementing the ERP system?
22. What are the advantages of upgrading the existing software?
23. What are the advantages and disadvantages of the refurbishment of the existing ERP system?
24. How will you decide whether to upgrade or replace your current ERP system?

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Chapter 39

Operation and Maintenance of the ERP System

INTRODUCTION

A successfully implemented ERP system will not produce results instantly. It needs constant monitoring and management. An ERP is an ongoing project. As technology advances, new software with more features and capabilities will emerge. To stay competitive, the organization has to adapt to the new environments and adopt the new technologies. This requires continuous improvement, continuous learning, and an ongoing implementation.

Most companies treat ERP implementation as projects, with the assumption that someday the projects will end but the ERP system cannot end with the implementation. In fact, once the implementation phase ends and staff have started using the ERP system, the real benefits of the ERP will be realized. An enterprise system is not a project; it is a way of life. No organization can say 'we are finished' and few ever will. There will always be new modules/features and versions to install, new persons to be trained, new technologies to be embraced, refresher courses to be conducted, acquired or divested business units to deal with and better fits to be achieved between business and system, and so on. Even if an organization declares final victory on implementation of ERPs, many extra years could be spent in getting real business value from them. Thus, ERP implementation requires a lifelong commitment by the management and users of the system.

Ideally, when the ERP system goes live people switch from their old practices to those required by the new system. If everyone is properly trained, they will know what he or she has to do when the new system is in place—operation and maintenance (O&M) phase. If the processes have been properly tested then operations will progress smoothly. If the data migration has been properly handled then the data will make sense to those using it. The success of this phase is measured by the lack of problems. However, the implementation is not finished. Work then begins on realizing the benefits of the new system. If problems are experienced during the O&M phase, mechanisms need to be in place to deal with them.

When problems arise there should be a suitable response mechanism which deals with them which everyone is aware of. This mechanism should be simple and provide a means for tracking progress in resolving the problem. When a problem is identified, it should be reported to the person vested with the responsibility of coordinating problem resolution. This will usually be the project manager. Initial investigation will reveal whether the problem is readily resolved, requires further investigation, or whether it is something that needs to be transferred to the vendor to deal with. Details about the problem are required. This will include a description of what was being done at the time the problem arose. The problem coordinator will establish who is going to deal with the problem and keep track of progress in resolving the problem. Readily resolved problems can be closed off quickly. The rest need to be monitored to ensure that they are being addressed properly.

EMPLOYEE RELOCATION AND RE-TRAINING

One problem the ERP implementation can present is what to do with the people whose jobs was made redundant by the ERP system. The ERP system will automate many of the business functions and many jobs in the organization will become redundant. Thus, the company should have a plan to re-locate those people whose jobs are taken over by the ERP system. However, the ERP systems will also create new job openings as they eliminate old ones. The complexity of today's ERP systems makes it necessary to have specialists to manage and maintain these tools. Today's systems need database administrators, system administrators, operations personnel, data entry operators, and so on. Hence the employees who have lost their jobs by the introduction of the ERP system can be given training and allotted to these jobs.

The development of new processes will result in the emergence of new job descriptions. Automation of manual tasks and the creation of new tasks make this inevitable. However, people tend to be resistant to change. Thus, human resource personnel need to be involved in the implementation at an early stage. The implications relating to changes in job descriptions need to be handled in an agreeable and friendly manner. Throughout, the benefits of what is being pursued should be promoted as well as the well-being of those affected. In organizations where change is a pervasive feature of life, this should not be a problem. In organizations where change is unknown, this has the potential to blow out of proportion. Handled carefully, everyone should emerge content.

CONTINUOUS TRAINING

We have seen the need for re-training of the employees for the proper functioning of the ERP system. However, there is a need for continuous training programs and refresher courses. New employees will be joining the company, and these employees should be properly trained in the basics of ERP and how to use the ERP system before they can be allotted to different departments. Thus there must be an induction, orientation, and training program that is conducted on a regular basis. It is pertinent that new employees undergo these programs before start they work as they will have an opportunity to imbibe the correct work culture and learn the correct work practices, so that they will be doing things in the correct way from day one.

Once the ERP system is introduced, the manner in which the companies conduct business will change. With the ERP systems, automation and new technologies will emerge. The company should make it a point to familiarize users with these technologies and find ways to motivate them to use these technologies. It is also a good idea to conduct refresher programs for the employees to reinforce the basics, correct working practices, and also to update them on the latest developments. Once a new module or a system upgrade is done, new capabilities and features become available and the employees should be trained on these new features so that they will be in a position to make the best use of them and their capabilities.

For example, most ERP systems have the facilities to send automatic notifications to managers regarding any issues as and when it arises. The company managers have the facility to see the details of the problems and then query the ERP database to analyze its implications. Therefore, the managers can communicate with their peers to resolve the issues as soon as possible. However for this to happen, the managers should make use of these technologies. One member abstaining from this process can delay the problem resolution. The company should therefore, have a plan to train and then motivate its employees to get the best out of the new features and facilities that are available to them.

Most systems can be configured to have an escalation mechanism—a mechanism that can escalate the issue to a higher authority if something does not happen within a specified period of time.

For example, the system could be configured to send a mail notification to the superior of a manager if that manager has not taken an action regarding an issue within a specified period. In such cases, senior managers should find out why the person is not using the technology and take the steps necessary to get him involved. Many people are apprehensive by the technology or are afraid to use it. These fears should be alleviated for the proper functioning of the ERP system and to get the maximum benefit from the system.

As we have seen, the success of an ERP system is not primarily dependent on the sophistication or features of the tools that are installed. It is the attitude and co-operation of the people—the users—that make the ERP systems capable of delivering the quality and productivity improvements that they are capable of.

REVIEW

Once the implementation is complete and the organization has started to use the system and has reached a stable state, a review of the system must be performed. The review provides an opportunity to learn from the implementation:

- Does the software do what is expected of it?
- What are the outstanding or emergent issues?
- What can be learned from the implementation?
- What could have been done better? How can this be used in the future?
- What timescale/budget is required to deal with the remaining issues?
- Has the implementation project been a success? This is particularly invaluable if there are successive phases involving the introduction of additional functionality.

The review should include eliciting feedback from users and managers. This feedback may reveal issues that can be readily addressed such as the provision of extra training or the modification of existing procedures.

OPERATION OF THE ERP SYSTEM

We have seen the post-implementation scenario of the ERP system. It is during the O&M phase that the ERP system delivers the full benefits that it is capable of. However, this will not happen instantly. Just because you have an excellent ERP system, a good tool, and have completed the implementation successfully you cannot assume that everything will go on smoothly and without any problems.

Here, one thing that should be noted is that the O&M phase of the ERP system is different from that of the software system(s). In the case of software, the operational phase commences when the system is turned over to the customer hence, the system is operational. The maintenance phase is implemented at the same time if the customer is paying the developing organization to maintain the system after delivery, i.e. for bug fixes, enhancements, modifications, etc. Otherwise, the system is considered 'turnkey' and all activity ceases when the system is delivered, i.e. the customer/buyer is on his own. In the case of the ERP system, the O&M phase starts once the system is implemented and the software development begins.

The O&M phase has to be carefully planned. During the O&M phase, the ERP sponsor should monitor the progress of the ERP system with the assistance of the ERP project manager. The ERP project manager is the most logical person to be entrusted the task of looking after the ERP system during the O&M phase. He has the experience, the knowledge and the contacts with the tool vendors and external

consultants, and he has worked closely with the 'ERP champions' in the organization. Appointing this person as the post-ERP implementation in-charge is a very good idea as things will be easier for him than for anyone else. There should be ERP teams (not end-users) who will assist the ERP post-implementation in-charge in the discharge of his duties. These people will do the various activities of the O&M phase like re-training, training of new employees, installing software upgrades, and so on.

The main objective of the O&M phase is to ensure that the ERP system achieves its projected benefits, the users are satisfied, and there are no conflicts. The organization of the ERP system and ERP team will depend on the nature of the organization. There can be a central ERP team or there can be independent ERP teams for each division. In either case, the ERP team members report directly or indirectly to the ERP project manager (now the post-implementation in-charge). The project manager will maintain close relationships with the other support departments like production, QA, testing, marketing, technical support, etc., so that he can coordinate the ERP-related activities. The main activities of the ERP project manager are ensuring that the ERP activities of the O&M phase are performed correctly, coordinating the ERP issues with the various departments, assessing the deficiencies in the system and correcting them, assessing the training needs of the existing and new users and giving them training, liaising with the top management giving the progress reports and mobilizing resources, etc.

Interdepartmental Coordination

As mentioned earlier, for the ERP system to function smoothly, the co-operation of all the departments is necessary. These departments might have conflicting interests. The marketing department might want the maximum number of features and release of the product at the earliest. The production team may not be able to incorporate all the features and complete the development as per the time schedule of the marketing team. The financial department might not want to give additional resources to a project, as there will be cost overruns. Managing these conflicting requirements is a very difficult task. The ERP project manager can act as a liaison between these departments and the company management and arrive at solutions that are satisfactory to all. For example, if the marketing team wants an early release of the product then some of the features could be assigned to the next release.

SWOT Analysis

The project manager (O&M phase) and the ERP team can assess the strengths, weaknesses, opportunities, and threats (SWOT) to the ERP system. The strengths should be reinforced so that they become ingrained into the organizational culture. The weaknesses should be rectified through appropriate corrective actions, so that the organization can be competitive. The opportunities and threats are identified at the strategic level by the management. But these should be converted into operational level tasks and be performed by the various departments in the organization. For example, the technical service department of an organization is finding it difficult to provide timely and quality service to the customers. This is a threat to the organization as customers will become dissatisfied and will move to another vendor. If the ERP team can create a help-desk of all the problems that have occurred in the past and how they were fixed, then the technical support team will be able to answer the customer queries quickly, if the help-desk has a previous instance of such a problem. If the help-desk is kept up-to-date by adding new problems and their solutions, over a period of time the efficiency of the technical support team will increase dramatically. Similarly many threats that affect the organization at the business level could be solved using the ERP activities as ERP keeps tracks of all the activities, changes, problems, and their solutions.

Documentation

During the implementation phase, the ERP plan is prepared and the ERP system is designed. During the course of the implementation, the plan will be revised and updated to reflect the changes that occurred during implementation. The ERP plan is the fundamental document for performing the ERP activities. It is the job of the O&M project manager to ensure that all the ERP team members and the members of the organization have access to the latest copy of the ERP plan.

During the training phase, the vendors and the external consultants will prepare user manuals, procedures, and best practices documents for training and reference. These documents and their latest versions also should be accessible to all users of the system. These documents could be hosted on the company intranet or on the Internet (in the case of distributed teams). The access to these documents could be restricted or controlled using user names and passwords.

Procedures and work instructions describe how tasks are carried out, the latter in more detail. The procedures and work instructions include process descriptions, roles and responsibilities, process flow, etc. The production of these documents is not a task for one person, but for those who define the processes. The process of producing this documentation commences during the ERP system design stage and develops through the implementation phase, at the end of which it is finalized. The procedures can be either in hard copy form or electronic form and can be posted on the company intranet or the company website. These procedures are actually part of the documentation control and should be revised following the appropriate change management procedures. Only the latest copy should be available for viewing.

Training

Training is a never-ending activity. One of the main tasks of the project manager or the ERP team is the training of new employees on the ERP concepts, tool usages, procedures, and best working practices. For this, the ERP team can conduct an induction program at regular intervals and ask project managers to send their new team members for training at the earliest possible time. Once the new employees are given the ERP training and told how ERP is practiced in the organization, they will do things the 'right way' from the beginning.

Continuous Monitoring

The ERP system automates most of the business functions of the organization. Nevertheless, there are many points where manual processes are retained and manual data entry is done. The ERP team should constantly monitor these activities to ensure that these activities—both manual and automatic—are performed correctly. The ERP plan and the ERP system should also be reviewed, audited, and updated periodically.

The O&M in-charge should find qualified auditors and reviewers so that the ERP system can be reviewed during the implementation stage and also during the O&M stages. The procedures and checklists for these reviews and audits should be developed and made available to the reviewers and auditors. The ERP database should be updated with the information regarding these reviews and audits.

ERP Database Management

The project manager or the ERP team should also ensure that the data migration has been done without any problems and the ERP database is up-to-date and not corrupted so that business functions can be executed flawlessly and decision-making features can be performed accurately. If the integrity

of the data in the ERP database is compromised, the information produced will be outdated, wrong, and useless. The status and business intelligent sub-systems are the eyes and ears of the organization and they depend heavily on the data in the ERP database. Therefore, the ERP team should make it their priority to ensure that the right information is provided to the right person at the right time. This will improve the quality of the decisions and make the organization more effective and efficient.

Customer Care

The real value of a good ERP system is realized during the O&M phase. The ERP system has all the information about that is happening in the organization like number of unprocessed orders, number of delayed shipments, number of customers who purchase more than twice a month, and so on. In other words, the ERP system contains a recording of all the significant activities and events that happened. The ERP database together with the help-desks, provide an environment where the customer care executives can answer customer queries quickly and resolve issues without delay.

Help-desks and Technical Support

Help-desks are repositories of the organizational knowledge that can be used by the maintenance and support team. The help-desk contains correct operating practices, problems with the software, how to solve them, details of problem reports and resolution, etc. When encountered with problem reports from customers, the maintenance team and support personnel can query the help-desk to see if a problem that is similar to or same as the current problem has occurred in the past. If there are past occurrences of similar or same problems, then the problem resolution will be quick. In order to get the maximum benefit from the help-desks they should be designed properly. They should contain all the details arranged and stored properly, so that it can be retrieved easily and intuitively. Many companies post frequently asked questions (FAQs) and their answers on their support websites and encourage users to first check the FAQ before calling the technical support. A well-organized and categorized FAQ can substantially reduce the workload of the technical support personnel. As new problems and their solutions get added to the help-desk, they will simultaneously get updated on the website too.

ERP MAINTENANCE PHASE

The ERP system needs regular maintenance in order to function properly. The ERP plan needs revision and updating as per the changing situations in the organization. We have already seen that the ERP system should be reviewed regularly. The review, comments, and suggestions should be incorporated into the system. Also the ERP system needs fine-tuning as the employees become familiar with it. Once the ERP system has reached a stable state, necessary actions should be taken to improve the performance. The ERP metrics that we have seen in the previous section could give an indication of whether the ERP system is functioning properly or not.

The ERP tools that are implemented are another area that needs maintenance. The project manager should be in regular contact with the vendors to see whether any upgrades or updates are available. All patches and upgrades should be installed to ensure that the tools are working at their maximum efficiency. Employees should be given refresher courses on the new functionality that gets added with each new upgrade. The training documentation should also be updated so that it is in sync with the procedures and processes.

According to Eric Kimberling, President and Founder of Panorama Consulting [1], the five ways to reduce ERP maintenance and support costs are:

1. **Negotiate lower software license fees.** Annual maintenance fees are usually a percentage of the software costs. Thus, negotiating for a lower price for the ERP software is a means to reduce the maintenance cost. This will also reduce the initial ERP investment.
2. **Limit software customization during ERP system implementation.** Customizations are costly—to implement maintain, and upgrade. Thus, the best way to reduce costs is to minimize customization. However, this is not as easy as it sounds. You can reduce customization by choosing an ERP package that best matches your business practices. The practices that are different have to be changed or the package has to be customized. Which option to choose is a decision the implementation team has to take in consultation with the consultants, vendor representatives, and end-users. As far as possible, avoid drastic customizations as they can prove very costly a few years down the road and after a couple of software upgrades.
3. **Explore third-party support and maintenance options.** One of the main revenue streams of the ERP vendors is the annual maintenance fees which we have seen can be anywhere from 20 to 33% of the initial implementation costs. However, there are many third-party companies that offer maintenance and support at much lower costs. Explore these options before signing the expensive AMC with the ERP vendors.
4. **Negotiate lower ongoing professional service rates.** Try to bring as much of the tasks and costs including travel and professional fees inside the scope of the AMC. Then other than the AMC you do not have to pay much to the vendors. Most vendors charge addition hourly rates and travel expenses for the professionals who come to attend the service calls and for upgrading the software. If you cannot make them part of the AMC, then negotiate for lower rates or consider third-part options.
5. **Quantify your total direct and indirect maintenance and support costs.** Keep track of your ERP maintenance and support expenses and make sure that they are well within the budget. If there are any extra expenses that can stretch the budget or exceed it, then those expenses should be investigated and necessary corrective actions should be taken.

SUMMARY

We have seen how to operate and maintain the ERP system after it has been successfully implemented. The proper maintenance needs careful planning on the part of the ERP team and adherence to the best practices by the users of the system. We also saw how to maintain and keep the ERP system in top shape. For the successful O&M of the ERP system, the support and sponsorship of the top management is absolutely necessary.

REVIEW QUESTIONS

1. An enterprise system is not a project; it is a way of life. Discuss.
2. What do you mean by employee relocation and re-training? What is its importance?
3. Why continuous training is required in the O&M phase?
4. What do you mean by an escalation mechanism?
5. What is the difference between the O&M phase of the ERP systems and other software systems?
6. What do you mean by product documentation?
7. What are the problems with an outdated or corrupted ERP database?
8. How is the real value of the ERP system realized during the O&M phase?
9. What happens during the ERP maintenance phase?
10. When should the company decide to go in for a new ERP system?

11. What is the need for conducting a review after completing the implementation?
12. What are the lessons that can be learned from the post-implementation review?
13. What are the objectives of the O&M phase?
14. What do you mean by interdepartmental coordination and what is its importance?
15. What do you mean by SWOT analysis and why it should be performed in the O&M phase?
16. What is the importance of documentation? How is it performed?
17. Why is training said to be a never-ending activity?
18. Why is continuous monitoring of the system important?
19. How do ERP systems help to improve customer service?
20. What are the tasks involved in ERP database management?
21. What are help desks and how do they improve the efficiency of technical support?
22. What are the ways to reduce ERP maintenance and support costs?

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Chapter 40

Measuring the Performance of the ERP System

INTRODUCTION

Measurements enable us to gain insight into the process and the project by providing a mechanism for objective evaluation. Lord Kevin once said "… when you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of a science…"

Measurement programs often go astray and fail to reach full success because of misconceptions and differences in expectations about the benefits to be realized as a result of a measurement exercise.

Measurement can be applied to find out the success of an ERP implementation. It should be done to verify continuously that the organization is moving forward in the right direction, while using the ERP system. It is a tool for ensuring that the system's performance and employees' efficiency are improving. It is necessary for the management to make sure that the system is delivering all the benefits that it was supposed to deliver like productivity improvement, error reduction, and reduced response time and so on.

The reasons that organizations should measure the performance of the ERP system at regular intervals after implementation are:

- To characterize in an effort to gain an understanding of processes, products, resources, environments, and to establish baselines for the organization
- To evaluate and determine status with respect to plans
- To improve by identifying road blocks, root causes, and other inefficiencies

Measurement is a management tool. If conducted properly it provides the management with practical insights. It assists the management in making decisions that will be beneficial for the organization.

Today's success is no guarantee of tomorrows'. Therefore, continuous improvement through constant monitoring and course corrections is a must for survival. In order to do this, and to know that an organization is performing well and is moving in the right direction, we need metrics. Metrics when measured correctly and used judiciously can be used for performance improvement and also to predict problems before they become serious. This performance measurement is a must.

ERP performance studies are undertaken by organizations to know the effectiveness or benefit of ERP. Evaluation is an important step that helps in analyzing the contribution of ERP to an organization. However, this process of assessment itself poses many problems. Normally, organizations have the tendency to perform this process in a professional manner so that it would yield results. They tend to lose focus as the whole process gets into action. It is geared with great enthusiasm, but confusions develop and mar things.

USE METRICS TO MEASURE SUCCESS

The success of an ERP project cannot be judged on the basis of anecdotal evidence. Measuring its effectiveness and the improvement it has provided establishes Return on Investment (ROI), justifies costs, and lays the foundation for a continuous improvement model. But the goal of measurement is not to measure; rather, it is to improve performance and processes are the point at which this can be best accomplished. The contemporary state of measurement has been described as:

- A proliferation of measures that are hard to interpret
- An unreasonable amount of effort for data collection
- Fraught with long delays
- Yielding little correlation between goals and measures
- Emphasizing financial measures unrelated to operational realities

The results of a recent study underscored the proposition that ERP systems support business processes and the measurable success of these systems is dependent on the continuous examination and improvement of those processes. Metrics are the evidence upon which success can best be judged.

For a metric to be of any use to an organization, it needs to measure one of the three different aspects of a process: cycle time, cost, or first pass yield (the percent of acceptable products produced during one cycle). All three metrics types are required to provide balanced improvement to a process. Metrics must also demonstrate all of the following characteristics, without which they are apt to be dismissed or worse, perpetuate a disinclination to evaluate performance:

1. Accurately expresses the phenomenon being measured
2. Objective and not subject to dispute
3. Comprehensible, readily communicated and understood
4. Inexpensive and convenient to compute
5. Timely with data sources readily available
6. Harmless, not inducing inappropriate behavior

HOW TO MEASURE?

As we have seen, there are some criteria involved in measuring the performance of ERP. Before going into specifics it is imperative to know the basis on which performance measurement is to be made. There are innumerable means of evaluating ERP performance. Each of them has their own advantages and disadvantages. There is no hard and fast rule as far as the appropriate method to be used is concerned. However, the organizations must decide and stick to one particular method, which must be put in use uniformly.

It is usually recommended to execute it midway through the ERP implementation. The next appraisal shall take place when the process is nearing completion. After ERP begins to operate the assessment shall take place within the time gap of 3, 6, and 12 months. These appraisals must be done on the basis of some set criteria. If these steps are not followed then the likelihood of the ERP's success is limited. The frequency of assessment depends on many factors such as the volume of business, ability to adapt to change, and the characteristic features of the software that is in use. The performance assessment will not serve the purpose if these determinants are not taken into account. Besides, any other measure deemed to result in the benefit of ERP should be accounted for.

Organizational Chart

The first step in the evaluation process is to draw up an organizational chart. The chart will help in identifying 'what is what and who is who' in the organization. The aim behind drawing this chart is to give a pictorial representation of the company. This representation will explain the organizational structure of the company in terms of materials and manpower. This chart will serve as a guideline with respect to seeing how things are moving about in the organization. It also helps to analyze the mistakes committed in due course of time. This forms the foundation of ERP performance evaluation.

Suitability in Relation to Business Mode

The performance assessment should not be a general process. It should be designed specially to suit the particular business that the firm engages in. Only then it will cater to the measurements properly; otherwise the assessment will be indifferent to the firm's modality of operation. ERP evaluation should use this as a guideline or framework to get results.

Accurate Quantification to Facilitate Correct Measure

The performance should be measured in terms of numeric variables; only then can the results be easily comprehended and become fit for analysis. These variables have to be meaningful and realistic so that it serves the purpose. They should be capable of being marked by a scale of ratings. Only then it is possible to comment on what has been achieved figuratively, otherwise things lag behind. There is a reason behind advocating this. Any study becomes authentic only when it is empirically supported by facts and figures. Hence, the assessment process will become valid and useful only if such statements support it. If the firm follows the trends and standards with the industry it will be helpful for studying the results and comparing the same with the competitors. This will help in increasing the benefit of ERP.

Account from all Relevant Sources

The records have to be collected from reliable sources. These records will help in devising a measure for the performance appraisal system. If a customary measure is arrived at, it will be helpful in finding out the extent of ERP's efficiency. It will be possible to suggest alternatives to increase the efficiency and provide ways and means to overcome the deficiency. ERP evaluation should play a constructive role in this

Perform Frequent Reviews during Operation

The modalities for measuring ERP in the postimplementation areas have been so far discussed. The real challenge lies in measuring ERP once it starts functioning in the organization. This requires things to be handled methodically since the results are detrimental on the ERP process. The method should focus more on calculating what the firm gains from ERP in connection with the money investment. The assessment should focus on the following issues:

- How has it contributed to perform vital function in an easy and convincing manner, which was otherwise and formally regarded as very tough?
- What is their level of comfort and state of expertise in making use of ERP software?
- How has it facilitated in correspondence within the organization?

Some experts also advocate the use of statistical tools to gather this information because it becomes practically difficult to obtain them at one stroke.

Solve Employee Problems and Clear their Mindsets

If there is a misunderstanding among the employees that the metrics are collected to judge their efficiency in dealing and using the ERP system, it could defeat the very objective of having the measurements. In such circumstances, the employees often tend to blow up issues beyond proportion in a positive manner or negative manner in order to stay in the good books of the employer. They do not understand the fact that this process is meant to test the efficiency of the software and more so aimed at increasing their comfort level with the software. Unless this is communicated clearly the employers will continue to give a rosy picture about the workings of the software. This will neither help to identify the defects of the software nor help in tackling the employees' problems with the software.

Classifying Measurement Areas

As stated earlier the measurement has to be constant in all the required areas. However, the degree of detail might differ in practice between one or more areas. In fact, the assessment process takes place quickly and within some areas whereas it tends to be tedious in certain other areas. Whatever be the case, companies need to constantly modify business processes so that it becomes ERP friendly. Moreover, the inherent flaws in the business process should be identified and removed because the ERP system will not function at its maximum potential unless the business processes are the best. The ERP system is not meant to restructure or modify the business process.

IMPORTANCE OF MEASURING PERFORMANCE

Many companies get everything done at the right time with regards to ERP right from software selection to customization, to training and implementation. They take all measures to provide the necessary impetus and invest in huge volumes even if it is pinching monetarily. They are more particular about the benefits and are hence unmindful of the costs and investments. What happens thereafter is something to be worried about and corrected. After going all the way and that too in the right manner, companies do not bother to review the working pattern of ERP. Unless they understand this it is not possible to achieve the benefit of ERP.

Companies wrongly mistake that the proper implementation of ERP is a guarantee to its success, whereas it is not so. Proper implementation facilitates efficient performance subject to the fulfillment of the imposed conditions. This is the major flaw that underplays the performance of ERP. The validity of any process has to be constantly monitored and amended if necessary, so as to ensure proper discharge of the assigned functions. Since this does not take place in the case of ERP, due to the popular myth, performance measurement is neglected. ERP evaluation aims to correct all the mistakes in addition to this.

There are a couple of other reasons associated with this myth. One issue is the lackadaisical attitude shown by the top managerial cadre in the organization with regards to implementing ERP. The organizational politics also have a vital role in this problem. Some questions that will be raised in this context will be:

- Who will be responsible for the performance measurement?
- Who takes the blame on account of failure?
- Who takes credit for success?

A lot of controversies arise due to these inhibitions. This also accounts for the failure to measure ERP. There might also be endless arguments among personnel in the organization, which might disrupt the performance process.

METRICS

You have implemented and are operating the ERP system. But how will you know that the ERP system is delivering the promised improvements. More importantly how will you know that the ERP system is helping in improving your software development process? You should measure the various parameters of the system. If you do not measure your current performance and use the data to improve your future work estimates, those estimates will just be guesses. Because today's current data becomes tomorrow's historical data, it is never too late to start recording key information about your project. You cannot track project status meaningfully unless you know the actual effort and time spent on each task compared to your plans. You cannot sensibly decide whether your product is stable enough to ship unless you are tracking the rates at which your team is finding and fixing defects. You cannot quantify how well your new development processes are working without some measure of your current performance and a baseline to compare against.

Metrics help you better control your software projects and learn more about the way your ERP system and organization works. As time goes on and people become more comfortable with the system, the performance should improve. You will be able to find this out only if you have measured the various parameters from the beginning. If the metrics reveal that the performance is not improving, then the management should investigate the reasons and take the necessary corrective actions.

It is very difficult to measure things like increased customer satisfaction, improvement in employee morale, improvement of order fulfillment, etc. These are intangible benefits that require conversion to quantifiable measures to create accurate, meaningful and useful information. That is where the metrics come into play. For example, dividing the number of satisfied customers by the total number of customers gives a quantifiable measure of customer satisfaction. These metrics when viewed over time provide a meaningful measure of the organization's performance. For example, if this week's customer satisfaction ratio is less than last week's, then it means that the customer care department is encountering some problem, which can be investigated and corrected. The following are some of the ERP related parameters that you can measure:

- Productivity improvements
- Reduction in inventory costs
- Reduction in material wastage
- Personnel reduction
- Other management improvements
- Financial close cycle reduction
- IT cost reduction
- Procurement cost reduction
- Cash management improvements
- Revenue/profit increases
- Transportation/logistics cost reduction
- Maintenance reductions
- On-time delivery improvements

The above list is by no means an exhaustive one. It is just a representative list of what can be measured. You should decide what more should be measured depending on the nature of your organization and projects.

Metrics are the lifeblood of a high-performance organization. The best companies use them for competitive advantage. They can provide significant benefits as an organization works to improve

its overall level of productivity, efficiency, and competitiveness. However, like everything else this could also be misused creating more problems than they solve. Some techniques to avoid this from happening are:

- Use common sense and organizational sensitivity when interpreting metric data
- Provide regular feedback to the individuals and teams who collect measures and metrics
- Do not use metrics to appraise individuals
- Work with the employees and teams to set clear goals and metrics that will be used to achieve them
- Never user metrics to point fingers or to threaten individuals or teams
- Metrics data that include a problem area should not be considered 'negative'; these data are merely an indicator for process improvements
- Do not obsess on a single metric to the exclusion of other important ones

TYPES OF METRICS

There are two types of metrics that can be measured—barometric and diagnostic. Barometric metrics are appropriate in every business. They tell you if some problem is approaching and they will warn you about an impending disaster. But they do not necessarily tell you what the cause is; they only point you in the right direction. The barometric measures should be maintained even when performance level is sustained for many months. The reason these metrics continue to exist is for audit purposes—understanding things are still under control.

Diagnostic metrics can change from business to business. These metrics are driven from root cause, seeking, and focusing on areas of weakness in a specific situation. Environment, skills, process variation—these things are different in different companies and therefore will require different metrics. That is why they are referred to as diagnostic measures. These measures correspond to the ERP business model plus the two topics of quality and safety. The following list gives some of the ERP diagnostic metrics.

- Business plan—Accuracy of the monthly profit plan of the business by product family. If the facility is a cost center, the accuracy of the budget becomes the base for accuracy
- Demand plan (forecast)—Accuracy of the monthly demand forecast by product family
- Operations plan—Accuracy of the monthly capacity plan by product family
- Master schedule—Accuracy of the weekly detailed schedule by line
- Material plan—Percent of orders that are released with full lead time to suppliers. This is measured to the current lead time field in the item master
- Schedule stability—Percent of orders that have completion dates revised within the fixed period time fence
- Inventory location balance accuracy—Percent of location balances that are perfect
- Bill of material (BOM) accuracy—Percent of BOMs that are perfect
- Item master file accuracy—Accuracy percentage of other item master fields that come up during the initial assessment of ERP weaknesses. This can include routing records, lead time records, cost standards, etc
- Procurement process accuracy—Percent of complete orders that are received from suppliers on the day (or hour) currently scheduled in the ERP business system
- Shop floor control accuracy—Percent of complete internal orders that are completed on the day (or hour) currently scheduled in the ERP business system

- First-time quality—Percent of units that make it through a process without exception handling, movement, rework or rejection
- Safety—Lost time accidents actual compared to plan. Minimum acceptable is company objective plus improving
- Customer service—Percent of complete orders that ship to the customer on the original promise date

There is a multitude of metrics that would be found in a high-performance business. The preceding list only represents the barometric measures. These will be the same in every business, from plastics to automobiles, from paint to capital equipment manufacturing. Organizations require these metrics to be at minimum levels of proficiency. These levels should not be misconstrued with high performance. The key to getting the value from metrics is really not the metric itself or even the collection of data. The real value comes from the action driven from the data.

BUSINESS PERFORMANCE MANAGEMENT

Business performance management (BPM) is a set of management and analytic processes that enable the management of an organization's performance to achieve one or more preselected goals. Business performance management is contained within approaches to business process management. Business performance management has three main activities:

1. Selection of goals
2. Consolidation of measurement information relevant to an organization's progress against these goals
3. Interventions made by managers in light of this information with a view to improving future performance against these goals

Although presented here sequentially, typically all three activities will run concurrently, with interventions by managers affecting the choice of goals, the measurement information monitored, and the activities being undertaken by the organization.

BPM is the area of Business Intelligence (BI) involved with monitoring and managing an organization's performance, according to Key Performance Indicators (KPIs) such as revenue, Return On Investment (ROI), overhead, and operational costs. Historically used within finance departments, BPM software is now designed to be used enterprise-wide, often as a complement to business intelligence systems. BPM software includes forecasting, budgeting, and planning functions, as well as graphical scorecards and dashboards to display and deliver corporate information. A BPM interface usually displays figures for key performance indicators so that employees can track individual and project performance relative to corporate goals and strategies. Some companies use established management methodologies with their BPM systems, such as balanced scorecard or Six Sigma. BPM tools ensure that the organization's goals and objectives are consistently being followed in an effective and efficient manner. The three main steps of BPM are:

1. **Data collection** – Includes the collection of both internal and external data, its organization, and storage
2. **Data analysis** – In this step, patterns are identified from the data and reports are generated for the use of the management
3. **Data application** – The information obtained by analyzing the data is used to lead the organization towards its goals and objectives

BPM is the application of fundamentally sound business management practices enhanced by timely and accurate information in order to effectively communicate, comprehend, and control the performance of an organization. BPM solutions bridge the gap between strategy and execution in several ways:

- **Improves Communication** – BPM provides executives an effective mechanism for communicating strategy and expectations to managers and staff at all levels of the organization via planning models and performance metrics tied to corporate goals and objectives
- **Improves Collaboration** – BPM also fosters a two-way exchange of ideas and information, both vertically between levels within an organization and horizontally among departments and groups which manage a shared activity
- **Improves Control** – BPM enables staff to continuously adjust plans and fix or improve operations in a timely manner by providing them with up-to-date information about market conditions and the status of operational processes
- **Improves Coordination** – BPM improves coordination among business units and functional groups that otherwise might act as independent fiefdoms, hoarding rather than sharing resources, and information

When implemented properly, the benefits of BPM are profuse and diffuse. Organizations are better able to exploit market opportunities as they arise and catch operational problems before they escalate out of control. They become more effective, more competitive, and more interesting places in which to work.

As we have seen, a properly implemented BPM bridges the gap between the long-term strategies and day-to-day operations by aligning business measures with critical success factors identified by the management. When BI and BA tools are integrated with BPM activities, organizations are able to generate a set of **KPIs (Key Performance Indicators)** designed to indicate where the company stands and where it should be in order to remain competitive and ahead of the competition.

Key Performance Indicators (KPIs)

A **KPI** is a business metric used to evaluate factors that are crucial to the success of an organization. KPIs differ from one organization to the other; business KPIs may be net revenue or a customer loyalty metric, while government might consider unemployment rates. KPIs are applied in BI to gauge business trends and advise tactical courses of action. Before KPIs can be identified, the following requirements must be met:

- A predefined organizational process
- Clear business objectives for the process
- Quantitative and qualitative measurements
- An active approach to finding and remedying enterprise variances

KPIs are above all else, a set of indicators to measure data against, a sort of enterprise success gauge. Ultimately, they help an organization assess progress toward declared goals. Indicators include quantitative metrics such as process tracking and progress measurement.

The term metric refers to measurements of business activity. But in a performance management system, we want to do more than just measure business activity; we want to measure performance aligned with business strategy. To distinguish between run-of-the-mill metrics and strategically aligned metrics, experts use the term key performance indicator, or KPI. The only difference between a metric and a KPI is that a KPI embodies a strategic objective and measures performance against a

goal. The goals attached to a KPI are multidimensional: they have ranges that are encoded in software, a time frame by which the goals must be achieved, and a benchmark against which the goals are compared. The elements of a KPI are:

- Strategy – KPI involves a strategic objective
- Targets – KPIs measure performance against specific targets. Targets are defined in strategic, planning or budgeting sessions and can take different forms like achievement, reduction, absolute, zero, etc.
- Ranges – Targets have ranges of performance like above, on, or below target
- Timeframes – Targets are assigned timeframes by which they must be completed. A timeframe is often divided into smaller intervals to provide performance milestones
- Benchmarks – Targets are measured against a baseline or benchmark. The previous quarter's results often serve as a benchmark, but external benchmarks like industry average can also be used

The goals associated with KPIs are known as targets because they specify a measurable outcome rather than a conceptual destination. Ideally, executives, managers, and workers collectively set targets during strategic, planning, or budget discussions. Such collaboration ensures buy-in and more accurate targets. Targets can also be set by a KPI team charged with translating strategic objectives into a performance plan.

Balanced Scorecard

Balance Scorecard (BSC) is one of the most popular BPM applications. It is a strategy performance management tool—a semi-standard structured report, supported by proven design methods, and automation tools, which can be used by managers to keep track of the execution of activities by the staff within their control and to monitor the consequences arising from these actions.

BSC is used to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. It was originated by Drs. Robert Kaplan and David Norton as a performance measurement framework that added strategic nonfinancial performance measures to traditional financial metrics to give managers and executives a more 'balanced' view of organizational performance.

BSC provides a framework that not only provides performance measurements, but helps planners identify what should be done and measured. It enables executives to truly execute their strategies. This new approach to strategic management was first detailed in a series of articles and books by Drs. Kaplan and Norton. The BSC approach provides a clear prescription as to what companies should measure in order to 'balance' the financial perspective. The balanced scorecard is a management system (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve center of an enterprise. The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect data and analyze it relative to each of these perspectives:

- **The Learning & Growth Perspective** – Learning and growth constitute the essential foundation for success of any knowledge-worker organization. This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. The question asked here is "What should we learn to grow and prosper?" The measurements include employee training, retention, skills, morale, etc.

- **The Business Process Perspective** – This perspective refers to internal business processes. The organization should ask "What are the processes in which we can excel and beat the competition?" This perspective promotes innovation, quality, and efficiency. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements
- **The Customer Perspective** – The increasing customer focus and realization of the importance of customer satisfaction form the basis of this perspective. If customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good
- **The Financial Perspective** – This perspective includes the traditional metrics that measure financial performance. The objective of this perspective is to find out the financial health, profitability, growth, and shareholder value

Figure 40.1 shows the Balance Scorecard Framework, which is adapted from the book **The Balance Scorecard** by Dr. Robert S. Kaplan and Dr. David P. Norton and published by Harvard Business Review Press in 1996.

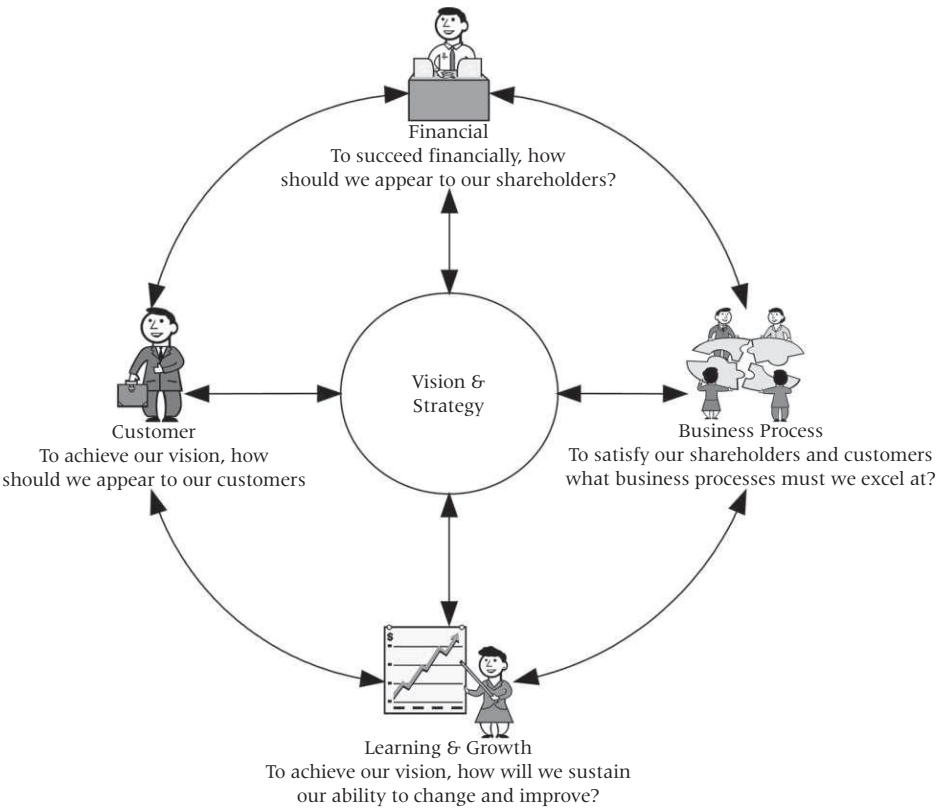

Figure 40.1 Balanced scorecard framework.

Using the Balance Scorecard

Balanced Scorecards, when developed as strategic planning and management systems, can help align an organization behind a shared vision of success, and get people working on the right things and focusing on results. A scorecard is more than a way of keeping score; it is a system, consisting of people, strategy, processes, and technology.

At one extreme, a measurement-based balanced scorecard is simply a performance measurement framework for grouping existing measures into categories, and displaying the measures graphically, usually as a dashboard. The measures in these systems are usually operational, not strategic, and are used primarily to track production, program operations and service delivery (input, output, and process measures).

At the other extreme, the balanced scorecard is a robust organization-wide strategic planning, management and communications system. These are strategy-based systems that align the work people do with organization vision and strategy, communicate strategic intent throughout the organization and to external stakeholders, and provide a basis for better aligning strategic objectives with resources. In strategy-based scorecard systems, strategic and operational performance measures (outcomes, outputs, process, and inputs) are only one of several important components, and the measures are used to better inform decision making at all levels in the organization. In strategy-based systems, accomplishments and results are the main focus, based on good strategy executed well. A planning and management scorecard system uses strategic and operational performance information to measure and evaluate how well the organization is performing with financial and customer results, operational efficiency, and organization capacity building.

The following steps will help you in creating a BSC that you can use to measure performance and plan business strategies.

1. Identify your vision, mission, goal, and objectives. In this step you will determine where you want your organization to be, what goals it should achieve, etc.
2. Identify the strategies to achieve your goal and objectives
3. Define perspectives. This means that you have to ask what you should do to do well in each perspective
4. Identify the Critical Success Factors or CSFs. Quantify the results that you want to achieve like when, how much, how, at what cost, etc.
5. Set up measuring mechanisms. Create mechanism that will measure the CSFs so that you can monitor that everything is going according to the plan. Ensure that the right things are measured and in the right and unbiased way
6. Analyze the measurements and create action plans, plan execution, measurement, reporting, monitoring, etc.
7. Follow up by monitoring, correcting, measuring, and ensuring that things are going as planned

Advantages of Balanced Scorecard

- Balanced Scorecard presents organizational goals in a single page chart broken down into relatable areas
- Balanced Scorecard allows companies to bridge the gap between mission statements or overarching goals and how day to day activities support the company's mission or objectives. A BSC goal of pleasing the customer can be tied to improving technical support performance according to the Service Level Agreement or exceeding the SLA

- BSC raises innovation and process improvement methods such as Six Sigma and lean manufacturing to a corporate goal. It also ensures that voice of the customer is equally important
- Balanced Scorecard does not exclude other methods of business reporting or process improvement
- Balanced Scorecards can provide a visual means of demonstrating how different goals are related. Increased sales improve the profit or sales goals under the financial section. Improved customer service meets the 'voice of the customer' goal
- Balanced Scorecards are straightforward enough to be used by many managers after gaining familiarity with the concept. Advanced training isn't required to implement a simple version of BSC

Limitations of Balanced Scorecard

- There are many different elements that go into creating a balanced scorecard. Once the scorecard is created, the nature of your business can change over time, requiring you to change the scorecard
- Balanced scorecard largely ignores developments of the external business environment. It selectively focuses on shareholders and customers and fails to consider the activities of competitors and interest groups such as suppliers
- Implementing a balanced scorecard system (or any new system) can cost a lot of money in training time and additional dollars for any consultants that are needed during the process
- The balanced scorecard acts as a fact sheet, but it requires that you analyze the facts and come up with an evaluation and a strategy. The scorecard will not solve all of the company's problems and it must be combined with a larger overall strategy to achieve its potential benefits
- Although the balanced scorecard is praised for balancing financial and nonfinancial metrics, it has nonetheless been criticized for being solely focused on balanced information. Thus, if the scorecard fails to include financial and nonfinancial objectives, it loses its value as a strategic tool
- As the key drivers of the organization changes, the balanced scorecard must be continuously updated to reflect such changes. This requires time, resources and labor which could act as a limitation for smaller organizations
- Balanced Scorecard does not include direct financial analysis of economic value or risk management
- Goal selection under Balanced Scorecard does not automatically include opportunity cost calculations
- Overly abstract Balanced Scorecard goals are easy to reach but hard to quantify

SUMMARY

Measurements enable us to gain insight into the process and the project by providing a mechanism for objective evaluation. Measurement programs often go astray and fail to reach full success because of misconceptions and differences in expectations about the benefits to be realized as a result of a measurement exercise.

Measurement can be applied to find out the success of an ERP implementation. It should be done to verify continuously that the organization is moving forward in the right direction while using the ERP system. It is a tool for ensuring that the system's performance and employees' efficiency are improving. It is necessary for the management to make sure that the system is delivering all the

benefits that it was supposed to deliver such as productivity improvement, error reduction, reduced response time, and so on. In this chapter we have seen the importance of measuring the performance of ERP systems and how the measurement is done.

REVIEW QUESTIONS

1. Measurements enable us to gain insight into the process and the project by providing a mechanism for objective evaluation. Discuss.
2. Why are measurement programs important?
3. What are the reasons that organizations should measure the performance of the ERP system at regular intervals after its implementation?
4. How do we use metrics to measure success?
5. Explain the importance of measuring performance.
6. Explain metrics in detail with examples.
7. What are the factors that should be considered while performing reviews during an operation?
8. Why accurate quantification and account from all sources is required for correct measurements?
9. How can we clear the mindsets of employees by solving their problems?
10. What are the uses of metrics?
11. How will you measure intangible benefits?
12. List some of the parameters that can be measured?
13. How do you measure performance?
14. What are the steps to safeguard the metrics?
15. What are metrics and what are the different types of metrics?
16. Give a list of ERP diagnostic metrics.
17. What is business performance management?
18. What are the main activities in BPM?
19. What are the main steps of BPM?
20. How does BPM solution bridge the gap between strategy and execution?
21. What are key performance indicators?
22. What are the elements of a KPI?
23. How are KPIs different from metrics?
24. What is balanced scorecard and what is it used for?
25. What are the four perspectives through which BSC views organization?
26. How does one use the BSC?
27. What are the advantages of BSC?
28. What are the limitations of BSC?

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Chapter 41

Maximizing the ERP System

INTRODUCTION

Enterprise Resource Planning (ERP) systems if chosen judiciously, implemented correctly, and used properly, can produce dramatic improvements in productivity and efficiency and can make the organization more competitive. But there are many ways to maximize the capabilities of the ERP system. In this chapter we discuss some of those techniques.

As we have seen, ERP systems can produce positive ROI and capitalize on high profile delivered functionality such as automated workflow and employee self-service when implemented as part of a comprehensive business process optimization program that includes:

- A realistic strategic plan that clearly defines the future state
- Project goals aligned with those of the organization
- A mandate and sufficient time to develop and implement processes that are efficient and designed to take advantage of delivered software functionality
- Management of the resulting change to the organization and its people

When examining ERP projects that have failed to meet expectations, it becomes evident that many organizations share a similar experience. It is characterized as a cycle of declining expectations as shown in Fig. 41.1.

When users remain silent on disappointing outcomes, they become resigned to accepting ERP systems as a disappointing, but still a necessary cost of doing business. To break this cycle, an organization must develop and execute a plan that addresses the entire scope of the project's objectives and manage the impact on the organization's human capital. Organizations can realize the benefits anticipated from an ERP system by improving its capabilities.

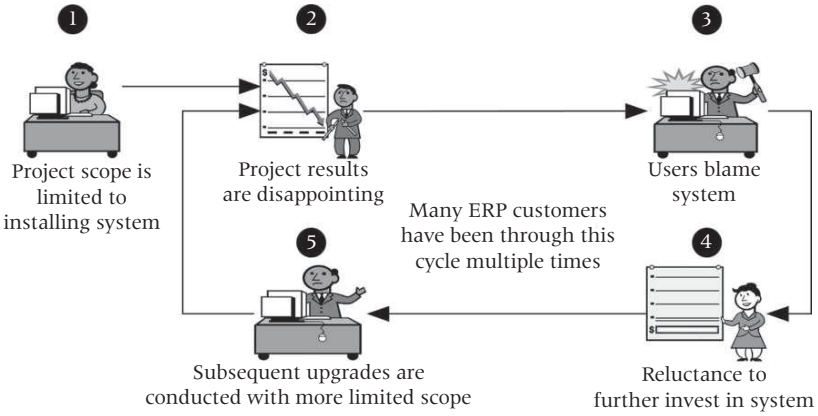

Figure 41.1 Cycle of declining expectations.

BUSINESS ANAYTICS, REPORTING, AND INTELLIGENCE

Business analytics and business intelligence tools are being integrated into ERP systems in order to facilitate better, accurate, and quicker decision-making. Companies have realized that to maximize the value of the information stored in their ERP systems it is necessary to extend these ERP architectures to include more advanced reporting, and analytical and decision support capabilities. This is best accomplished through the application of data warehousing, data mining, OnLine Analytical Processing (OLAP), and other analysis, reporting and business intelligence tools and techniques.

This integration of information tools with the ERP package provides a comprehensive information delivery solution. ERP system cannot meet all of the analytical and reporting needs of an organization for a variety of reasons including:

- The requirement to integrate information not contained in the ERP systems
- ERP databases and files have been designed to optimize performance for getting data into the applications and therefore, lack the constructs required for multidimensional analysis
- Most ERP solutions lack the advanced functionality of today's leading reporting and analytical tools; for those ERP systems that have this functionality, companies are hesitant to use it because of the performance impact on their operational (online) systems

Many ERP solution providers are providing enhanced data extraction functionality as an integral component of their analytic reporting application solutions. Further, we see an explosion in the number of companies focused on delivering information extraction functionality optimized for specific ERP solution. There are a number of unique challenges associated with this information integration. The good news is that effectively implemented, such a system can significantly extend the value of the ERP to the organization.

Fine-tuning the ERP system

By themselves, ERP systems serve an important function by integrating separate business functions—materials management, product planning, sales, distribution, financials, and others—into a single application. As we have seen in the previous section, ERP systems have three significant limitations. First, managers cannot generate custom reports or queries without help from a programmer. This inhibits managers from obtaining information quickly so that they can act on it for competitive advantage. In addition, this can also create a backlog for IT. Second, ERP systems provide current status only, such as open orders. Managers often need to look past the current status to find trends and patterns that aid decision-making. Third, the data in the ERP application is not integrated with other enterprise or division systems and does not include external intelligence.

You can overcome these limitations by adding a data warehouse and a business intelligence front end to your ERP system. Just as ERP fine-tunes resource planning and management, business intelligence for ERP fine-tunes ERP. A data warehouse or data mart organizes ERP data so that it is easily accessible for online analysis. Business intelligence systems improve business competitiveness by providing reporting and analysis tools to the desktop, enabling communication with the entire supply chain via the Web and automating alerts and actions.

Flexible Reporting and Analysis

Operational reports from the ERP system show recent events, but they do not satisfy managers' requirements for planned versus actual monitoring, forecasting, and exception analysis. Without business intelligence, managers must compile these reports manually from standard reports. By

Table 41.1 ERP reports can be of use to numerous departments

Department	Uses for daily orders reports
Order	Which products have not shipped by their expected ship date?
Marketing	What types of products are selling best and worst? Which customers are most profitable? Which customers have made purchases that meet the criteria for a thank-you note?
Sales	Did any customers purchase a product that requires another product?

allowing flexible reporting and analysis, a business intelligence system can unlock the value of the data in ERP reports. The information in the ERP daily orders report for example, can be of use to numerous departments, as shown in **Table 41.1.**

Business intelligence systems provide OnLine Analytical Processing (OLAP) and data mining tools that managers can use from the desktops to answer the types of questions listed in Table 41.1 and to discover significant trends and patterns. For example, analysts can drill down to obtain progressively more detailed information about retail sales, change metrics, view graphs and charts, reuse reports, create 'what-if' analyses, and generate best-case and worst-case scenarios.

Valuable in its own right, ERP information becomes even more valuable when it is combined with information from other sources. A business intelligence system allows this, as well. For example, a marketing manager might want to combine sales information from the ERP system with consumer demographics from A. C. Nielsen or business demographics from Dun & Bradstreet. With this information, the company can better segment its customers and improve customer relationship management. An automobile manufacturer for instance, can combine its internal ERP data with external databases to identify customers likely to be receptive to advertisements for a sports car, sedan, van, or sports vehicle. Similarly, a pharmaceutical company can integrate its ERP information with sales and prescription information from pharmacies and doctors to better target its advertising. Similarly, the purchasing department of a computer manufacturer might combine its ERP data with external data about sales forecasts for microprocessors. With this information, purchasing can react to rising demand by consolidating all memory purchases to obtain a better price from a single supplier. In another example, a sales organization could combine the data from its ERP system with that of its Sales Force Automation (SFA) system. With the combined information, sales analysts, and sales engineers can create special promotions for overstocks and supply up-to-date product availability to the sales force at the point of sale.

Closing the Loop

Businesses can optimize their investment in ERP systems by closing the loop between the business intelligence system and the ERP system. The loop begins when the company discovers valuable business information from the ERP system; it closes when the company feeds those discoveries back into the ERP system to continually improve business processes. For example, an online business can use the business intelligence system to discover each customer's purchasing patterns and then update the operational system with recommended products. The next time the customer visits the site the operational system would tailor the Web page to feature products the customer would be likely to purchase.

Automatic Alerts and Actions

Business intelligence systems for ERP can also issue alerts when certain events occur or thresholds are met, enabling your business to react more quickly to problems and opportunities. For example, if a certain number of customers return a product for the same reason, the system can automatically alert engineering, manufacturing, customer service and send a letter to customers to apologize and offer a replacement or a reduced price on an enhanced product. Similarly, a customer service manager might want the system to generate a thank-you note to all customers who purchase a product and suggest the customer also purchase a warranty.

Thus, by integrating information from disparate company functions, ERP systems are a gold mine of valuable business intelligence. Unfortunately, ERP reports generally provide only a fraction of the useful information in the system. Data warehousing and business intelligence unlock the power of ERP systems by providing managers with simple, on-demand online analysis and push reporting; the ability to combine ERP information with external data; and alerts, actions, and automated responses.

EXTEND THE POWER OF ERP USING INTERNET

The ultimate value from the ERP investment results from the integration of the ERP system not only with a business intelligence front end, but also with the Internet. When you provide a Web-based interface to the information in the business intelligence system, the Internet becomes an enterprise information utility for employees, partners, suppliers, and customers.

A popular early application for integrating ERP business intelligence with the Internet is supply chain management. All participants—engineering and product design, vendors and suppliers, manufacturing, sales and marketing, distributors, and customers—can gain access to business intelligence when they need it for their mutual benefit. Consider a national hardware store chain: the retailer can use its business intelligence system to adjust its charges for shelf space and to better manage inventory levels. A tool supplier can take advantage of point-of-sale (POS) information to monitor purchasing trends as they occur and adjust manufacturing before an overrun or underrun occurs. The supplier in turn, can share the information with its suppliers. Product designers, both for manufacturing and service companies, can capture customer information in real time, refine their products for greater market appeal, or even customize them for key customers. In a financial services company, a product designer can capture information about customers' investment habits, using data mining tools to develop new investment packages. By adding a Web-based interface to your ERP business intelligence, you can integrate the supply chain, speeding time to market, and gaining manufacturing efficiencies.

TRAINING AND LEARNING

One of the biggest complaints of many enterprises in the market for performance improvement or company-wide learning products is that vendors often push technology before other more immediate concerns such as, what will happen if my knowledge workers forget some key step and require assistance? Who will provide it and if no one does, what does that do to learning capabilities, and productivity levels within my organization? Every forward thinking enterprise values productivity, which is one of the first things to suffer when technological systems are not end-user-friendly. Finding a compatible vendor, one who provides efficient, cost-effective, real time learning, and support without unnecessary bells and whistles, is essential if organizations are to maximize the return on investment for learning.

When organizations are implementing new enterprise-wide technologies, untrained users may end up needing three to six times as much support as end-users who have been trained. In addition, the calls to the help-desk that are generated due to a lack of learning, equates to loss of money. Lack of proper training and education can result in loss of productivity, as the untrained person will either get help from the help-desk or from a coworker. This will either increase the help-desk workload or affect the productivity of the person who is disturbed by the untrained person.

So training and education plays a significant role in maximizing the productivity of the ERP systems. The training should include formal as well as informal methods. Formal methods include classroom training on ERP basics and how to use the system properly. The informal training can include self-learning mechanisms like online help, computer-assisted training, documentation, Web-based training, and so on. Also the employees who are using the system should be given frequent refresher courses, so that they are up-to-date with the latest developments and to reinforce the best practices.

We need to remind ourselves that untrained users simply do not take advantage of the system for the intent that it was purchased. Organizations are challenged from the standpoint of getting their return on investment from an ERP system because their end-users are not trained properly. So, proper training and education and frequent retraining is one of the most important aspects for maximizing the ERP system.

SUMMARY

Almost all technology today is focused on compressing to zero the amount of time it takes to acquire and use information, to learn, to make decisions, to initiate action, to deploy resources, and to innovate. When action and response are simultaneous, we are in real time. Imagine the competitive edge you could gain by compressing time-to-market, increasing the speed of innovation, streamlining manufacturing, and personalizing customer relationships at every point of contact. The strategy is 'market velocity,' and it requires the ability to discover and act on important business intelligence in real time. Today, real time business has finally become cost-effective because of the convergence of Enterprise Resource Planning (ERP) applications, business intelligence, and the Internet.

REVIEW QUESTIONS

1. What are the guidelines for business process optimization that will improve the efficiency of the ERP system?
2. Explain the cycle of declining expectations with the help of a diagram.
3. How does the integration of business analytics and business intelligence tools to the ERP system facilitates better, accurate, and quicker decision-making?
4. What are the applications that are integrated with the ERP system to improve the decision-making and reporting facilities?
5. Why an ERP system cannot meet all the analytical and reporting needs of an organization?
6. How do you fine-tune the ERP system?
7. How can overcome the limitations of ERP?
8. What are data warehouses and data marts?
9. How ERP enables flexible reporting and analysis?
10. Give some examples of how ERP information becomes more valuable when it is combined with information from other sources.
11. Businesses can optimize their investment in ERP systems by closing the loop between the business intelligence system and the ERP system. Explain

12. How do automatic alerts and actions help in improving the efficiency of the ERP system?
13. How Internet extends the power of ERP?
14. How training, education, and learning play a significant role in maximizing the productivity of the ERP system?

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Part V

The Business Modules

- Business Modules of an ERP Package
- Financials
- Manufacturing (Production)
- Human Resources Management
- Plant Maintenance
- Materials Management
- Quality Management
- Marketing
- Sales, Distribution, and Service

Chapter 42

Business Modules of an ERP Package

INTRODUCTION

What is business? It is not just buildings, machinery, or money. Business is people—not only people who voluntarily come together because they can do much more working together than they could work alone, but also people who do work on their own as entrepreneurs. Business can then be defined as the activities of individuals or groups who are involved in developing, producing, and distributing the goods and services needed to satisfy other people's needs.

Business uses resources to produce goods and services. These resources are land, labor, and capital. These three resources become productive when combined in a rational way for some creative or gainful purpose. This is the function of the fourth resource—entrepreneurship or management. Entrepreneurs or managers combine resources like land, labor, and capital in different ways to produce goods or services (see Fig. 42.1). So, it is the function of the management to plan effectively and efficiently the resources available to the enterprise. The Enterprise Resource Planning (ERP) systems help the management by making the planning process more productive and efficient.

All ERP packages contain many modules (see Fig. 42.2). The number and features of the modules varies with the ERP package. In this chapter we will see some of the most common modules available

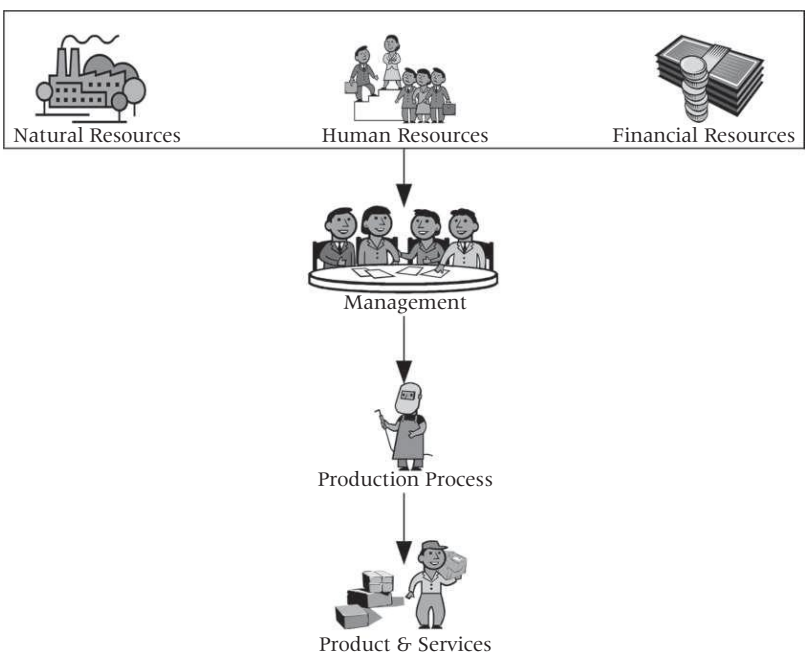

Figure 42.1 Management combines the business's resources to produce goods and services.

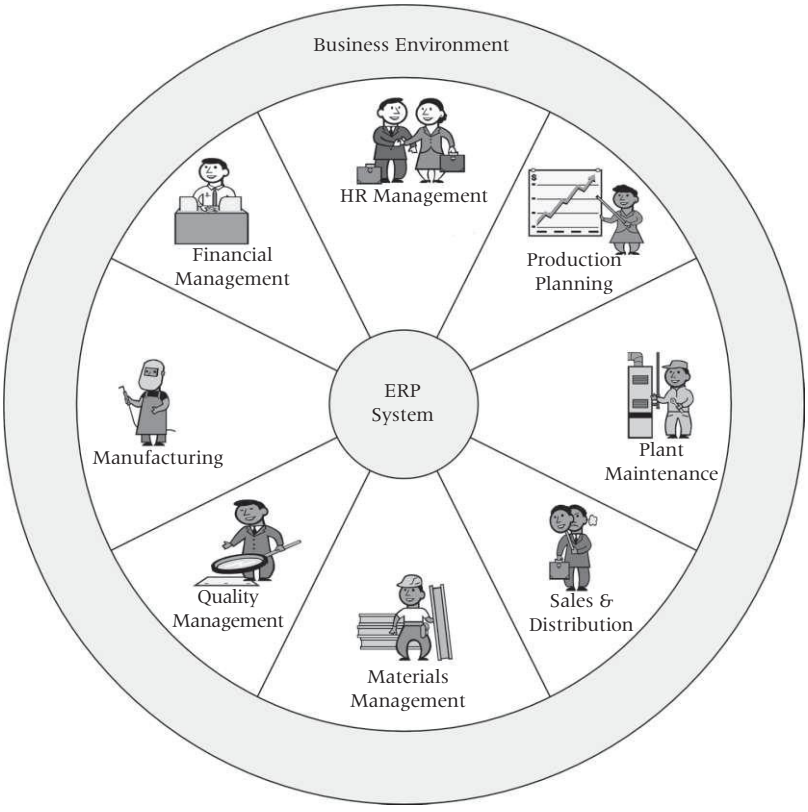

Figure 42.2 ERP system.

in almost all packages. They are finance, manufacturing and production planning, sales and distribution, plant maintenance, quality management, materials management, and so on. This is by no means a comprehensive list. Some packages will have a subset of this and some will have more modules and/or features. For detailed information, you will have to consult the product literature of the specific ERP system.

Computerized systems existed for the different business modules even before the pre-ERP era. But what makes ERP different and capable of producing dramatic results is the integration and automation of the various business functions. Rather than functioning in isolation catering to the needs of their own departments, the different modules in an ERP system are integrated. They send and receive data across departmental barriers. Another feature that improves productivity and reduces response and reaction times is the automation of the various procedures and tasks. Most of the tasks, which were done manually in the pre-ERP era, are now automated. So, a task that involved the coordination of two or three departments would take days in a non-ERP environment. But with the procedure automation and module integration, the same task will be completed within minutes and that too just by an action initiated by a single person (which triggers a lot of other processes in many different modules).

This is explained in the following situation. Suppose a company receives a purchase order. In the non-ERP situation, the order entry clerk will enter the order details. These order details are then passed on to the finished goods inventory section, where the inventory clerk will check whether the items ordered are available or not. If the items are available, the distribution department is notified

and they will pack the items and send it to the customer. The accounts department is also notified, where the invoice/bill will be prepared and sent to the customer. If the item is not in stock, then the production-planning department is notified, which in turn schedules the item for production. The manufacturing or the production department receives the production plan and checks whether all the items required to make the item are in the inventory. If not, the purchasing department is notified and the procedures for purchasing the raw material are set into motion. If the materials are available, then the production department in association with the plant maintenance department sets up the machines for production. Some machines may be under repair and the production might get delayed.

However in an ERP system, these same activities will happen differently. The way the same order processing, production, and distribution happen in an ERP system is shown in Fig. 42.3. As soon as the order entry clerk enters the order into the system, the system checks the inventory records and finds out whether the items are available or not. If the items are available, procedures are triggered automatically that will inform the people in the sales and distribution department and finance department. The information will contain the details of the items to be shipped, the most economic route to the customer and so on. Also the system will trigger the procedures in the financial module so that the invoices are sent to the customer. The information is transferred electronically (that is if the customer is connected to the supplier) through Electronic Data Transfer (EDT) and the payments are received electronically through Electronic Funds Transfer (EFT). If the items are not available, then the production-planning module makes a production schedule which is made available to the production, materials management, and plant maintenance modules. This prepares everybody to start production as per the schedule. The materials requirement planning is done and any item that is not in stock is ordered and

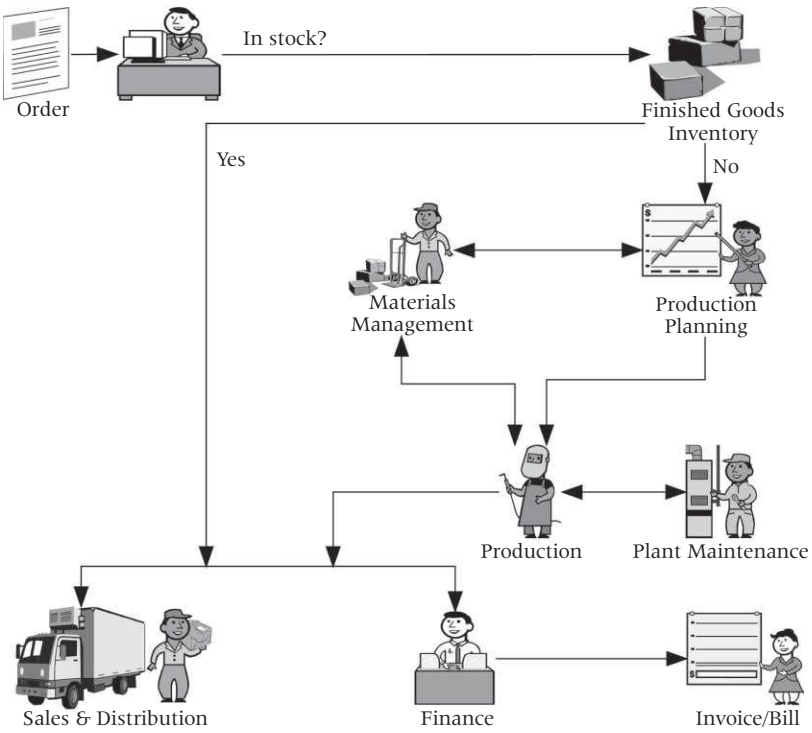

Figure 42.3 Order processing in an ERP system.

if the supplier is connected to the company's system the ordering and the associated processes happen electronically. The plant maintenance gets the list of machines required and ensures that all of them are available. In this way, the production of the item goes through without any hitches. Thus, an order entered into the ERP system by the order entry clerk triggers many procedures and automatically performs a host of functions. All these processes take only a few minutes to complete.

Once the order is received, within a very short period of time the goods are on its way to the customer. If the goods are not readily available, the customer is informed about it and is given the delivery schedule. Thus, other that the order entry clerk and the people in the distribution, production, and maintenance departments, all the other tasks are done by the system and that too automatically. In a non-ERP environment, these tasks could take days or even weeks to complete. Since the ERP system stores all the data in a central database and all the modules update the database on a real time basis, the information available in the database is current up-to-the minute. This integration of the different business functions and the automation of the business processes and the availability of information (which is accurate and current) is what make the ERP systems capable of producing dramatic improvements in productivity and profitability.

FUNCTIONAL MODULES OF ERP SOFTWARE

ERP software is made up of many software modules. Each ERP software module mimics a major functional area of an organization. Common ERP modules include modules for finance, manufacturing, production planning, human resources, plant maintenance, materials management, quality management, marketing, sales and distribution, purchasing, inventory control, product distribution, order tracking, finance, accounting, marketing, and HR. Organizations often selectively implement the ERP modules that are both economically and technically feasible. Some of these modules are as follows.

- **Financial module**—Both for-profit organizations and nonprofit organizations benefit from the implementation of the ERP financial module. This module is the core of many ERP software systems. It gathers financial data from various functional departments and generates valuable financial reports such as the balance sheet, general ledger, trial balance, and quarterly financial statements.
- **Manufacturing module**—This module enables an enterprise to marry technology with business processes to create an integrated solution. It provides the information based upon which the entire operation should be run. It contains the necessary business rules to manage the entire supply chain process whether within a facility, between facilities, or across the entire supply chain. It provides the freedom to change manufacturing and planning methods, as needs change. The manufacturing modules of most ERP vendors do not limit businesses to a single manufacturing method, such as make-to-stock or make-to-order. Instead, many manufacturing and planning methods can be combined within the same operation, with unlimited flexibility to choose the best method—or combination of methods—for each product at each stage throughout its life cycle.
- **HR module**—HR (Human Resources) is another widely implemented ERP module. The HR module streamlines the management of human resources and human capitals. HR modules routinely maintain a complete employee database including contact information, salary details, attendance, performance evaluation, and promotion of all employees. An advanced HR module is integrated with knowledge management systems to optimally utilize the expertise of all employees.

- **Materials management module**—This module facilitates the process of maintaining the appropriate level of stock in a warehouse. Inventory control involves identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances, and reporting inventory status. Integration of the inventory control module with sales, purchase, and finance modules allows ERP systems to generate vigilant executive level reports.
- **Production planning module**—In the process of evolution of Manufacturing Requirements Planning (MRP) II into ERP, while vendors have developed more robust software for production planning, consulting firms have accumulated vast knowledge of implementing production-planning modules. Production planning optimizes the utilization of manufacturing capacity, parts, components, and material resources using historical production data and sales forecasting.
- **Plant maintenance module**—Plant maintenance provides you with technical and business reports and various presentation options, according to the criteria used: for example, organizational unit, location, execution period for the tasks, or system manufacturer. This information helps you to reduce the duration and costs of plant downtimes as a result of damage and to recognize possible weak points within your technical system in good time. It also forms the basis for defining an optimum maintenance strategy.
- **Purchasing module**—This module streamlines procurement of required raw materials. It automates the processes of identifying potential suppliers, negotiating price, awarding purchase orders to the supplier, and the billing processes. The purchase module is tightly integrated with the inventory control and production-planning modules. It is often also integrated with supply chain management software.
- **Marketing module**—An ERP marketing module supports lead generation, direct mailing campaign, and more.
- **Sales, distribution, and service module**—Revenues from sales are the life-blood for commercial organizations. The sales module implements functions of order placement, order scheduling, shipping, and invoicing. It is closely integrated with the organizations e-commerce websites. Many ERP vendors offer online store front as part of the sales module.

In the next eight chapters we will see some of the main ERP modules in greater detail.

INTEGRATION OF ERP, SUPPLY CHAIN, AND CUSTOMER RELATIONSHIP APPLICATIONS

The initial ERP systems were standalone systems that contained modules like those mentioned in the previous section. Slowly, technologies like CRM, SCM, PLM, business intelligence, etc. began to be interfaced with the ERP systems to improve the competitiveness, efficiency, and effectiveness of the ERP systems. But these used to be software products from third-party vendors that had interfaces with the ERP system. As competition grew, ERP vendors started offering these technologies as part of their ERP offerings (see Fig. 42.4).

SAP, the ERP market leader offers SAP 360 Customer (Customer Relationship Management), SAP ERP Product Lifecycle Management, SAP ERP Supply Chain Management, SAP ERP Human Capital Management, and SAP ERP Supplier Relationship Management along with SAP ERP. QAD offers Supply Chain, Customer Management, Analytics, and Interoperability along with the QAD Enterprise Applications. Similarly, almost all the major ERP vendors offer a host of technologies that improve the performance of the organization to their ERP offerings.

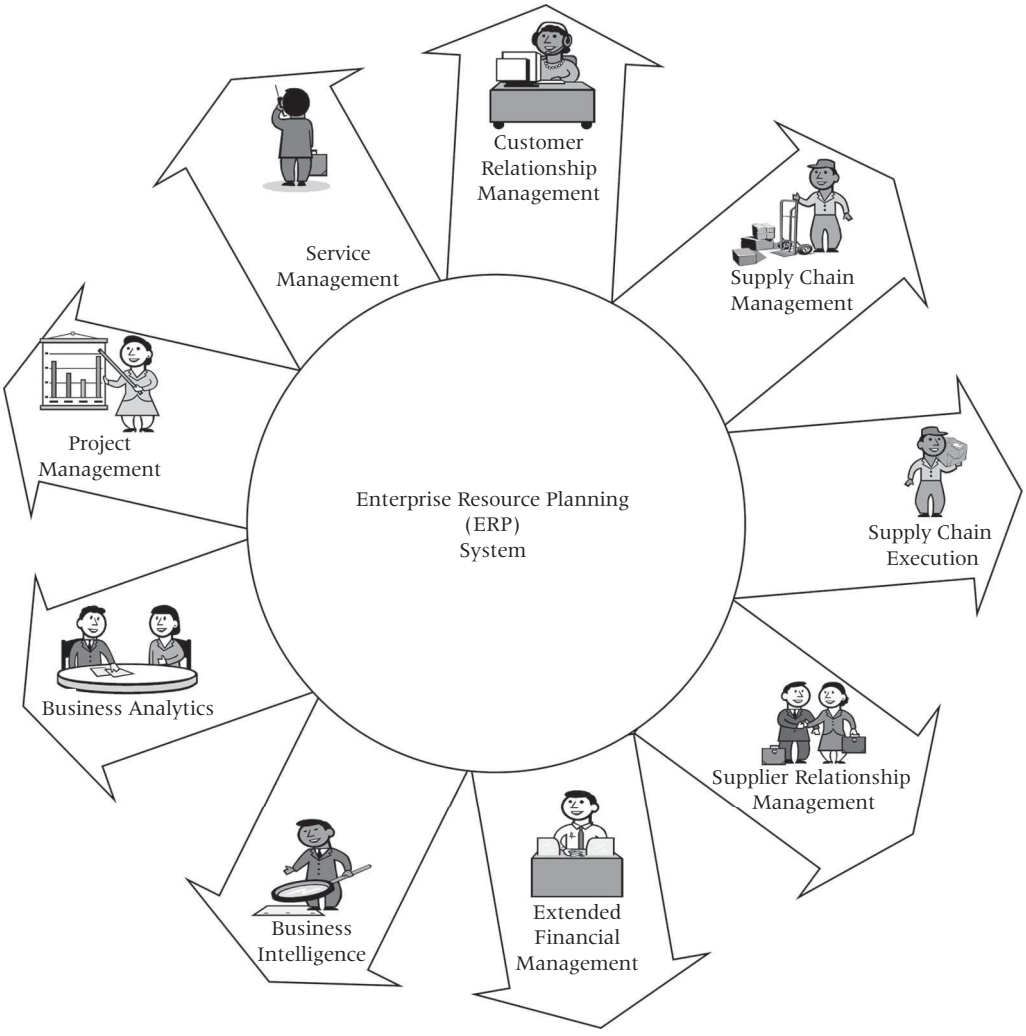

Figure 42.4 Supply chain integration.

SUMMARY

All ERP packages contain many modules. The number and features of the modules varies with the ERP package. Computerized systems existed for the different business modules even before the pre-ERP era. But what makes ERP different and capable of producing dramatic results is the integration and automation of the various business functions. Rather than functioning in isolation and catering only to the needs of their own departments, the different modules in an ERP system are integrated. They send and receive data across departmental barriers.

ERP software is made up of many software modules. Each ERP software module mimics a major functional area of an organization. Common ERP modules include modules for finance, manufacturing, production planning, human resources, plant maintenance, materials management, quality management, marketing, sales and distribution, purchasing, inventory control, product distribution, order tracking, finance, accounting, marketing, and HR.

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REVIEW QUESTIONS

1. Explain the role of management in running a business with a diagram.
2. How ERP system is different from old computerized information systems?
3. Explain the automation of business processes achieved by ERP systems with an example.
4. What are the different functional modules of an ERP system?
5. Explain the functions, subsystems, and features of the financial module.
6. Explain the functions, subsystems, and features of the manufacturing module.
7. Explain the functions, subsystems, and features of the HR module.
8. Explain the functions, subsystems, and features of the materials management module.
9. Explain the functions, subsystems, and features of the production planning module.
10. Explain the functions, subsystems, and features of the plant maintenance module.
11. Explain the functions, subsystems, and features of the quality module.
12. Explain the functions, subsystems, and features of the purchasing module.
13. Explain the functions, subsystems, and features of the marketing module.
14. Explain the functions, subsystems, and features of the sales and distribution module.
15. Explain the integration of ERP, supply chain, and customer relationship applications with the help of a neat sketch.

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Chapter 43

Financials

INTRODUCTION

All people and businesses have practically unlimited wants and needs that call for money. Yet individuals and businesses—regardless of size—have limited funds to spend on those needs. As a result, **financial management**, the business function involved in effectively raising and using funds, is required.

The entire concept of information technology is based on the premise that providing the right information to the right people at the right time can make a critical difference to the organization. Much of this key information could be taken from the **financial data**. But merely having financial data is not enough. You need a set of processes and views of your data that provide up-to-the-minute financial information in exactly the form you need it to make that critical difference, to help with that crucial decision. Accounting software needs access to information in each area of your organization, from R & D and market research through manufacturing, distribution, and sales. Your financial solution must provide management with information that can be leveraged for strategic decisions in order to achieve competitive advantage.

This chapter provides an overview of the financial solutions in most of the ERP packages. In today's business enterprise, you need to know that your financial decisions are based on today's data, not numbers from records closed a month ago, or even a week ago. And you need to know that this same 'today's' data represents every segment of your organization's activities, whether your enterprise stretches across a room or around the globe. This is essential, because the most efficient way to get your enterprise to where you want it tomorrow is to know exactly where it is today.

Whatever the financial goals of your organization may be, the financial application components of the ERP solutions work hand-in-hand to improve the bottom-line. This is true because the financial functionality is tightly integrated across all business areas and in all geographic areas. This tight integration includes all the other different modules, from materials management to human resources to logistics. Because the ERP system automatically links related areas, it eliminates the need to repeat procedures. You enter your data only once. Within the ERP system all areas work in concert, creating a new level of efficiency in handling your financial data.

The objectives of the Financials module are to streamline and automate the organization's financial operations while ensuring regulatory compliance and gaining real-time insight into overall performance. This module helps to:

- Improve forecasting and planning accuracy
- Enhance your core financial capabilities and generate accurate reports in real time
- Capture processes from different applications—for a single version of financial truth
- Reduce Cost Of Goods Sold (COGS) and maximize profitability
- Make management accounting information available through role-based portals
- Collect, assign, and analyze costs by project, order, cost center, or business process
- Evaluate the profitability of markets, channels, products, and customer segments
- Proactively plan for and manage global business performance, profit, and growth
- Ensure compliance with IFRSS and GAAP regulations
- Integrate accounts payable and receivables, fixed assets, and other subledgers

- Generate balanced and reconcilable financial statements
- Integrate financial close processes with centralized scheduling
- Allocate costs to different business segments through document splitting
- Reduce the cost and complexity of parallel accounting and multiple sets of books
- Analyze customer behavior and sales to quickly identify and seize new opportunities
- Support both local- and group-level statutory reporting standards
- Evaluate and respond to changing business conditions with accurate, timely financial data
- Report, analyze, and allocate cash in real time
- Deploy a long-term solution for financial management processes
- Operate in multiple geographies, industries, and languages—all consolidated in real time

The finance modules of most ERP systems provide financial functionality and analysis support to thousands of businesses in many countries across the globe. Besides financial application components these ERP systems also include human resources, logistics, business workflow and links to the Internet. Hundreds of business processes are covered in these systems. The finance modules of most ERP systems will have the following subsystems:

- **Financial Accounting** (General Ledger, Accounts Receivable/Payable, Special Ledgers, Fixed Asset Accounting, Legal Consolidation)
- **Investment Management** (Investment Planning/Budgeting/Controlling, Depreciation Forecast/Simulation/Calculation)
- **Controlling** (Overhead Cost Controlling, Activity-based Costing, Product Cost Accounting, Profitability Analysis)
- **Treasury** (Cash Management, Treasury Management, Market Risk Management, Funds Management)
- **Enterprise Controlling** (Executive Information System, Business Planning and Budgeting, Profit Center Accounting)

Financial Accounting

The objective of a good financial accounting system is company-wide control and integration of financial information that is essential to strategic decision-making. The financial accounting module of an ERP system gives you the ability to centrally track financial accounting data within an international framework of multiple companies, languages, currencies, and charts of accounts (see Fig. 43.1). For example, when raw materials move from inventory into manufacturing, the system reduces quantity values in inventory and simultaneously subtracts values for inventory accounts in the balance sheet. Most financial accounting modules comply with international accounting standards such as GAAP and IAS. They also fulfill the local legal requirements of many countries.

General Ledger

The General Ledger (GL) is essential both to the financial accounting system and to strategic decision-making. Through active integration with business processes in logistics and in the accounting subledgers, the GL serves as a central pool of financial data for financial reporting as well as for other accounting areas. However, the origin of centrally stored data can still be traced at any time by drilling down on data from a given transaction.

The general ledger supports all the functions needed in a financial accounting system. This includes flexible structuring of the chart of accounts at group and company level, distributed application scenarios, real-time simultaneous update of subledgers and the general ledger, elimination of

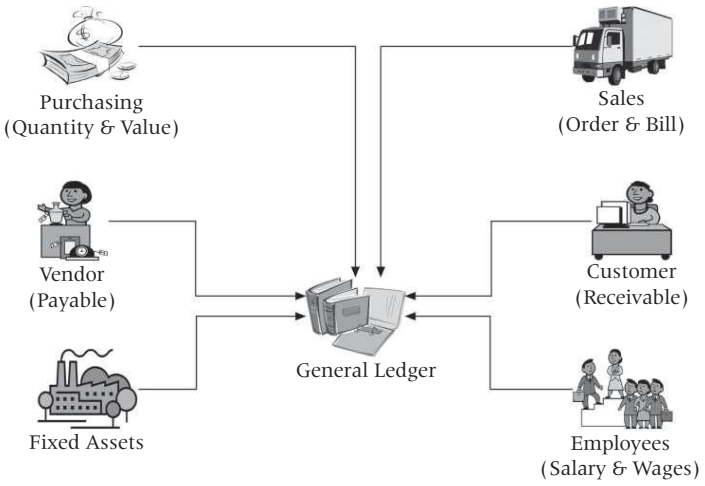

Figure 43.1 The financial module components.

time-consuming reconciliation, and parallel views of data in both the general ledger and managerial accounting applications. The GL provides document parking, posting, reporting, and an integrated financial calendar for automating periodic activities. The system also provides summary information from other components at a user-defined level of detail. By creating combinations of entered data, you generate data summaries that can be used in planning, allocation, distribution and reporting.

The GL will usually have features that allow you to take advantage of more functions in general ledger and in cost center accounting. For example, you can create your own database tables and define non-standard fields to suit specialized accounting or reporting requirements. Some ERP systems support features like the option of grouping data selectively and then updating it in ledgers you define, provision for parallel charts of account and currencies, planning, and allocation tools, direct data entry in special purpose ledgers for adjustment postings, user-defined reporting, etc.

Accounts Receivable and Payable

ERP systems offer a financial overview of global business partner relationships in the accounts receivable and payable functions. These subledgers are integrated both with the general ledger and with areas in sales and distribution and materials management, where financial data originates. Accounts receivable and payable transactions are performed automatically when related processes take place in other modules. This module uses standard business rules for procedures ranging from data entry and reporting to processing payments and bank transactions. Accounts receivable and payable functions include Internet integration, document management, and full support for EDI processing including automatic integration with cash management, and flexible reporting using customer and vendor information systems. The module also provides enterprise-wide credit management with workflow integration, payment automation with EFT and check processing and document parking with various approval procedures.

Asset Accounting

Asset accounting manages the company's fixed assets. Within the financial accounting system, asset accounting serves as a sub-ledger to the general ledger, providing detailed information on asset related transactions. Significant features include country-specific charts of depreciation complying

with local legal requirements, full support throughout the asset life cycle from acquisition to retirement, depreciation simulation and interest calculation, and integration with project management and order accounting for management of capital assets. Asset accounting also provides integration with plant maintenance for management of machinery and equipment, management of leased assets and assets under construction, mass processing with workflow integration and interactive reporting.

Legal Consolidation

Consolidated financial statements need to be integrated effectively with operational data at the individual company level. Using different valuation methods, you can plan balance sheet strategies to suit the company requirements. The legal consolidation subsystem is closely linked to the financial accounting system; permitting direct data transfer from individual statements into the consolidated report. This eases the workload of your staff and reduces data entry errors. In addition to the consolidated statements required by law, legal consolidation also allows you to create multiple views of your consolidation data. With these views you can generate reports about legal entities or segments of your business.

Controlling

The controlling system gathers the functions required for effective internal cost accounting. It offers a versatile information system with standard reports and analysis paths for the most common questions. In addition, there are features for creating custom reports to supplement standard reports.

Overhead Cost Controlling

Many organizations experience a significant increase in the percentage of indirect costs, which cannot be directly assigned to the products manufactured, or services rendered. While cost monitoring and optimization may be quite advanced in production areas, transparency is often lacking in overhead cost areas. The overhead cost controlling subsystem focuses on monitoring and allocation of the overheads.

Cost Center Accounting

Cost center accounting analyzes where overhead occurs within the organization. Costs are assigned to the sub-areas of the organization where they originated. The system offers a wide variety of methods for allocating posted amounts and quantities. In particular, activity accounting permits the allocation of great many costs to products based on cost sources enabling assignments, which were not previously possible.

Overhead Orders

Overhead orders subsystem collects and analyzes costs based on individual internal measures. This system can monitor and automatically check budgets assigned to each measure.

Activity-based Costing

The goals of the entire organization should come before the goals of individual departments when it comes to business process reengineering. The activity-based costing module is a response to the growing need for monitoring and control of cross-departmental business processes in addition to functions and products. Seeing costs from a new perspective substantially enhances organizational transparency in overhead areas. The system automatically determines the utilization of business processes by products, customers, and other cost objects based on the cost drivers taken from the

integrated accounting environment. This significantly reduces the effort involved in maintaining a business process model in a separate system.

Product Cost Controlling

The product cost controlling module determines the costs arising from manufacturing a product or providing a service. Plan and standard values serve in valuating warehouse stock and for contrasting revenues received with costs. In addition, the values in product cost controlling are crucial for determining the lowest price limit for which a product is profitable. Simulations illustrate the effects of changes in production methods on the cost of goods manufactured.

Cost Object Controlling

Cost object controlling helps you monitor manufacturing orders. Integration with the logistics components results in a logistical quantity flow that provides instant information on actual cost object costs, allowing ongoing costing calculations at any time. Follow-up calculations determine and analyze the variances between actual manufacturing costs and the plan costs resulting from product cost planning.

Profitability Analysis

The profitability analysis subsystem examines the sources of returns. As part of controlling sales, profitability analysis is the last step in cost-based settlement where revenues are assigned to costs according to market segment. You can define any market segment—distinguishing for example, between products, customers, orders, sales organizations, distribution channels, and business areas—and evaluate it according to contribution and revenue margins. Information from profitability analysis frames important decisions in areas such as determining prices, selecting customers, developing conditions, and choosing distribution channels.

Investment Management

Investment management provides extensive support for investment processes from planning through settlement. Investment management facilitates investment planning and budgeting at a level higher than specific orders or projects. You can define an investment program hierarchy using any criteria for example, by department. As a result of subsequently assigning the specific investment measures (internal orders or projects) to positions in the hierarchy, you are kept up-to-date about available funds, planned costs, and actual costs already incurred from internal and external activities. The investment program allows you to distribute budgets, which are used during the capital spending process. The system helps you monitor and thereby avoid budget overruns.

Investment management provides tools enabling you to plan and manage your capital spending projects starting at their earliest stages. In the initial stage of the capital spending process you enter the application for the spending project as an appropriation request. You define your own evaluation and approval process during which the system keeps a detailed history of the status of the appropriation request. You transfer the data from the appropriation request to the investment measure when the request is approved for implementation. You enter detailed plan values in the appropriation request and its different variants, for use in the pre-investment analysis.

Depending on their complexity investment measures that need to be monitored individually can be represented either as internal orders or projects. These internal orders or projects provide the means for actually carrying out the capital investment; i.e., they serve as the objects for collecting primary and secondary costs, for calculating overhead and interest, for managing down payments and

commitments, and for handling other related tasks. As the result of having an asset under construction assigned to it, the investment measure also benefits from the overall required asset accounting functions. Settlement is both flexible and almost fully automatic. This kind of settlement ensures complete integration with business planning and control and provides consistently up-to-date values. The investment management module recognizes the importance of the asset accounting aspects of investment measures. The system automatically separates costs requiring capitalization from those that are not capitalized, debiting the correct costs to the asset under construction. For different accounting needs the system can use different capitalization rules for making this split. At its completion the investment measure can be settled to various receivers by line item. Asset accounting provides precise proof of origin for all transactions affecting acquisition and production costs.

Budgeted balance sheets and cost planning are always based on current values. Planned depreciation values for investment measures and appropriation requests can be transferred directly to ongoing overhead cost planning. The system recalculates expected depreciation amounts whenever planning data is updated.

Treasury Module

You can gain a significant competitive advantage by efficiently managing your short, medium and long-term payment flows, and the resulting risk exposure. Tasks such as short-term monitoring and concentration of bank account balances, medium-term planning, and forecasting of incoming and outgoing resources in accounts receivable and payable through to a longer-term view of areas such as materials management and sales, underline the importance of integrating information from various company divisions. Linking these operating divisions to realize and plan financial transactions and positions in treasury has a significant impact on your company's success. Such integration also facilitates management and control of cash flows and risk positions throughout all divisions in your company. The treasury component provides you with a basis for effective liquidity, portfolio, and risk management.

Cash Management

The cash management subsystem allows you to analyze financial transactions for a given period. Cash management also identifies and records future developments for the purposes of financial budgeting. The company's payment transactions are grouped into cash holdings, cash inflows and cash outflows. Cash management provides information on the sources and uses of funds to secure liquidity to meet payment obligations when they become due. Cash management also monitors and controls incoming and outgoing payment flows, and supplies the data required for managing short-term money market investments and borrowing. Depending on the time period under review, a distinction is made between cash position, short-term cash management and medium and long-term financial budgeting. The cash management component thus ensures that all information relevant to liquidity is available to you for analysis purposes, creating a basis for the necessary cash management decisions.

Treasury Management

In your role as treasurer, you take the results of your current liquidity, currency and risk positions, and consider the conditions prevailing on the money and capital markets before implementing concrete decisions in the form of financial instruments in treasury management. This component offers functions for managing financial deals and positions, from trading through to transferring data to financial accounting. Treasury management also supports flexible reporting and evaluation structures for analyzing financial deals, positions and portfolios. For short-term liquidity and risk management you

can use money market or foreign exchange transactions to smooth out liquidity squeezes and gluts, or to eliminate currency risks. Securities and loans come into play in the medium and long-term.

Derivative financial instruments facilitate active management of interest rate and currency risks. The trading area contains functions for recording financial deals, exercising rights, performing evaluations, and calculating prices (for example, option price calculator). In back office processing, you enter the additional data required for processing deals (such as account assignment and payment details) and generate automatic confirmations. Position management functions, such as securities account transfers or corporate actions relating to securities are also supported in the back-office area. The general ledger is updated in the accounting area, which also offers flexible payment processing functions in addition to valuation and accrual/deferral methods. By using common organizational elements throughout, various organizational structures can be represented in the system, such as a central enterprise-wide treasury department or 'in-house banks.' This also ensures full integration of the treasury into other modules of the system.

Market Risk Management

Market risk management plays a vital role within the treasury in ensuring your company's competitiveness. The process involves a complex feedback loop encompassing data collection, risk measurement, analysis and simulation as well as active planning of financial instruments. This process dovetails closely with other treasury and corporate functions. Market risk management acts as an integrated, central risk control station with monitoring, and management functions. Access to information on the current and future cash flows and on financial deals already processed is an absolute must. As a result, cash management, which pools all cash flows from your business sectors such as sales and distribution or purchasing, forms the basis. Consequently, all cash flows from the company's operating business can be accessed for the purposes of risk management. Furthermore, all financial transactions managed in treasury management can be evaluated together with the cash flows generated by the various operating divisions. The component provides various measurements for analyzing and assessing interest rate and currency risks. Mark-to-market, effective rate and effective yield calculations are based on up-to-the-minute market data, uploaded via data feed and financial transactions or positions. By simulating market data, you can determine the risk structure of 'what-if' analyses (such as crash scenarios or worst-case scenarios). You can also measure and compare the impact of alternative hedging strategies using simulated transactions.

Funds Management

A funds management sub-system supports your funds management process from budgeting all the way through to payments, including monitoring expenditures, activities, resources, and revenues. Budgets are entered for areas of responsibility that can cover as many management levels as you require. Funds centers and their hierarchical structure provide a base for top-down budgeting and represent responsibility areas within budget control. The system enables you to control your various fund commitments and determine how much of your budget has already been utilized via availability checking. The information system can supply you with information at any time on when, where, and how your fund commitments arose. Analyses by responsibility area and commitment items allow you to identify any budget bottlenecks.

Enterprise Controlling

Enterprise controlling comprises of those functions that will optimize shareholder value while meeting internal objectives for growth and investment. This module usually includes executive information system, business planning and budgeting, consolidation, and profit center accounting.

Executive Information System

The executive information system provides an overview of the critical information necessary to manage your organization. This component integrates data from other ERP components and non-ERP data sources, both inside and outside your enterprise. Drill-down reporting and the report portfolio are available to evaluate and present the data. In drill-down reporting you can analyze the data interactively. Exceptions can be defined in order to highlight areas of concern. The drill-down reports can also be made available in the graphical report portfolio for less experienced users. The report portfolio is aimed at users with basic knowledge of the system who wish to access information put together for their specific needs.

Business Planning and Budgeting

Business planning and budgeting support the management teams of business units and groups in the calculation of business targets such as return on investment. This module also supports central investment planning, budget release and tracking. This module automatically transfers data about investment requirements from transaction applications and provides extensive analysis functions for budget monitoring.

Profit Center Accounting

Profit center accounting analyzes the profitability of internal responsibility centers. A company's organizational structure is represented in the form of a profit center hierarchy with the profit center as the smallest unit of responsibility. All business transactions in financial accounting, materials management, asset management, and sales and distribution, which affect profits, are automatically reflected in profit center accounting. It is also possible to analyze selected balance sheet items by profit center and use them for calculation of ratios (such as ROI). Profit center planning is part of total corporate planning. Profit centers in particular, emphasize the integration aspect of corporate planning as plans from other application areas can be combined, extended and altered in this module. Profit center related postings, can be analyzed through the system's standard reports and facility to create custom reports for special analyses. There is also provision to provide profitability information to appropriate management and controlling departments.

SUMMARY

This chapter provides an overview of the financial solutions in most of the ERP packages. In today's business enterprise you need to know that your financial decisions are based on today's data and not on numbers from records closed a month ago or even a week ago. You also need to know that this same 'today's' data represents every segment of your organization's activities whether your enterprise stretches across a room or around the globe. This is essential because the most efficient way to get your enterprise to where you want it tomorrow is to know exactly where it is today.

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Chapter 44

Manufacturing (Production)

INTRODUCTION

The term production or operations is often used interchangeably with manufacturing, because modern production methods were first developed and applied in manufacturing industries. But even though a service like dry cleaning does not produce a tangible object it does involve production. If you view production as a process, it becomes clear that even services such as dry cleaning begin with resources—cleaning fluid, machines, presses and people—and, end up with a product—clean clothes.

So, all business firms are involved in some type of production. The key concept in operations management is transformation or the conversion of input (resources) into output (goods or services). The term transformation implies physical changes but today, it also includes the conversion of resources into services (see Fig. 44.1). Production or operations then, is the use of human, physical, and financial resources to produce products or services.

The goals of the manufacturing module is to accelerate and streamline the entire manufacturing process—from planning and scheduling to monitoring and analysis—while improving efficiency across the organization's value chain. As a result, you can improve efficiencies, lower costs, deliver higher-quality products, and boost margins. The manufacturing module helps to:

- Be first to market with innovative, high quality products
- Centralize product development, supplier sourcing, and product ramp-up processes
- Optimize inter-enterprise product development and sourcing of complex components
- Monitor the flow of information through engineering, planning, and execution
- Document each step of the production process
- Create high-quality products – and get them to market quickly
- Respond to demand volatility by accelerating the planning process and facilitating fast changes
- Utilize a wide variety of basic strategies for production planning and execution
- Plan, schedule, and sequence production on the factory floor
- Improve plant performance with real time visibility and transparency across all shop floor processes
- Deploy workers and other resources on the shop floor when and where they are needed
- Document, monitor, and dispatch inventory throughout the production lifecycle
- Reduce manufacturing costs and cycle times
- Proactively identify and fix potential issues with real time tracking and analysis
- Deliver the right orders to the right place, at the right time
- Improve on-time delivery rates and customer satisfaction
- Ensure product quality and regulatory compliance

As we have seen, production takes place in all kinds of business as well as nonbusiness operations. Production in hospitals for example, does not mean just delivering babies. It also covers the process

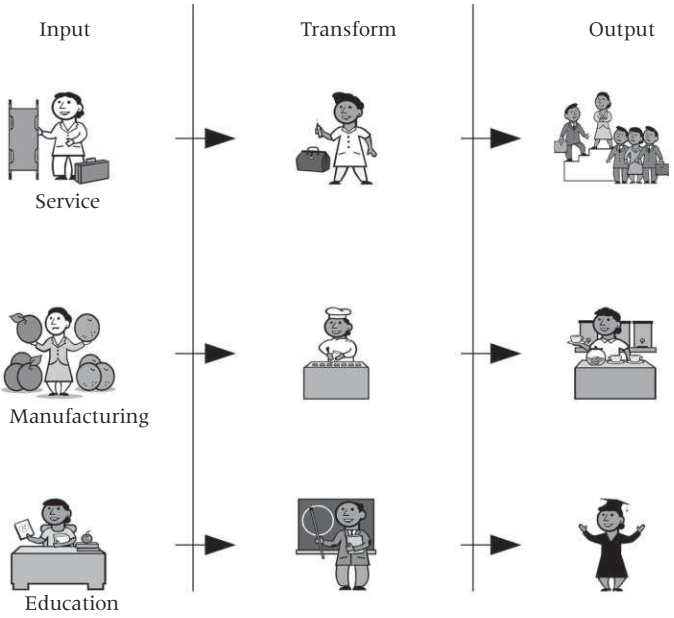

Figure 44.1 Transformation systems.

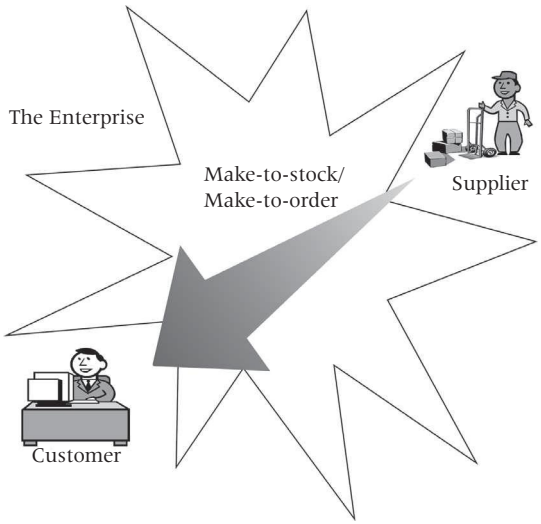

Figure 44.2 The manufacturing process.

of serving meals, performing surgery, taking and reading X-rays, conducting physical therapy, cleaning rooms and receiving payments. Supermarket production operations include ordering and pricing inventory, stocking the shelves, packaging and displaying products, and so on. Governments issue permits and licenses, collect taxes, register voters, provide police and fire protection, and so on. Contractors construct, repair and demolish buildings, build highways and bridges, and landscape parks. Similarly, banks grant loans, cash, or issue cheques, and handle deposits and withdrawals.

Production processes vary greatly in complexity, production time and the amount of resources, information and planning needed, and the number and type of machines and employees needed. The production of a car takes time and requires a variety of very expensive machines and highly skilled employees. Typing a letter on the other hand is a short process using mainly a word processor.

Competition in the next millennium places increased emphasis upon time as expressed by speed, quality, service, and global focus. Agility is the watchword. Manufacturers are measured by their ability to react quickly to sudden, often unpredictable changes in customer demand for their products and services. To compete successfully beyond the year 2000 requires manufacturing applications that are time and activity based and above all else, focused on the customer. Increasingly, these manufacturing applications are a center point within the spectrum of a supply chain running from customer to supplier and encompassing the entire enterprise.

A good manufacturing system should provide for multimode manufacturing applications that encompass full integration of resource management. These manufacturing applications should allow easier exchange of information throughout the entire global enterprise or at a single site within a company. Regardless of how big or small an enterprise is, these applications should provide a wealth of features/functions, broad scope of coverage, operational stability, and a platform-independent architecture. These capabilities empower an enterprise to achieve productivity gains, adopt forward-thinking technologies and implement process reengineering. As a company's internal processes become more sophisticated or as market forces change, these solutions should be capable of meeting the challenge. The manufacturing system should be integrated with the other modules of the package.

A robust manufacturing planning, business process and execution system must satisfy a variety of business practices and production methods. These business practices and production methods place stringent demands on the manufacturer. Regardless of how manufacturers view their internal operations, to the customer it boils down to quick response to customer demand in two fundamental ways: Manufacturers either make products to stock prior to receipt of a customer order, or they make and ship the products upon receipt of a customer order. Manufacturers must accomplish this task quickly, efficiently, and cost effectively in order to remain profitable and competitive. These two fundamental ways of responding to customer demand can be broken down into several alternative modes of manufacture.

Today, companies must be able to deliver customer-specific products with the lead time of standard, off-the-shelf products. To help manage product and market shifts, the manufacturing module provides the freedom to change manufacturing and planning methods as needed. The manufacturing modules of most ERP vendors do not limit businesses to a single manufacturing method such as make-to-stock or make-to-order (see Fig. 44.2). Instead, many manufacturing and planning methods can be combined within the same operation with unlimited flexibility to choose the best method—or combination of methods—for each product at each stage throughout its life cycle.

In addition, this control and visibility comes without having to sacrifice the functionality needed to efficiently manage different types of production. These systems support the entire range of production strategies; only one system is needed to manage all manufacturing activities. Engineer to order products can be planned using the system, while the system's forecasting and distribution planning features handle make-to-stock items. Products that are assembled to order can be planned using advanced features available in the manufacturing module. All demands can be aggregated into user-definable plans at a detail or summary level. Enterprise requirements then flow into consolidated production schedules and material and capacity plans, and all production activity can be scheduled and tracked through shop floor control systems.

The manufacturing module should enable an enterprise to marry technology with business processes to create an integrated solution. It must provide the information base upon which the entire operation should be run. It should contain the necessary business rules to manage the entire supply chain process whether within a facility, between facilities, or across the entire supply chain. Control and execution can be performed at strategic, tactical, and operational levels within the business. These require effective planning to support contract commitments throughout the supply chain, control over intermediate range planning horizons and time fences, and execution over the short range of frozen scheduling required by the factory floor. Whether it is a single site implementation, several sites within one country, or hundreds of them covering the globe, the manufacturing system should provide the foundation for creating concurrent business processes across the supply chain and achieving Return On Assets (ROA) improvement.

HOW DOES MANUFACTURING RESPOND TO THE CUSTOMER?

Manufacturers must respond quickly and effectively to customer demands. While agility is desirable, without an effective enterprise manufacturing system it results in speed without purpose. The very heart of an enterprise manufacturing system centers on its integrated planning, business process and execution capabilities. Traditional closed loop MRP concepts have long heralded the importance of effective planning, business process understanding and timely execution. Strategically, effective planning results in improved inventory turns, productivity increases, and improved return on assets. Tactically, effective business processes provide improved customer satisfaction, reduced time to market and improved market share. Effective execution provides short cycle time, quality assurance, continuous improvement and quick response to process variability. All three elements contribute to management's decision to install an enterprise-wide manufacturing management system. Some of the major subsystems of the manufacturing module are:

- Material and capacity planning
- Shop floor control
- Quality management
- Just-In-Time (JIT)/Repetitive manufacturing
- Cost management
- Engineering data management
- Engineering change control
- Configuration management
- Serialization/Lot control
- Tooling

Material and Capacity Planning

Today's customer-focused business environment makes it more critical than ever for manufacturers to have an effective production plan for managing material and capacity. Customers want accurate shipment dates—sometimes to the hour—even when there are schedule and product changes. The planning systems of ERP packages are designed to provide the responsiveness your company needs to meet these customer requirements. With these systems, planners can simulate alternative plans; gaining the information they need to determine which parts and assemblies to make, which to buy and when to manufacture or purchase.

Most packages have features to generate recommendations for purchases and production and where necessary, recommend changes to current plans to prevent under or over-utilization of work

centers. If requirements change often, exception based planning features can run continuously, providing virtually real time visibility of the changing plans, using item time fences to avoid erratic production plans. Material plans can be developed from a wide variety of sources that include the master schedule, sales forecasts, and dependent and independent demand. An extensive selection of order modifiers provides even greater control and flexibility.

For analysis, planners can create an unlimited number of simulations (see Fig. 44.3). Your company can customize planning processes because input is described by system parameters that are easily changed. To reduce effort and accelerate communication across the supply chain, planned orders can be confirmed and converted automatically (or manually) into production and purchase orders. In addition, graphical reporting makes potential material and capacity problems easy to identify.

Meeting your business goals requires detailed production planning and effective execution control. ERP packages give your company full control with flexible scheduling and sophisticated shop floor functionality. They also offer extensive freedom for defining production processes in the most appropriate way. Depending upon the requirements of your company's product and processes, production can be scheduled using work orders or repetitive build schedules. With the repetitive planning feature, companies can implement JLT techniques to streamline material issue and production reporting. Using the shop floor control facility, your company has the visibility necessary for managing lead times and carefully controlling the amount of work-in-process and the timely release of production orders.

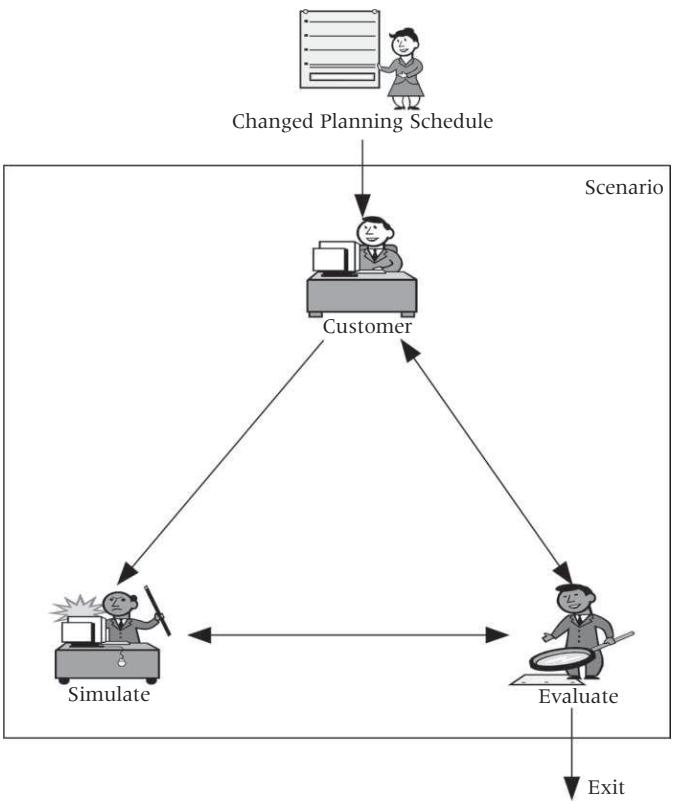

Figure 44.3 The simulation process.

Most of these systems are flexible enough to enable your company to establish order-processing priorities that reflect business priorities. For achievable supply chain plans, both internal and external operations—and their relationships are considered by the system when creating production plans and assigning priorities. The Electronic Planning Board provides a graphical production management tool that delivers immediate visibility of changes in capacity utilization. The planning board shows all scheduled production, current production status, utilization, and materials and capacity availability.

Shop Floor Control

With increasing emphasis placed upon reducing manufacturing time in support of the need to reduce product time to market, manufacturers have turned greater attention to evaluating their shop floor activities. Process reengineering efforts and elimination of waste has necessitated greater reliance upon powerful, user-friendly, flexible shop floor planning, and control systems. Management needs timely, accurate information and the ability to manage the shop floor by exception. Cost information must be flexible as well. As factories are realigned to reduce material travel time through a facility, this realignment places an added burden upon the supporting systems. Managers must often experiment with trial and error approaches in the never-ending search for process improvement. Shop floor control systems must be flexible and adapt to changing needs.

A shop order can be reprinted at any time with user selection of whether to reallocate material. This reprinting gives a shop foreman flexibility to print a duplicate copy when an order is split between operators. This feature also gives the shop scheduler the ability to reprint the shop packet and to reflect new material allocations that correct previous shortages. Every shop order can be maintained throughout its life. All systems provide a full function shop order maintenance capability, allowing the user to evaluate and adjust operation steps and components. Orders can be rescheduled either backward or forward. For example, an operation's start date can be overridden to reflect changed events and then the order can be forward scheduled to reflect the impact upon future operations.

Quality Management

With product quality under the microscope in all industries today, every company strives for superior quality in its products and services. All manufacturing modules track quality control activities across the enterprise—from intermediate producers to finished goods. These systems allow a wide variety of characteristics and parameters to be specified in test and inspection operations and maintain an extensive history to improve product quality and identify recurring problems.

Elimination of defects in standard product designs and manufacturing methods before production is just as important as eliminating defects during production. In fact, to achieve quality levels manufacturers must focus on identifying and correcting defects in underlying product designs and production methods not simply inspect the in-coming material and finished goods. The quality management systems usually support the benchmarking and use of optimal product design, process engineering and quality assurance data by all functional departments within the manufacturing enterprise; thereby facilitating definition of repeatable processes, root cause analysis and the continuous improvement of manufacturing methods. This documentation supports the job functions of the quality assurance and production managers in validating the manufacturer's conformance to ISO 9000, Good Manufacturing Practices (GMP) worldwide, MIL-Q-9858 in the United States, and a variety of country specific industry standards of quality assurance. Specification control in the quality management system offers a state-of-the-art approach for documenting specifications and enables an organization to standardize and simplify its quality assurance and control functions.

Sample types, sample rules and testing levels are completely user-defined for maximum flexibility and ease of use. Maintenance of standard specifications detailed sampling instructions and testing procedures is performed online. Cyclic, subsequent, and repeat testing options are available to support the material acceptance function, with breakdowns of test procedures into multiple dispositions to improve inventory turnover and reduce inspection lead times. The system's database eliminates redundant specifications and ensures that a single change to standard procedures takes effect immediately throughout the organization. User-defined review and commitment controls ensure maximum accuracy. The material procurement subsystem provides tools for implementing total quality management programs within an organization. Original manufacturers may be defined independently from vendors so that businesses can strictly adhere to quality assurance and control functions without preventing their buyers from seeking the best possible price and delivery terms. Each item supplied by an original manufacturer may be linked to a standard product specification. Actual test results and material disposition histories are retained according to item, lot, original manufacturer and specification, for in-depth quality performance review and analysis.

The material inspection subsystem offers a wide range of capabilities for process supervision and control. These capabilities are fully integrated with the other modules such as purchasing, inventory management and shop floor control functions to ensure that the right quality control procedures are followed. Capabilities include online maintenance of product specifications by production method and customer, event driven sample requests, sample log-in, test results entry, quality performance analysis, and equipment calibration support. Product quality metrics are collected and archived in a manner that offers full support for statistical process control techniques. Material disposition is another feature available in many systems that offers advanced material review and disposition functions that ensure the right quality control decisions are made and leave an audit trail of decisions for compliance purposes. Capabilities include automated material review and approval, automated material dispositioning, sublot control, optional automatic second dispositioning, optional automatic repeat testing, grading, redesignation, and implementation of user-defined policies and procedures for authorization and control.

Production reporting supports complete production reporting. Both employee and crew labor reporting is possible, with crew reporting automatically allocating efficiencies between crewmembers. User-defined shift teams can be entered to support quality circles and subsequent reporting of results. Employee/clock maintenance provides for designation of employees and teams. Both labor grades and labor rates can be designated. Labor grades entered by employee override those designated for the work center. Labor rates enable the entry of actual cost data even when labor grades have not been established. The shop floor control system is fully integrated with cost accounting and control. Both production reporting and employee/clock maintenance contribute data that is summarized at the time of shop order closure with full variance analysis reporting made available to the user. Shop floor control also makes use of a powerful and flexible shop calendar facility, which can be global with overrides reflecting each facility and each work center within each facility.

Just-In-Time/Repetitive Manufacturing

The past decade has seen a surge of interest in the adaptation of Just-In-Time (JIT) manufacturing techniques. While companies have embraced the concepts of waste elimination, product factory layout, manufacturing cells, and Kanban signaling, many implementations have struggled for lack of software tools to effectively support the transition. Many systems not only provide high volume repetitive manufacturing functionality, but also provide for the transition to rate-based production by allowing the use of repetitive scheduling even for products that are not rate-based. This allows a production facility to transition products from discrete manufacture into a JIT/repetitive focus. For

example, when the demand pattern for an item begins to stabilize and show a repeatable/predictable pattern, then a production schedule can be initiated even though the item may not be designated as rate-based. Over time, as the item's demand pattern grows, the item can be switched to full rate-based production scheduling. This transition capability enables production facilities to adopt process reengineering, setup reduction programs, Single Minute Exchange of Die (SMED) programs, employee empowerment work teams, etc. with the confidence of knowing that the planning and control system will effectively support their efforts. JIT/repetitive focus includes strong analytic capabilities. A production inquiry presents both current production status and past history. The history provides current day, month-to-date, and year-to-date results as well as calculation of maximum and average production results per hour. A purchase/production plan report shows current on-hand quantity and scheduled receipts by planning period. A cumulative production report shows production status information by item, which includes quantity that have been ordered, received, are remaining, and are due, as well as quantity allocated and year-to-date receipts. A down time analysis report highlights all causes of down time by reason code. A quality control/reject analysis report tracks all rejections by reason code. A yield analysis by operation identifies where lost productivity is occurring. A cumulative purchasing report shows total procurement needs by item, effectively displaying daily delivery performance and summed delivery results. An item allocation report provides details regarding on-hand and allocation status for child items, including lot number and lot tracing status for lot-controlled items. A JIT work list compares the production plan to the capacity plan for rate-based items. This tool quickly identifies discrepancies based upon actual performance, so that production rates and/or daily output goals can be adjusted proactively and monitored on a timely basis. Reports covering employee efficiency and detailed cost by item and lot tracing status for lot-controlled items are also provided.

Cost Management

With competition increasing the pressure on margins, your business needs accurate, and detailed manufacturing cost reporting for effective business management. ERP packages provide extensive cost information at several levels that help businesses to identify cost drivers and reduce product costs. They support multiple inventory valuation methods so you can choose the costing method that best reflects your company's business. You can choose standard, LIFO (Last In First Out), FIFO (First In First Out), moving average unit, or lot costing, and costing methods can be assigned by item. To reduce administrative overheads, prevent input errors and provide faster and more accurate information for planning, these systems provide detailed records of time and materials data on the shop floor. For example, many systems have features that let your company compare estimates and production costs for different work centers, machines, employees, and order quantities while monitoring overtime, indirect hours, subcontracted jobs, and other costs. Moreover, to provide even more accurate production and inventory planning these systems can track material usage for each job. Additionally, if the activity is associated with a project, project information is automatically updated. Many vendors also support Activity Based Costing (ABC) with activity visibility by cost object as well as costs for user-defined groupings, such as departments. There will be provisions that allow employees to report non-production activities such as maintenance, holidays and illness. Manufacturing system provides extensive information about production costs at several levels, which gives you the visibility you need to identify cost drivers and reduce product costs.

Engineering Data Management

The first step to shorter product development cycles is increased efficiency in design and development activities. Engineering data management is designed to help your company trim data transfer time,

reduce errors, and increase design productivity by providing an automated link between engineering and production information. Most packages allow smooth integration with popular CAD packages to simplify the exchange of information about drawings, items, BOMs, and routings.

Engineering Change Control

By using engineering change control, businesses can gain effective control over engineering change orders. Your company can define the authorization steps for approving and implementing an engineering change order. When these steps are completed the system automatically implements the change in the production database.

Configuration Management

Configuration management dramatically reduces order cycle time by eliminating the lengthy engineering review typically associated with determining feasibility, and cost associated with the configured end item. This reduction is achieved by creating a flexible user-defined knowledge base that is accessed by a powerful analytic engine.

The knowledge base contains the sales and engineering expertise of the organization. Product attributes and variables such as height, width, or cubic pounds of pressure, are entered in the knowledge base in the form of an option matrix. The knowledge in the option matrix structure can also be augmented by user-defined calculations such as height × width = area and by Boolean rules. Boolean rules allow definition of complex product relationships. For example, 'if refrigeration and insulation are chosen under trailer options and the total area is greater than 120 feet, then double axle must be chosen under axle options.' The analytic engine interprets the knowledge base in conjunction with user selections to ensure that the customer specified product can be built and sold. As a result, the order entry process is a dynamic conversation between the order taker and the customer that culminates with a fully priced and cost of the product on the sales order, as well as the related manufacturing detail necessary to move the order directly into production.

The process starts with an attribute master containing configuration related questions and answers. Attributes are the building blocks of a configuration structure. The configuration structure categorizes and sequences attributes to create a flow of questions and possible answers during entry of sales orders for configured products.

Serialization/Lot Control

Many systems will provide the facility for the designation of raw material lots and the serialization of component parts made from those lots. This serialization is applicable to commercial aviation, defense industry suppliers, and capital equipment manufacturers who provide service over the life of their products on an individual unit-by-unit basis. Examples include heavy machinery, off road equipment, and highway tractor/trailers. Manufacturers who use lot control often must allocate production prior to its completion. The lot control system provides for the pre-allocation of lot numbers. This feature is available throughout the product offering and includes MRP, shop floor control, order processing, and JIT. Many systems allow production orders to be pre-assigned with lot numbers for the parent item. When the shop order is released, the lot master record will be created and allocations to a higher level of parent item will be permitted. The manual pre-allocation of pre-assigned lots is possible for both customer orders and shop orders with visibility to planned and actual production, as well as existing inventory.

Tooling

For many manufacturers, ensuring that proper tooling is available is just as critical to production schedules as the availability of material. The ERP systems extend capacity and inventory management to include these valuable resources. These systems help to ensure that tools and materials arrive together at scheduled operations by storing tools in inventory and planning and allocating the required tools as part of the production order. They also provide visibility of tool use and calculate the remaining useful life of a tool and can automatically route tools for maintenance based on usage.

SUMMARY

The manufacturing module should enable an enterprise to marry technology with business processes to create an integrated solution. It must provide the information base upon which the entire operation should be run. It should contain the necessary business rules to manage the entire supply chain process whether it is within a facility, between facilities, or across the entire supply chain. Control and execution can be performed at strategic, tactical, and operational levels within the business. Some of the major subsystems of the manufacturing module are material and capacity planning, shop floor control, quality management, JIT/repetitive manufacturing, cost management, engineering data management, engineering change control, configuration management, serialization/lot control, tooling, etc.

Chapter 45

Human Resources Management

INTRODUCTION

The last two decades have seen a marked change in **Human Resource Management (HRM)**, i.e., the process of acquiring, deploying, and developing people for organizational success. It is sometimes called **Human Capital Management (HCM)**. Until recently the people involved in human resource work were usually called personnel managers. Their duties normally centered on staffing activities such as hiring, keeping employment records, attending to minor medical benefit problems, and organizing company teams and outings. Since then, dramatic changes have occurred in our society and in the make-up of the workforce. No longer can companies afford to look at people as a commodity to be exploited to exhaustion and then discarded. In today's organizations employees are viewed as human resources that need to be carefully nurtured, accommodated, and developed.

Human resources management is an essential factor of any successful business. The competitive environment of the next millennium, with its economic and technological challenges, will affect your HR department like all other areas of your enterprise. In short, HR managers must continually review and optimize their business processes. The HR modules of most ERP systems have a set of rich features and will integrate seamlessly with the other modules and are thus, invaluable aids in improving productivity. They offer company-wide solutions for HR departments and make it possible for other departments to access specific employee data.

A human resource management system has to be adaptable to company specific requirements as well as to constantly growing HR requirements. It should cover all the functions required in business practices and be flexible enough to allow you to optimize your business processes by tailoring the ERP solution to suit your organization's needs. Today, many businesses cross boundaries. The system should support the organization's international needs with country specific versions of the HR components. Apart from languages, currencies and legal requirements, accounting systems often vary from country to country as well, making this a vital feature. A flexible structure enables quick and easy customization of the system to suit your requirements. When you log-on in a particular language, screens, messages, and documents appear in the language you specify. You then have access to the system's complete functionality.

The HRM or HCM module gives the employees every opportunity to achieve their career goals at the same time the organizations business objectives by automating, streamlining, and extending the organizations HRM processes. The HRM module helps the organization and HR managers to:

- Automate employee administration, time management, payroll, and legal reporting processes
- Consolidate all workforce-related core processes and data onto a single platform
- Depict and analyze your organizational and reporting structures
- Create and manage tailor-made benefits packages
- Record, track, monitor, and evaluate your employees' working times and activities
- Support compliance with changing global and local HR regulations
- Understand, evaluate, and measure your workforce's contributions to the bottom line

- Attract and hire the right people – and make new hires productive quickly
- Identify and grow future leaders
- Align team and individual goals with corporate goals and strategies
- Maximize the impact of training
- Develop and deploy talent more rapidly and flexibly than ever before
- Pinpoint where your talent lies and train and cultivate your workforce
- Align employee goals with your overall business objectives
- Improve productivity by automating paper-based HR processes
- Enable employees to manage important life and work events on their own
- Bring your distributed workforce together in an employee interaction center
- Increase employee satisfaction with personalized service and accurate information
- Provide managers with an intuitive portal to accomplish their key tasks

The different ERP systems offer many different subsystems under the HR umbrella. Listed below are some of the most common subsystems. Here again, the idea is not to be comprehensive but to give an idea about the options available. The various subsystems under the HR module are:

- **Personnel management** (HR master data, personnel administration, information systems, recruitment, travel management, benefits administration, salary administration)
- **Organizational management** (organizational structure, staffing schedules, job descriptions, planning scenarios, personnel cost planning)
- **Payroll accounting** (gross/net accounting, history function, dialog capability, multi-currency capability, international solutions)
- **Time management** (shift planning, work schedules, time recording, absence determination)
- **Personnel development** (career and succession planning, profile comparisons, qualifications assessments, additional training determination, training and event management)

Personnel Management

Personnel management includes numerous software components, which allow you to deal with human resources tasks more quickly, accurately, and efficiently. You can use these components not only as part of the company-wide ERP solution, but also as standalone systems.

Personnel Administration

Information is no longer owned by specific departments, but is shared by multiple entities across your organization. This eliminates duplicate entries, reduces the chance for error and improves data accuracy. The HR modules provide a global, fully integrated data structure for the enterprise without compromising your control over individual segments of your operations.

Employee Master Data

The human resource module has a centralized database with integration to multiple components for processing employee information. The system provides tools to save you time and help you tailor the system to fit your needs. The HR module contains features for storing any desired information about your employees. Most systems have the facility to scan the original documents for optical storage. The HR information system displays graphical information such as organization charts or employee data. The system can produce charts and reports—both standard- and customer-defined.

Recruitment Management

This function helps in hiring the right people with the right skills. Reducing the cost of recruiting and hiring new employees is a challenge for the HR professional who is responsible for placing people with the right skills and education in the right job, at the right time. These requirements are fulfilled only through effective automation of the entire recruitment process. The recruitment component is designed to help you meet every facet of this challenge. This component includes processes for managing open positions/requisitions, applicant screening, selection and hiring, correspondence, reporting, and cost analysis.

Effective management of your organization's job openings helps your HR recruiters, managers and also interested candidates. The HR recruitment component allows direct access to data stored in other components of HR including personnel administration, payroll, and personnel planning. These links eliminate duplication of data entry and improve your productivity. Some examples of shared data related to job openings include position open date, location and reporting specifics, job descriptions, and skills and education requirements. This information can be used for both internal job postings as well as external advertisements with newspapers, magazines, colleges, or recruitment firms.

In selecting candidates, employee and applicant qualifications are matched with the requirements of the job. HR recruitment interfaces directly with word processing packages to generate standard applicant letters. In some systems there is even the facility to send e-mail messages.

Many systems provide tools to analyze costs incurred during advertising and interviewing for each open position. With the HR recruitment component, you can efficiently and effectively manage your job openings, your applications and applicant data, costs, and the hiring process. Once a selection has been made and an applicant has been hired, the data gathered during the recruitment process becomes new hire information. You can thus, eliminate duplicate data entry and the possible introduction of errors caused by re-entering the data.

Travel Management

This module helps to process the travel expenses effortlessly in several currencies and formats. HR travel management allows you to process a business trip from start to finish—from the initial travel request right through to posting in financial accounting and controlling. This includes any subsequent corrections and all retroactive accounting requirements. Integration with the other modules ensures correct posting, taxation, and payment of trip costs. Travel data can be entered by the person traveling, or by a secretary, or by the relevant department, either before, or after the trip. The entry of a travel request automatically generates a workflow that makes the administrator's work much easier. Business, employee, and country specific trip provisions can be implemented via system settings. Travel management automatically calculates the tax and also automatically processes credit card transactions for a particular trip. The receipts can be entered in any currency and include supplementary receipt information. An optical archive is available for long-term archiving of travel receipts. Travel costs can be divided into different levels (employee, trip destination, and receipt). Expenses can be posted to numerous accounts assignment objects for example, cost center, order, project, or cost object. You reimburse costs incurred during a trip through payroll accounting, accounts payable accounting or by data medium exchange. In addition, travel management provides multiple report formats. You can enter receipts in any currency and then print reports in your native currency. Travel expense accounting provides you with self-explanatory forms, statements, and an electronic approval process to improve communications and reduce unnecessary calls to the HR department.

Benefits Administration

This system brings flexibility and power to your benefits program. As organizations continue to grow, as laws change and employee requirements expand, you need a flexible system to satisfy all your requirements. The benefits administration component provides you with the capabilities and flexibility to effectively manage benefits programs for diverse employee populations. Benefits administration uses a hierarchical structure that gives you the ability and flexibility to add new programs at any time. These systems can maintain an unlimited number of benefit types and individual plans that are offered to your employees. With benefits administration you can establish benefits groups based on specific employee demographics. Your company needs options for enrolling employees in benefits programs. This module furnishes you with real-time processing allowing you to prepare employee specific enrolment forms using any, or all employee data. Using the benefits administration component, you can define eligibility groups and rules based on a wide range of factors. You can determine the variables, rules and cost formulas for each benefits plan. You can design the types of benefit plans that best fit your employee demographics. You determine the options to be offered to employees and the benefits administration component provides the framework to administer them efficiently. The costs associated with each benefits plan option are automatically calculated to ensure consistent and accurate reports.

With the benefits administration feature, you can maintain an unlimited amount of savings plans for your employees to consider. The benefits administration component gives you the capability to maintain both deferred and nondeferred options as well as employer matched and unmatched contributions. The component tracks employee changes and investment histories.

These systems have powerful querying and reporting features that will provide you with standard reports to assist you in administering your programs and help you respond to requests quickly, accurately and confidently. Employees also can have direct access to their individual benefits information, eliminating many time-consuming questions your HR staff must address every day.

Salary Administration

This function helps in simplifying the process of rewarding your employees. Administration of salaries is an ongoing process within your human resources department. It is particularly important during the review process when your goal is to justly reward good performance. The salary administration module assists you in the salary review process by taking into account standard salary changes within the company as well as individual compensation exceptions.

Organizational Management

With this module you can maintain an accurate picture of your organization's structure. It will assist you in maintaining an accurate picture of your organization's structure, no matter how fast it changes. In many cases graphical environments makes it easy to review any moves, additions or changes in employee positions. You can also create multiple simulations for your organization as you explore your options for making adjustments in personnel. Planning features designed to assist you include graphical organization charts, staffing schedules by headcount, percentage, working hours, job and work center descriptions, and job tasks and descriptions.

A personnel costing is a strategic success factor for every company. Accurately forecasting personnel costs provides your management team with a more complete cost picture to assist them in making informed decisions. The personnel cost planning functions enable you to perform cost comparisons between target and actual personnel costs and create cost previews. You can forecast wages, salaries, and other cost elements for open and filled positions, based on simulated, planned, or actual payroll figures.

Payroll Accounting

The payroll accounting system can fulfill the payroll requirements and provide you with the flexibility to respond to your changing needs. Payroll accounting should address payroll functions from a global point-of-view. You should be able to choose to centralize your payroll processing or decentralize the data based on country or legal entities. Most payroll accounting systems give you the options and capabilities to establish business rules without modifying your existing payroll. Many systems have the features to remind you when transactions are due for processing. When the process is completed, a built-in audit trail date stamps the record for future reference. The system automatically creates a history record for every payroll transaction. With payroll accounting, you have the ability to tailor the system to your organization's requirements. When policy or legislative changes occur, you can adapt the system. The system maintains information on employees in a master file shared with all other modules. Whether your business operates solely in one country or has expanded to international locations, most ERP vendors have incorporated features to satisfy your requirements. With country specific versions of payroll accounting you can fulfill language, currency, and regulatory requirements.

Time Management

This module assists in simplifying the administration and evaluation of time data. Time management is a powerful tool that helps you administer and evaluate data related to the time that your employees spend working. This component can simplify your efforts whether your organization uses centralized or decentralized data, to determine employees' working hours. Time management manages work schedules efficiently and effectively by automating schedule generation and allowing flexible definition of time models, schedules per location, and organization level. With time management you can set flexible working hours and process work notices as times are recorded. Individual and group piecework calculation for employee incentive wages is also available through the incentive wages feature. The time evaluation component allows daily processing of employee time data. It is a flexible tool designed to handle complicated evaluation rules to fulfill regulatory requirements and determine overtime and other time related data. The time evaluation component stores your organizations' business rules and automatically validates the number of hours worked and wage types. The results of time evaluation can be shown on a time sheet that provides a detailed overview of daily balances and time wage types. Most packages provide a review feature that will provide all necessary information and tools to review and maintain employee time data.

Shift Planning

The shift planning module helps to plan your workforce requirements quickly and accurately. You are able to arrange a target plan that can be drafted for any given period. You can plan your shifts according to your requirements, taking into consideration all criteria including absences due to leave, or sickness, and employee requests for time off. Shift planning keeps you informed at all times of any staff excess or deficit; a convenient planning board is provided to guide you when entering and copying shifts for any designated period of time. Furthermore, you can check the plans at any time against rules governing employees' working time for example, to detect noncompliance with relevant legislation. All time data relating to your employees is centrally administered. This means that not just the planned working time but also short-term changes to your shift plan brought about by, for example, sickness, or over-time, are relayed directly to the time management component. Another advantage of shift planning is that it enables you to temporarily assign an employee, or employees to another organizational unit where they are needed, allowing for a temporary change of cost center.

Personnel Development

This function helps in selecting the best people and enhancing careers more effectively. The system provides advanced tools to automate the labor-intensive process of matching internal job requirements to qualified candidates. You can profile predefined tasks and prerequisites of each position in your organization. Additionally, you can profile the qualifications of employees and external candidates under consideration for each position. A comparison of the qualifications and profiles assists you in selecting individuals for further consideration. Effective personnel development planning ensures that the goals of the organization and the goals of the employee are in harmony. The benefits of such planning include improvements in employee performance, employee potential, staff quality, working climate, and employee morale. A good system should provide organizations with a method of modeling suitable career opportunities for employees within the company. Also there should be features to determine the areas in which employees need further training. Once this is established, you can then draw up individual plans for further education.

Training and Event Management

Every successful organization should plan the training and events faster than ever before. A good HR system will have features to assist you with planning, managing and analyzing your scheduled seminars, training courses, and business events. Detailed information for each of the events is maintained to facilitate production of event catalogs and schedules. There should be tools to maintain information on the internal, or external organizers of each event, as well as details such as prerequisites, objectives, content, time schedule, prices, capacity, locations, attendee billing information, and budgets. Resources such as instructors, rooms, equipments, and course materials can be automatically suggested, saving you a great deal of data entry time. On completion of a training course, appraisal forms can be automatically issued. Appraisals can be carried out for instructors, attendees, business events, and training courses.

There will be features for providing the training coordinator with reports on event data ranging from catering requirements to registrant qualifications for each business event. The reporting feature provides measurements of education and training performance.

SUMMARY

HRM is an essential factor of any successful business. The competitive environment of the next millennium, with its economic and technological challenges, will affect your HR department like all other areas of your enterprise. In short, HR managers must continually review and optimize their business processes. The HR modules of most ERP systems have a set of rich features and will integrate seamlessly with the other modules and are thus invaluable aids in improving productivity. They offer company-wide solutions for HR departments and make it possible for other departments to access specific employee data. The various subsystems under the HR module are personnel management, organizational management, payroll accounting, time management, personnel development, etc.

Chapter 46

Plant Maintenance

INTRODUCTION

The achievement of world-class performance demands delivery of quality products expeditiously and economically. Organizations simply cannot achieve excellence with unreliable equipment. The attitude towards maintenance management has changed as a result of quick response manufacturing, 'just-in-time' (JIT) reduction of work in process inventory, and the elimination of wasteful manufacturing practices. Machine breakdown and idle time for repair was once an accepted practice. Times have changed. Today when a machine breaks down, it can shut down the production line and the customer's entire plant.

The plant maintenance module provides an integrated solution for supporting the operational needs of an enterprise-wide system. The module includes an entire family of products covering all aspects of plant/equipment maintenance and becomes integral to the achievement of process improvement.

Plant maintenance supports various options for structuring technical systems with its object, type and function-related views, and enables flexible navigation. Data concerning planning, processing, and history of maintenance tasks is documented in the system and complies with business verification requirements. You can use the catalog feature of the plant maintenance system to define causes, activities and maintenance tasks. All maintenance tasks such as inspection, servicing, and repair activities are saved in a historical database. In addition to standard indicators, diverse analysis options are also available in many systems for evaluating this data.

Plant maintenance provides you with technical and business reports and various presentation options, according to the criteria used: for example organizational unit, location, execution period for the tasks, or system manufacturer. This information helps you to reduce the duration and costs of plant down times as a result of damage and to recognize possible weak points within your technical system in good time. It also forms the basis for defining an optimum maintenance strategy in the sense of 'Total Productive Maintenance' (TPM), or risk-optimized maintenance. The major subsystems of a plant maintenance module are:

- Preventive maintenance control
- Equipment tracking
- Component tracking
- Plant maintenance calibration tracking
- Plant maintenance warranty claims tracking

Preventive Maintenance Control

Preventive maintenance control provides planning, scheduling, and control of facilities and equipment. Equipment lubrication, component replacement and safety inspection can be planned, scheduled, and monitored. Maintenance tasks can be tracked for each machine or piece of equipment by two user-defined modes, as well as calendar day frequency.

These modes could include tracking by hours of operation, units of production produced, gallons of fuel consumed, or the number of days' operation since the last service interval. Preventive maintenance control enables organizations to lower repair costs by avoiding down time, machine breakage, and process variability. Companies achieve higher machine utilization and improved machine reliability and tolerance control along with higher production yields.

Equipment Tracking

Equipment is an asset that needs to be monitored and protected. In many situations, equipment maintenance costs constitute the single largest controllable expenditure of an organization. All facets of plant location history and utilization history are described and tracked. This history includes acquisition and disposition information and associations between different pieces of equipment to pin-point operational dependencies.

Running totals for operation units to date (miles, hours, days, units of production, etc.) are also provided. Each piece of equipment is defined by model and serial number. User-defined data sheets can be developed which allow for the grouping of user data into formats that can be linked to equipment records. All of this information can be used to create equipment specifications, which provide detailed information for technical specialists working in equipment operations, maintenance, and transportation control.

Component Tracking

Components are typically subsets of larger equipment and deserve the same amount of cost controlling scrutiny. Component tracking enables equipment managers to identify components with chronic repair problems. They can determine whether a repair or replacement should be covered by warranty.

Planning component replacements, rather than waiting for component failures to occur reduce unscheduled equipment down time. Component tracking includes repair/exchange history and component service life.

Plant Maintenance Calibration Tracking

Plant maintenance calibration tracking allows organizations to leverage their investment in the plant maintenance module by providing for the tracking of equipment calibration in support of ISO 9000 requirements.

Plant Maintenance Warranty Claims Tracking

Plant maintenance warranty claims tracking is an administrative system designed to provide control of all items covered by manufacturer and vendor warranties. It enables plant management to recover all of the warranty reimbursements to which they are entitled but have not been able to recover in the past. Features include the ability to establish the type and length of warranty for example, elapsed day, months, mileage stipulation, or operating units. A complete history of all the work is performed for each item, covered by the warranty as well as complete information regarding the warranty service provider.

SUMMARY

The plant maintenance module provides an integrated solution for supporting the operational needs of an enterprise-wide system. The plant maintenance includes an entire family of products covering

all aspects of plant/equipment maintenance and becomes integral to the achievement of process improvement.

Plant maintenance supports various options for structuring technical systems with its object, type and function related views, and enables flexible navigation. Data concerning the planning, processing and history of maintenance tasks is documented in the system and complies with business verification requirements. You can use the catalog feature of the plant maintenance system to define causes, activities, and maintenance tasks. All maintenance tasks such as inspection, servicing, and repair activities are saved in a historical database.

The major subsystems of a plant maintenance module are preventive maintenance control, equipment tracking, component tracking, plant maintenance calibration tracking, plant maintenance warranty claims tracking, etc.

Chapter 47

Materials Management

INTRODUCTION

The module for material management optimizes all purchasing processes with workflow driven processing functions, enables automated supplier evaluation, lowers procurement and warehousing costs with accurate inventory and warehouse management, and integrates invoice verification. The functions of this module is to optimize, streamline and automate the physical flow of materials, and also managing the procurement-to-payment business cycle—from self-service requisitioning to flexible invoicing and payment. The major objectives of the materials management module are:

- Increase visibility into purchase orders, contract management, and invoice handling
- Streamline and optimize the flow of materials
- Reduce costs by lowering inventory levels and consolidating shipments
- Maintain high levels of supplier and customer satisfaction
- Optimize basic business processes—from requisitioning to invoicing for simple procurement, or efficiently manage the procurement-to-payment processes
- Improve processes for procurement, inbound, outbound, warehouse, and transportation management
- Reduce unnecessary stock and improve spend performance
- Rely on a single, complete, and integrated solution
- Apply flexible options for consolidating orders, shipments, and deliveries
- Enable rule-based automation and collaborative order combination over the Internet
- Manage multiple processes and reports required for foreign trade
- Deliver products on time and on budget by creating comprehensive transportation plans, successfully executing plans, and monitoring shipments.

The main submodules of the materials management module are:

- Prepurchasing activities
- Purchasing
- Vendor evaluation
- Inventory management
- Invoice verification and material inspection

Prepurchasing Activities

This system supports the complete cycle of bid invitation, award of contract, and acceptance of services. The prepurchasing activities include maintaining a service master database in which, the description of all the services that are to be procured can be stored (see Fig. 47.1). The system also keeps a separate set of service specifications that can be created for each concrete procurement project or proposed procurement in the purchasing document. Sets of service specifications may include

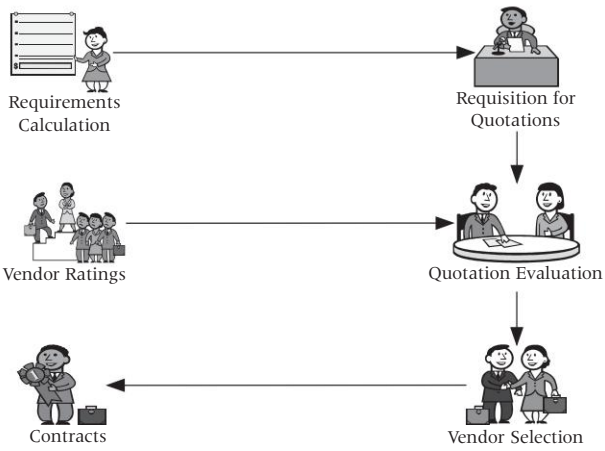

Figure 47.1 Prepurchasing activities.

both items with services and items with materials. When creating such specifications, the user does not have to list individual services manually. Instead, the data is simply copied from the master data. Use of this technique means that the data has to be entered only once and manual entry effort is reduced to a minimum.

There are two ways of entering service specifications—planned and unplanned. Planned service specifications are those services whose precise nature and intended scope are already known at the beginning of a procurement project. At the time they are requested, they are either entered with the aid of a service master record or set out in service specifications as short or long texts. Prices and quantities are stipulated in both cases. A procurement project may constitute or include a number of individual services, which you initially cannot or do not wish to specify in detail (for example, the construction of an office building). Such initially undefined service specifications, which are termed as 'unplanned service specifications' thus have no descriptions. They are entered in the form of money value limits. Service specifications may be specified in terms of an upper limit. This allows you to exercise a degree of cost control in such situations. You can set a value limit at the uppermost level (for example, 5 crores for the construction of the office building). In addition, you can set limits for individual contracts within the project (for example 100,000 rupees for masonry works and 150,000 rupees for electrical installations). The system checks the adherence to both these sublimits and the overall limit. When the services have been performed, they are recorded in entry sheets and then accepted. The accepted service entry sheet constitutes the basis for subsequent invoice verification in the case of services.

Purchasing

Purchasing is a very important component of the materials management module. This module is fully integrated with other modules in the system. It supports all phases of materials management: materials planning and control, purchasing, goods' receiving, inventory management, and invoice verification. Good communication between all participants in the procurement process is necessary for purchasing to function smoothly. Purchasing communicates with other modules in the system to ensure a constant flow of information. The purchasing subsystem manages the activities from

procurement to payment by increasing the visibility of the procurement lifecycle and supporting a wide range of activities:

- Perform requisitioning, purchase order management, and invoice verification
- Manage catalog content
- Enable employee self-service procurement of material and services
- Integrate all business partners – from designers, to manufacturers, to customers
- Collaborate with suppliers on product development through payment management

For example, it works side by side with the following modules:

- **Cost accounting system**—Orders for materials and services consumed directly illustrate the interface to the cost accounting system. This is because they can be assigned to a cost center directly.
- **Financial accounting**—Purchasing and accounting both maintain information on vendors. Information on each vendor is stored in a vendor master record, which contains both accounting and purchasing information. The vendor master record represents the vendor account in financial accounting. Through purchase order account assignment, purchasing can also specify which G/L accounts are to be charged in the financial accounting system.
- **Sales and distribution**—Within the framework of Material Requirements Planning (MRP), customer requirements from sales can be passed onto purchasing. In addition, when creating a requisition you can assign it to a sales order.

Purchasing system performs tasks like procurement of materials and services, determination of possible sources of supply for a requirement identified by the materials planning and control system, or arising directly within a user department, monitoring of deliveries and payments to vendors and so on.

Vendor evaluation

The vendor evaluation component has been completely integrated into the materials management module. Information such as delivery dates, prices, and quantities can be taken from the purchase orders. Vendor evaluation also uses data from quality management, such as the results of incoming inspections, or quality audits. It also accesses basic data in materials management such as goods receipt data from inventory management.

The vendor evaluation system supports you in the optimization of the procurement processes, in case of both materials and services. In the case of procurement of materials the system helps you to select sources of supply and facilitates the continual monitoring of existing supply relationships. It provides you with accurate information on the prices and terms of payment, and delivery. By evaluating vendors you can improve your enterprise's competitiveness. You can quickly determine and resolve any procurement problems that may arise on the basis of detailed information and in collaboration with the relevant vendors. In the case of procurement of services, you can check the reliability of the vendors from whom you procure services on a plant-by-plant basis. You can determine whether the vendors perform the services within the specified time frames and appraise the quality of the work carried out.

Most of the vendor evaluation systems offer you a point based evaluation system based on certain selection criteria. Most systems have their own predefined set of criteria but will allow the user-defined

criteria also. Using these criteria, the performance of the vendors is measured and points are given. You can determine and compare the performance of your vendors by reference to their overall scores. The main criteria that are usually used are price, quality, delivery, service and support, replacement of returns, lead times, and so on. The vendor evaluation system ensures that evaluation of vendors is objective since all vendors are assessed according to uniform criteria and the scores are computed automatically.

Inventory Management

Inventory management systems allow you to manage your stocks on a quantity and value basis and plan, enter, and check any goods movements and carry out physical inventory. The main objective of the inventory management system is to lower the costs by accurately tracking material and demand, reducing inventory levels, and consolidating shipments. It helps to:

- Record and track the quantity and value of materials
- Manage and optimize all warehouse resources
- Plan, enter, and document stock movements within the warehouse
- Track goods receipts and issues, picking and packing, and physical stock transfers
- Monitor all activities – from workload planning to RFID and barcode scanning
- Facilitate the movement of incoming and outgoing physical goods, including logistics involving multiple manufacturers and customers by monitoring the receipt of goods, tracking external demand, managing in-store activities, monitoring delivery and distribution, documenting proof of delivery, etc.

In the inventory management system the physical stocks reflect all transactions resulting in a change in stock and thus, in updated inventory levels. The user can easily obtain an overview of the current stocks of any given material. For each material, not only are the stocks in the warehouse shown, but also the stocks ordered but not yet delivered, reserved for production or for a customer, and the stocks in quality inspection can be monitored. If a further subdivision by lots is required for a material, one batch per lot is possible. These batches are then managed individually in the stock. Special stocks from the vendor or from the customer (for example, consignment stocks) are managed separately from your company's own stock.

The stocks are managed not only on a quantity basis but also by value—a prerequisite for cost accounting. With every goods movement, the following values are updated:

- Stock value for inventory management
- Account assignment for cost accounting
- Corresponding G/L accounts for financial accounting via automatic account assignment

Both the quantity and the value are updated automatically when entering a goods movement. Goods movements include both 'external' movements (goods receipts from external procurement, goods issues for sales orders) and 'internal' movements (goods receipts from production, withdrawals of material for internal purposes, stock transfers, and transfer postings). For each goods movement a document is created which is used by the system to update quantities and values and serves as proof of goods movements. Goods' receipt/issue slips are printed to facilitate physical movements and the monitoring of the individual stocks in the warehouse. The adjustment between the physical stocks and the book inventories can be carried out automatically.

Most inventory management systems support inventory methods like periodic inventory, continuous inventory, inventory sampling, and cycle counting. In a periodic inventory all stocks of the

company are physically counted on the balance sheet key date. In this case every material must be counted. During counting, the entire warehouse is usually blocked for material movements. With the continuous inventory procedure, stocks are counted continuously during the entire fiscal year. In this case, it is important to ensure that every material is physically counted at least once during the year. In inventory sampling randomly selected stocks of the company are physically counted on the balance sheet key date. If the variances between the result of the count and the book inventory balance are small enough it is presumed that the book inventory balances for the other stocks are correct. Cycle counting is a method of physical inventory where inventory is counted at regular intervals within a fiscal year. These intervals (or cycles) depend on the cycle counting indicator set for the materials. For example, cycle counting allows fast-moving items to be counted more frequently than slow-moving items.

Invoice Verification and Material Inspection

The invoice verification component is part of the materials management system. It provides the link between the materials management component and the financial accounting, controlling, and asset accounting components. Invoice verification in materials management serves the following purposes:

- It completes the materials procurement process which starts with the purchase requisition, continues with purchasing and goods receipt and ends with the invoice receipt
- It allows invoices that do not originate in materials procurement (for example, services, expenses, course costs, etc.) to be processed
- It allows credit memos to be processed, either as invoice cancellations, or discounts

Invoice verification does not handle the payment, or the analysis of invoices. The information required for these processes are passed on to other departments.

Each invoice contains various items of information. To post an invoice you must enter this information into the system. If an invoice refers to an existing transaction, certain items of information will already be available in the system. The system proposes this information as default data so that you only need to compare it and if necessary, correct any possible variances.

If an invoice refers to a purchase order for example, you only need to enter the number of the purchase order. The system selects the right transaction and proposes data from the purchase order including the vendor, material, quantity ordered, terms of delivery, and terms of payment. You can of course, overwrite this default data if there are variances. You can display the purchase order history to see for example, which quantities have been delivered and how much has already been invoiced. If there are variances between the purchase order or the goods' receipt and the invoice, then the system will issue a warning on the screen. If the variances are within the preset tolerance limits the system will allow the invoice to be posted but will automatically block it for payment. The invoice must then be released in a separate step. If the variances are not within the tolerances the system will not allow the invoice to be posted.

When the invoice is entered, the system also finds the relevant account. Automatic postings for sales tax, cash discount clearing, and price variances are also generated and the posting records displayed. If a balance is created the user is required to make corrections, as an invoice can only be posted if the balance equals zero. As soon as the invoice is posted, certain data such as the average price of the material ordered and the purchase order history is updated in the system.

The invoice posting completes invoice verification. The data necessary for the invoice to be paid is now contained in the system. The accounting department can retrieve the data and make the appropriate payments with the aid of the financial accounting component.

SUMMARY

The materials management module optimizes all purchasing processes with workflow driven processing functions, enables automated supplier evaluation, lowers procurement and warehousing costs with accurate inventory and warehouse management, and integrates invoice verification. The main modules of the materials management module are prepurchasing activities, purchasing, vendor evaluation, inventory management, invoice verification, and material inspection, etc.

Chapter 48

Quality Management

INTRODUCTION

The ISO 9000 series and a host of other international standards define the functions of quality management and the elements of a quality management system. The functions in the quality management module support the essential elements of such a system. The other integrated modules in the system complement this functionality. These standards require that quality management systems penetrate all processes within an organization. The task priorities according to the quality loop shift from production (implementation phase) to production planning and product development (planning phase), to procurement, and sales and distribution, as well as into the entire usage phase. In the area of production, quality assurance is no longer viewed in terms of inspection and the elimination of defects alone. Instead, the production process itself becomes the focus of attention.

CAQ & CIQ

Just as the requirements for quality management systems have changed due to the quality standards (like ISO 9000 standards), the term Computer-Aided Quality management (CAQ) must also be redefined. Computer-Integrated Quality management (CIQ) is a more appropriate term because an isolated CAQ system cannot carry out the comprehensive tasks of a quality management system. The ERP system takes this into consideration by integrating the quality management functions into the affected applications themselves (for example procurement, warehouse management, production, and sales/distribution) instead of delegating them to isolated CAQ systems. As a result of this approach, the processes described in the quality manual can be implemented and automated in the Electronic Data Processing (EDP) system.

The representation of the elements of a quality management system within the ERP system is not the only responsibility of the quality management module. Instead, the ERP system must be considered as a whole in which all integrated modules contribute their part. Within the framework of the system for example, the human resources module handles personnel-related matters. The controlling module handles the management of quality related costs, and the plant maintenance module handles the monitoring of test equipment. As a part of the logistics application, the quality management module handles the traditional tasks of quality planning, quality inspection, and quality control. For example, it supports quality management in procurement, product verification, documentation, and in the processing of problems.

The quality management module's internal functions do not directly interact with the data or processes of other modules.

QUALITY MANAGEMENT MODULE—FUNCTIONS

The quality management module fulfills the following functions:

- Quality planning (management of the basic data for quality planning and inspection planning, material specifications, inspection planning)

- Quality inspection (trigger inspections, inspection processing with inspection plan selection and sample calculation, print shop papers for sampling and inspection, record results and defects, make the usage decision, and trigger follow up actions)
- Quality control (dynamic sample determination on the basis of the quality level history, application of statistical process control techniques using quality control charts, quality scores for inspection lots, quality notifications for processing internal or external problems and initiating corrective action to correct the problems, inspection lot processing and problem processing, quality management information system for inspections and inspection results along with quality notifications)

Computer-Integrated Quality Management (CIQ)

The integration of quality management in the ERP systems provide considerable advantages because only an integrated system can support all of the elements of a quality management system according to international standards. The integration allows the quality management functions to influence all processes within a company, thereby affecting all phases of a product's life cycle.

The quality management module uses the system's integration to link the tasks of quality management with those of the other applications, such as materials management, production, sales/distribution, and cost accounting. An inspection that is triggered automatically upon goods receipt is an example of this. The quality management module is integrated with the master data and processes of the following applications:

- Materials management (purchasing, inventory management, warehouse management, material requirements planning)
- Production (work scheduling, shop floor control)
- Sales and distribution (delivery, creation of quality certificates)

The quality management module supports the exchange of data with other applications in order to prevent related data from being recorded and stored redundantly. For example, the information provided by a goods receipt posting relating to the material, vendor and lot size is automatically transferred to the inspection lot data record when an inspection is triggered.

SUMMARY

The ISO 9000 series and a host of other international standards define the functions of quality management and the elements of a quality management system. The functions in the quality management module support the essential elements of such a system. In the area of production, quality assurance is no longer viewed in terms of inspection and the elimination of defects alone. Instead, the production process itself becomes the focus of attention. The integration of quality management in the ERP systems provide considerable advantages because only an integrated system can support all of the elements of a quality management system according to international standards. The quality management module fulfills functions such as quality planning, quality inspection, quality control, quality assurance, etc.

Chapter 49

Marketing

INTRODUCTION

The marketing module enables organizations to maximize their efficiencies of marketing resources and empowers marketers, to acquire and develop long-term customer relationships. Marketers can analyze, plan, execute, and measure all marketing activities. With the tools and features of the marketing module, you gain a flexible application to command a marketing success. The marketing module supports critical marketing processes like:

- Marketing resource management
- Segment and list management
- Campaign management
- E-mail marketing
- Trade promotion management
- Lead management
- Marketing analytics
- Web-based marketing surveys
- Self-service portal

Marketing Resource Management

This subsystem helps you to analyze, plan, develop, implement, and measure all marketing activities to maximize the efficiencies of your available resources and gain visibility and control into your marketing processes. The marketing resource management subsystem helps you control and manage your budget and marketing expenditure. The application also allows you to facilitate collaboration among team members and coordinate marketing activities across the enterprise, increasing the speed, and effectiveness of your marketing processes.

Segment and List Management

The segment and list management subsystem helps you in managing enterprise customer and prospect data without the need for IT support. With this, you can create and capture customer profile data to better target and personalize marketing messages and you can view all relevant enterprise customer information from a central point. Using an interactive, drag-and-drop interface your marketers can perform ad hoc, high-speed customer segmentation and segment analysis, quickly identify opportunities, and gain insights into customer segments with the data visualization features.

Campaign Management

This subsystem helps to analyze, plan, execute, and measure marketing activities through all inbound and outbound interaction channels to build long-term profitable relationships. With the campaign management subsystem, you can make the most of dialog marketing by implementing inbound and outbound campaigns that are both multichannel and multiwave. You can develop and execute the

best marketing strategy, using constraint based optimization techniques to determine the optimum marketing mix.

E-mail Marketing

Are you making the most of your marketing resources? In a fiercely competitive market, it is critical to gain visibility with prospects, and maintain communication with customers and partners. Effective marketing of your business goes far beyond product promotion. The e-marketing subsystem is a powerful application for delivering effective e-mail marketing campaigns. It is also an excellent tool for distributing important communications to your employees, partners, prospects, and customers. E-marketing can be used by customer service to communicate critical support information by your channel manager to share program updates, or by your human resources department to inform employees of new benefits policies. Innovative thinking will uncover dozens of areas where e-mail marketing programs can be used to drive revenues, improve customer satisfaction, and streamline internal processes. It enables you to:

- Drive efficiency and gain true ROI from your campaigns
- Shorten campaign cycles, allowing you to produce more campaigns, more often, while reducing overhead
- Target the right people with the right message
- Swiftly build personalized and content rich messages without being a Web guru
- Obtain immediate feedback, allowing you to track campaign activity as soon as the campaign is launched and track customer behaviors such as when they opened the e-mail, how many times they viewed it and whether they logged in to the corresponding Web site.

Trade Promotion Management

With this subsystem you can effectively manage trade promotions that increase brand equity and achieve sales objectives. With the trade promotion management application, you can gain complete visibility into trade programs at each stage of their life cycles in order to reduce error, improve efficiency, and control trade spend. In the consumer products industry trade promotions can account for up to one-fifth of a company's profit or loss. To lower costs you require functionality for managing promotion processes and budgets, bringing together all involved parties both inside and outside your organization.

With trade promotion management you get an application that gives you complete visibility into trade programs at each stage of their life cycles. So, you can effectively manage trade promotions that increase brand equity and achieve sales objectives. This subsystem delivers powerful connectivity. The application enables a closed-loop process that adds value to each of the five major steps in the trade promotion process: headquarter planning, field accounts planning, sell-in and negotiation, retail execution and validation, and pre- and post-event evaluation, and analysis. At each process step your entire organization has a single system and a real time view of all relevant information that allows facts based decision-making and collaboration. So you can reduce error, improve efficiency, and control trade spending. The business benefits include channel specific planning, reduced planning cycle time, informed spending decisions, improved sales forecasts, fact based selling opportunities, reduced out-of-stock situations, etc.

Lead Management

You can generate highly qualified, prioritized leads, and automate your lead distribution process to handle leads faster with this subsystem. Lead management enables you to align marketing and

sales organizations and extend your lead management process to partner organizations in order to increase conversion rates. The application provides full visibility into the lead management process enabling you to optimize all activities.

Marketing Analytics

With this subsystem it is possible to leverage a wide range of analytics, such as customer values, churn scores and satisfaction scores, into make profitable decisions. Insights gained from the analysis will help you understand why marketing activities did or did not work. The application also helps you identify business challenges and opportunities and predict customer behavior, anticipate their needs, and create more relevant, targeted messages.

Web-based Marketing Surveys

The survey subsystem enables better communication between you and your customers. Many organizations now understand the need to capture information on the opinions and behavior of the people that matter to their business such as employees, customers, business partners, and suppliers. The survey subsystem is a comprehensive survey solution with real time, web-based reporting, and analysis. It allows you to easily create and deploy surveys either on a website, or within an e-mail. Once the survey is deployed, you can then take advantage of the reporting and analysis tools of the survey software to really understand what your target audience is telling you and respond accordingly. This information can then be used to make your marketing efforts more targeted and therefore more successful.

- **Online surveys**—This subsystem manages the entire survey cycle from building individual survey questions, to launching the survey either on a website, or via an e-mail. It delivers valuable information about your business in real time, allowing you to react quickly to address any issues that become apparent. Its user-friendly environment allows users to be up and running quickly with the minimum of training. By simplifying the survey design and deployment process advanced surveys shortens the deployment cycle, which allows you to gain more knowledge from more surveys more often. This subsystem dramatically reduces overhead by eliminating the need for expensive printed surveys, which need to be mailed to the target base. It also minimizes the time spent collating and tabulating results into meaningful data.
- **Getting the right information at the right time**—One of the major problems with traditional survey methods (for example print and telephone) is that by the time you have received the information, you have lost the opportunity to act, or even worse you may have lost a valuable customer to the competition. With online surveys the results are available as soon as the respondents complete the survey. This allows you to react to mission critical responses decisively and immediately.
- **Multiple deployment options**—The survey subsystem creates each survey as a separate hyperlink that can be placed on any website to help drive traffic to the survey. You can also upload contact lists and databases and send them a direct and unique link to the survey and track their individual response details. Furthermore, via integration with e-marketing you can actually place the survey in an e-mail so that your respondent never even has to leave his e-mail application to answer your questions.
- **Instant results**—All effective marketing and support efforts are results orientated. The granular results available will allow you to keep your finger on the pulse and prepare appropriate action plans. Overall summary results are available and these can be drilled down to the individual page, or question level and to the individual user level so that you can 'slice and dice' the data any way you wish. Easy to understand reports are available and all result data can be downloaded to excel for further analysis if necessary.

Self-Service Portal

This subsystem amplifies customer satisfaction with self-service. The self-service portal form helps you meet the demands of today's customer by allowing you to provide them with access to information and answers to their questions at their convenience. This robust, integrated application works with common Internet browsers to give enterprises in the small to mid-market a global support presence. Implementing this feature is like hiring a round-the-clock customer support agent—it provides all the necessary information and solutions your customers need to help themselves, anytime, anywhere. With the self-service portal customers can submit support calls as well as check on the status of open calls. In addition, customers can view their registered products, support agreements, and returned merchandise authorizations. The variety and scope of information accessible through the self-service portal can be customized, so even while empowering your customers with self-service, you remain in control of the information. The FAQ feature, an online store of answers to your customers' most frequently asked questions, allows customers to help themselves to information at anytime of the day and from anywhere in the world.

SUMMARY

The marketing module enables organizations to maximize the efficiencies of marketing resources and empowers marketers to acquire and develop long-term customer relationships. Marketers can analyze, plan, execute, and measure all marketing activities. With the tools and features of the marketing module you gain a flexible application to power marketing success. The marketing module supports critical marketing processes like marketing resource management, segment and list management, campaign management, e-mail marketing, trade promotion management, lead management, marketing analytics, web-based marketing surveys, self-service portal, etc.

Chapter 50

Sales, Distribution, and Service

INTRODUCTION

In today's global business environment, the one thing companies can count on is rapid change and the new opportunities and challenges that change is sure to bring. New competition pushes businesses to achieve higher levels of service while evolving technology compresses product life cycles, and forces companies to adopt new technologies or risk losing market share. In this ever-changing environment keeping a competitive edge means being able to anticipate and respond quickly to changing business conditions. The sales, distribution, and service module should support a wide range of customer-focused processes from selling products and delivering services to aftermarket warranty claims, service orders, and returns. It should help the organization to:

- Manage the complete sales order lifecycle, as well as all post-sales activities by tracking and managing inquiries, quotations, order generation, and processing, streamlining and automating contract, and billing cycle management processes, turning the Internet into a profitable sales and interaction channel and motivating sales force members with valuable incentive programs, commissions, profit sharing, and bonuses
- Simplify and accelerate the entire order-to-cash cycle
- Deliver orders on time and improve customer satisfaction
- Improve service delivery by tracking time spent on services and analyzing profitability
- Drive sales by facilitating customer engagement across all sales channels
- Streamline processes and reduce operational costs
- Boost productivity and increase sales and profit margins
- Accelerate logistics, manufacturing, service, and workforce processes
- Benefit from profitable sales and interaction channels
- Manage all important operational and financial aspects of your after sales service by managing installations, service contracts, warranties, service requests, and orders, helping OEMs and third-party providers run service as a strategic line of business, monitoring equipment warranties, maintenance agreements, and service license agreements, determining and creating billing documents based on services rendered and/or resources consumed.

To keep pace with these rapid changes companies need an integrated and a flexible enterprise system that supports all aspects of their business with state-of-the-art functionality. This innovative solution should upgrade effortlessly and interface easily with third-party applications as well as have the ability to incorporate existing systems while extending its reach to the Internet and e-commerce.

With today's business environment characterized by growing competition, shrinking cycle times, and the accelerating pace of technological innovation, companies are increasingly being forced to streamline business processes. In a world in which it is no longer enough to simply have the best product; these companies are focusing on core competencies and closer partnerships over the whole supply chain. Here, increased efficiency in sales and distribution is a key factor to ensure that companies retain a competitive edge and improve both profit margins and customer service. In helping

business to 'beat them on delivery', the sales and distribution modules of many ERP vendors offer a comprehensive set of best-of-breed components for both order and logistics management.

Many of these systems are tightly integrated with the Distribution Requirements Planning (DRP) engine of the 'for just-in-time' (JLT) deliveries. This integration enables the mapping and supply of single-site or multisite organizations and the definition of relationships in a company's internal supply chains. Developing precise logistics planning for JLT deliveries, this system can also generate replenishment orders by using defined warehouse requirements. The following are the sales related business transactions:

- Sales queries, such as inquiries, and quotations
- Sales orders
- Outline agreements, such as contracts, and scheduling agreements
- Delivery/shipment
- Invoicing/billing
- After sales support

During sales order processing the following basic functions are carried out:

- Inquiry handling
- Quotation preparation and processing
- Contracts and contract management (order management)
- Monitoring the sales transactions
- Checking for availability
- Transferring requirements to materials planning (MRP)
- Scheduling the delivery
- Calculating pricing and taxes
- Checking credit limits
- Invoicing/billing
- Creating printed or electronically transmitted documents (confirmations, and so on)
- Depending on how your particular system is configured, these functions may be completely automated or may also require some manual processing. The data that results from these basic functions (for example shipping dates, confirmed quantities, prices, and discounts) is stored in the system where it can be displayed and in some cases, changed manually during subsequent processing. The sales and distribution module very actively interacts with the material management and financial accounting modules for delivery and billing. Figure 50.1 shows the sales and distribution and associated processes.

Typically a sales and distribution module will contain the following subsystems:

- Master data management
- Order management
- Warehouse management
- Shipping
- Billing
- Pricing
- Sales support
- Transportation
- Foreign trade

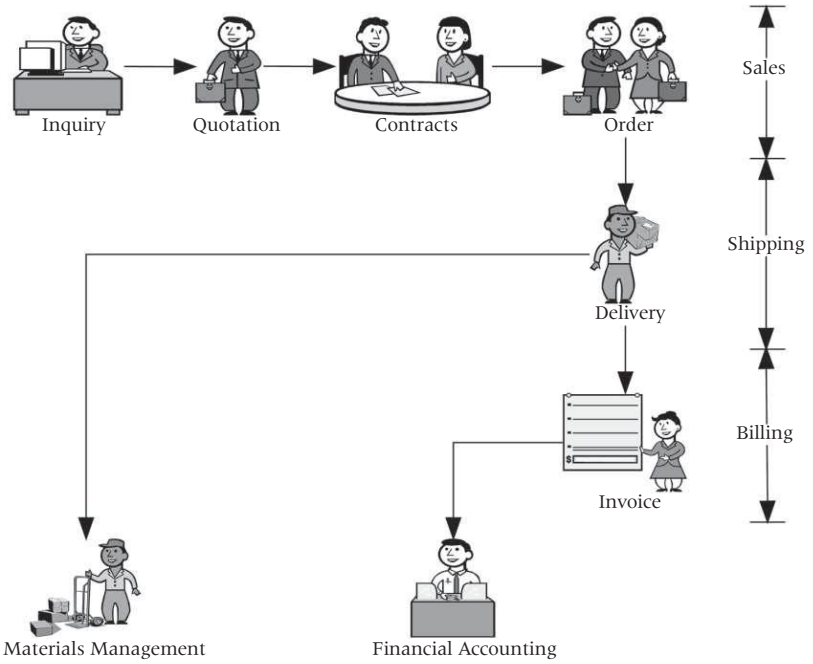

Figure 50.1 Sales and distribution.

Master Data Management

Every company will have products, customers, and will require raw materials and will have suppliers. The task of the master data management module is to keep information about all these entities so that these can be made available to the decision-makers and also for the automatic generation of reports, contracts, invoices, and so on.

In sales and distribution, products are sold or sent to business partners or services are performed for them. Data about the products and services as well as about the business partners is the basis for sales processing. Automatic sales processing using an ERP system requires that the master data has been stored in the system. In addition to sales and distribution, other departments of the company such as accounting, or materials management access the master data.

Order Management

This module usually includes sales order management and purchase order management and supports the entire sales and purchase processes from start to finish. With companies today being confronted with increasingly demanding customers and increasingly complex buying and selling organizations, both internally and externally, order management combines the provision of efficient management solutions with the possibility of anticipating and responding quickly to changes in global business conditions.

Sales Order Management

Applications in sales order management represent a company's most important point of contact with the customer. These applications allow a company to manage sales operations quickly and efficiently and provide comprehensive solutions for the management of quotes, orders, contracts, prices, and

customer discounts. Through the use of templates the system streamlines order entry procedures to manage products ranging in complexity from standard stocked items to those that are engineered to order. The system can also customize and streamline order entry procedures to the specific requirements of both an individual business and its customers; as well as generate intelligent pricing and discount strategies that are accompanied by simulation capabilities to support 'what-if' scenarios and are available for multicurrency environments.

The system can also create online available-to-promise calculations to ensure that there is sufficient product availability for a specific customer and if so, to identify exactly where and when that product is available. The built-in contract and release management system evaluates whether or not customer contract agreements are being met and incorporates multilevel customer credit reviews and substantial order blocking functionality. Evaluation of sales performance is possible through extensive report capabilities that retrieve both current and past information that concern orders, cancellations, budgets, and revenues. Rebate and commission control enables the automatic calculation of employee and supplier commissions to reward achieved targets based on predefined agreements and customer bonuses or rebates to reward customers for purchasing certain quantities. Electronic Data Interchange (EDI) streamlines communication throughout a company's entire supply chain, from customer to supplier. The system should support standard business documents such as orders and invoices along with general information such as project information and product specifications.

A good system will have tools and features for Sales Force Automation (SFA) and customer service. These tools include the tracking and tracing of appointments, schedules and follow ups, plus product, and sales feasibility information.

Purchase Order Management

Purchase order management is increasingly essential in today's ever more competitive business environment because it enables a company to make the correct purchase decisions about quality and price, where quality refers to supply lead time as well as to the (to be purchased) product itself.

Purchase order management includes online requisitioning, centralized contract management, just-in-time schedules, and vendor management (see Fig. 50.2). Offering access to an approved supplier list, purchase order management enables a purchase quotation to be sent to multiple suppliers. The purchase contract information is made available to the people in the purchasing department. This information will help in supplier selection and provide insight about which suppliers can supply items with the right specifications in the shortest period of time. The system will have the facility to generate purchase contracts.

Purchase requisition is a function that is used in the purchase in process. Purchase requisitions allow companies to enter nonsystem planned requirements for various types of items. Requisitioning can be linked to workflow for authorization purposes and to approve suppliers. Schedules can be used instead of orders to provide detailed purchase and delivery information. These schedules are generated in contracts in JLT environments in which customer service, in-time delivery and cost reduction are all-important, and can be sent through the supply chain by means of EDI communication. In addition, schedules are fully linked with other modules of the system.

Sophisticated vendor management tools allow companies to check the reliability and performance of vendors. The vendor rating system can handle both objective and subjective criteria. Objective criteria are tracked and traced automatically by the system and can include information about receipts, quality approval, invoicing, and purchase order confirmation. The user determines the subjective criteria. Together, these criteria enable companies to make the right purchase decisions with regard to quality, price, and delivery. Purchase order analysis enables historical as well as statistical data to be used to assist in the analysis of purchase activities.

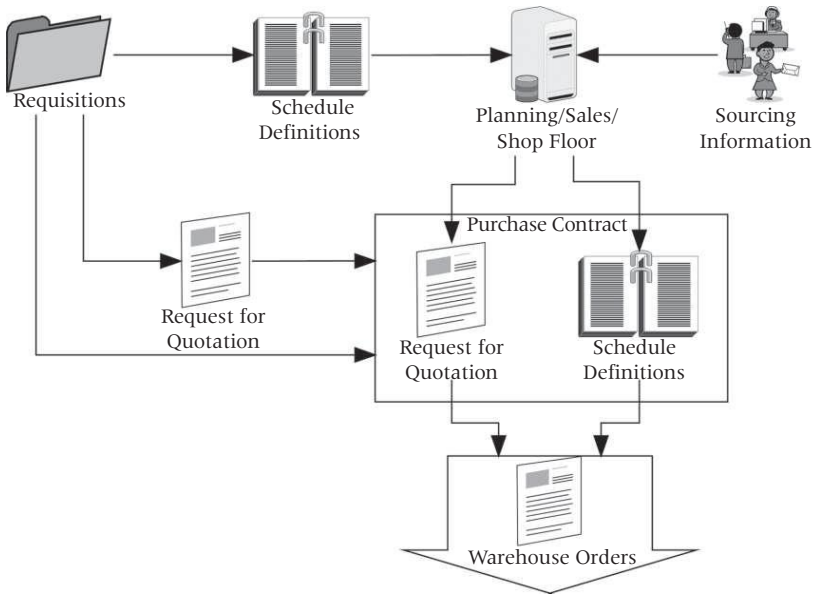

Figure 50.2 Purchase flow.

Warehouse Management

This module provides real time information about inventory levels across the enterprise and tools to manage the daily operational needs of single-site, or multiplesite four-wall warehouses. Coordination of an organization's warehouse network is one of today's most important business needs and requires an understanding of the relationship between different organizational units such as warehouses, production facilities, sales offices, and purchase offices. While the mapping of a single-site or multi-site organization and the definition of relationships in the internal supply chain can be undertaken with the help of the Distribution Requirements Planning (DRP), the actual transfer of goods can be handled through the warehouse management application.

The various components of a good warehouse management application will be designed to meet a wide range of warehousing needs such as the mapping of internal goods flows within warehouses and the monitoring of all warehouse inventory transactions. In addition, these components are centralized for areas that include production, sales, purchase, projects and service, and provide companies with the tools to inform customers about where (the company's, or the customer's) goods are located, the number of goods on hand, current storage conditions, and projected delivery schedules.

The warehouse management application should also offer expanded capabilities such as cross docking, rules based inventory replenishment, picking optimization, multilevel packaging, and consigned goods management. These capabilities also allow for easy integration with financial tools to provide greater enterprise-wide insight into costs. Components of a good warehouse management application include the following:

- **Inventory planning**—Comprises all planned inventory movements, which enable the accurate forecasting of trends and the consequent adjustment of re-ordering points, safety stock, lead times for orders, and service levels. Inventory planning also allows the commitment of inventory to a specific customer order—'hard allocation'—so that customers receive the right order in the right quantity at the right time

- **Inventory handling**—Allows for monitoring of all warehouse order scenarios such as the receipt, issue and transfer of inventory. Functions include the previously mentioned expanded capabilities such as cross docking, receipt by back-flushing, rules based replenishment of inventory, picking and wave-picking optimization, assembly, and multilevel packaging. To ensure fast communication with suppliers and customers advanced shipping notifications can be received or sent by means of EDI, which enables shipments to be received and allocated ahead of time
- **Intelligent location assignment**—This is used to create intelligent storage put-away lists, which enables the storage of goods that are automatically inspected for quality and the detection of dedicated locations by criteria such as item, storage conditions, packaging definitions, size restrictions, and location availability
- **Inventory reporting**—This function permits full visibility of inventory at single, or multiple sites and provides a company with the tools to give customers accurate delivery dates. The system's extensive reporting capabilities also enable consigned goods management
- **Inventory analysis**—This module enables the analysis of information that result from warehousing activities and the use of feedback in process optimization. In addition, inventory analysis supports inventory forecasting, inventory valuation, ABC analysis, and slow moving analysis
- **Lot control**—This facility offers lot tracking and tracing so that a company can trace all the raw materials and finished goods its products require. In a business world where customers demand product responsibility, lot of control helps to store product quality data and meet ISO 9001 certification standards
- **Distribution data collection**—This is an essential element in paperless warehousing that provides the communications link between storage and shipping systems and warehousing equipment like barcode scanners

Shipping

The shipping module supports the following functions:

- Monitoring dates of orders due for delivery
- Creating and processing deliveries
- Planning and monitoring work lists for shipping activities
- Monitoring material availability and processing outstanding orders
- Picking (can be linked to the warehouse management system)
- Packing deliveries
- Information support for transportation planning
- Support for foreign trade requirements
- Printing and sending shipping output
- Data update in goods issue

The 'Delivery' is the central shipping document. When a delivery is created (at the shipping point), shipping activities such as picking and delivery scheduling are initiated and monitored and the data generated during shipping processing is recorded (see Fig. 50.3).

A delivery can refer to a sales order or to a transportation order for stock transfer. Depending on your requirements you can create deliveries automatically using work lists, or manually. You can make agreements with your customers for complete and partial deliveries and for order combinations. The monitoring functions allow you to monitor created deliveries and outstanding sales activities.

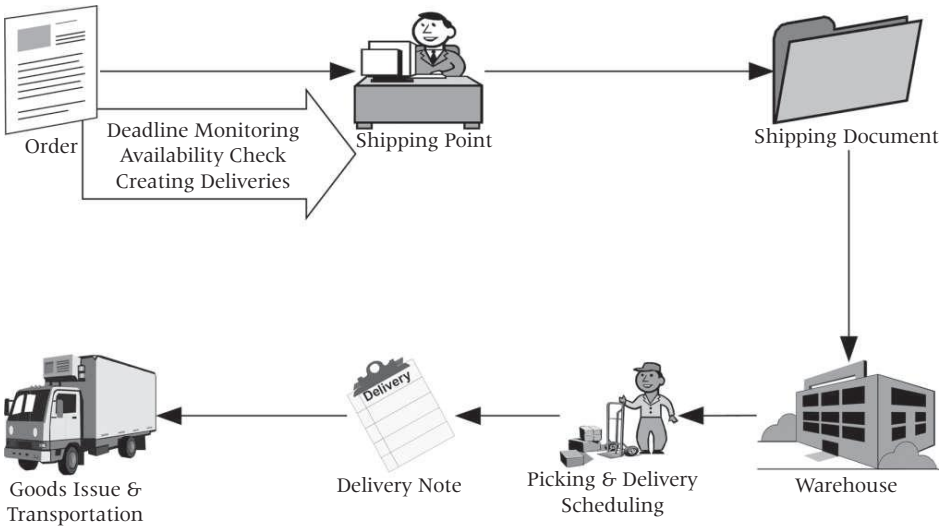

Figure 50.3 The shipping process.

Billing

A business transaction is completed for the sales and distribution department once it has been billed. ERP systems support the billing functions like issuing of invoices on the basis of goods and services, issuing of credit, and debit memos based on corresponding requests and pro forma invoices, canceling billing transactions, giving rebates, transferring billing data to financial accounting, purchasing, and so on. The billing system is integrated with the other modules like financial accounting, so that the documents are automatically generated.

Pricing

The term pricing is used broadly to describe the calculation of prices (for external use by customers or vendors) and costs (for internal purposes, such as cost accounting). The pricing module keeps the information about the prices of the various items, the details about the quantity discounts, the discounts to the different customer categories and so on, and enables the organization to generate documents like quotations, delivery notes, invoices, etc. Also since this information is available to all the sales people they can make better decisions thus, improving the sales performance.

Sales Support

The sales support component helps your sales and marketing department to support your existing customers and at the same time, to develop new business. Sales support provides an environment where all sales personnel—both the field sales people and the staff in your sales office—can contribute to and access valuable information about customers, sales prospects, competitors and their products, and contact people. The sales support component functions both as a source of information for all other areas of sales and distribution, and as an initiating force for acquiring business.

The sales support function has a rich tool set that will help you in creating direct mailings to develop new business as well as to consolidate the existing customer base. On the basis of sales information you already have stored in the system, you can create address lists of the customers and sales prospects that you wish to target with your direct mailing campaign.

Transportation

Transportation is an essential element of the logistics chain. It effects both inward and outward movement of goods. Effective transportation planning is required in order to ensure that shipments are dispatched without delay and arrive on schedule. Transportation costs play a considerable role in determining the price of a product. It is important that these costs are kept to a minimum in order to keep the price of a product competitive. Efficient planning and processing of transportation contributes to keeping these costs down. The aim of the transportation element of the SD system is to provide basic functions for transportation like transportation planning and processing, freight calculation, freight settlement, customer freight calculation, and freight invoicing, as well as functions for service agent selection.

The transportation functionality fulfills the requirements in the areas of transportation planning and processing for both inbound and outbound shipments. You can control and monitor the entire transportation process from the planning stage right through to the dispatch of the goods from your shipping point (outbound shipment), or the vendor location (inbound shipment) and their arrival at the customer location (outbound shipment), or your plant (inbound shipment).

Foreign Trade

In domestic, and increasingly in international trade, you are required by the authorities to adhere strictly to laws and regulations. The growing tendency towards the formation of trade areas is a further challenge to a company operating on a worldwide basis. The entire logistics chain from the import of raw materials, finished and unfinished goods, to the sale of goods and the transfer of data to materials management and financial accounts, is significantly influenced by foreign trade activities. These main tasks in foreign trade processing can be carried out using the foreign trade system.

SUMMARY

In a world where it is no longer enough to simply have the best product; companies are focusing on core competencies and closer partnerships over the whole supply chain. Here, increased efficiency in sales and distribution is a key factor to ensure that companies retain a competitive edge and improve both profit margins and customer service. In helping business to 'beat them on delivery', the sales and distribution modules of many ERP vendors offer a comprehensive set of best-of-breed components for both order and logistics management. The sales, distribution, and service module offer the automation of the business transactions like sales queries, inquiries and quotations, sales orders, outline agreements such as contracts and scheduling agreements, delivery/shipment, invoicing/billing, after sales support, etc.

Part VI

The ERP Market

- ERP Marketplace and Marketplace Dynamics
- ERP Vendors

Chapter 51

ERP Marketplace and Marketplace Dynamics

INTRODUCTION

The ERP market is a very competitive and fast growing market. Economic growth, new emerging markets, and increasing demand from SMEs contribute to industry growth, whereas high cost of ERP implementation and software piracy tend to block the growth rate. Economic growth fueled IT spending in the manufacturing, banking and finance, and public sectors. IT spending, technological innovations, and economic growth influence the industry dynamics. High market growth, increasing mergers and acquisition, and high product diversification have made the industry highly competitive, calling for constant innovation by companies to maintain and gain market share. Accessibility of such new delivery models such as Software as a Service (SaaS) will boost SMEs investment in the software.

MARKET OVERVIEW

According to Lucintel (www.lucintel.com), a leading global management consulting and market research firm, the global ERP software industry reached an estimated $47.5 billion in 2011 with 7.9% CAGR (Compound Annual Growth Rate) and is forecast to attain an estimated $67.7 billion by 2017 with a 6.1% CAGR over 2012–2017. The report focuses on North America, Europe, Asia Pacific, and rest of the World. Currently, North America's dominance prevails in the industry. Asia Pacific, and Rest of the World witnessed the highest growth during 2006–2011, and this growth momentum is likely to continue during 2012–2017. Asia Pacific and Latin America are expected to be industry drivers due to their large base of SMEs heavily investing in software.

The ERP marketplace is stable and growing after a bit of a slow-down during the 2008–2009 recession. Companies that postponed investment in enterprise systems during the difficult times are now beginning to invest again as business returns to a growth phase with the improving economy.

ERP market size, impressive as it is, is not really of much important to anyone except ERP software suppliers. Although there are quite a number of those suppliers, a small handful enjoy a majority of the ERP market share. 2011's top three ERP suppliers were SAP, Oracle, and Microsoft. Market leaders also include Infor and Epicor. Between the four companies, they enjoy more than half of all ERP revenue over the last several years.

After the top five, there are a number of other established, successful ERP suppliers including Consona, Sage, QAD, IFS, NetSuite, HansaWorld, HarrisData, and others. Each of these companies has carved out a place in the ERP marketplace by offering alternatives to 'big ERP' that are affordable, quicker and easier to implement, and/or specially designed to address the unique needs of a specific market segment. The mid-market remains a fertile area for growth as well as a key competitive battleground, with industry specialization representing the best opportunity for differentiation.

Interestingly, the concept of a supply chain management market distinguishable from and ERP market has never really taken hold. Supply chain software evolved from Advanced Planning

and Scheduling (APS) and supply chain planning functionality has been absorbed by the ERP market, blurring the distinctions between the two segments. Generally speaking, supply chain software, in addition to planning and optimization, includes warehouse management, transportation management and supply chain event management systems.

The ERP market has undergone a significant consolidation over the last ten years. Many of the independent ERP suppliers that evolved in the 1980s and 1990s merged or were acquired as companies sought out additional functionality, technology or market share. For example, SAP acquired Business Objects, Sybase, SuccessFactor, Syclo, Ariba, etc. Oracle acquired PeopleSoft, J.D. Edwards, Siebel, Hyperion, etc. Infor acquired GEAC ERP, SSA Global, Lawson Software, etc. The ERP market continues to benefit from a widespread acceptance of the idea that business must have integrated information systems to be competitive.

ERP MARKET TIERS

Depending on your organization's size and needs, there are a number of ERP software vendors to choose from in the large enterprise, mid-market and small business ERP markets. ERP market segments or tiers are created based on the company size (revenue, number of users, etc.) and the features required by the organizations. A comparison of the characteristics of the ERP vendors of the three market tiers is shown in Table 51.1.

Large Enterprise ERP (ERP Tier I)

The ERP market for large enterprises is dominated by three companies: SAP, Oracle, and Microsoft. Tier I ERP vendors sell complex ERP products that have successfully penetrated the Tier I market that consists of companies with annual revenues in excess of $ 250 million with global ERP requirements. These Tier I ERP vendors have developed mid market pricing and implementation strategies to make them more appealing to the mid market buyer. They rarely sell to a Tier III company unless that company has plans to grow into a Tier II company quickly. Tier I ERP companies have a complex

Table 51.1 Characteristics of the ERP vendor tiers

Tier I ERP Products	Tier II ERP Products	Tier III ERP Products
For companies with annual revenue more than $250 million	For companies with annual revenue between $25 million and $250 million	For companies with annual revenue less than $25 million
High complexity	Medium complexity	Limited functionality
Highest cost of ownership	Medium cost of ownership	Lowest cost of ownership
Can be used in many industries	Vertical industry focus	Vertical industry focus
Industry-specific solutions for most industries	One product for all industries	One product for all industries
Largest ERP companies	Medium ERP companies	Small ERP companies
International operations	International operations	
Multilanguage, multicurrency capabilities	Can have multilanguage and multicurrency support	

set of requirements. Most significant is the need to manage multiple companies and multiple plants with international locations. Only a few vendors have functionality to meet these needs. Tier I ERP products have a higher cost of ownership. This is simply because these products are just more complex than their Tier II ERP competition, and thereby cost more to implement and support. The benefit to a Tier I ERP product is that they have more functionality that you can grow into, and that these companies have the size and resources to keep up with technology.

Mid-market ERP (ERP Tier II)

The Tier II market is the largest of all the tiers in terms of the number of potential customers. This is the mid-sized tier. The customers of Tier II software usually are in the $25 million to $250 million dollars. Tier II ERP products generally have medium complexity. They address all of the application needs of a larger company but their applications are less complex. Tier II ERP products have a lower cost of ownership than a Tier I ERP product. Their software is lower which means their annual fees are lower and they easier to implement and support. Often the Tier II vendor has a vertical industry focus whereas a Tier I product can be sold in many vertical markets. They are usually just a few localized sites. For example a company that has a main office or head quarters, with a manufacturing facility and a distribution outlet would be a typical Tier II client. Often though, Tier II customers are single site. The main indication is the size of the company by revenue. This is important in that there will not be more than a couple of hundred users. Some references to the Tier classification refer to the number of employees. This is really not a good indicator as sometimes smaller companies with labor intensive processes may only have a few computer users.

Vendors in this class include Infor, QAD, Glovia, Sage, IFS, Epicor, ABAS, CDC Software, Cincom, Fujitsu, IBS, Plex Systems, Ramco, and a host of others.

The problem that the Tier II vendors face is that the Tier I players are pushing down into this space. The market in the Tier I arena is small and to continue to expand their businesses, the Tier I players are reducing cost, simplifying transaction sets, and offering outsourced hosting and other incentives to allow a medium sized company to have the broad features of the Tier I package. The benefit to a Tier II ERP product is that they are designed and priced for the middle market. They also may better partners for a mid-market company.

Small Business ERP (ERP Tier III)

Tier III software is designed for single site customers of under $25 million dollars. These are companies with 5 to 30 users and have less demanding needs. Often these companies have just grown out of the accounting packages and are looking to expand their capabilities. These companies tend to be the family run or small corporations. Vendors in this class include Consona, Exact Globe, Expandable, Activant Solutions, NetSuite, Smarter Manager, Solarsoft Business Systems, Syspro, Visibility, xTuple, etc.

The benefit to a Tier III ERP product is that they are designed for small establishments, have a low cost of ownership, and are quick and easy to implement. The risk is that a company may outgrow the product in a few years, and the ERP Tier III vendor is a smaller company with limited size and resources to keep up with technology.

SAAS, IAAS, AND PAAS

As we have seen in Chapter 26, **SaaS** or **Software as a Service** is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.

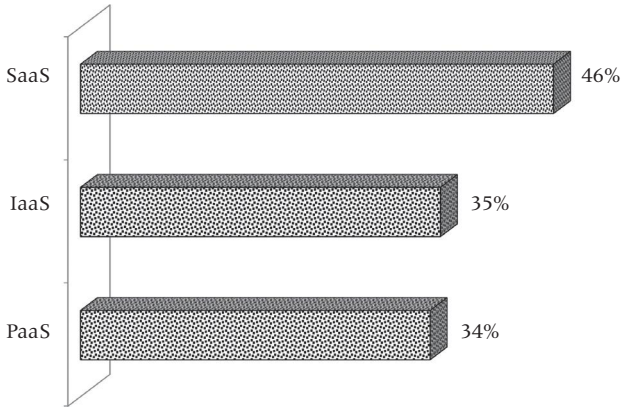

Figure 51.1 Likely investments in different cloud computing service models.

PaaS or **Platform as a Service** is a way to rent hardware, operating systems, storage, and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

IaaS or **Infrastructure as a Service** is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers, and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis. IaaS is one of three main categories of cloud computing service. The other two are Software as a Service (SaaS) and Platform as a Service (PaaS). Infrastructure as a Service is sometimes referred to as Hardware as a Service (HaaS).

According to KPMG International [1], nearly half of the end-users surveyed (46%) stated that their most likely investments are expected to be in cloud-delivered SaaS. The results of the study are shown in Fig. 51.1.

MARKETPLACE DYNAMICS—ON-PREMISE ERP

SAP and Oracle are the two biggest names in the ERP market. The companies have competed head-to-head with each other for decades and both have demonstrated keen ability to adapt to the changing demands both of their clients and the economic environment. Although Microsoft Dynamics is not quite of the same scale as SAP and Oracle, the three together comprise the entirety of the Tier I ERP market. Each have grown to offer solutions to suit clients outside of their historical target market; SAP and Oracle now are becoming more viable for small and mid-sized businesses while Microsoft Dynamics is now more viable for mid- to large-sized businesses. The growth of the ERP market is fuelled by the following there factors.

- ERP vendors are continuing to expand market presence by offering new applications such as supply chain management, sales force automation, customer relationship management, business analytics and business intelligence, and human resources
- To sustain their rapid growth, ERP vendors will look to sell more licenses into their installed base

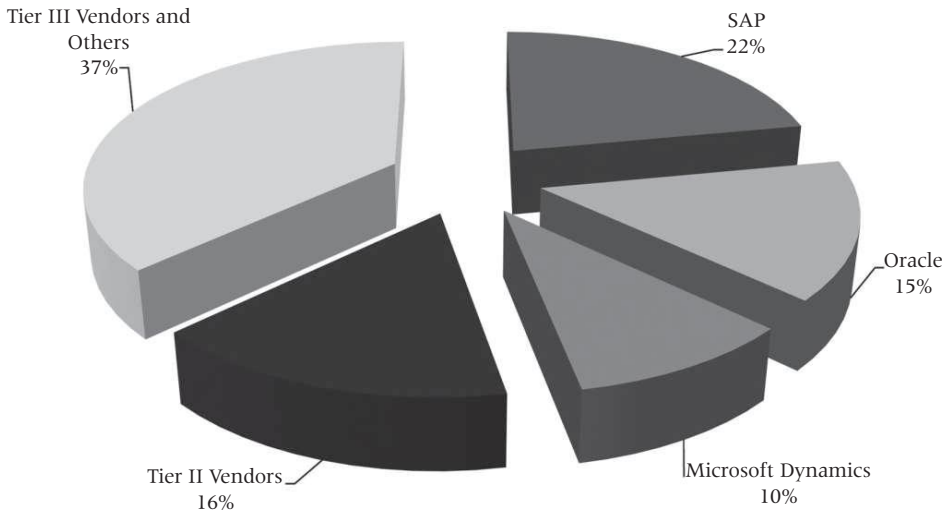

Figure 51.2 ERP market share 2012. (*Source*: Panorama Consulting Solutions)

- While ERP originated in the manufacturing market, ERP usage has spread to nearly every type of enterprise including retail, utilities, public sector, and healthcare organizations

The ERP market is projected to bring in sales in the $50.3 billion dollar by 2015, according to Forrester [3]. The figures for the year 2010 and 2011 were $43 billion and $45.5 billion respectively. The expected figure for the year 2012 is $46.4 billion and is supposed to cross $50 billion by 2015. As we have seen earlier Lucintel has estimated the ERP revenue is $50.3 billion for the year 2015 and 67.7 for the year 2015. Both the studies predict similar growth rates for the ERP market. According to Panorama Consulting Solutions [2], the ERP market share of 2012 is as shown in Fig. 51.2. The study also revealed that SAP is the most commonly short listed ERP system, but once short-listed, Oracle has the highest percentage of selection.

MARKETPLACE DYNAMICS—ON-DEMAND ERP

In 2011, the on-demand or SaaS-ERP comprised just two percent of the ERP market. SaaS-ERP accounted for 14.1% of the total SaaS market. The other solutions that are part of the SaaS market are CRM (31.4%), Content Communication and Collaboration (26.4%) and others (28.1%). According to a Forrester study [3], the SaaS ERP which is just 2% of the ERP market is expected to grow by about 21% annually through 2015 to reach 4%.

SaaS-ERP gained momentum as SMEs started opting for it because of the low initial cost. Another factor that led to the growth of the on-demand ERP market was the decision by SAP and Oracle to come out with SaaS products. IT departments are attracted to the SaaS model because it provides relief from disruptive version upgrades and manages a large number of disparate applications.

As SaaS ERP solutions eliminate the need to install hardware and ensure easier and faster implementation, executives involved in technology decision-making across businesses are increasingly turning to these solutions. However, the penetration of SaaS within ERP varies greatly between sub-segments, with Human Capital Management (HCM) having the most penetration. The availability of HR systems as SaaS—which can be paid for on a monthly subscription basis—

helps companies manage HR data in real time. Some of the core HR areas for SaaS that are gaining importance are labor management, HR administration, payroll and recruitment.

According to KPMG International [1], in 2011, the worldwide SaaS ERP market revenue reached $1.7 billion, up by 13.3% from $1.5 billion in 2010. In 2012, the worldwide SaaS market revenue is expected to reach $2 billion. The global SaaS market is expected to reach $3 billion by 2015, growing at a CAGR of 14.7% during 2011–2015. Companies across industries are increasing their investments, shifting their projects from on-premise to SaaS.

In 2011, North America accounted for 63.4% of the global SaaS market. In 2011, SaaS revenue in the region reached $1.1 billion; a 20% increase over the revenue generated in 2010 and is expected to grow to $1.8 billion by 2015. Ease and speed of deployment and lower Total Cost of Ownership (TCO) are driving the growth. In Latin America, SaaS revenue is forecast to total $97.9 million in 2015, up from $46.7 million last year.

In Western Europe, SaaS revenue grew 23.3%, from $300 million in 2010 to $400 mbillion in 2011 and it is expected to grow to $700 million in 2015. In the Eastern European region, it is projected to reach $38.1 million in 2015, up from $19.1 million last year. Apart from these regions, Northern Europe, which comprises the UK, Ireland, the Netherlands and Nordic countries, is also experiencing a robust SaaS adoption. Major factors contributing to the robust growth in the European SaaS market include culturally open outlook toward technology adoption, well-established internet infrastructure and English as the primary language.

In the Asia Pacific region, SaaS market revenue grew 21.5%, from $84.9 million in 2010 to $103.1 million in 2011 and is expected to grow to $200 million by 2015. Australia, New Zealand, Hong Kong, Singapore, and South Korea are some of the key SaaS markets that offer growth opportunities for service providers. In Japan, SaaS revenue reached $60.2 million in 2011, up 35.4% from $44.5 million in 2010 and is expected to grow to $88.7 million by 2015. Major factors spurring growth include established infrastructure, more stable networks and availability of vendor sales, marketing and support service structures.

INDUSTRY WISE ERP MARKET SHARE

According to a study by TEC [4], between October, 2011, and March, 2012, in TEC's online Evaluation Centers, manufacturing companies were in the top spot, with 28% of projects (See Fig. 51.3).

This data is based on evaluation projects from firms with annual revenues averaging between $51 and $250 million, and ERP software selection budgets averaging between $250,001 and $500,000.

Figure 51.4 shows the top ERP features and functions that manufacturers requested in TEC's Evaluation Centers. Financials and accounting is, not surprisingly, in first place. This is a core part of ERP functionality, and manufacturers seeking to improve their efficiency are no doubt looking for better ways to manage and track accurate information about their current and projected financial activities. The rest of the top five—purchasing management, inventory management, APS, and sales and order management—speak to manufacturers' needs to accommodate a broader spectrum of activities, such as managing larger and more sophisticated orders and supporting multiple facilities for inventory planning and costing.

ERP – THE INDIAN SCENARIO

The Indian scenario is slightly different from the global one. Today, India is transforming into a world IT hub and all major players in the field are working constantly towards promoting and expanding their market. In this scenario ERP solutions will be playing a major role in growth of small and

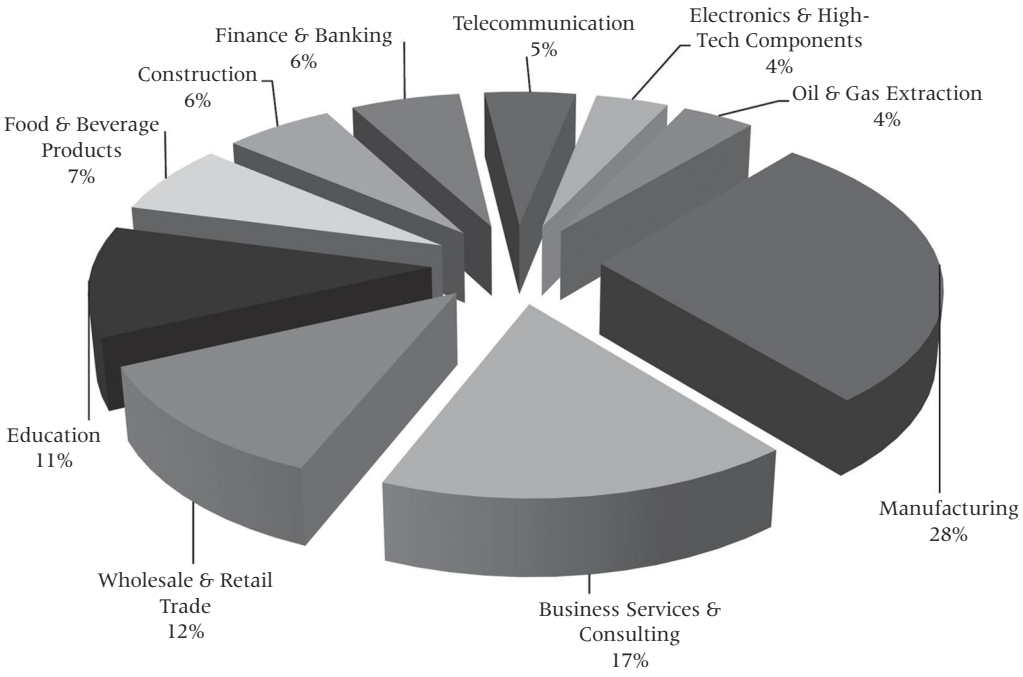

Figure 51.3 Top 10 industries evaluating ERP solutions.

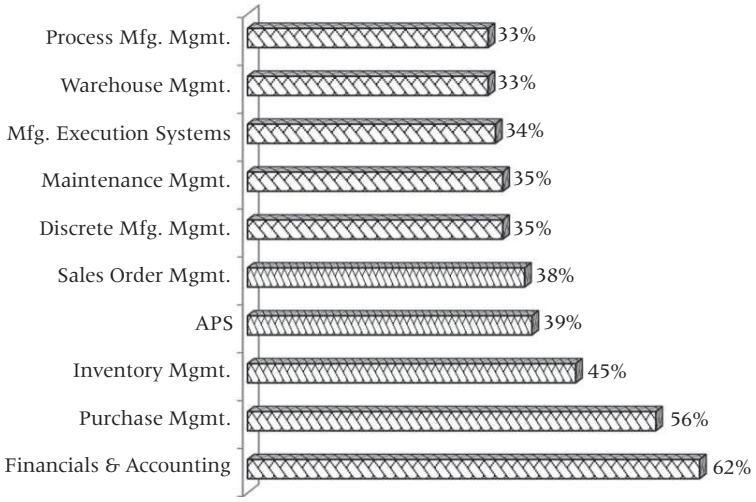

Figure 51.4 Top ERP modules requested.

medium size industries in India apart from contributing largely into the big business enterprises. In India, the small and medium-sized enterprises are the major force that pushes the growth. Small and medium enterprises across industry verticals and micro verticals, such as automotive, pharmaceuticals, and textiles, are leveraging ERP solutions to gain sustainable competitive advantages.

Inflexibility of earlier ERP systems from Tier I vendors like SAP and Oracle pushed the customization drive during the early days. But the situation has changed as the major ERP vendors have changed

their game plan and have come out with solutions suited for the Indian market. Majority of Indian manufacturers are small by global standards, requiring easy-to-use ERP solutions to meet their specific process requirements, including localization needs to address the continually evolving tax and statutory requirements. In this aspect the Indian ERP vendors have a definite advantage as they can respond to the market demands faster.

Initially the ERP solutions were used only for back office functions. They were not given the due importance and were treated just like another supporting function. Reasons like lack of awareness formed one part while other reasons were costs and technical difficulties. But that situation has changed and now organizations are going in for the full supply chain integration. Customers are moving from a best-of-breed to a best-for-business approach, implying that they prefer extensions to their existing ERP for applications like planning and optimization, business intelligence and knowledge management. This has resulted in ERP vendors introducing new technologies.

High cost of the ERP system is a major deterrent for most SMEs. So they prefer to go in for Tier III vendors for on-premise solutions or the SaaS option for on-demand solutions. Most Indian ERP vendors offer on-premise solutions that are affordable to SMEs and many of them also offer SaaS versions.

Market Size and Forecast

Indian ERP market is booming and is poised for an exponential growth in the coming years. Sonal Desai of Computer Reseller News [5], predicts a bright future for ERP vendors in the coming years. In an interview with industrial experts Ms. Desai brings out the trends, market size, opportunities, and the reasons for the growth of the Indian ERP market.

According to Kalyan Banga, Manager, Product Development, Netscribes India (www.netscribes.com), the Indian ERP market is currently estimated to be worth $7.3 billion and is expected to grow at a CAGR of 25 percent in the next 3–4 years. And a study by AMI Partners reveals that of the 4.1 million Indian SMBs with PC penetration almost a million would consider investing in an ERP solution in the next four years.

The main factor the fuel the growth of the Indian ERP market is the increased interest of the SMEs and they are attracted to ERP adoption by the reduced product and service cost, enhanced productivity, low time consumption, automation, diminished risk of stock-outs and lower lead time.

According to Paresh Shah, Partner, PH Teknow (www.phteknow.com), a Mumbai-based Microsoft partner, there is a new breed of second-generation entrepreneurs who want to grow fast, expand geographically, and are looking at scalable options. These new-age entrepreneurs have the technical know-how and a detailed process plan in place and are our new prospects. These next-generation businessmen are willing to invest in ERP right from the start. Vikram Suri, MD, Sage Software, India and the Middle East, has a similar opinion. He feels that these new-age CXOs are driving ERP deployments. "They have a good sense of their business, so they will not adopt a technology just for the sake of it but only to enhance their business." New-age businessmen realize that ERP not only enhances productivity but also results in cost savings. This realization at an early stage is leading start-ups to deploy ERP. For example, the Alila Diwa Goa, a 5-star hotel and part of the Alila Group of Hotels, had earmarked investment for ERP at the planning stage itself. The company implemented the Sage Accpac ERP at the hotel.

According to Devesh Aggarwal, CEO, Compusoft (www.compusoftindia.co.in), a Mumbai-based Microsoft partner, "Global best practices also play a major role in influencing new entrepreneurs to opt for advanced technologies. With compliance being the new norm across industries, vendors are embedding industry best practices and standard processes in ERP solutions, and these are a huge draw."

Another growth factor for ERP is the increasing technical awareness among SMBs who are moving from vendors who offer just the core ERP functionality to more sophisticated vendors who offer SCM, CRM and BI with ERP. This has proven advantageous for the global ERP vendors to establish themselves in the Indian market and if they play their cards right and formulate the right strategy for pricing and functionality they can increase their market share.

Market Opportunities

Finance, distribution, retail, media, and services contribute 30% to 40% to the overall ERP segment. Sensing the opportunities, vendors are introducing vertical-specific templates to enable partners to close deals and deploy the solutions faster. According to a recent Zinnov study [6], retail is the single-largest vertical by addressable opportunity with two million firms ready for technology adoption and expansion, followed by professional services at 1.9 million and manufacturing at 1.2 million. By 2015, retail will stand at 2.5 million, professional services at 2.3 million, manufacturing at 1.6 million, and hotels and restaurants at 1.1 million enterprises. The education segment is not far behind, and is expected to grow to 1.1 million units from the current 0.9 million units. Oracle is working with partners to develop industry-specific solutions. SAP has developed templates for 26 industries and is now looking at the auto components, dairy, specialty chemicals, infrastructure, healthcare, sugar, poultry farms, and textile sectors.

On-premises vs. On-demand ERP

The increasing popularity of on-demand or SaaS ERP model has changed the market dynamics in the Indian ERP market too. Most ERP vendors offer both on-premises and on-demand versions of their ERP products. Like the global market, in India also the cloud-based and hosted ERP deployments are slowly growing even though the on-premise deployments still dominate the market. All the major international players like SAP, Oracle, Microsoft, Infor, Epicor, Sage, etc. and the Indian players like Ramco Systems and 3i Infotech have both on-premise and on-demand.

SUMMARY

The ERP market is a very competitive and fast growing market. According to Forrester the ERP market will reach $50.3 billion dollar by 2015 and according to Lucintel the global ERP market will reach $67.7 billion by 2017. SAP, Oracle, and Microsoft are the top three ERP vendors. The ERP market has undergone a significant consolidation over the last ten years. Many of the independent ERP suppliers that evolved in the 1980s and 1990s, merged or were acquired as companies sought out additional functionality, technology or market share.

Depending on your organization's size and needs there are a number of ERP software vendors to choose from in the large enterprise, mid-market and small business ERP markets. ERP market segments or tiers are created based on the company size (revenue, number of users, etc.) and the features required by the organizations.

The biggest customers of the ERP solutions is the manufacturing industry followed by business service and consulting, wholesale and retail, and education. The most often implemented ERP modules are Financials and accounting, purchase management, inventory management, advanced planning and scheduling, and sales order management.

In the Indian market, the SMEs rule the market and most ERP vendors—both International and India—are coming out products that are affordable and attractive to those market.

REVIEW QUESTIONS

1. Give an overview of the ERP market.
2. Explain the trends in the ERP market.
3. What are ERP market tiers? What are their characteristics?
4. What are tier I ERP vendors? Give examples.
5. What are tier II ERP vendors? Give examples.
6. What are tier III ERP vendors? Give examples.
7. What is the impact of SaaS, PaaS, and IaaS software distribution models on the market?
8. Discuss in detail the marketplace dynamics of on-premise ERP.
9. Discuss in detail the marketplace dynamics of on-demand ERP.
10. How on-demand ERP is going to influence the ERP market?
11. What is the dynamics of the Indian ERP market?
12. What is the significance on the focus on small and mid-sized companies?
13. What is the forecast on the Indian ERP market size?
14. What are market opportunities for ERP vendors in the Indian market?
15. What is the dynamics of on-demand and on-premise ERP models in the Indian market?

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Chapter 52

ERP Vendors

INTRODUCTION

ERP vendors are the people who develop and sell the ERP packages. They are the people who have invested huge amounts of time and effort in research and development, to create the packaged solutions. If one studies the history of ERP packages and finds out how each package evolved, then it soon becomes evident that every ERP package grew out of the experience or opportunity of a group of people working in a specific business who created systems that could deal with certain business segments. ERP vendors spend crores of rupees in research and come up with innovations that make the packages more efficient, flexible and easy to implement and use. Also, with the evolution of new technologies the vendors have to constantly upgrade their products to use the best and latest advancements in technology.

Now with the ERP marketplace become crowded with more and more players entering the market and the competition increasing, today's ERP packages have features and functionality to cater to the needs of businesses in almost all sectors. Even though there hundreds of vendors of different size in the ERP market, more than 70% of the market share is owned by the top ten vendors.

We will see an overview of some of the top ERP vendors and the products in this chapter. The reason for not going into the details of each company and their products are many. The ERP market is very dynamic and volatile with many new companies entering, existing companies merging, and small companies being acquired by large ones and so on. So the information provided will be soon outdated if a lot of details are provides as each company will be bringing new products, phasing out existing ones and so on. Another factor is the ease of availability of the vendor information. All the vendors have websites and detailed information with comprehensive product torus, brochures, video tutorials and demos are available on the websites. This information will be current and up-to-date as the vendors will keep the information on their websites current. A constantly updated and maintained list of ERP vendors and the links to their websites can be found at the Wikipedia page which is at *http://en.wikipedia.org/wiki/List_of_ERP_software_packages*.

SAP AG

In 1972, five former IBM employees—Dietmar Hopp, Hans-Werner Hector, Hasso Plattner, Klaus Tschira, and Claus Wellenreuther—launched a company called Systems, Applications, and Products in Data Processing (SAP) in Mannheim, Germany with a vision to develop standard application software for real-time business processing. With total revenues of $ 18.54 billion in the financial year 2011, this company is now the recognized leader in providing collaborative business solutions for all types of industries and for every major market. Headquartered in Walldorf, Germany, with locations in more than 130 countries and more than 61,000 employees, SAP AG is the world leader in enterprise software and softwarerelated services.

Business Suite

With SAP's Business suite, you can run your operations from procurement to supply chain management efficiently with applications that integrate seamlessly with one another. You can get all of your lines of business working together – aligning processes, gaining efficiencies, and sharing information across the organization for better decision making. You can collaborate both within and outside your business network – relying on a single platform, leading services, and integrated solutions, delivered on premise, on demand, and on device.

The business application that are part of the Business suite are Customer Relationship Management (CRM), Enterprise asset management, Financials, Human capital management, Procurement, Product Lifecycle Management (PLM), Supply Chain Management (SCM), etc. These applications can also be integrated with SAP ERP for the most efficient functioning of the enterprise.

SAP Analytics

You can improve the efficiency and effectiveness of your organizations by using the features provided by SAP Analytics. With SAP analytics, you have virtually unlimited knowledge at your fingertips. The analytics software can help you process massive amounts of data instantly–for real time insights you need to make more informed decisions anytime and anywhere–even from your mobile device. The analytics solutions include applied analytics, business intelligence, data warehousing, enterprise information management, enterprise performance management, governance, risk, and compliance, etc.

SAP ERP

SAP ERP is SAP's flagship ERP product. It was earlier known as SAP R/3. In 2004, SAP R/3 was replaced with the introduction of ERP Central Component (SAP ECC). SAP ECC is the foundation software to which the different functional modules can be integrated, The modules available are financials (financial accounting and management accounting), human capital management (hr and payroll, time and attendance, and talent management), sales and service (sales order management, aftermarket sales and service, professional service delivery, and incentive and commission management), procurement and logistics execution (procurement, inventory and warehouse management, inbound and outbound logistics, and transportation), product development and manufacturing (product development, product data management, production planning, and manufacturing operations), corporate services (plant maintenance, project management, quality management, and travel management), etc.

SAP's industry specific solutions are available for more than 24 industries including aerospace & defense, automotive, banking, chemicals, consumer products, defense and security, engineering, construction, and operations, healthcare, higher education and research, high tech, industrial machinery and components, insurance, life sciences, media, mill products, mining, oil and gas, professional services, public sector, retail, telecommunications, transportation and logistics, utilities, wholesale distribution, etc.

SAP Business One

Designed specifically for small businesses that want to fully integrate their end-to-end business and grow, the SAP Business One application provides a single, affordable solution for managing the entire business, including accounting, financials, sales, service, customer relationships, warehousing, and operations.

SAP Business ByDesign

SAP Business ByDesign is a SaaS solution that is ideally suited for SMEs and subsidiaries of large corporations. It is a complete, integrated suite that can run your whole enterprise – financials, human resources, sales, procurement, customer service, and supply chain.

SAP Business All-in-One Solutions

SAP Business All-in-One solutions are designed for midsize or quickly growing small companies that need to optimize their business and outperform their competition. For companies that want to focus on operational excellence, business agility, and customer intimacy, the solutions provide in-depth functionality for running the entire business efficiently.

Website: www.sap.com

ORACLE CORPORATION

Oracle Corporation (founded in 1977) is the world's second largest software company and the leading supplier of software for enterprise information management. With total revenues of $37.1 billion in the financial year 2012, the company offers its database, tools and applications products, along with related consulting, education and support services. Oracle employs more than 115,166 people (as of June, 2012) in more than 145 countries around the world.

Headquartered in Redwood Shores, California, Oracle is the first software company to implement the Internet computing model for developing and deploying enterprise software across its entire product line: databases and relational servers, application development and decision support tools, and enterprise business applications. With the acquisition of PeopleSoft and JD Edwards, Oracle offers one of most comprehensive range of applications.

Oracle Applications

Oracle Applications provide complete choice and a secure path for customers to benefit from the latest technology advances. Oracle offers more than ten comprehensive product lines, including Oracle E-Business Suite, Siebel, Fusion, Primavera, PeopleSoft, JD Edwards, etc. Each product line is designed to meet specific business needs in areas such as sales, business intelligence, enterprise resource planning, commerce, and more.

Oracle's industry solutions are best-in-class products that address complex business processes relevant to a wide range of industries. Oracle's solutions speed time to market, reduces costs, and deliver a competitive edge. Some of the industries served by Oracle's specific industry solutions are aerospace and defense, automotive, chemicals, communications, consumer goods, education and research, engineering and construction, financial services, healthcare, high technology, industrial manufacturing, insurance, life sciences, media and entertainment, natural resources, oil and gas, professional services, public sector, retail, travel and transportation, utilities, wholesale distribution etc.

Oracle E-Business Suite

Oracle E-Business Suite is the most comprehensive suite of integrated, global business applications that enable organizations to make better decisions, reduce costs, and increase performance. With hundreds of cross-industry capabilities spanning enterprise resource planning, customer relationship management, and supply chain planning, Oracle E-Business Suite applications help customers

manage the complexities of global business environments no matter if the organization is small, medium, or large in size.

Siebel

Oracle's Sibel CRM is one of the world's most complete Customer Relationship Management (CRM) solution and helps organizations differentiate their businesses to achieve maximum top- and bottom-line growth. Siebel delivers a combination of transactional, analytical, and engagement features to manage all customer-facing operations. With solutions tailored to more than 20 industries, Siebel CRM delivers comprehensive on premise and on demand CRM solutions that are tailored industry solutions with ole-based customer intelligence and pre-built integration.

Oracle Fusion Applications

Oracle Fusion Applications were designed, from the ground, up using the latest technology advances and incorporating the best practices gathered from Oracle's thousands of customers. They are 100 percent open-standards-based business applications that set a new standard for the way we innovate, work, and adopt technology. The Fusion applications include CRM, SCM, financials, governance, risk and compliance, human capital management, procurement, project portfolio management, etc.

Oracle Primavera

Oracle Primavera is the leading Enterprise Project Portfolio Management (EPPM) solution for project-intensive industries. It offers best-in-class capabilities focused on mission critical PPM requirements of industries like engineering and construction, discrete and process manufacturing, public administration, financial services and others. Oracle Primavera enables enterprise agility, team productivity, portfolio predictability and overall project management efficiency. The result is the ability to drive down costs, minimize risk and deliver results to key stakeholders.

Oracle's PeopleSoft Applications

Oracle's PeopleSoft applications are designed to address the most complex business requirements. They provide comprehensive business and industry solutions, enabling organizations to increase productivity, accelerate business performance, and provide a lower cost of ownership. Oracle continues to introduce new PeopleSoft functionality. More than 200 additional features have been added since the initial PeopleSoft 9.1 release, and more are coming through the PeopleSoft Release Process Model. Oracle's PeopleSoft Release Process Model provides multiple methods for delivering new features between major releases. Feature Packs, bundles, and maintenance packs give you the flexibility to add the features you need without impacting your productivity or business activity.

Oracle's JD Edwards EnterpriseOne

Oracle's JD Edwards EnterpriseOne is an integrated applications suite of comprehensive enterprise resource planning software that combines business value, standards-based technology, and deep industry experience into a business solution with a low total cost of ownership. EnterpriseOne is the first ERP solution to run all applications on Apple iPad. JD Edwards EnterpriseOne also delivers mobile applications. Only JD Edwards EnterpriseOne offers more choice of databases, operating systems, and hardware so you can build and expand your IT solution to meet business requirements. JD Edwards delivers over 80 application modules to support a diverse set of business processes and key industry solutions such as consumer package goods, manufacturing, asset intensive, and projects and services.

Oracle's JD Edwards World

Oracle's JD Edwards World single platform solution enables better collaboration both within and outside your business network. Get all of your lines of business working together sharing information, boosting performance, trimming costs, and driving profitable growth.

JD Edwards World takes your organization down the path of profitable growth and redefines what your industry can do by providing a large portfolio of business processes and key industry solutions such as consumer packaged goods, manufacturing, asset intensive, and projects and services. JD Edwards World is built for the IBM Power Systems, System i models, and allows you to stay on top of enterprise topics, trends, and challenges.

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MICROSOFT DYNAMICS

Microsoft Corporation, headquartered in Redmond, Washington, develops, manufactures, licenses, and supports a wide range of products and services related to computing. The company was founded by Bill Gates and Paul Allen on April 4, 1975. With revenue of $73.72 billion in 2012, Microsoft is the world's largest software company.

Microsoft Dynamics ERP

Microsoft Dynamics ERP business solution software empowers your people to be more productive and enables your systems to adapt as you grow while delivering the insight you need to respond quickly in an ever-changing world. Microsoft Dynamics ERP is a family of enterprise resource planning products primarily geared toward midsize organizations as well as subsidiaries and divisions of larger organizations. Microsoft Dynamics ERP includes four primary products:

1. **Microsoft Dynamics AX** – Microsoft Dynamics AX (formerly Axapta) is the complete ERP solution for enterprises that provides a purpose-built foundation across five industries (Manufacturing, Distribution, Retail, Services, and Public Sector), along with comprehensive, core ERP functionality for financial, human resources and operations management. It empowers your people to anticipate and embrace change so your business can thrive. All of this is packaged in a single global solution giving you rapid time to value
2. **Microsoft Dynamics GP** – Microsoft Dynamics GP (formerly Great Plains) software delivers out-of-the-box business management functionality, from operations management,

and financial management to human resource management and manufacturing. It connects the many moving parts of your organization, giving you better visibility into and control over what's going on in your business

3. **Microsoft Dynamics NAV** – Microsoft Dynamics NAV (formerly Navision) is a business solution from Microsoft that delivers business management functionality for small and midsize businesses. A unique combination of business intelligence, collaboration and communication tools connects the many moving parts of your organization, giving you better visibility into and control over what's going on in your business
4. **Microsoft Dynamics SL** – Microsoft Dynamics SL (formerly Solomon IV) is designed to help companies easily manage complex project accounting. Companies can streamline processes and get real insight so that you can estimate projects correctly—and always deliver them on time and on budget thereby providing greater control, increased profitability, and more flexibility to grow your business

Microsoft Dynamics ERP solutions offer industry-specific capabilities for a number of industries including distribution, manufacturing, public sector, retail and services. Microsoft business partners have built on this foundation to create highly specialized solutions that enable you to get the full value of your investment faster.

Microsoft Dynamics CRM

Microsoft Dynamics CRM is a customer relationship management application from Microsoft that provides sales, service, and marketing capabilities. Microsoft Dynamics CRM is sold as on-premises software or as a SaaS offering called Microsoft Dynamics CRM Online.

Website: www.microsoft.com/en-in/dynamics/default.aspx

INFOR

Infor is the one of the largest providers of enterprise applications and services. With more than 12,400 employees 70,000 customers in 194 countries Infor solutions improve operations, drive growth, and quickly adapt to changes in business demands. Infor offers deep industry-specific applications and suites, engineered for speed, using ground-breaking technology that delivers a rich user experience, and flexible deployment options that give customers a choice to run their businesses in the cloud, on-premises, or both. Infor acquired GEAC ERP (2006), SSA Global (2006) and Lawson Software (2011) thereby increasing its share and presence in the ERP and enterprise applications market.

Infor ERP

Infor ERP software focuses on what matters to a manufacturer—absolute control over the operations and supply chain, the core of the business that delivers service, productivity, and profit. Infor solutions are designed to combat the complexities of a modern manufacturing supply chain, Infor ERP software provides robust, out-of-the-box capabilities with industry-specific needs built in. This means a better fit for your requirements, fewer customizations, and faster, more reliable implementations. From production management software for manufacturing, to comprehensive value stream mapping, Infor solutions provide all the necessary tools to hone the organization into a truly lean manufacturing operation. Infor ERP solutions are designed by industry experts, many with decades of experience in their fields. Whether the organization produce highly complex products from distinct parts and components, or goods made by blending a variety of ingredients, Infor ERP software can help to reduce costs, improve operational efficiency, and give the information needed to make

better and faster decisions. Infor ERP provides the manufacturing intelligence software you need to keep your organization lean, agile, and ahead of the competition. The ERP offering from Infor are:

- **Infor LN** – ERP solution for managing the demands of complex manufacturing, distribution, and service industries, giving you unparalleled control over your global operations
- **Infor M3** – ERP system to support organizations that are in the business to make, move, or maintain products, including distribution, equipment service management and rental, fashion, food and beverage, and manufacturing
- **Infor StyleLine** – Provides the foundation for discrete manufacturers in a broad range of industries, such as metal fabrication, industrial equipment and machinery, and high-tech and electronics, to improve business efficiency, customer service, and productivity
- **Infor VISUAL** – Infor VISUAL is designed for order-driven manufacturers in various industries, including discrete manufacturing, aerospace & defense, automotive, and industrial equipment and machinery
- **Infor Adage** – Infor's ERP solution designed for manufacturers in the food and beverage, chemical, and pharmaceutical industries, where bill of material-based software cannot model the operations
- **Infor System i** – This is a series of solutions—Infor LX, Infor XA, and Infor System 21—developed on a secure platform built by IBM for a lower total cost of ownership

Business Applications

Infor offers a complete range of business applications that could be easily and seamlessly integrated with the ERP solutions. These major applications are in the areas of customer relationship management, enterprise asset management, enterprise performance management, enterprise resource planning, financial management, human capital management, product lifecycle management, service management, supply chain management, etc.

The main industrial segments for which Infor caters to are aerospace and defense, automotive, chemicals, distribution, equipment, fashion, food and beverage, healthcare, high tech, hospitality, industrial manufacturing, public sector, etc.

Website: www.infor.com

EPICOR

Epicor Software Corporation is a global leader delivering business software solutions to the manufacturing, distribution, retail and services industries. With nearly 40 years of combined experience serving midmarket organizations and divisions of Global 1000 companies, Epicor has more than 20,000 customers in over 150 countries. Epicor Enterprise Resource Planning (ERP), Point Of Sale (POS), Supply Chain Management (SCM), and Human Capital Management (HCM) enable companies to drive increased efficiency, and improve profitability.

Epicor ERP

Epicor has a new way of approaching how enterprise resource planning (ERP) systems and business software solutions are designed, developed, and deployed. They have changed the way ERP software is used to maximize productivity across your business. Epicor ERP is more than business software; it is the key to possibilities not yet imagined. Epicor's ERP software provides a single point of accountability to drive increased profit, whether you're operating locally, regionally, or globally.

Epicor ERP modules include financial management, sales management, human capital management, service management, product data management, project management, planning and scheduling, production management, supply chain management, customer relationship management, enterprise performance management, governance, risk and compliance, global business management, etc. Epicor provides industry specific solutions for the manufacturing, distribution, hospitality, and service industries.

Epicor's mobile solutions can support more customers, transactions, and products, and maintain a wider range of business partner relationships. The mobile solutions securely and cost-effectively distribute and automate subsets of existing enterprise business systems outside of the company network—whether connected or remote. Epicor customers can enjoy a rapid return on investment and can transact business where it happens, regardless of location. Epicor tools enable companies to easily deploy and manage mobile devices and services to many users and disparate geographies.

Epicor Enterprise

Epicor Enterprise is an end-to-end, proven ERP solution that includes Customer Relationship Management (CRM), financial management, and Supply Chain Management (SCM) and is designed for service and distribution industries.

Epicor iScala

Epicor iScala is an industry-specific end-to-end ERP solution designed for the divisions and subsidiaries of multinational corporations and large local or regional companies that may have significant cross-border trading.

Epicor Vantage

Epicor Vantage is an easy-to-use end-to-end ERP solution designed to meet the needs of progressive make-to-order and mixed-mode manufacturing and distribution companies.

Epicor Express

Epicor Express has been developed from Epicor's next generation ERP solution. This is Epicors SaaS (on-demand) ERP solution. With Express you are provided everything in one integrated system to manage your business. You are provided everything you need to manage your opportunities, orders, and operations in one integrated on demand ERP solution. SaaS eliminates many of the barriers that keep companies from implementing or upgrading their ERP solution; more importantly it enables them to focus on their core business operations instead of managing IT. The Express delivery model is designed to help you reduce complexity, get up and running quickly, and decrease on-going operational costs.

Some other ERP solutions from Epicor are ManFact, Manage 2000, Avante, DataFlo, etc.

Website: www.epicor.com

SAGE GROUP, PLC

Sage provides business software, services and support to small and medium sized businesses. The software products include ERP (Sage Accpac ERP), CRM, and payroll solutions. With 5.8 million customers, over 14,500 employees and more than 25 years of experience working with small and medium sized businesses, Sage is the third-largest business applications vendor in the world.

Sage Software India (P) Ltd is a subsidiary of Sage Group plc. Sage Software has over 1000 customers in India for its CRM, ERP, Payroll and HRMS products across industries like, trading and

distribution, manufacturing, services, IT/ITES, financial services, media, travel and hospitality, and engineering services and projects.

Sage Accpac ERP

Sage Accpac ERP is an advanced application built on a multi-tiered, object-oriented architecture. Designed for the SME market, Sage Accpac can be deployed either as a Web-based application or as a desktop application. Sage Accpac ERP is available in three editions 100, 200, and 500. While Sage Accpac ERP 100 is the entry level solution for growing business, the Accpac ERP 500 edition provides the mid-market customers with all the tools necessary for seamless functioning.

Sage Accpac lets organizations to choose the solutions and configurations that work best for them. The organization can choose and configure the applications, the database, the deployment options and languages, the network environment or operating system, and the add-on software developed by Sage and its business partners to suit their business in the best possible way. At its core, Sage Accpac ERP provides you the tools to outperform your competition in these areas, and more. The main functional modules of Sage Accpac ERP are:

- **Financial Management** – A powerful set of tools to help you confidently streamline time-consuming accounting processes, manage your business' complex finances, and comply with regulations
- **Operations Management** – Tools that streamlines your inventory handling and order fulfillment processes, and ties together your supply chain so your business delivers every time, on time
- **Project and Job Costing** – A time-and-material system for estimating, tracking, costing, billing of projects, simplifying cost control, and planning
- **Business Intelligence and Reporting** – Make quicker, better decisions with powerful BI and reporting capabilities that allow you to run analyses, create budgets, build reports, and securely distribute information
- **Service and Maintenance Management** – Service Manager by Technisoft is a multi-award winning Service, Maintenance, and Job Cost application that manages the ongoing, preventative maintenance and general servicing of your machinery, vehicles, and other equipment. Service Manager is fully integrated to the Sage Accpac ERP accounting suite

Sage also offers industry based ERP solutions like Accpac Autosimply and Accpac Optipro (discrete manufacturing), Accpac BatchMaster (process manufacturing), IDMSYS (hospital management), etc.

In addition, the organization provides **Sage CRM**, which is a powerful, easy to use customer relationship management solution that integrates directly with Sage Accpac ERP right out of the box. With Sage CRM, you can automate your business processes to synchronize sales, marketing, and customer care activities across your organization, giving you complete business and customer perspectives, anytime, anywhere. And since it integrates with other business applications through an intuitive Web services interface, you can enhance your productivity even further.

Website: www.sage.com and www.sagesoftware.co.in

PLEX SYSTEMS

Plex Systems, founded in 1995, is a pioneer in SaaS and cloud computing model of ERP and other business applications. The main product of the company is Plex Online a comprehensive SaaS ERP solution for the manufacturing industry.

Plex Online

Plex Online SaaS ERP has a global reach and connects and manages the entire manufacturing process for organizations in North America and their global subsidiaries. Plex Online Manufacturing ERP software provides unparalleled coverage and access to operational intelligence for manufacturing industries like aerospace and defense, automotive, food & beverage, high tech /electronics, industrial manufacturing, precision metalformers, etc. In addition to the SaaS ERP software, Plex Online provides other enterprise solutions including business intelligence, quality management systems, manufacturing execution systems, supply chain management, customer relationship management, etc.

Website: www.plex.com

QAD

QAD was founded in 1979 and now has presence in 90 countries and employs more than 1300 people. The company's flagship product is its ERP solution—QAD Enterprise Applications (formerly QAD MFG/PRO). It is available in 26 languages and has more than 5,500 installed sites in over 90 countries.

QAD Enterprise Applications

For more than 25 years, QAD MFG/PRO was QAD's flagship Enterprise Resource Planning (ERP) suite. In 2007, QAD launched its successor—QAD Enterprise Applications. Built from the MFG/PRO foundation, QAD Enterprise Applications is designed to streamline the management of global manufacturing companies' operations, supply chain, financials, customers, technology, and business performance. QAD Enterprise Applications includes the following application suites: financials, customer management, manufacturing, supply chain, service and support, enterprise asset management, analytics, etc. QAD Enterprise Applications provides manufacturing companies the solutions they need to plan for the future as they continue to meet daily manufacturing goals.

QAD On Demand

QAD On Demand is a SaaS Enterprise Resource Planning (ERP) solution created exclusively for manufacturing companies. Whether you are a growing start-up or an established global brand, with QAD On Demand web-based ERP software you can harness all of the power of QAD Enterprise Applications. QAD On Demand web ERP lets you focus on your business, not your software. As a manufacturer, you need to focus on meeting demand. QAD offers the following services in their On Demand package: application support, server hardware, systems administration, database administration, applications administration, upgrade planning, first-line user support, disaster recovery, usage and analysis reporting, etc.

Website: www.qad.com

3I INFOTECH

3I Infotech is a global Information Technology company which provides technology solutions to over 1500 customers in more than 50 countries across five continents, spanning a range of verticals. 3I Infotech offers software solutions for asset and wealth management, ERP, IT infrastructure management, payment processing, corporate and retail banking, document management, insurance management, etc. It provides solution for industries like banking, financial services, healthcare,

manufacturing, retail and distribution, contracting, government, insurance, pharmaceutical, telecommunications, media, and entertainment, etc.

ERP Solutions

3I Infotech suite of ERP products equips companies of all sizes with powerful capabilities to manage enterprise-wide systems, teams, and data. Built to ensure integrated information management and automated operations across the organization for a range of industries, Orion ERP gives companies complete control over the value chain and instant access to actionable and critical business information. The various ERP products of the company are:

Orion Enterprise

Orion Enterprise is a dynamic enterprise resource planning solution that allows organizations to smoothly integrate disparate teams, functions, processes, and systems. The ERP platform, with built-in CRM and SCM capabilities, offers organizations sharp insights into and control over operations across the value chain through a single application. With its powerful suite of tools such as workflow management and portal and a set of ready functional modules, Orion Enterprise addresses the needs and challenges of diverse industries. The main modules of the system are finance, manufacturing, sales, SCM, retail, contracting, auto dealership management, human resources, and payroll, etc.

Orion Lite

Orion Lite is a fully integrated enterprise resource planning solution, which empowers SMEs with an integrated information system that enables sharper decision-making and facilitates greater control over business processes, while minimizing turnaround time and maximizing ROI. This GUI-based suite uses clientserver architecture and can be set up in just seven days to ensure that clients get immediate returns from the following modules: business configuration, finance, manufacturing, and resources.

Orion Advantage

Orion Advantage is an ERP system designed to help SMBs slash costs, speed time-to-market, and optimize resource utilization. It is a ready-to-deploy, single-window, micro-vertical-specific ERP solution that enables budget and deadline-driven delivery of high-quality, customized products. The key modules are finance, production, procurement, inventory management, sales, quality, maintenance, human capital management, etc.

Website: www.3i-infotech.com

RAMCO SYSTEMS

Ramco Systems is a leading software company focused on consulting, products, and managed services business. Started as an R & D division of Ramco Industries Limited in 1992, Ramco Systems was later established as an independent company in 1999. Headquartered in Chennai, the company has 17 offices spread across India, Asia-Pacific, US, Canada, Europe, the Middle East, and Africa. The company focuses on providing innovative business solutions that can be delivered quickly and cost-effectively in complex environments. Ramco has over 150,000 users from 1000+ customer organizations, globally since its inception. The company provides solutions to multiple verticals including banking, insurance, manufacturing, supply chain, aviation, transportation and logistics, healthcare,

governance, retail, and more. Ramco has a wide variety of products including ERP, analytics, aviation, etc. and supports multiple deployment models including public cloud, private cloud, community cloud, and on-premise.

Ramco ERP Suite

Ramco ERP on Cloud covers the entire spectrum of enterprise functions through a suite of products—manufacturing, financial management, Supply Chain Management (SCM), Human Capital Management (HCM), Customer Relationship Management (CRM), Enterprise Asset Management (EAM), project management, process control, analytics, advanced planning and optimization, and connectors.

Ramco Analytics Suite

Ramco Analytics Suite is a comprehensive business analytics tool for today's decision makers, which provides a 360° view of your organization's performance and empowers you with critical insights into the Key Performance Indicators (KPI) to 'Measure, Monitor, and Manage' your business goals and growth.

Ramco Aviation Suite

Ramco Aviation Suite covers the entire spectrum of maintenance operations—from maintenance planning to line, hangar, shop and engine maintenance, reliability and engineering, and technical records providing efficiencies in human capital management, purchasing, inventory, warranty, maintenance, financials, third-party maintenance, and sales.

Ramco GRP Suite

Ramco GRP Suite is a solution for Governments, covering a wide spectrum of Governance processes including financial management, budgeting planning and execution, debt management, project management and accounting, procurement, human capital management, citizen services, and analytics.

Website: www.ramco.com

Part VII

ERP—Present and Future

- Turbo Charge the ERP system
- Enterprise Application Integration (EAI)
- ERP and E-Business
- ERP, Internet, and WWW—ERP II
- ERP and Total Quality Management
- Future Directions and Trends in ERP

Chapter 53

Turbo Charge the ERP system

INTRODUCTION

Today the primary objective of almost all the information technology initiatives and innovations is to reduce the amount of time it takes to acquire and use information, to learn, to make decisions, to initiate action, to deploy resources, and to innovate. When action and response are simultaneous, we are in real time. Imagine the competitive edge you could gain by drastically reducing the time-to-market, increasing the speed-of-innovation, streamlining manufacturing, and personalizing customer relationships at every point-of-contact. The strategy is 'market velocity,' and it requires the ability to discover and act on important business intelligence in real time. Today, real time business intelligence has finally become cost-effective because of the convergence of four technologies—Enterprise Resource Planning (ERP) applications, data warehousing, Business Analytics (BA) systems, and the Internet.

Most large corporations have already gone through the process of implementing an ERP system. Nowadays, the focus is on implementing the extensions and components of ERP that corporate managers think have the greatest potential to improve the bottom-line, manufacturing, and Supply Chain Management (SCM) systems. The major consultants, integrators, and vendors are responding to this management focus by beefing up the ERP capabilities that go to the sweet spot of the value chain for a wide range of industries such as chemical, health care, manufacturing, and even service.

The latest versions of ERP packages allow customers to access their ERP data and applications over the Internet and extranets with a user interface that supports HTML, Java, and XML. ERP systems also provide an Internet interface for existing EDI data systems so that manufacturing companies can integrate their trading partners in a modern e-commerce system. The key factor is to remember that any ERP system is a means to an end. It has to help the organization manage complex business processes so it can improve profitability, increase productivity, and run more efficiently.

LIMITATIONS OF ERP SYSTEMS

ERP systems serve an important function by integrating separate business functions—materials management, product planning, sales, distribution, financials, and others—into a single application. However, ERP systems have three significant limitations.

- First, managers cannot generate custom reports, or queries without help from a programmer. This inhibits managers from obtaining information quickly so they can act on it for competitive advantage. In addition, this can also create a backlog for the IS department
- Second, ERP systems provide current status only, such as open orders. Managers often need to look past the current status to find trends and patterns that aid better decision-making
- Third, the data in the ERP application is not integrated with other enterprise or division systems and does not include external intelligence

One simple and cost-effective way to solve this problem is to add a data warehouse and BA front-end to the ERP system. Just as ERP fine-tunes resource planning and management, BA fine-tunes

ERP. A data warehouse or data mart organizes ERP data so that it is easily accessible for online analysis. BA systems improve business competitiveness by providing reporting and analysis tools to the desktop, enabling communication with the entire supply chain via the Web, and automating alerts and actions.

Importance of ERP Data

Here one important factor that should be noted is that the effectiveness of a data warehouse-BA front-end in delivering high quality information to the decision makes is very much dependent of the quality of data in the system. Organizations that feed their ERP system with high quality, accurate data are able to achieve greater reductions in costs, streamline their supply chain, and ultimately report greater profits than the organizations that did not. So if you want to improve the power of the ERP system, then one of the main concerns should be the quality and accuracy of data that is already in the system and that is entered into the system. Quality information requires accurate, precise and high-quality data. If the data is bad, even the best BA system could not be of much help and the information that is generated would be of little use.

FLEXIBLE REPORTING AND ANALYSIS

Operational reports from the ERP system show recent events, but they do not satisfy managers' requirements for planned versus actual monitoring, forecasting and exception analysis. Without a BA system, managers must compile these reports manually from standard reports.

By allowing flexible reporting and analysis, a BA system can unlock the value of the data in ERP reports. The information in the ERP daily orders report, for example, can provide information that will help in better decision-making and can be of use to the decision-makers in more than one department.

- Which product shipments are not on schedule?
- What are the best selling products? Which are the ones that are not moving?
- Which customers are most profitable?
- Which customers are placing repeat orders?
- Which customers have made purchases to get the maximum discount?
- Did any customers purchase a product that requires another product?

BA systems provide On-Line Analytical Processing (OLAP) and data mining tools that managers can use from the desktops to answer the types of questions above and to discover significant trends and patterns. For example, analysts can drill-down to obtain progressively more detailed information about retail sales, change metrics, view graphs and charts, reuse reports, create 'what if' analysis and generate best-case and worst-case scenarios. Valuable in its own right, ERP information becomes even more valuable when it is combined with information from other sources. A BA system allows this, as well. Consider the following examples:

1. **Customer service**—A marketing manager might want to combine sales information from the ERP system with consumer demographics, or business demographics. With this information, the company can better segment its customers and improve customer relationships. An automobile manufacturer for example, can combine its internal ERP data with external databases to identify customers who are likely to be receptive to advertisements. Similarly, a home appliances manufacturer can integrate its ERP information with sales information from the retail outlets to better target its advertising and better serve the market

2. **Manufacturing and purchasing**—The production department of a computer manufacturer might combine its ERP data with external data about sales forecasts for production planning. With this information, purchasing can react and stock the items necessary for uninterrupted production
3. **Sales**—A sales organization could combine the data from its ERP system with that of its Sales Force Automation (SFA) system. With the combined information, sales analysts, and sales engineers can create special promotions for overstocks and supply up-to-date product availability to the sales force at the point-of-sale

CLOSING THE LOOP

Businesses can optimize their investment in ERP systems by closing the loop between the BA system and the ERP system. The loop begins when the company discovers valuable business information from the ERP system; it closes when the company feeds those discoveries back into the ERP system to continually improve business processes. For example, an online business can use the BA system to discover each customer's purchasing patterns and then update the operational system with recommended products. The next time the customer visits the site the operational system would tailor the Web page to feature products the customer would be likely to purchase.

AUTOMATED ALERTS AND ACTIONS

BA systems for ERP can also issue alerts when certain events occur or thresholds are met, enabling your business to react more quickly to problems and opportunities. For example, if a certain number of customers return product for the same reason, the system can automatically alert engineering, manufacturing, customer service and send a letter to customers to apologize and offer a replacement or a reduced price on an enhanced product. Similarly, a customer service manager might want the system to generate a thank-you note to all customers who purchase a product and suggest the customer also purchase a warranty.

EXTEND THE POWER OF ERP USING BUSINESS ANALYTICS

The ultimate value from the ERP investment results from integrating the ERP system not only with BA front-end, but also with the Internet. When you provide a Web-based interface to the information in the BA system, the Internet becomes an enterprise information utility for employees, partners, suppliers, and customers. Many ERP vendors are moving in this direction and are offering BA and Internet integration solutions as part of their ERP offerings.

A popular early application for integrating ERP and BA with the Internet is SCM. All participants—engineering and product design, vendors and suppliers, manufacturing, sales and marketing, distributors, and customers—can gain access to BA system when they need it for their mutual benefit. Consider for example, a national hardware store chain. The retailer can use its BA system to adjust its charges for shelf space and to better manage inventory levels. A tool supplier can take advantage of Point-of-Sale (POS) information to monitor the current purchasing trends as they occur and adjust manufacturing before an overrun or under run occurs. The supplier in turn, can share the information with his suppliers. Product designers, both for manufacturing and service companies can capture customer information in real time, refining their products for greater market appeal, or customizing them for key customers. In a financial services company, a product designer can capture information about customers' investment habits using data mining tools to develop new investment packages.

Implementation Requirements

Given below are some guidelines for the implementation of a successful BA front-end to an ERP solution:

1. **Clarify your business objectives and obtain executive sponsorship**—Be clear about what you want to accomplish and at what level you will influence the organization. Then, win the support of management to the level of the data warehouse, whether that is the department level, or enterprise level. Sponsorship is crucial for success
2. **Begin with a reasonable scope and ensure you have adequate resources**—Clear business objectives will help determine the scope of your project. It is highly advisable to start with a single business area so that you can quickly demonstrate a return on investment. Team members need to understand the data structures and the data in the ERP systems and the data warehouse. Depending on your resources, you will either deploy the ERP and BA systems in parallel or wait until the ERP system is in production before beginning work on the BA system
3. **Choose a vendor with industry expertise in both data warehousing and ERP**—The complexity of data warehousing and ERP is multiplied when the two are combined. A vendor with experience in both disciplines will deploy the solution more quickly and help you develop an architecture that meets your current needs and will accommodate your future requirements
4. **Choose a data warehouse platform that delivers high availability**—Many BA systems become mission critical, which raises the stakes for availability. For example, a stock exchange might use its BA system to store all trades, both for trending and to supply to a national news channel. A call center might use the BA system as the database of record when customers call
5. **Select tools that speed implementation and reduce cost**—Several third-party vendors provide data extraction tools that support the major ERP applications (SAP, Oracle, Microsoft Dynamics, etc.). The data definitions in the ERP system become a foundation for the BA system. To reduce costs, if you have multiple instances of an ERP system—for different countries or divisions, for example—it is advantageous to configure them the same way and to standardize tools across the different projects. In the future, it is likely that ERP vendors will either purchase data extraction tool providers or develop their own tools. It is generally more cost-effective to purchase a prepackaged data extraction tool than to develop your own
6. **Increase the velocity of information**—The trend is toward real time updates. Telephone companies that maintain call-detail records typically must extract each minute because huge volumes impose a performance penalty on the servers. Banks that maintain portfolio records also tend to update the BA system each minute
7. **Plan for performance and growth**—The more data you retain on the BA system, the more trends managers can observe and analyze. However, more data usually requires more performance power. Therefore, most companies seek a balance. Some companies decide to store all open items, retain closed items for one quarter and retain financial information for six months after end-of-year processing. Companies that want to perform trend analyses keep closed items for longer periods
8. **Close the loop for continual improvement**—The ultimate in BA for ERP is a closed loop system, which updates the ERP system with information discovered through business analysis or from outside sources. Building a closed loop system usually requires custom programming, but the increase in market velocity is well worth the investment

SUMMARY

By integrating data from disparate company functions, ERP systems are a gold mine of valuable BA. Unfortunately, ERP reports generally provide only a fraction of the useful information in the system. Data warehousing and BA unlock the power of ERP systems by providing managers with simple, on-demand online analysis and push reporting; the ability to combine ERP information with external data; and alerts, actions and automated responses. By adding a Web-based interface to your ERP and BA systems, you can integrate the supply chain, speeding time to market, and gaining manufacturing efficiencies. Ultimately the ERP and BA combination helps your company increase its market velocity with faster time to market, improved manufacturing and distribution processes, and more personalized customer interaction.

The latest version of ERP packages allow customers to access their ERP data and applications over the Internet and extranets with a user interface that supports HTML, Java, and XML. ERP systems also provide an Internet interface for existing EDI data systems so manufacturing companies can integrate their trading partners in a modern e-commerce system. The key factor is to remember that any ERP system is a means to an end. It has to help the organization manage complex business processes so it can improve profitability, increase productivity and run more efficiently.

REVIEW QUESTIONS

1. Discuss the importance of the convergence of three technologies—Enterprise Resource Planning (ERP) applications, data warehousing, and the Internet.
2. Discuss the limitations of ERP systems.
3. Explain what you mean by flexible reporting and analysis.
4. Explain how to improve the power of ERP using BA.
5. What are the implementation requirements of integrating the BA as the front-end to an ERP system?

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Chapter 54

Enterprise Application Integration (EAI)

INTRODUCTION

In today's competitive and dynamic business environment, applications such as Supply Chain Management (SCM), Customer Relationship Management (CRM), Business Analytics (BA), and integrated collaboration environments have become imperative for organizations that need to maintain their competitive advantage. **Enterprise Application Integration (EAI)** is the process of linking these applications and others in order to realize financial and operational competitive advantages. In an era of economic globalization and e-businesses, enterprises are struggling with the ERP system in achieving objectives like maintaining a competitive edge, providing access to the global trading environment, etc. However, some enterprises have many difficulties in integrating all kinds of their internal and external resources. They are unable to take on exchanges of customer information streams, internal resources streams, and supply streams both internally and externally. Therefore, information isolated island has become the main bottleneck in the development of an enterprise. The information isolated island can be eliminated by integrating internal system (ERP) and external systems (SCM, CRM).

As we have seen, business application systems are typically no island systems. Customer data, for example, have to be available for the accounting system and likewise for the CRM system or the SCM. To serve this requirement the relevant application systems have been interfacing each other on a one-to-one basis in the past and often still do today. For a given number of systems this will result in a squared number of interfaces between these systems and leads to a very high number of point-to-point interfaces which negatively influence the operational and maintenance efforts for such a network. A release upgrade for one of the systems e.g., impacts on large parts of the whole network due to many cross-dependencies between the systems. To reduce the number of interfaces and to reduce complexity, many organizations started to deploy Enterprise Application Integration (EAI) middleware as shown in Fig. 54.1.

One of the challenges facing modern organizations is giving all their workers complete, transparent, and real time access to information. Many of the legacy applications still in use today were

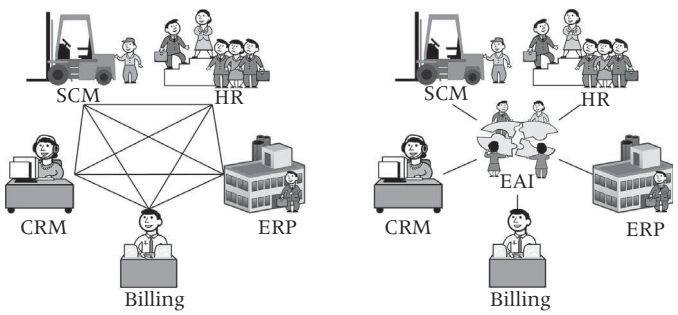

Figure 54.1 Reduction in the number of physical interfaces using EAI.

developed using arcane and proprietary technologies, thus creating information silos across departmental lines within organizations. These systems were not efficient to enable seamless movement of information from one application to the other. EAI, as a discipline, aims to alleviate many of these problems as well as create new paradigms for truly lean proactive organizations.

EAI intends to transcend the simple goal of linking applications and attempts, to enable new and innovative ways of leveraging organizational knowledge to create further competitive advantages for the enterprise. As companies all over the world increasingly seek to convert their operations into one smooth stream, the challenge will most probably be, to accomplish integrating their operations while keeping their systems online. Any approach that seeks to throw out the entire existing operational structure of a company and start from scratch, will inevitably lead to a loss of knowledge gained in the maintenance of the old system, and will involve a period of consolidation which may impact the company adversely, and may cause an expensive disruption in daily transactions thus leading to organizational collapse in some extreme circumstances. Businesses have realized this and have increasingly demanded a middle-of-the-road approach where there is a smooth phasing out of the existing system and a comfortable transition to newer technologies that address their future problems without compromising the current operations. EAI integrates the various components of an organization—people, processes, applications, business partners, and enterprise data. This is shown in Fig. 54.2.

This middle-of-the-road approach is EAI, a design philosophy prescribing a solution which seeks to bridge the gap between applications that have been developed at different times, with different purposes in mind and with different priorities, to share information in a timely manner. This concept addresses the need for different applications to share relevant information, mirror changes in information to maintain data consistency, and reduce the time, money, and efforts required to—develop, maintain, and sustain this framework. When different systems cannot share their data effectively, they create information bottlenecks that require human intervention in the form of decision-making or data entry. With a properly deployed EAI architecture, organizations are able to focus most of their efforts on their value creating core competencies instead of focusing on workflow management.

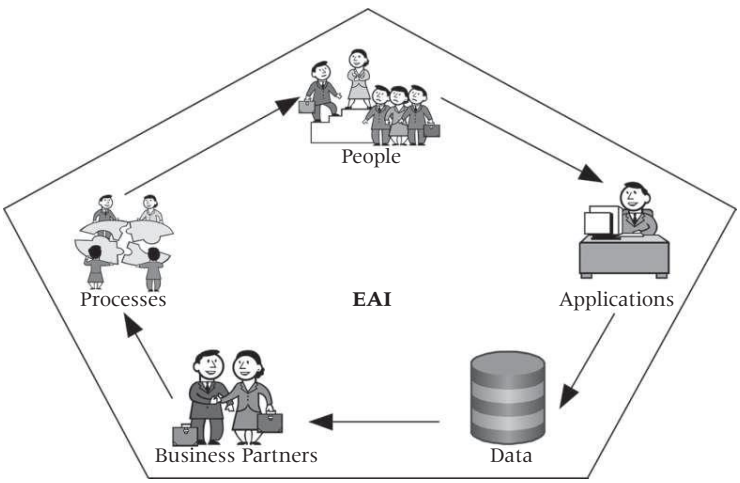

Figure 54.2 Enterprise application integration.

ERP AND EAI

We have seen that for high quality information and better decision-making, ERP alone is not sufficient. ERP systems have three significant limitations:

- The inability of managers to generate custom reports or queries without the help from a programmer. This inhibits managers from obtaining information quickly so they can act on it for competitive advantage
- ERP systems provide current status only, such as open orders. Managers often need to look past the current status to find trends and patterns that aid better decision-making
- The data in the ERP application is not integrated with other enterprise or division systems and does not include external intelligence

There is another side for this problem. In many ERP implementations, all the systems in the organization would not have been covered by the ERP functionality. As a result, there will still be a few systems which work outside the ERP system. But for the ERP system to function smoothly, the data from other applications must be integrated with the ERP system.

The above-mentioned limitations of ERP systems and the presence of computer and information systems outside ERP, diminishes the value of the data in the ERP system and prevents the ERP systems and organizations from realizing the full potential. In order to realize the dramatic efficiency and productivity improvements, streamline the business process, forecast the future with a reasonable level of accuracy, increase the responsiveness of the organization, improve customer satisfaction by offering products that they want, and so on ERP systems must be integrated with other systems in the organizations and also with other systems like CRM, SCM, data warehousing and data mining, OnLine Transaction Processing (OLTP), etc. It is in this area that the Enterprise Application Integration or EAI methods, tools, and techniques come into play.

EAI is a business computing term for the plans, methods, and tools aimed at modernizing, consolidating, and coordinating the business applications in an enterprise. Typically, an enterprise has existing legacy applications and databases and wants to continue to use them while adding or migrating to a new set of applications that exploit the Internet, e-commerce, extranet, and other new technologies. EAI may involve developing a new total view of an enterprise's business and its applications, seeing how existing applications fit into the new view and then devising ways to efficiently reuse what already exists while adding new applications and data.

USES OF EAI

EAI can be used for different purposes:

- **Data (information) integration**—ensuring that information in multiple systems is kept consistent. This is also known as EII
- **Process integration**—linking business processes across applications
- **Vendor independence**—extracting business policies or rules from applications and implementing them in the EAI system, so that even if one of the business applications is replaced with a different vendor's application, the business rules do not have to be reimplemented
- **Common facade**—an EAI system could front-end a cluster of applications, providing a single consistent access interface to these applications, and shielding users from having to learn to interact with different applications

EAI IMPLEMENTATION PITFALLS

Seventy percent of the time, EAI projects fail. Most of these failures are not due to the software or technical difficulties, but due to management issues. EAIIC European Chairman Steve Craggs has outlined the seven main pitfalls undertaken by companies using EAI systems and explains solutions to these problems [1].

1. **Constant change**—The very nature of EAI is dynamic and requires dynamic project managers to manage their implementation. EAI implementations are very fluid; they change frequently, require changes in different components and what's more, they spread across businesses and even across value chains into different companies as a business process integrated all the way through from start to end
2. **Lack of EAI experts**—EAI requires knowledge of many issues and technical aspects. EAI's complex (and often proprietary), asynchronous parallel processing and data combinations can befuddle programmers and help-desk staffers who are used to a straight line approach
3. **Competing standards**—Within the EAI field, the paradox is that EAI standards themselves are not universal. There is a range of different standards organizations working on Web services with W3C and OASIS, and they are coming up with standards definitions that are starting to conflict more and more. On top of that, these standard bodies often have quite a heavy involvement from vendors and vendors might be deciding to pursue their own agendas. Since standards cannot guarantee interoperability, companies should budget for testing and validation—even when relying on standards
4. **Thinking of EAI as a tool as opposed to a system**—One organizational issue of EAI implementation was the failure to realize that EAI's business critical, real time nature can be difficult to control and often negatively impact on other projects and service levels throughout and beyond the enterprise. It really requires a whole set of disciplines and tools and procedures to be built up to deal with things such as capacity management and load balancing, security, change management and monitoring. The business analyst is the one defining the flows and yet the IT people are the ones responsible for the actual execution
5. **Discarding details along the way**—As the EAI system expands, information that may seem unimportant today may become crucial. Operational requirements for example, often differ when you actually get beyond the project development stage. One possible remedy is keeping a record of definitions, structures, interfaces and flows, and gathering statistics
6. **Emerging requirements**—EAI implementations should be extensible and modular in order to allow for future changes
7. **Unclear accountability**—Since so many departments have many conflicting requirements, there should be clear accountability for the system's final structure

The applications, whose data are being integrated, often belong to different departments, which habitually have technical, cultural, and political reasons for not wanting to share their data with other departments.

ADVANTAGES AND DISADVANTAGES OF EAI

The advantages of EAI are real time information access among systems, streamlined business processes that helps in raising the organizational efficiency and ability to maintain information integrity across multiple systems, etc.

The disadvantages include prohibitively high development costs, especially for Small and Medium Business (SMBs), resources intense, complex and long duration implementations, need for highly skilled professionals, and project managers and so on.

EAI TRENDS

Given below are some facts about EAI. It includes the current figures and future trends:

- EAI is considered to be a very prominent issue within the IT industry. The industry sees EAI as one of the areas for sales growth over the next few years. EAI is a strategy on the back of which the industry hopes to sell a variety of products—including more hardware
- A VNU (www.vnu.com) commissioned technology research of 240 IT managers working across different industries revealed that exactly half of the companies were undertaking EAI strategies. Only 19% believed that EAI had already been achieved. These figures would suggest that EAI is well underway with almost 80% of companies believing they will have achieved it over the next few years
- EAI provides companies with a common view of data across the business and gives CRM systems the information needed to serve customers better
- According to a research by the Butler Group (www.butlergroup.com), EAI is a top priority for chief information officers but hype and complexity are stopping companies from investing in specialist software. Web services are now being tipped to be the low-cost integration alternative
- Over the next five years the market will change rapidly, with web services and Business Process Management (BPM) leading to the reemergence of Service-Oriented Architecture (SOA). This trend will promote business-to-business trading
- EAI seeks to tie together different software—such as legacy code and a front office package—to work as one application. Research conducted by Spikes Cavell & Co revealed that 87% of users rated EAI as increasing their ability to do business
- Ovum (www.ovum.com) estimated that the EAI market was worth $ 32 billion by 2004 and according to Gartner Group (www.gartner.com), EAI accounts for 30% to 40% of total software maintenance budgets. Users have seized EAI as the key to pulling disparate systems together so they can operate smoothly online
- The rise in EAI projects has been prompted by consolidation within the IT industry due to overcapacity as IT managers are being asked to produce return on investments much more quickly. IT directors are also aggressively renegotiating existing IT contracts
- EAI involves data collection, standardization, and consolidation. It also requires relevant technologies such as warehouse, portal, wireless, and Web services applications as companies seek to become Real Time Enterprises (RTE)

EAI PRODUCTS

Until recently, connecting an ERP program to one or more standalone applications has been a slow and cumbersome process requiring many hours of hand coding. But a new generation of EAI products promises to speed the work of linking applications and eliminating or reducing the need to develop custom code. EAI products are poised to take the IS market by storm. Application integration is becoming a booming marketplace. For a major corporation, the cost savings on implementation could easily reach into millions of dollars, depending on the scope of the project.

Finding an appropriate EAI software can be a daunting task and the decision-maker is presented with a bewildering array of choices as they plan their links. Some of these companies are marketing themselves as point-to-point solution providers, while others are concentrating on database to ERP connections. Still others promise to provide easier connections from anywhere to anywhere.

With the EAI field growing at a rapid rate, vendors are anticipating a lucrative market. What we are seeing is that organizations are shifting their focus from integration services to integration products. EAI tools are designed to give developers the ability to interconnect at a business process level an array of business applications with ERP products from SAP, Oracle, Microsoft Dynamics, etc. Using EAI tools, a programmer could for example, create links that let order management information flow among an ERP financial application, a standalone contact manager and a Lotus Notes based field service database as if they were all related, homogeneous applications.

While EAI products have been around for several years it has only been over the past few years that they have been fine-tuned for use with various ERP applications. By working with the ERP vendors, EAI vendors have made the ERP integration smoother and easier. The estimates on how much cost reduction is achieved by the EAI products differ. According to many, the usage of EAI products can cut application development costs by more than 50%. But all users agree that EAI products save several months of hand coding and innumerable headaches.

MESSAGING IS THE MEDIUM

Messaging-Oriented Middleware (MOM), which is designed to handle all inter-program communications logic through message queues, is another technique that can get ERP systems and standalone applications to exchange information. The MOM systems fit between different software applications to transport and translate information. It takes a message such as a transaction, and intelligently routes and reformats that message for one or more target systems.

There are several advantages to taking the messaging-oriented middleware route, including the availability of security and other management-layer services. The technique also allows messages to be sent and received when the program at the opposite end is not running. This is a particularly useful feature for links between departments and over vast distances. The MOM enabled EAI systems support a wide range of ERP products, including SAP, Oracle, and PeopleSoft applications. The software can also be used by organizations that need to move information between many kinds of legacy environments and modern applications. But the major problems with the messaging-oriented middleware EAI solution are the very steep learning curve, need for external consultants and high maintenance costs.

THE RIGHT TOOL

Given this complexity, finding the right EAI tool for an application integration project requires a substantial amount of research. Since the EAI software market is in its formative stages, some vendors are still struggling to meet customers' exact needs. Most vendors have the popular applications pretty well covered, but might run into problems when trying to integrate an ERP with an obscure or custom application.

At the same time, major ERP vendors themselves are beginning to address the need to link their products to front-office applications. A recent report from Hurwitz Group Inc. says that ERP vendors such as SAP, Oracle, and Baan are developing their own compatible front-office solutions. This means availability of better-integrated options.

Getting an EAI to link applications flawlessly can be tricky. So why tackle ERP integration at all? Simple: in any event, it is still usually easier to create an integration link than to develop a custom-coded solution in-house.

SUMMARY

In today's competitive and dynamic business environment, applications such as SCM, CRM, BA, and integrated collaboration environments have become imperative for organizations that need to maintain their competitive advantage. EAI is the process of linking these applications and others in order to realize financial and operational competitive advantages. In this chapter we have seen integrating ERP with other enterprise applications.

REVIEW QUESTIONS

1. What do mean by Enterprise Application Integration?
2. How does EAI reduce the number of physical interfaces between systems?
3. How does EAI integrate the various components of an organization?
4. What is the connection between ERP and EAI?
5. Discuss the limitations of ERP systems.
6. What are the uses of EAI?
7. What are the EAI implementation pitfalls?
8. Discuss the advantages and disadvantages of EAI.
9. Discuss the trends in EAI.
10. What are the EAI products?
11. What do mean by messaging-oriented middleware?
12. How will you find out the right EAI tool for your organization?

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Chapter 55

ERP and E-Business

INTRODUCTION

Companies have invested billions of dollars collectively in Enterprise Resource Planning (ERP) systems with the objective of attaining an important business promise—complete enterprise integration. For companies faced with incompatible information systems and inconsistent operating practices, ERP has been a dream come true. ERP presents companies with the opportunity to standardize and automate business processes throughout the organization, thus increasing productivity and reducing cycle time.

Although ERP systems have delivered value, it is becoming clear that the ERP model, which wraps organizational processes into one end-to-end application, may no longer be sufficient for today's fast-moving, extended enterprises. With the rapid growth of the Internet, the business environment has changed dramatically. The world has become a global marketplace. The worldwide Business-to-Business (B2B) market is growing and will continue to grow at exponential rates.

E-business has changed the definition of enterprise systems. Beyond the core business functions that ERP has traditionally focused on, e-business pushes the ERP from the inside core of the companies to the network edge. Companies are realizing that the most challenging part of e-business initiatives is not in developing a Web storefront but in extending ERP to accomplish B2B and Business-to-Consumer (B2C) solutions. A new extended enterprise system emerges by integrating ERP with e-business, which creates business that is more agile, more focused and more competitive than traditionally structured business and tight B2B connections. These technologies include Customer Relationship Management (CRM), Supply Chain Management (SCM), data warehousing, data mining, On-Line Analytical Processing (OLAP), Electronic Data Interchange (EDI), Electronic Funds Transfer (EFT), business intelligence, etc.

ERP AND E-BUSINESS

ERP is a structured approach to optimizing a company's internal value chain. The software, if implemented fully across an entire enterprise, connects the various components of the enterprise through a logical transmission and sharing of data. When customers and suppliers request information that have been fully integrated throughout the value chain or when executives require integrated strategies and tactics in areas such as manufacturing, inventory, procurement, and accounting, ERP systems collate the data for analysis and transform the data into useful information that companies can use to support business decision-making. ERP systems if implemented successfully, enhance, and redesign business processes to eliminate non-value-added activities and allow companies to focus on core and truly value-added activities. The following are two examples where ERP systems have dramatically increased the efficiency and productivity of companies: One company has used ERP to reduce the processing time for updating pricing data from 80 days to five minutes and another has used ERP to decrease its annual purchasing cost by 15%.

E-business stands for 'electronic business,' which involves communications and doing business electronically through the Internet. E-business is defined as the use of electronically enabled

communication networks that allow business enterprises to transmit and receive information. It can significantly improve business performance by strengthening the linkages in the value chain between businesses (B2B) and consumers (B2C). Besides increasing efficiency in selling, marketing, and purchasing, e-business achieves effectiveness through improved customer service, reduced costs and streamlined business processes. Furthermore, e-business creates a strategic, customer-focused business environment for shared business improvements, mutual benefits, and joint rewards. Companies use the Internet to implement Customer Relationship Management (CRM) and Supply Chain Management (SCM) capabilities, which enable them to link their operations seamlessly with customers and suppliers. For example, a beverage manufacturer with 40% growth and Rs.700 crore in annual sales revenue sells its products through 150 distributors nationwide as well as general stores and cafes in the country. By using Oracle's ERP system and e-business platform, the salespersons can track sales and promotions through the Internet and are provided assistance and suggestions to enhance their performance. The salespersons and distributors have access to commission reports and they can track and adjust sales orders. Through consolidating its financial, compensation, sales, and depletion data into a single report, the organization prevents out-of-stock and partial shipments. The forecasted need for 50% more labor force to handle customer service issues in the past was eradicated by integrating ERP system with e-business.

By definitions and by their respective functions, traditional ERP systems take care of internal value chain (i.e., within a company) whereas e-businesses establish the value chain across the market and industries. More and more companies construct their systems' architectures by integrating ERP systems with e-business. They use Web-based interface (corporate portals) with outside entities plus add-on modules such as CRM, SCM, etc. in the integration.

E-BUSINESS—SUPPLY CHAIN INTEGRATION

When the brick and mortar companies make their transition to e-business, they do so using the enabling technologies that we have seen in Chapter Eight. In this chapter we will discuss how each technology plays a role in this transformation and how the supply chain is integrated and how it works. When e-business is integrated with ERP, the whole extended system provides a vision of business processes that span multiple businesses and enterprises. In the most ideal case, companies should be able to connect disparate platforms, applications and data formats across the value chain, including not only suppliers but customers as well. Furthermore, companies should retain the flexibility to change and add functions to applications as business needs evolve. Companies need to be able to adapt their ERP systems to the emerging world of e-business.

THE E-BUSINESS PROCESS MODEL

In a traditional business process, after a customer order is received, the order information flows from department to department through order entry, manufacturing, warehousing, distribution, and finance until the product is delivered to the customer and the payment is received. The key elements of the value chain have been controlled by separate and disparate information systems that could not communicate with one another. Not only did the companies not take an integrated view of their own business processes, but they also had an equally vague understanding of how their systems relate to the systems of their suppliers, competitors, business partners, distributors and customers. Hence, these transactions are typically carried out with minimal, or no shared business processes.

In recent years, there has been a revolution in systems planning and design. Management takes an integrated company-wide view of its IT investments and choices, and implements an ERP system that integrates the core business processes of an entire company into single software and hardware

system. Customers, suppliers, and business partners are consciously included in the business process, systems operation, and systems development. An ERP system is analogous to the internal technological hub of a company. When fully implemented as an integrated suite, it can be thought of as a company's central repository. The five major processes in a typical ERP system are: finance, logistics, manufacturing, human resources, and sales/marketing. The focus of ERP systems is on the efficiency and effectiveness of the internal process. It offers a way to streamline and align business processes, increase operational efficiencies and bring order out of chaos.

Like their traditional counterparts, e-businesses also functions through interaction with their customers and suppliers. So the business process starts with the suppliers and involves the manufacturing of a product or rendering of a service and providing the customers with the product or service. It involves getting feedback from the customers, giving feedback to the suppliers and collecting information about the customers and suppliers. It also involves collecting payments from customers, making payments to suppliers, and collecting details about these financial transactions. It involves collecting information about the customers, suppliers, competitors, the business environment, the advancements in technology, and so on and using this information to make better and intelligent decisions.

All these processes happen in traditional business organizations also. However, they do not happen in the way it happens in an e-business. For example, in an e-business the customers make payments using electronic means. Purchase orders are sent over the Internet. Business-to-business communications happens over an EDI network. The operations are streamlined and automated using enterprise solutions. There is information integration to a level that is unimaginable in the traditional business process.

So when an organization receives an order from a customer, the order will automatically trigger a lot of activates down the supply chain—the customer is sent an e-mail acknowledging the receipt of the order and, the payment details are sent to the bank for verification and authentication. Once the payment is authenticated, the inventory is checked to see whether the goods to be shipped are available. If available, they are sent to the customer and at the same time, the sales department, and the finance departments will update their records so that the necessary documentation can be produced and the organization's central database is also updated. If the item is not in stock, the suppliers are informed via EDI regarding the raw materials requirement. The production planning is done and the shop floor management system computes the requirements in terms of machines and people required to perform the job. So, when the raw materials arrive from the suppliers the plant and people are ready for production. Once the material is produced the goods are shipped to the customer. The beauty of the system is that a single customer order will automatically trigger most of these processes and since the information flows across departmental and even organizational barriers, everybody knows what to expect and what to do. The customers can check the system through the Web to know the status of his/her order and once the item is shipped, they can track the shipment online until it is delivered. This automation and integration of the business processes up and down the supply chain is what makes the e-business model such a huge success. The improvements in productivity, operational efficiency and customer satisfaction and the reductions in cost, cycle times and overheads can be dramatic as the organization starts to do business the e-business way.

E-business is focused on efficiency and effectiveness of external, cross-enterprise processes. While ERP technology supports business strategy, e-business opens the door to new strategic opportunities, which forces ERP to take one step further—to move from the single ERP system model to the extended ERP system model. The Web technology provides the bridge between companies and their business partners to make e-business possible, while e-business makes the ERP system more transparent and outward. Instead of thinking about ERP within a company, we may view the ERP system along the value chain of companies in the same industry, or across industries. Companies are now turning their attention outward to engage in business with customers, suppliers and business partners through the

use of the Internet and Web-based technologies. ERP functionality has to move onto the Web because that is where most of the core business processes are being carried out. The earlier example on the flow of a customer order and the steps in the process flow across the boundaries of the companies would now be handled by a number of different companies behaving as if they are one.

If a corporation decentralizes autonomous business units, they need to be able to access and share data between departments, managers, and employees. With ERP systems, a transaction only needs to be entered once. The system can process the transaction across different software modules resulting in highly comprehensive and integrated information that can be used for decision-making. While an ERP system can be viewed as a repository for data, information and knowledge, and it extends beyond functional boundaries by redefining enterprise-wide processes, a Web enabled ERP system forces companies to look at processes that span multiple enterprises.

COMPONENTS OF THE E-BUSINESS SUPPLY CHAIN

The major partners of the supply chain are the suppliers, the organization, and the consumers and any other parties involved in the business transactions (like banks, middlemen, etc.). Supply chain refers to the complex network of relationships that organizations maintain with trading partners to procure, manufacture, and deliver products or services. Supply chain encompasses the facilities where raw materials, intermediate products and finished goods are acquired, transformed, stored and sold. These facilities are connected by transportation links along which materials and products flow. Supply chain consists of many companies, individuals and institutions. SCM is the coordination of material, information, and financial flows between and among all the participants.

Today, SCM requires modern technologies and techniques for its efficient functioning. For example, customers place orders and make payments over the Internet or other electronic means. The organization communicates with its trading partners using EDI. It uses ERP packages to streamline its operations, improve productivity, and achieve information integration. The organization and its trading partners use data warehouses and the information provided by techniques like data mining, OLAP, etc. to make better decisions. The CRM systems help the organizations is offering high-quality and personalized service to the customers. The geographical information systems help the logistics management systems in planning the best delivery routes, finding the suppliers that are nearer and so on. These technologies form the components of the e-business supply chain.

ERP/E-BUSINESS INTEGRATION

Most organizations consider ERP as their most important and strategic platform because it provides a solid foundation and information backbone for e-business. When ERP and e-business are properly implemented, they supercharge each other. E-business is the best vehicle to share business information with partners for creating major B2B synergies. A fully integrated ERP system will capture and create accurate, consistent and timely relevant data, and assist in intelligent business decision-making. The impact of ERP/e-business integration is substantial, ranging from reduced inventory and personnel level to improved order and cash management. It also results in improved customer responsiveness, reduced IT costs, and the availability of resources for value-added activities.

We have seen that in order to survive in today's business environment, every organization has to streamline its operations, maximize productivity, cut costs, reduce waste, improve customer service, and so on. The successful organizations are constantly innovating new and better methods of serving customers and at the same time improving their profit margins. To do so, organizations need to tightly integrate the supply chain—using modern technology—so that information, material

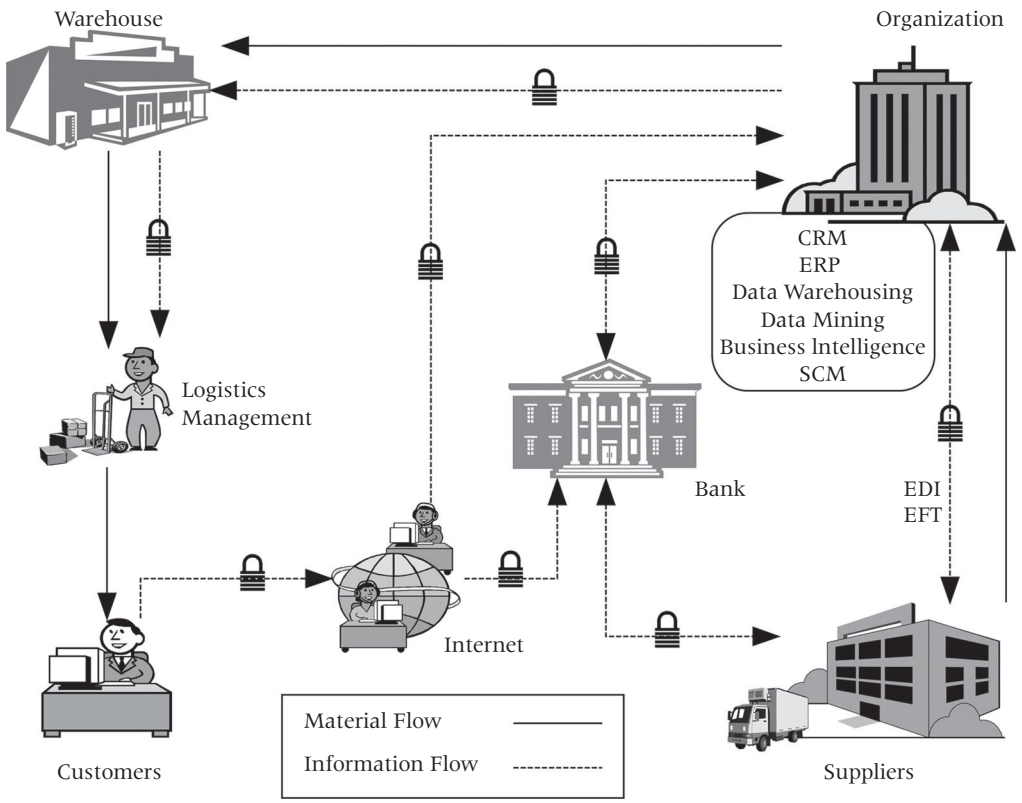

Figure 55.1 Supply chain integration.

and money automatically flows up and down the supply chain at high speeds without any hitches and glitches. Organizations also need to offer the customers personalized service. This is the era of intense competition and customer loyalty is constantly shifting as the Internet allows customers to choose organizations that offer the best products and services. So, an organization must collect information about the customers and analyze it to find the customer preferences, purchase patterns and so on. To do this it must have a good CRM system.

Keeping customers happy and offering personalized service will not have any effect if the operating efficiency of the company is poor. In order to improve efficiency and to have better information integration, companies should have an ERP system in place. An efficient and well-implemented ERP system can raise the productivity to unprecedented levels. As we have seen earlier, every organization generates huge amounts of data—financial statements, purchase and sales details, information about the environment, details about the competition and so on. The organization can benefit greatly if this data is put to use. Data warehousing, data mining, OLAP and other such knowledge discovery tools and business intelligence tools and techniques help the organization in collecting, collating and analyzing these data and come up with business intelligence that can be used by executives to make better and informed decisions. In today's information age, the company that has better business intelligence will definitely have an edge over its competitors.

Delivering goods to consumers and getting the raw materials and spare parts from the suppliers requires a good understanding of locations and distances. Finding the best route for a delivery van or finding the nearest supplier can be automated if the company is using a good Geographical

Information System (GIS). The GIS could be integrated into the supply chain (or more specifically with the logistics management system) to improve the efficiency of procurement and delivery.

Traditional businesses spend a lot of time, effort (and paper!) for communicating business information and making and accepting payments. E-businesses do the same thing over digital networks. The savings in terms of time, effort, error reduction, etc. are quite dramatic. EDI messages help business to automate the procurement and supply processes. EFT is used to accept and make payments between trading partners. The organizations can accept payments—credit card payments, digital cash, etc.—over the Internet. The use of electronic media for information transmission and financial transactions greatly reduce the time required for completing a transaction at the same time automating the business processes involved. An overview of the supply chain integration for e-businesses is shown in Fig. 55.1.

The companies that have successfully implemented ERP systems will become the masters in helping other suppliers to integrate ERP and e-business to create a Web-based extended ERP environment. A well run Web enabled ERP system will make the entire value chain very powerful. Examples of successful e-businesses include IBM (www.ibm.com), Intel (www.intel.com), and Cisco (www.cisco.com) in the high-tech industry; Microsoft (www.microsoft.com), Oracle (www.oracle.com), and SAP AG (www.sap.com) in the software industry; E-bay (www.ebay.com), WebStore (www.webstore.com), and eBid (www.ebid.net) in the online auction segment; Citibank (www.citibank.com), HDFC Bank (www.hdfcbank.com), and Charles Schwab Corporation (www.schwab.com) in the financial services; and Amazon (www.amazon.com), Flipkart (www.flipkart.com), and Shoppers Stop (www.shoppersstop.com) in the retail industry, etc.

SUMMARY

This chapter provides an overview of the different technologies that are used in an e-business and how they are integrated to make the organization achieve its goals. This chapter is intended as an introduction of these technologies and how they fit into the e-commerce/e-business landscape. We have seen a detailed discussion of each of the enabling technologies in Chapters Eight – 17 but a detailed discussion on the implementation details is beyond the scope of this book. Each of these enabling technologies has numerous books written about them and the reader is advised to consult these as well as the Internet for a more detailed discussion on these topics.

REVIEW QUESTIONS

1. What are the technologies that are integrated into the organization's ERP system to make it an e-business?
2. What do you mean by e-business?
3. What are the five major processes in a typical ERP system?
4. What are the advantages of doing business the e-business way?
5. What are tools that help the organizations in making better and informed decisions?
6. How has e-business changed the definition of enterprise systems?
7. Define e-business and explain how it can improve the functioning of the organizations.
8. How the quality of decision-making process improves in an e-business?
9. How can GIS integrated into the supply chain to improve the efficiency of procurement and delivery?
10. Explain the connection between ERP and E-business.
11. Explain the technologies involved in ERP-E-business integration.
12. Discuss how the different enabling technologies help in integrating the supply chain.
13. Explain the E-business process model.

14. What are the components of the e-business supply chain?
15. Explain ERP-E-Business integration with the help of a diagram.

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Chapter 56

ERP, Internet, and WWW—ERP II

INTRODUCTION

Enterprise Resource Planning (ERP) implementations have swept through the business sector since the early 1990s, helping corporations to drive down costs and operate more efficiently. ERP has allowed department heads to view their data more easily and manage it more effectively. It also has streamlined a host of manufacturing and distribution processes, ranging from product development to order processing to the cataloging of goods.

Still, conventional ERP has fallen short in a few areas that are critical in today's business needs. First, its scope is limited. ERP helps automate individual departments, but it has not extended its back-office benefits into the front office to help businesses manage people, workloads and supply chain issues. Second, it has not delivered consistent control of all the processes of the business. Competitive pressures and globalization have made it clear that the business world is still in need of more effective, total enterprise solutions.

Traditional ERP implementations have typically penetrated only 15%–20% of an organization. The original vision that such a solution would touch all of the processes within an organization has turned out to be overly optimistic. Organizations have had to implement multiple solutions to store various data and questions persist about how corporations can consolidate and use their storehouses of information to deliver better products and services while maintaining profit margins. Integration has become the big issue. Knowledge within a majority of organizations currently resides in silos that are maintained by a select few without the ability to be shared across the organization.

THE INTERNET EXPLOSION

Extending ERP applications became a central issue when IT organizations were attempting to reduce redundancies and save time and money as they scrambled to create e-commerce applications. By extending the existing applications to support e-commerce, organizations could not only leverage existing investments in their ERP solution but also speed the development of their e-commerce capabilities. As a result, self-service applications were developed and deployed, reducing errors and providing a sense of control to end-users, that was not available prior to the Internet.

As part of this increase in self-service applications, sell-side, and buy-side applications became increasingly important and popular. Sell-side applications enabled customers to buy things faster and cheaper, while buy-side products such as e-procurement solutions enabled companies to reduce maverick spending and better leverage purchasing power with suppliers.

However, the integration of these applications with existing ERP and back-office applications turned out to be more difficult and more expensive than originally planned. Integration is not strictly an IT problem; rather, it is a strategic business problem.

ERP applications are an integral component of any information architecture and today's application systems are required to address more than the processes taking place within the walls of an enterprise; they must be able to address the players and processes involved in an extended enterprise that reaches customers, partners, suppliers, and employees worldwide.

The need to incorporate best-of-breed applications and integration to internally developed systems has become a priority within IT departments. ERP vendors cannot provide all of the applications that integrate into and complement the ERP backbone. As a result, it is important for ERP vendors to look at how their applications interact with applications outside of the fold. They must move to integration models based on industry-accepted standards and non-proprietary Application Programming Interfaces (APIs). Web services promise to play a large role in this new integration model, enabling ERP functionality to be fully leveraged using industry-standard technologies.

Within almost every industry there are business requirements to lower costs, increase revenue and improve operational efficiencies. In order to achieve these goals companies must connect internal groups, extend processes to partners, expand business opportunities, and reduce transaction costs. These business requirements can only be met by technologies that are cost-effective, flexible, and agile. The technologies must support automated collaboration, real time integration, secure interactions, and low-cost coupling.

As previously mentioned, new business models are forcing organizations to accelerate the business reengineering initiatives they undertook when they first began to implement ERP systems in the 1990s. To maintain competitive advantage, almost all companies must now be able to conduct their business online as part of an increasingly Internet based, global economic community. As we all know, the Web has improved performance and productivity, enabled collaboration, dismantled trade barriers and created an enormous range of global opportunities. As a result of the Web's burgeoning adoption and success as a means of conducting business, productivity has increased tremendously; however, the lack of interoperability has been frustrating to many.

Organizations must provide customers, employees, suppliers, distributors, and numerous other parties with the information they need, when they need it. As a result, business systems and processes can no longer remain isolated and disparate. Business success now requires better performance from easier application integration. Systems must share information internally with other applications as well as externally through Web applications, Business-to-Business (B2B) exchanges and value-added networks. These exchanges and transactions must be real time, online and immediate– i.e., conducted anytime, anywhere, and without compromise to security or transaction integrity.

The emerging Web services paradigm offers the promise of new efficiencies and improved integration designed to enhance collaboration between internal and external applications. For example, Web services can serve as the bridge between an e-procurement application and an internal inventory system. As items are purchased through the e-procurement application, a Web service specific to inventory reduction can be invoked to adjust inventory levels. As soon as reorder points are hit, a Web service could be used to place a standard order with an external suppliers system. Through the use of Web services, the cycle time between buying and replenishment can be greatly reduced and the potential for errors virtually eliminated.

Although Web services are relatively nascent and adoption rates currently low, it is critical for ERP vendors to begin taking steps to prepare for this rapidly maturing initiative. By acting now, vendors will be in a position to achieve tangible, immediate benefits through enhanced development practices, and provide their customers with less complex integration projects. With the growing need for Web services deployment as well as an increased demand for internal integration and B2B integration, vendors must be very mindful of application integration. This critical integration of applications within an enterprise is quickly becoming common practice.

The increased level of integration required to support such a system will necessitate the use of an abstraction layer to expose and provide access to the business processes, logic, rules, and data residing within existing legacy and ERP systems for utilization by the other applications. The use of Web services as a means of publishing, discovering and invoking transactions is an ideal way to eliminate

the complexity behind the system. In much the same way HTML and browsers gave people easy access to documents, Web services technologies including Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), and Universal Description, Discovery and Integration (UDDI) will allow applications to connect with other applications, regardless of location or platform.

ERP, INTERNET, AND WWW

We have seen the need and importance of the integration of ERP and other business technologies to deliver the productivity improvements and remain competitive. ERP needs to be tightly integrated with the Internet and WWW or World Wide Web, in order to take advantage of that powerful medium. Since most of the business transactions are conducted over the Internet and most information is accessed and disseminated over the organization's portal on the WWW, these two media are becoming important for organizations. With the advancements in encryption technologies and Internet security, conducting business over the Internet is becoming safer. So extending the ERP applications to the Internet and WWW is the next logical step for organizations. Also information dissemination and data transfer across the Internet is cheaper compared to expensive private networks and dedicated transmission lines. Taking hints from the growing popularity of the Internet and WWW, most ERP vendors are Internet or Web enabling their ERP offerings.

ERP systems are used to integrate and optimize an organization's internal manufacturing, financial, distribution and human resource functions. In contrast, **ERP II** addresses the integration of business processes that extend across an enterprise and its trading partners. ERP II forms the basis of Internet enabled e-business and collaborative commerce.

The main reason why ERP II came into existence was the need to look at a way to give customers and partners access to scheduling, delivery, inventory, manufacturing, invoicing, and planning information. Over the last few years, solutions like Customer Relationship Management (CRM) and Supply Chain Management (SCM) have leveraged the Internet to support these processes. ERP II incorporates them all in a single package.

To be globally competent, an organization needs to open and reach out to its collaborative partners. ERP II enables businesses to compete by providing information online and adding real value to businesses of all types and sizes. Functionality improvements associated with SCM, supplier relationship management, and CRM can be associated with ERP II. All of these tend to encourage collaboration with entities or companies outside of the original enterprise that implemented ERP.

ERP II can enable access to information by those outside the company or original entity, e.g., a manufacturing plant that allows access to planning information by another plant or its customers. Software that allows access by those outside the company has more stringent security plus design to avoid access to certain company information. ERP generally refers to a software system that is resident on, and accessed through, a company computer and secure company network. ERP II may enable Web-based or Internet access through an Internet browser; this is one approach to allowing external users to access ERP.

Software as a Service (SaaS) usually refers to a vendor hosting the software and data, in a business model where the same version of the software is used for multiple clients. ERP has only recently been introduced on a SaaS basis, and can be described as ERP II if deployed in this way.

Today's business leaders need information to be more readily accessible. They want real time views into their businesses so that decisions can be made when they need to be, irrespective of where there are located. They also need this information without the added time of tracking data and generating reports. Managers want to monitor key metrics in real time to actively track the health of their business. ERP was a good start, but the market is currently demanding more. The

one dominant conclusion is that ERP must now involve the entire enterprise, delivering consistent, measurable processes and up-to-the-second information that supports profitable decision-making irrespective of the location of the user. It is here the Internet, WWW and mobile applications come into picture and boost the power of ERP by offering 24×7 hour access to business information and business intelligence irrespective of the geographical location of the user, enabling him/her to make informed and timely decisions.

ERP TO ERP II—BRINGING ERP TO THE ENTIRE ENTERPRISE

ERP solutions were developed to deliver automation across multiple units of an organization, to help facilitate the manufacturing process. ERP addressed the issues of raw materials, inventory, order entry and distribution, but it was unable to extend to other functional areas of the company such as sales, marketing and services. ERP also failed to provide value for non-transactional relationships with external partners and vendors, and other non-inventory, non-order operations. The evolution from ERP to ERP II is given in Table 56.1.

ERP did not tie in any CRM capabilities that would allow organizations to capture customer-specific information, nor did it work with Web sites or portals used for customer service or order fulfillment. Call center or quality assurance staff could not tap into the ERP solution, nor could ERP handle document management, such as cataloging contracts and purchase orders. All technologies adapt to changing business climates if they are to survive and prosper.

The ERP market is no exception. As businesses entered the 21st century, they began to tinker with the idea of **extended ERP**—bringing functionality that existed outside of the ERP system into the mix. There were—and continue to be—issues with integrating such functionality, as businesses thus far have had to implement any 'middleware' number of solutions to solve specific IT problems.

ERP II is the next step in extended ERP. It is a solution that includes the traditional materials planning, distribution, and order-entry functionality strengthened by capabilities like CRM, Human Resources Management HRM, document/Knowledge Management (KM), and workflow management. Such a system can quickly, accurately and consistently operate an entire organization. It delivers information in an instant to the people who need it. It manages the access to that information by establishing security roles and ratings that define which employees can use certain pieces of information. It also addresses the issue of multiple office locations by making the solution Web-based, so employees can access the system no matter where they may be.

Table 56.1 The evolution of ERP to ERP II

ERP (1990–1999)	Extended ERP (2000–2005)	ERP II (2005 Onwards)
• Materials Planning • Order Entry • Distribution • General Ledger • Accounting • Shop Floor Control	• Scheduling • Forecasting • Capacity Planning • e-Commerce • Warehousing • Logistics	• Project Management • Knowledge Management • Workflow Management • Customer Relationship Management • Human Resource Management • Portal Capability • Integrated Financials • Internet and WWW Integration

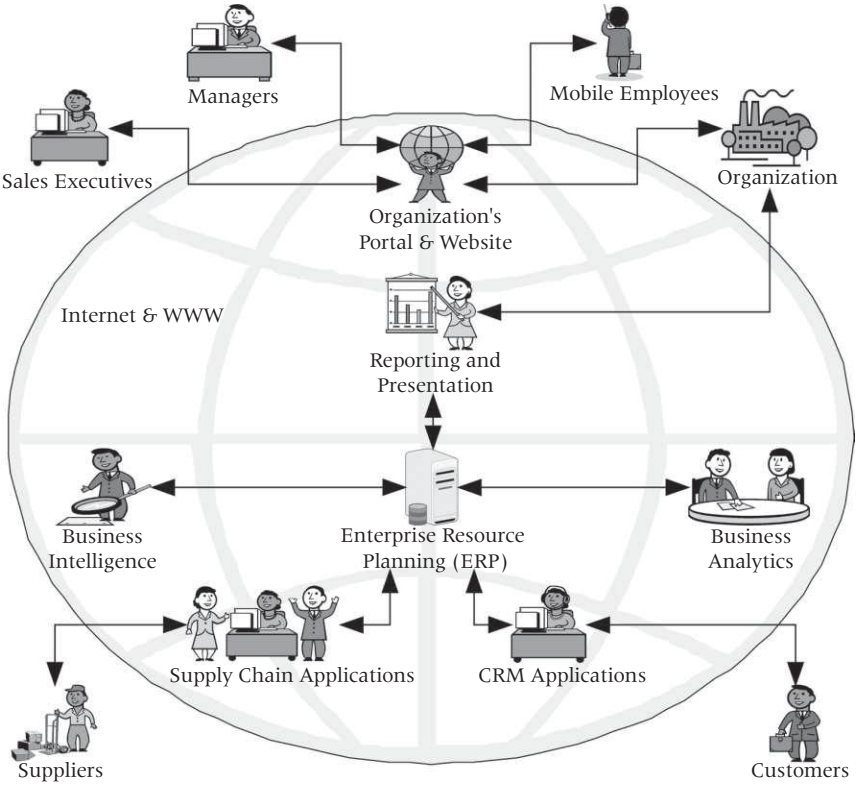

Figure 56.1 ERP II, Technologies, Internet, and WWW.

Businesses are utilizing the Internet more and more. It is no longer just a tool for e-mail, research, and single transaction commerce. It is quickly becoming a tool for globalizing a business—a tool that allows an organization to tie together its employees, its suppliers and its customers. It enables the free flow of information and the next generation of solutions will be built upon it.

With Web enabled B2B, the ERP system can go much beyond the boundaries of your enterprise. You can integrate it with business intelligence to analyze your data; and you can couple it with CRM or SCM to increase your involvement with your customers and suppliers. Various enterprises are implementing these cross-functional changes.

Demand for more sophisticated processing capabilities to sharpen competitive edge has resulted in ERP II systems. Many businesses are looking to improve and extend processes, offering customers, suppliers, and other trading partners access to integrated processing. This is done through concepts like self-service functionality and aims to deliver more efficient and effective processes with reduced costs. Enabling technologies like ERP II have led to the advent of collaborative commerce (C-commerce). C-commerce is the electronic interaction of businesses, whether within the supply chain or an industry. The boundaries of the enterprise have shifted and now extend to customers and suppliers who are outside the organization. With ERP II the customer, the vendor, the supplier and the company all work in unison. The strongest features of ERP II are its web-centricity and designed-to-integrate architectures.

ERP II facilitated access to Internet and made it a part of the working component. Even though ERP was a web friendly application it did not make full use of Internet but they served as a means of

support. This act equals possessing technology and not using it. However ERP had its own reservations in using Internet abundantly. ERP II worked on them and hence became a totally Web friendly application (see Fig. 56.1).

C-commerce enables business partners from multiple companies to exchange information posted on e-commerce exchanges. For example, companies can develop new products with their suppliers by sharing each other's data across online marketplaces. Collaborative commerce also enables organizations to find new partners to solve one-off design problems. In this scenario, the organization's competitive edge will be your ability to take good information and put it on the Internet and enable people to collaborate on it. Unlike old-style ERP, ERP II will cut across all business processes, such as customer relationship management, as well as traditional functions including finance and human resource management. ERP II will also be applicable to all industries not just the finance, manufacturing and distribution sectors that were the focus of ERP. Buying and selling over the Web is only a part of ERP II. The main focus is on business interaction and the questions asked are "whom are you working with" and "who is your focus". C-commerce is about intellectual capital.

To compete on a functional level today, businesses must adopt an enterprise-wide approach to ERP that utilizes the Internet and connects to every facet of the value chain. They must change their own internal processes and procedures to foster collaboration efforts both inside and outside the organization, and they must integrate technologies that allow their collaboration efforts to take full flight. Changing internal processes is not always easy. Corporations must abandon old methods that strived to preserve and protect data in individual fiefdoms. They need to allow data to be shared within an organization on a rule and roles based system. They must overhaul reporting structures that limit decision-making to a select few. They must open lines of communication and collaboration within the organization and to outside partners, suppliers and customers. Without open processes the extension of ERP throughout an enterprise will fail.

Systems that leverage advanced levels of ERP II functionality integrate disparate software packages in a manner that is seamless and transparent to those using them. A single interface loads information from separate systems, allowing it to be modified and saved back. Actions can trigger events in individual systems resulting in a chain of events across the enterprise and throughout the value chain.

Software providers need to provide vehicles to connect traditional ERP capabilities with front office processes. They need to present companies with the means to unify the people, processes and knowledge that matter most to a business. By linking traditional ERP with advanced tools that help run a business, customers can create an accurate, up-to-the-moment view of the extended enterprise to enhance decision-making, analysis, scenario planning, and ongoing management of the value cycle. This approach also provides companies with the unique ability to see where processes intersect, how they impact each other and the workflow that drives them to produce a clear picture of the business—leading to cost savings and operational efficiencies.

Solutions that bridge the gap between the back and front office worlds give organizations the ability to exchange information with the ERP solution. They also tie in additional functionality, such as giving designated individuals easy access to information critical to their job function or role in the value cycle through a Web-based interface inside and outside the company. The result is a substantive competitive advantage.

True enterprise-wide solutions create an environment in which companies can not only model but also effectively streamline workflow and automate manual, unsecured processes into a secure centralized environment. Access to information and documents should be based on a role and rules based schema, giving business managers the ability to control access to data on a need-to-know and need-to-access basis for projects and outside managed operations. This roles and rules based

approach eliminates the 'data islands' outcome inherent in most, if not all, ERP deployments. Such a model also allows for the involvement of outside stakeholders with the use of portal capabilities.

This enables all members of the value chain to be included in processes. But most importantly, advanced ERP requires a powerful workflow component and integration with the Internet and WWW. Workflow that provides each member of the value chain with a process-centric view of the business, based on his/ her role and responsibilities. Workflow that does not depend upon a crude 'send' only model like e-mail, but also on a business rules system, that automates the flow of communication and tasks. Workflow that can ensure that assigned tasks are completed, or elevated if need be. Workflow that can be used in conjunction with advanced alert management technology to make certain that potential problems in the production chain do not become crises. Constant evolution of today's business requirements have led to workflow processes to be updated as needs change.

BEST PRACTICES OF ERP II

ERP II will not render the required benefits if companies do not adopt the best practices in choosing and using them. This is said to be important because ERP II has just crossed its infancy. Many elements have to be taken care of in order to ensure that they get the best out of ERP II. In order to achieve them one should follow ERP II best practices. Some of the best practices are as follows.

Choosing Multiple Vendors

ERP II can give the best to a company/user when they avail the service of more than one vendor. This is because of the fact that ERP II is a unique application capable of handling multiple tasks. There may be some vendors who are specialized in serving particular industries while others may be interested in some other functions. Even though the technicality of ERP II has come a long way in catering to all functions and to all industries each individual vendor/ package has their own unique specialty, which shows them apart from the competitor. When ERP II can offer the best of mix and match combinations it will be wiser for the companies to select the best application by choosing to blend the niche and special qualities of the different vendors/ packages.

Exploit the Core Strengths

It is a well-known fact that ERP II has been developed to meet the deficiencies or drawbacks of ERP. There is no point in using ERP II for delivering the same task and targets set for ERP. This makes the existence of ERP II meaningless. Nevertheless they can be done by ERP itself, but using ERP II for the same purpose will increase the efficiency and productivity. The stress should be on the additional work and venues for expansion.

Redefine Business Process

Companies can redefine their business during the process of restructuring. They should keep the core strengths of ERP II technicality in mind while doing so. The idea is to enable the company to perform a task, which was not possible in ERP. However, the company cannot carry the good old process for this purpose. On the contrary, they should be more advanced in order to be compatible with ERP. When it comes to ERP there are two options—the company can either modify its business or modify ERP solutions. Both of them have their own pros and cons. However, when it comes to ERP II it is always advisable to modify the business of the company, as ERP II technically, is an advancement that can change the company's fate by leaps and bounds.

Periodic Assessment

Companies have to periodically monitor the pace at which ERP II is moving. This will help them in many ways. First, it will give an overall idea and the different advantages when compared with ERP. Second, they will help in reducing the mistakes because the company must have a clear idea on the working of enterprise application ever since ERP intervened. This evaluation will not only help them to know how ERP II is better from ERP but also guide them in implementing valuable guidelines from the success and failure stories of ERP.

SUMMARY

In this chapter, we have discussed how traditional ERP implementations have set the groundwork within organizations to start capturing all information onto one true 'enterprise' system. It outlined a clear vision of how the next generation of ERP systems will include the bulk of the functionality that traditionally has been found outside of the ERP system. Finally, this chapter highlighted the benefits that can be associated with such an ERP system and the efficiencies that can be realized across an organization.

Business in this century is complex, fluid and customer-centric. It requires stringent, yet flexible processes and communications systems that extend globally and respond instantaneously. The processes and systems must be integrated. No part of the enterprise can escape the pressure to deliver measurable results.

ERP gave businesses a vehicle to manage information and use it to their advantage. It organized customer data in ways that helped individual departments operate more efficiently, and it created streamlined processes that helped manufacturing operations cut costs and move products along more quickly. But traditional ERP systems failed to complete the task they ultimately set out to accomplish: to unify the enterprise and turn it into one smoothly running machine.

ERP II promises to bridge this gap. New software tools are available that link departmental communications, work processes, customer data and supplier capabilities into a centrally functioning system—all focused on driving the enterprise forward. Enterprises are already starting to benefit from extending their ERP installations to more of their organizations. ERP was a giant step forward when first introduced however, over time it had reached a plateau in functionality and most products on the market offered similar functionality. The market then saw new buzz terms such as lean manufacturing, arise that did not bring new functionality, but promised greater efficiencies, when in fact all it did was deliver what ERP was supposed to do in the manufacturing space.

ERP II in contrast, does offer advancements in functionality. It delivers on the original concept of ERP being for the entire enterprise, so that the whole organization can operate more efficiently. No longer does corporate information sit isolated in departmental silos, but is housed with all corporate information, used to benefit the entire organization namely, its business partners, supplies, customers, etc. This information enabling creates a new level of cohesion and eliminates most of the departmental and organizational information barriers facilitating smooth and seamless flow of information. The integration of ERP, the enabling technologies like Customer Resource Management (CRM), Supply Chain Management (SCM), the analysis and business intelligence tools with Internet and WWW enable the organizations to do business in the Internet way at astonishing speeds and high efficiencies.

REVIEW QUESTIONS

1. What are the advantages of ERP?
2. Success in business now requires better performance from easier application integration. Why?

3. What do mean by the Web services and what does it offer the organizations?
4. How do web services reduce inventory costs?
5. What do you mean ERP II?
6. Why ERP II came into existence?
7. How ERP II does enable c-commerce?
8. What is collaborative commerce or C-commerce?
9. C-commerce is about intellectual capital. Explain.
10. What is connection of SaaS and ERP II?
11. Which are the areas conventional ERP has fallen short?
12. What are the advantages of extending application to support e-commerce?
13. Why it is important that an organization be able to conduct its business online?
14. How has the Internet and WWW improved the performance and productivity of businesses and created global opportunities?
15. How can business conduct its transactions in real time at anytime, and from anywhere without compromising security or transaction integrity?
16. What is the difference between ERP and extended ERP?
17. What is the difference between ERP and ERP II?
18. What is ERP II and what are its components?
19. How does ERP II allow organizations to choose multiple vendors?
20. How does ERP II allow organizations to exploit the organization's core strengths?
21. How does ERP II allow organizations redefine business processes?
22. Traditional ERP implementations have penetrated only 15% to 20% of an organization. Why?
23. Explain the effect of the Internet explosion on ERP.
24. How can web services improve the efficiency of an organization?
25. Explain the connection between ERP, Internet, and WWW and how the integration of the three makes the ERP more efficient.
26. Trace the evolution of ERP II.
27. Explain the concept and advantages of c-commerce?
28. How does ERP II deliver cost savings and operational efficiencies?
29. Explain the best practices of ERP II.
30. The integration of ERP, the enabling technologies like CRM, SCM, the analysis and business intelligence tools with Internet and WWW enable the organizations to do business in the Internet way at astonishing speeds and high efficiencies. Discuss.

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Chapter 57

ERP and Total Quality Management

TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management (TQM) is a management approach that originated in the 1950's and has steadily become more popular since the early 1980's. TQM is more than just a philosophy. It is the culture of an organization committed to total customer satisfaction through continuous improvement. In such a culture, resources, material, equipment, and quality management systems are cost effectively implemented and fully utilized.

Total quality is a description of the culture, attitude, and organization of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations. To successfully implement TQM, an organization must concentrate on the eight key elements—ethics, integrity, trust, training, teamwork, leadership, recognition, and communication.

Ethics is the discipline concerned with good and bad in any situation. Integrity implies honesty, morals, values, fairness, adherence to the facts, and sincerity. These are characteristics that customers (internal or external) expect and deserve to receive. Trust is a by-product of integrity and ethical conduct. Without trust, the framework of TQM cannot be built. Trust fosters full participation of all members. It allows empowerment that encourages pride of ownership and encourages commitment. Training is very important for employees to be highly productive. Supervisors are solely responsible for implementing TQM within their departments and teaching their employees the philosophies of TQM. Employees should be trained in areas such as interpersonal skills, the ability to function within teams, problem solving, decision-making, job management performance analysis and improvement, business economics, and technical skills. To become successful in business, teamwork is also a key element of TQM. With the use of teams, the business will receive quicker and better solutions to problems. Leadership in TQM requires the manager to provide an inspiring vision, make strategic directions that are understood by all and to instill values that guide subordinates. The success of TQM demands communication with and among all the organization members, suppliers, and customers. Recognition is the last and final element in the entire system. It should be provided for both suggestions and achievements, for teams as well as for individuals. Employees strive to receive recognition for themselves and their teams. The eight elements mentioned above are keys in ensuring the success of TQM in an organization and the supervisor plays a huge part in developing these elements in the workplace. Without these elements, the business entities cannot be successful TQM implementers.

The effective use of TQM provides a much higher quality ERP implementation that function properly upon first use, on time, with less cost, and more overall value. More importantly, TQM ensures satisfaction of all participants, including Enterprise Resource Planning (ERP) vendors, service providers, systems integrators, team members who implement the software, and the company that purchased the software. Characteristics of TQM are fundamentally common to all different types of business process flows and ERP functional modules.

CHARACTERISTICS OF TQM

The important characteristics of TQM include customer-driven quality, top management leadership and commitment, continuous improvement, fast response, actions based on facts, employee participation, and a TQM culture.

Customer-Driven Quality

TQM has a customer-first orientation. The customer, not internal activities and constraints, comes first. Customer satisfaction is seen as the company's highest priority. The company believes it will only be successful if customers are satisfied. The company that implements TQM is sensitive to customer requirements and responds rapidly to them. In the TQM context, 'being sensitive to customer requirements' goes beyond defect and error reduction, and merely meeting specifications, or reducing customer complaints. The concept of requirements is expanded to take in not only product and service attributes that meet basic requirements, but also those that enhance and differentiate them for competitive advantage.

Each part of the company is involved in total quality, operating as a customer to some functions, and as a supplier to others. The engineering department is a supplier to downstream functions such as manufacturing and field service, and has to treat these internal customers with the same sensitivity and responsiveness as it would treat external customers.

TQM Leadership from Top Management

TQM is a way of life for a company. It has to be introduced and led by top management. This is a key point. Attempts to implement TQM often fail because top management does not lead and get committed but just delegates and pays lip service. Commitment and personal involvement is required from top management in creating and deploying clear quality values and goals consistent with the objectives of the company and in creating and deploying well-defined systems, methods, and performance measures for achieving those goals. These systems and methods guide all quality activities and encourage participation by all employees. The development and use of performance indicators is linked, directly or indirectly, to customer requirements and satisfaction, and to management and employee remuneration.

Continuous Improvement (Kaizen)

Continuous improvement of all operations and activities is at the heart of TQM. Once it is recognized that customer satisfaction can only be obtained by providing a high-quality product, continuous improvement of the quality of the product is seen as the only way to maintain a high level of customer satisfaction. As well as recognizing the link between product quality and customer satisfaction, TQM also recognizes that product quality is the result of process quality. As a result, there is a focus on continuous improvement of the company's processes. This will lead to an improvement in process quality. In turn this will lead to an improvement in product quality and to an increase in customer satisfaction. Improvement cycles are encouraged for all the company's activities such as product development, the use of EDM/PDM , and the way customer relationships are managed. This implies that all activities include measurement and monitoring of cycle time and responsiveness as a basis for seeking opportunities for improvement.

Elimination of waste is a major component of the continuous improvement approach. There is also a strong emphasis on prevention rather than detection and an emphasis on quality at the design stage. The customer-driven approach helps to prevent errors and achieve defect-free production.

When problems do occur within the product development process, they are generally discovered and resolved before they can get to the next internal customer.

Fast Response

To achieve customer satisfaction, the company has to respond rapidly to customer needs. This implies short product and service introduction cycles. These can be achieved with customer-driven and process-oriented product development because the resulting simplicity and efficiency greatly reduce the time involved. Simplicity is gained through concurrent product and process development. Efficiencies are realized from the elimination of non-value-adding effort such as re-design. The result is a dramatic improvement in the elapsed time from product concept to first shipment.

Actions Based on Facts

The statistical analysis of engineering and manufacturing facts is an important part of TQM. Facts and analysis provide the basis for planning, review and performance tracking, improvement of operations, and comparison of performance with competitors. The TQM approach is based on the use of objective data and provides a rational rather than an emotional basis for decision-making. The statistical approach to process management in both engineering and manufacturing recognizes that most problems are system related, and are not caused by particular employees. In practice, data is collected and put in the hands of the people who are in the best position to analyze it and then take the appropriate action to reduce costs and prevent nonconformance. Usually these people are not managers but workers in the process. If the right information is not available then the analysis, whether it is of shop floor data or engineering test results, cannot take place; errors cannot be identified and therefore cannot be corrected.

Employee Participation

A successful TQM environment requires a committed and well-trained work force that participates fully in quality improvement activities. Such participation is reinforced by reward and recognition systems, which emphasize the achievement of quality objectives. Ongoing education and training of all employees supports the drive for quality. Employees are encouraged to take more responsibility, communicate more effectively, act creatively, and innovate. As people behave the way they are measured and remunerated, TQM links remuneration to customer satisfaction metrics.

TQM AND ERP

Both ERP and TQM share similar goals—customer satisfaction, productivity improvement, increased competitiveness, waste reduction, effort duplication prevention, and so on. ERP systems will help in achieving these goals when used in conjunction with TQM. Here ERP has the role of an enabler of the TQM principles and philosophies. ERP is also benefited by the implementation of TQM. Effective use of TQM creates better performing ERP systems. TQM brings problem solving techniques and continuous improvement opportunities for all ERP systems. The effective use of TQM helps companies obtain the maximum return on investment from expensive investments.

So, for organizations applying, or targeting TQM in their businesses, ERP software has become an essential necessity. In the next few sections we will explore the relationship between TQM and ERP by comparing the fundamental principles at the root of these two concepts.

Leadership

Having strong leadership is critical for the overall success of an ERP system. The leadership role senior management plays for an ERP system is often greatly misunderstood. Successful ERP implementations will have one or more senior managers closely involved in the installation and maintenance of the ERP system.

The senior manager has the authority and power to resolve conflicting needs in the allocation of resources for the ERP system and does so as needed. Too often senior management takes the role of only providing motivational support for those involved in the implementation of an ERP system. This is not enough. ERP implementations that go poorly always do so in the absence of good management.

Commitment

To be successful with an ERP system, commitment must come from team members, management, financial resources, ERP service providers, and computer resources. Lack of commitment of ERP team members is noticeable in most ERP implementations. To ensure rapid and smooth implementation, team members must be capable of dedicating 60–100% of their time to the ERP project. Lower committed times of 20–30% or less, do not work well because of the high learning curves required for ERP implementations.

Customer Focus

Customer focus ranks first among the basic principles of TQM. What customer focus connotes can be summarized as the understanding of customer needs and expectations and the continuous effort to increase customer satisfaction. When we examine the advantages brought on by the use of ERP systems, we observe the same device occupying the first place. Some of the advantages resulting from a successful ERP implementation are minimization of disaccords by creating records of all communication with the customers; organization's enhanced ability to listen systematically to what the customer is communicating, faster response to customer requests and increased quality in the services offered to the customer.

As we have seen, the most important concept of total customer satisfaction is in understanding who the customer is and what his role is. The customer of an ERP system is the company who has purchased it and intends to use it for their business. ERP systems are complex in nature and are not well supported by traditional customer service techniques.

As common consumers of the market, when we purchase products we generally expect the company that we purchase the product from to provide services and directions in making that product successful for its intended use. ERP systems are not that simple. The success of an ERP system is highly dependent upon the leadership, commitment and implementation technique by the company that purchased it. Generally, ERP vendors do not have the authority or power to tell their customers how they may or may not use or install an ERP system.

Product failure and dissatisfaction are common because many companies do not understand their role in the implementation and use of ERP. Companies often place pressure on their ERP vendors in an attempt to resolve issues and problems outside of the ERP vendor's control. This begins a vicious cycle that sometimes erupts to a bitter court battle. No matter who wins, the end result is still the same: an ERP system that does not work.

For successful ERP implementations, customers must better understand their roles, and ERP vendors must become more aggressive in educating their customers on how to be successful with an ERP system.

Total Involvement and Communication

The process of total involvement is well suited for ERP systems. The installation of an ERP system can be thought of as being similar to designing a complex product for your customer. An ERP system may be sold as a standard package but the way in which it will be installed and used requires significant design work. The overall quality of the installation will be greatly improved by the involvement of all affected parties.

Companies that attempt to install ERP systems while keeping end-users in the dark during the design process have notably higher failure rates. The process of communicating how an ERP system will affect people and the changes required, gives concerned parties an opportunity to recognize mistakes and avoid costly decisions.

Total involvement has many important benefits in the early design phases including: less rework, higher user acceptance, less training, faster implementation times, higher success rates, better performance, and less post-implementation support.

Teamwork

Again, according to total quality management basics, full participation in the business processes must occur in the organization and those processes must be embraced through teamwork. In any ERP implementation, the starting point involves the definition of the processes and the formation of an interdepartmental project implementation team. The primary goal of teamwork is for the business to be grasped in whole as a single entity by all departments and personnel, and thereby being able to focus on the main processes, instead of getting lost in the disconnected subprocesses. In a successfully realized ERP implementation, all departments have a better understanding of the needs of each other. Because data exchange takes place through a central database and does so mostly without manual intervention, the accuracy of the data and its reliability increases. As a result, the corporation is coerced to conduct its business not as a collection of independent departments but as a unified team.

ERP vendors, consultants, management, and ERP team members must all work together for successful ERP implementation. Successful communication is required for this to happen. How the ERP team is to be arranged is generally given little thought in an ERP implementation. Quite interestingly, traditional TQM concepts of teamwork where team members are allowed to communicate and make decisions outside of the direct line of management supervision has not worked well for ERP implementations. Due to the complexity of ERP systems they require a massive amount of coordination and synchronization of organizational resources. These organizational resources are often badly stressed between finding time to implement the ERP system and keeping the business running.

These conflicting needs require the decision-making capability of the management responsible for the overall organization and implementation of the ERP system. Successful ERP implementations will usually have a strong senior manager of the company coordinating and synchronizing activities with the power and authority to resolve conflicting needs of personnel resources. Without the strong centralized resource guiding the ERP team, individual functions and team members tend to become lost in the chaos. Teamwork is most important, but works best when clear direction is present.

Continuous Improvement

Continuous improvement, another basic principle of total quality management, is an inherent consequence in an organization where ERP software is in use. For an organization that has made the appropriate choice in their ERP system the associated best practices are in a sense, acquired for free. The maintenance of the ERP software and installation of new releases on an orderly basis further

assures that the system promotes the evolution of the organization in a continual fashion.

The concept of continuous improvement is understood well by world-class companies but rarely applied effectively to ERP systems. There is a strong effort by companies to fix ERP systems, which often leads to layers and layers of complex software modifications. Eventually the complexity becomes so great that companies are forced to abandon the ERP system and implement a new one.

This is not continuous improvement. Continuous improvement in an ERP system is the process of better learning how to use the ERP system for long-term competitive advantage in the marketplace without making unnecessary software modifications. Success is rarely invented or obtained overnight. Small simple installations can show large scale improvement in a period of three to six months, while larger complex installations may take five or ten years. No matter what the size of an organization or its complexity, when it comes to ERP systems, continuous improvement is shown in small incremental steps.

Training and Education

ERP system training can be thought of in terms of what button to push and when it should be pushed. Education can be thought of as the reason for pushing that button and how it relates to the overall system. Companies will all too often attempt to use training as a substitute for education or vice versa. The results are usually dismal. ERP systems need both training and education as we have seen in Chapter 33.

ERP systems should begin with education for the team core members. It is important to understand the overall design and functional capabilities of a new ERP system. Once these functional capabilities are clearly understood the core team members will be in a better position to implement the ERP system and develop training programs.

ERP training programs are classes that are designed specifically for the company using the ERP system. These classes will show in detail how to use the software for specific business process flows. These ERP training programs cannot use standard ERP vendor supplied training programs since they are oriented towards education, not training. ERP training programs must be custom developed for almost every situation. Educational training classes provided by ERP vendors are focused on the functionality of the system and how it works in a general sense, and are not specific to a company.

Relationships with Suppliers

Maintenance of up-to-date and reliable information on suppliers, and assessment and evaluation of suppliers also constitute important aspects of TQM applications. Most ERP systems provide support for associated functionality through dedicated modules.

Ownership

Overall company satisfaction in an ERP system correlates strongly with end-user ownership. Companies where the ownership has shifted from the end-users of the system to the Information Systems (IS) function suffer from a barrage of mistakes and rework. These types of environments have trouble learning from their mistakes and often occupy their time in endless political meetings and red tape.

Companies with high end-user ownership will use their ERP system for long-term strategic business management. These types of companies are rare, making it difficult to learn from another's success. A complete lack of ownership will lead to catastrophic results. When the end-users, management, and the ERP vendor no longer support the ERP system, death is almost certain to occur.

Accurate and Reliable Data and Statistical Analysis

To achieve total quality management it is critical to be able to collect, analyze and assess in a systematic method such information as production data (product trees and route information), quality control criteria and associated values, customer complaint records related to products, and job order data. Within today's accelerated production environments it is next to impossible to accurately and reliably achieve these tasks without the use of an advanced ERP system.

SUMMARY

Total Quality Management (TQM) is a management strategy aimed at embedding awareness of quality in all organizational processes. Total quality provides an umbrella under which everyone in the organization can strive and create customer satisfaction. Organizations that embrace total quality management as a management approach and organizations that actively apply it in their businesses, should definitely invest in the ERP software. Not using an ERP system will result in a much costlier task to implement total quality management in the organization. For those businesses that have not yet started TQM and ERP implementations, starting both simultaneously and treating these as integrated projects will allow organizations to attain the best returns.

REVIEW QUESTIONS

1. What is TQM? Explain.
2. What are the characteristics of TQM?
3. Explain how TQM and ERP complement each other.
4. What are the common goals of ERP and TQM?

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Chapter 58

Future Directions and Trends in ERP

INTRODUCTION

The only constant is 'change;' no more so than in the constantly evolving, high-speed world of technical innovation. And so the question is, "how will these inevitable changes affect the ERP market?" In this chapter we will survey the industry landscape and check out what's on the horizon—keeping in mind that often what appears to loom large in the distance turns out to be a mirage.

That said, ERP industry watchers are agreed on at least one point—one size does not fit all; each organization is different and should have specific needs and requirements. So vendors must offer customized products if they want to survive. As the market stands now, no one doubts ERP's ability to continue dominating back-office practices in areas of traditional strength such as financial management, human resources, and basic manufacturing. But people want more. The dream of Enterprise Resource Planning (ERP) systems is that a single application can track and monitor all of a business's functions. ERP vendors are adding more features to their products and integrating new applications so that they can deliver a one-stop application to the organizations. There are many challenges that must be met in order to achieve this perfect integration, but despite these challenges the movement toward a global ERP system is a key factor shaping the future of enterprise resource planning. According to Karen Goulart [1], ERP's future depends on how flexible developers are able to make the old workhorse, IT leaders, and analysts say. Its future also depends on how responsive ERP systems are to such trends as mobility, big data, social media, and cloud computing.

NEW MARKETS

As larger enterprises become saturated with new generation client/ server ERP systems, vendors are being forced to find new markets for their product suites to continue to drive their growth. This pressure is causing ERP vendors to increase their appeal to small business clients through a number of initiatives. These initiatives include the following:

- Software as a Service (SaaS), Cloud, and hosted offerings to attract Small- and Medium-size Enterprises SMEs as the cost of ownership is very low
- Supplementing their direct sales force with reseller channels
- Lowering the entry price point of the on-premise versions to make it financially viable
- Stratifying their software offerings to appeal on the basis of reduced functionality
- Improving the implementation methodologies for faster deployment
- Porting the products to platforms such as Microsoft Windows

NEW CHANNELS

Vendors such as SAP AG Inc., Oracle Corporation, etc. have been building reseller channels—both in the U.S. and worldwide—to reach the smaller businesses that are looking for the complete one-stop

shop for their ERP solutions. The ERP software is made more financially attractive by lowering the entry price point for each module and ramping up the total costs by pricing based on user licenses.

FASTER IMPLEMENTATION METHODOLOGIES

All ERP vendors have suffered from the perception that their software is difficult and costly to implement. This perception has provided huge profits for the consulting firms that have generated billions in fees from their ERP software implementation 'practices.' Even though only 10% to 15% of the implementations have taken years to complete and have eaten up millions of dollars of consulting costs, the fact remains that implementing ERP packages is difficult.

An ERP system may consist of dozens of modules that are deployed on a multinational basis to service hundreds of users from many different business departments. There may also be a complete change of IS infrastructure—say from a mainframe to a Windows platform—while a number of core business processes are being simultaneously reengineered. ERP vendors have thus begun to focus their effort on making the implementation process easier, by providing more effective tools and methodologies to speed up the process, creating elite consulting teams to intensify resources when required, and using model-based approaches and opening up their systems for easier integration.

For example, ASAP Methodology for implementation is the SAP roadmap for implementing SAP solutions in a cost-effective, speedy manner. ASAP provides a proven, repeatable implementation methodology to streamline projects and achieve lower Total Cost of Implementation (TCI). Oracle Business Accelerators (OBAs) are powerful, cloud-based rapid implementation tools developed and maintained by Oracle to get the applications up and running on a wide range of Oracle Applications, both quickly and reliably. In addition to this, Oracle has Oracle Accelerate Solution Partners to help you in implementing the Oracle applications.

Despite the availability of new channel partners and best-of-breed implementation practices, ERP systems have often been difficult to implement because of a dearth of skilled consulting resources. As a result, initiatives such as Oracle's, Oracle Consulting or SAP's Platinum, consulting services are leading the way in creating highly skilled consulting teams and are charged with delivering fully trained and experienced consultants on a worldwide basis to speedup implementations.

EASIER CUSTOMIZATION TOOLS

Customization is one of the hidden costs of any ERP implementation. All ERP implementations require some amount of customization. The consulting firms charge huge sums for these efforts. This makes a considerable impact on the ERP implementation budget. In order to lower the customization costs, most ERP vendors offer customization tool kits along with their products.

REDUCTION IN IMPLEMENTATION TIME

Companies discouraged ERP implementation because it took such a long time to get them installed and set the whole process into action. Since this resource was spent excessively, there were chances for reduction in potential business and losing man-hours. The current day ERP applications are less complex to install and requires less training. This has reduced the amount of time spent on ERP. Companies are thereby assured of spending lesser time for ERP. With the popularity and growth of SaaS model, the implementation time has reduced. Without the incurred time and technical issues associated with the installation and configuration of data center appliances, hardware servers, platform software and related computing hardware, SaaS ERP system implementations generally achieve a jump-start and a decreased implementation period.

GROWTH OF THIRD-PARTY SERVICE PROVIDERS

The implementation and maintenance of the ERP system by the ERP vendors is very costly with the annual maintenance costs coming up to 20% to 25% of the implementation costs. The services by the Authorized Service Providers (ASPs) or Value-Added Resellers (VARs) of the ERP vendors are also expensive. There are many third-party service providers and independent consulting firms who offer the implementation and maintenance at a fraction of the costs charged by the ERP vendors. The future will see growth of this third-party service provider market as more and more companies are trying to cut costs of both implementation and maintenance of their ERP systems.

ACQUISITIONS AND MERGERS

The top ERP vendors are still acquiring small ERP organizations, installation, and maintenance service providers, other related technology (CRM, SCM, BA, BI, etc) providers etc. to consolidate their market positions, augment their core ERP systems with best-of-breed industry solutions, and to improve their offerings. For example, SAP purchased Ariba, Oracle acquired SelectMinds Human Capital Management (HCM) software, Epicor acquired Solarsoft, and so on. This acquisitions and mergers will continue in the future also as it will help the top vendors to consolidate and improve their positions and also help them gain entry into new market segments that they did not have a presence.

GROWTH OF SAAS AND CLOUD ERP MARKET

The growth in the global Software as a Service (SaaS) market is largely driven by the increasing need of organizations, across industries, to cut costs, and by the relative speed and ease with which SaaS solutions can be deployed. Further, an increasing number of small- and medium-size firms are adopting SaaS, prompting service providers to introduce a wider range of SaaS solutions. Many vendors are also looking at potential acquisitions to strengthen their market position.

At the same time, major concerns remain regarding security, network instability, limited integration with existing systems, and longer than anticipated implementation cycles. This has caused customers to focus more on stringent service level agreements, contract terms, and governance structures.

In 2011, the SaaS ERP comprised just 2% of the market. It gained momentum as SMEs started opting for it because of the low initial cost. Another factor that led to the growth of the on-demand ERP market was the decision by SAP and Oracle to come out with SaaS products. IT departments are attracted to the SaaS model because it provides relief from disruptive version upgrades and managing a large number of disparate applications. According to a Forrester study [2], the SaaS ERP which is just 2% of the ERP market is expected to grow by about 21% annually through 2015 to reach 4%.

According to Embracing the Cloud—KPMG's 2011 Global Cloud Survey report [3] which is based on a global survey of over 900 executives in 15 countries—nearly half of the end-users surveyed (46%) stated that their most likely investments are expected to be in cloud-delivered SaaS. As SaaS—also referred to as 'on-demand software'—provides applications through the internet, it eliminates the need to install, run or maintain programs in internal systems. The following factors are contributing to the robust growth seen in global SaaS market:

- **Cost cutting** – Uncertain economic conditions and recession are forcing organizations to tighten IT budgets and this drive is pushing demand for cloud computing services as it an opportunity to save costs. SaaS-based applications do not require up-front investments for physical infrastructure, deployment, and training

- **Ease and Speed of deployment** – The speed and ease of deployment have contributed to the increasing popularity of the SaaS model. The faster implementation of SaaS and the immediate access it offers reduce the time taken by customers to realize value from software purchases. Growth is also being driven by consumers' increasing familiarity with the SaaS model
- **Increasing demand from SMEs** – Increasing adoption of SaaS by Small- and Medium-size Enterprises (SMEs) is another major factor driving growth

With the continued economic recession and bleak predictions, the expensive ERP sales will suffer and the ERP models that have low Total Cost of Ownerships (TCO) like SaaS and hosting (cloud) models will eat into the market share of the Tier I and II vendors. More and more SMEs will invest in these low TCO models making it the *de facto* standard for SMEs. The smaller ERP vendors will start offering their solutions in SaaS or hosted models. The Tier I and II vendors will also try to grab a share of these growing markets by offering various flavors of the on-demand models like SaaS and hosted ERP. For example SAP has come out with SAP Business ByDesign which is a fully integrated on-demand ERP system designed for SMEs. Similarly Oracle has come out with a host of SaaS applications including ERP, CRM, database, sourcing, transportation, etc. under the name Oracle on-demand.

INDUSTRY SPECIFIC SOLUTIONS

All the ERP vendors are now capable of delivering specialized variants of their applications to service vertical markets such as government, healthcare, financial service, or retail environments. Some vendors are also moving into more specialized areas, such as Supply Chain Management (SCM) and demand forecasting or sales automation and marketing. Both SAP and Oracle are offering customized solutions for more than 20 industries. Most of the other Tier II and some Tier III ERP vendors offer industry specific solutions for 4–5 industries. This specialization will increase as the ERP vendors try to find ways to improve their competitiveness.

MOBILE ERP SOLUTIONS

According to a study by IDC [4], more than 1.19 billion workers – 34.9% of the global workforce – will be using mobile technology by 2013. If organizations want to stay ahead of the game, the employees should have the tools they need to handle critical tasks and make informed decisions in real time – no matter where they are. The solution to this is mobile applications. Mobile strategies are beginning to take form in the small-to-medium business ERP space. While mobile devices like laptops, PDAs, and tablets made it possible to work on the road, now workers can use their ERP applications on their mobile devices to take advantage of business capabilities and insights. These mobile ERP applications allow companies to benefit from improved quality of service, greater productivity, deeper business relationships, competitive advantage, and more accurate data capture:

- **Improved quality of service** – Mobile ERP systems allow employees to improve quality of service to customers by giving them access to relevant information
- **Greater productivity** – Many mobile workers waste much time driving in cars or sitting in airports. Mobile ERP helps these workers use that time productively. All mobile workers have tools, materials, and information to eliminate downtime
- **Deeper business relationships** – Having information at their fingertips helps mobile workers deepen business relationships and response times
- **Competitive advantage** – The ability to deliver real time information on-the-spot to accounts helps organizations improve their competitive advantage

- **More accurate data capture** – Mobile ERP software makes it easy for workers to enter all relevant data accurately as they gather it on the field without rekeying the data into back end systems (potentially making errors along the way)
- **Increased win rates with mobile access to real time customer data** – With information at their fingertips, the sales executives could answer customer queries better, generate quotes in real time and so on thus close the deals faster. The capability to have information from anywhere and at any time can also lead to faster, more informed decisions at the point of action thus accelerating the sales cycles

Today, most ERP vendors have started to develop mobile applications for reporting and dash-boarding to systems so that the mobile employees can access the ERP system and data. With mobile ERP, the mobile workers can take advantage of the functionality, data, and benefits of their ERP application not only in the office—but also on the road. Mobility will become only more and more prevalent in the workplace and organizations should choose a system that can scale with their business and also have the capability and flexibility to integrate with new technology solutions in the future.

GROWTH OF BA AND BI SOLUTIONS

As companies look to increase ERP benefits realization, more will invest in business analytics and business intelligence software to get increased return from their existing ERP systems. Organizations have realized that installing a new ERP system in place of the existing one will not necessarily help them make better use or sense of business information without the tools to better support decision-making among both employees and leadership. In addition, executive teams will be under increasing pressure in a shaky economy, which will put more pressure on their employees to provide high quality information and intelligence to the decision makers wherever they are. This will give rise to tremendous growth opportunities for BA and BI tools.

NEED-BASED APPLICATIONS

Organizations had to implement ERP throughout their systems irrespective of the fact whether they help in all the functions or in one particular function. This was proving to be a big hurdle to the firms. In addition, this remained as the main disadvantage or setback of ERP. Firms had to purchase all the applications even if it meant that most of them would be idle except for the core function.

The latest ERP software programs have overcome this menace. They offer need-based applications. The firms need not be worried even if these software programs were not available. They were given the liberty to purchase and install software programs pertaining to that particular function. This advantage has helped to increase the scope of ERP not only among large firms, but also small and medium businesses as well.

ON-PREMISE ERP WILL NOT DIE

ERP gurus has been predicting the death of on-premise or traditional ERP that is not going to happen in the near future. The SaaS and hosted models will take some of the big vendors' clients in the SME segment away, but they will not be able to replace the traditional on-premise ERP solutions. Large, multinational clients still are not comfortable with the relative lack of flexibility, control, and security offered by SaaS ERP solutions. However, smaller and midsize companies are more likely to adopt SaaS and companies of all sizes will be more likely to adopt niche solutions such as CRM or HCM which is good for SaaS. Perhaps most importantly, SaaS and cloud options will become integrated into everyday ERP options.

EXPENDITURES

With the economic recession and slowdown, the budget for ERP systems in most companies will be less. This will affect the ERP sales and the profit margins of the vendors. As organizations try to cut costs at every turn, ERP vendors will have to offer their products are very competitive prices. Most SMEs will opt for Tier II or III vendors or SaaS offerings to reduce the TCO. So there will be reduction in the ERP spending and a drastic change in the spending pattern which will move towards the smaller, less expensive packages or SaaS solutions. The organizations will take more time to analyze before deciding to go in for an ERP system. If the existing systems are doing well or could be revamped with the addition of a few bolt-ons, then most companies will choose to keep the existing system and get more years from it by making minor modifications and additions to it rather than discarding it for a new ERP system.

OPEN SOURCE ERP

Open Source (OS) ERP has done away with the hassles of paying license fees not only during installation but also whenever a modification is made. The company is relieved from depending on the vendor even for minor matters. The attractiveness of OS ERP is the absence of an up-front license payment and a generally lower cost of ownership, although doubts remain about the level of support that can be expected. So, even though there will be more takers for the OS ERP products, the numbers will not be big as the move will be more towards SaaS ERP.

ENTERPRISE APPLICATION INTEGRATION

As the need for integrating the supply chain is becoming more and more urgent, most ERP vendors are offering these applications (like Supply Chain Management (SCM), Customer Relationship Management (CRM), Business Intelligence (BI), Business Analysis (BA) and reporting, etc.) as a part of their ERP offerings. If these applications are not part of the ERP software, then features and capabilities to integrate these applications seamlessly with the ERP software are provided. This integration of the supply chain can produce dramatic cost saving and productivity improvements. For example SAP's Business Suite includes SAP 360 Customer (SAP's CRM solution), SAP PLM, SAP SCM, SAP EAM (Enterprise Asset Management), SAP HCM (Human Capital Management), and SAP SRM (Supplier Relationship Management) in addition to SAP ERP. Similarly QAD offers supply chain, customer management and analytics as add-ons to its MFGPRO system.

Improving decision support has been another focus of almost all the ERP vendors. Vendors are integrating data warehousing, data mining, and OLAP technologies, business analytics and business intelligence tools, and analysis and reporting tools with the ERP system. These tools provide the decision-makers with accurate, relevant, and timely information and enable them to make better and informed decisions quicker. For example SAP's Analytics include Applied Analytics, BI, Data Warehousing, Enterprise Information Management (EIM), Enterprise Performance Management (EPM), and Governance, Risk, and Compliance (GRC) solutions.

SOCIAL COLLABORATION

Social tools can be effective in the workplace when tied into your ERP solution. User-friendly social applications can help increase productivity and improve collaboration both within your enterprise and with your business partners. As the next generation of ERP systems emerges, social applications are proving their value in connecting businesses internally and with customers. Not the same as integrating ERP systems with external social media sites, social ERP apps mirror the functionality of

online social networking tools. The interface may act like Facebook, but it is secured and maintained with your ERP solution.

Social ERP tools can facilitate collaboration and communication among employees and partners using your ERP system. Connecting people quickly and easily enables them to proactively solve business problems together. Primary benefits of social functionally for ERP:

- Facilitate collaboration and communication in the enterprise
- Easily track conversations, projects and processes
- Improve business processes
- Document business processes to support lean initiatives
- Enhance customer engagement
- Build and maintain your knowledge base

Analysts are predicting that social media and social apps will become a more significant component of the ERP landscape. Becoming more social can improve your company's agility and facilitate competitive advantage. Making your enterprise social brings the power of the back-office to the front-office, helps customers collaborate, and drives growth.

MARKET SNAPSHOT

SAP will remain the undisputed leader of the ERP market for the foreseeable future, but the acquisitions of PeopleSoft and JD Edwards by Oracle make it a worthy competitor. Microsoft has moved to the third spot after a series of acquisitions. These three organizations together hold more than 47% of the market share and will decide the events of the ERP marketplace. Tier II solutions (including Infor and Epicor) represent just 16% percent of the market while Tier III and others represent 37% of the market.

One thing is clear; no one wants just ERP anymore. The emerging trends in the enterprise packaged application industry are its integration with new, cutting-edge technologies such as Sales Force Automation (SFA) and customer management. Driven in part by the huge impact of Internet based commerce, these new applications are leading to a seeming divergence between so-called back-office and front-office functionalities.

ERP REVENUES

The ERP market is projected to bring in sales in the $50.3 billion dollar by 2015 (see Fig. 58.1), according to Forrester [2]. This is a healthy market by almost any comparison. The ERP marketplace is stable and growing after a bit of a slow-down during the 2008–2009 recession. Companies that postponed investment in enterprise systems during the difficult times are now beginning to invest again as business returns to a growth phase with the improving economy.

ERP market size, impressive as it is, is not really of much important to anyone except ERP software suppliers. Although there are quite a number of those suppliers, a small handful enjoy a majority of the ERP market share. Top three ERP suppliers of 2012 were SAP and Oracle. Market leaders also include Microsoft and Infor. Between the four companies, they enjoy more than half of all ERP revenue over the last several years.

In the fiscal year ended in December 2011, the SAP revenue from selling software licenses were 28% of the total revenue while the remaining 72% came from software support, subscription and other software-related services, consulting, and other services. So the recurring revenue stream for SAP was 72% of the total revenue. With the fiscal year ended in May 31, 2012, Oracle got 70% of its revenue from the software business out of which 43% is from software license updates and product

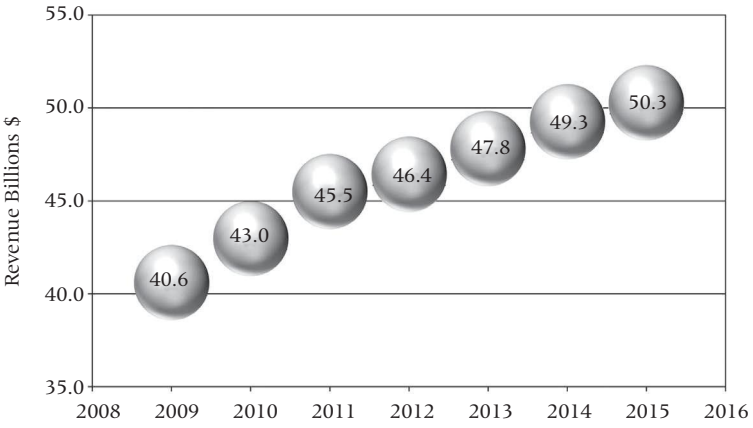

Figure 58.1 ERP revenue growth. (*Source:* Forrester Research)

support and the remaining 27% from new software licenses. The 43% (software license updates and product support) is a recurring revenue stream. Not only is this highly important to them, but it has driven some of their acquisitions. The other format for recurring revenue, SaaS, is not working as well for the big players, but the situation is improving with more acquisitions and focus on SaaS and on-demand products. Variable revenue schemes however, are becoming the sweet spot for big ERP vendors. Faced with scarce possibilities for new large licensing deals, vendors have adjusted their pricing models so that they can get incremental license revenue though higher levels of usage. The vendors' use of variable revenue contracts is pretty clever. These contracts call for additional payment based on the metrics of their customers' usage. If the customer uses the platform more, he pays more.

SUMMARY

ERP systems have been around since the mid-1970s when they first ran on mainframe computers. Enterprises that invested huge sums in these big and complex systems now have elaborate legacy setups that they are absolutely dependent upon to run their companies. Because there is so much at stake, ERP providers and customers introduce changes to technology and deployments gradually, in order to avoid costly mistakes.

Nonetheless, ERP systems do change—albeit slowly. For example, people started talking about adapting ERP software to client/server technology at the beginning of the 1980s, but it wasn't until the late 1990s that more client/server versions rather than mainframe versions were shipped.

Today, ERP is still evolving—and adapting to developments in technology and the demands of the market. The important trends are shaping ERP's continuing evolution—improvements in integration and flexibility, mobility, on-demand applications (cloud and SaaS), extensions to e-business applications, a broader reach to new users, the adoption of latest technologies, etc.

ERP trends reflect positive signals for the ERP vendors and companies availing their services. It is important to remember the fact that both the vendor and the company will be able to make use of any advantage (including the modern facilities) only through proper coordination, teamwork, and nurturing a cordial atmosphere. Mere IT ERP trends will not help in this aspect.

REVIEW QUESTIONS

1. What is the one point that all ERP experts agree upon?
2. What are the market segments that ERP vendors are creating?

3. Why are ERP vendors building new marketing channels?
4. What are faster implementation methodologies and why are they developed?
5. What are ASAP from SAP and OBAs from Oracle?
6. Why easier tools for customizing are developed?
7. How is the implementation time reduced?
8. What is the reason for the growth of third-party service providers?
9. Why are ERP vendors acquiring and merging with other companies?
10. What is the impact of SaaS and Cloud ERP on the market dynamics?
11. What are the reasons for the growth of the global SaaS market?
12. What is the attraction of industry specific solutions?
13. Why mobile ERP solution emerging as a major segment?
14. Why are BA and BI solutions gaining more popularity?
15. What are need-based applications?
16. Will on-premise ERP die?
17. How the recession has affected ERP spending?
18. What is the impact of open source ERP on the ERP market?
19. Why enterprise application integration is growing popular?
20. Why ERP is starting to embed social collaboration?
21. Give the ERP market snapshot.
22. What will the ERP revenues in the coming years?

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Part VIII

Appendices

- Appendix A. ERP Case Studies

APPENDIX A

ERP Case Studies

INTRODUCTION

Note: *The case studies presented here are compiled from various sources including the Internet, the ERP (Enterprise Resource Planning) vendors' Web sites, the Web sites of organizations who implemented the systems, articles, new items, and press releases, which have appeared in print and electronic media. The intention of these case studies is to provide the reader with an idea of the situations where ERP projects are implemented and what the benefits of the ERP implementation are. This is by no means a comprehensive account of the implementation process. For a full detailed version of the implementation efforts—the success stories—readers are directed to the vendors and the organizations featured here.*

SAP AT COCA-COLA HELLENIC BOTTLING COMPANY S.A.

Company Profile

Coca-Cola Hellenic serves 579 million people in 28 countries. They are one of the largest bottlers and vendors of Coca-Cola Company's products in the world, and the largest based in Europe. Their unique portfolio of brands, mix of geographies, and passion for marketplace implementation make them a leader in the alcohol-free beverage industry. The Coca-Cola Hellenic company is located in Maroussi, Greece and employees more than 42500 people.

Problem/Situation

The company wanted to develop an end-to-end process support system to expand its capabilities and to cover new business requirements, by providing a single solution for all countries and markets. The management also wanted to formalize the best practices in a template and then roll it out in a pilot implementation. In addition, they sought to build new capabilities to support retail customers.

Solution and Implementation

With operations in 28 countries, the Coca-Cola Hellenic at Maroussi, Greece, serves a population of approximately 560 million. Its product portfolio consists of 613 different beverages, of which 485 are noncarbonated drinks.

The company wanted to implement an integrated commercial functionality, including mobile applications. Thus they had to replace their 25–year old legacy system and they moved from a decentralized Information Technology (IT) system to a centralized system. SAP Advanced Planning and Optimization component was introduced to assist the management with all aspects of business planning. The SAP NetWeaver® Business Warehouse component was also added at that time.

The next set of objective was to realign their approach from functional areas to cross-functional, end-to-end processes. The processes involved in this step were market to cash, forecast to deploy, procure to pay, finance management, and human resources. The realignment has to happen in such a way that the redesign of all the processes had to be in alignment with the new business-strategic initiative, called 'Excellence Across the Board,' which was a separate but a complementary program to improve the efficiency and outcome of all the processes.

The selection of SAP to provide the products and services necessary to meet these objectives was based on some pivotal considerations, in particular, integration and the consequential lower total cost of ownership. "While there were alternatives," says Sven Erlekam, the implementation project manager, "at the end of

the day, if you want end-to-end processes, you need integration rather than individual best-of-breed applications. Integration also has implications for flexibility—i.e. your ability to change your process and to add new capabilities.''

The emphasis on the integration provided Coca-Cola Hellenic with a considerable incentive to remain with SAP in the next phase of IT development. The SAP products and services implemented as part of the project included:

- The first instance of the latest version of the SAP NetWeaver® Mobile component going live
- SAP Customer Relationship Management application
- SAP Mobile Asset Management application
- SAP Mobile Direct Store Delivery application
- Services from the SAP Consulting organization and the SAP Active Global Support (SAP AGS) organization

Coca-Cola Hellenic began by developing the template for the market-to-cash process and deploying a pilot implementation into two major markets to test it. SAP Consulting was viewed as an essential part of the project, providing an end-to-end solution for Coca-Cola Hellenic's bottling business. Erlekam states, ''SAP Consulting has taken a key role in the important area of market-to-cash, and together with them we have been successful in the integration of new processes and the latest technology into the SAP template. We piloted the template in two countries, and we'll continue to roll it out to the entire group. SAP will continue to be an important partner in those projects.''

In the area of mobility, SAP Consulting—supported by Movilitas, an experienced partner in mobile development—took the lead. In order to improve usability, mobile solutions require user-friendly, easy-to-understand screens, and flow logic for the mobile device. SAP AGS joined this project to help resolve issues surrounding performance, stability, and integration.

The company reviewed and revised about 341 processes, 151 of them commercial. ''We're really talking about massive organizational and process change here,'' says Kiril Topalov, SAP Program Director at Coca-Cola Hellenic. The major change is integration. In the past, there were over 400 different applications covering sales and distribution, various customer relationship activities, back-office support, warehouse management, and so on. ''For the first time, we tried to standardize and harmonize the way the commercial processes functioned, again in an end-to-end environment,'' says Topalov. ''So, for example, that means if somebody places an order, immediately there's an availability-to-promise check using the whole warehouse management functionality. And when we execute this order, we monitor the respective key business indicators with respect to the customer service level.''

Benefits

Coca-Cola Hellenic is still performing its evaluation of the benefits; many of them already beginning to appear. They expect to achieve improvements in the following areas:

- Advance account management
- Customer asset management
- Trade promotion management
- Distribution and order management
- Overall field sales management

The company estimates that the implementation will roll out to the last of the 28 countries it serves in 2013. ''At the moment, we are running deployments in four countries, two of them the biggest in our group,'' says Topalov. The implementation has resulted in a complete transformation of the information systems, processes, and people at Coca-Cola Hellenic.

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SAGE AT REUTERS MARKET LIGHT (RML)

Company Profile

Reuters Market Light (RML), part of the Thomson Reuters group, offers Indian farmers up-to-date, local and customized commodity pricing information, and news and weather updates through SMS based subscription. It provides localized and personalized information via SMS text messages on weather, market prices, local and international agriculture, commodity news and crop advisory tips, thus enabling farmers to make informed decisions, reduce waste, and maximize their profits. RML today employs more than 300 full-time content professionals, offering news and data on multiple crops in different markets and weather locations across of India.

Problem/Situation

RML provides its services through pre-paid vouchers having validity in days or months, which farmers can buy from local retail stores and activate the services on their mobile phones for commencement of customized SMS based information services. Discrete systems were being used for the management of voucher printing and distribution, customer profile activation and management, content management, and distribution as well as complaint management.

As RML's services expanded across the country to varied geographies and the subscriber base increased manifold, the complexities of profile management, content management, and delivery also increased. "Today a very large farmer community in many villages across India relies on our service to get information which is critical to the way they work," shared Mr Ranjeet Pawar, Vice President Operations, RML. "It was therefore important for us to automate critical processes like customer profile management, content management, and delivery and voucher management to ensure that the correct information reaches the farmer at the right time and all grievances are seamlessly addressed to provide maximum levels of service availability."

RML's SMS based content services offers farmers with updates on local weather patterns, weather forecast for the next 24 hours, news updates related to agriculture policy and government packages, as well as pricing information of chosen commodities in the local markets in the farmers' vicinity. These services are provided through the sale of pre-paid vouchers of varying denominations having validity of 1, 3, 6, or 12 months.

RML was dependant on multiple systems to perform the various processes involved in customer acquisition, content management, and service delivery. Separate systems were used for voucher management, customer profile management, content management and delivery, and complaint management. As the subscriber base grew and the number of markets and crops that the company was addressing expanded in tandem, it became increasingly challenging to maintain high standards of service quality, delivery, and availability using these disparate systems. So RML decided to have an integrated solution that would unify all our systems and provide with a single platform to ensure that it could offer the farmers with the pertinent and critical information on time.

Solution and Implementation

Sage Accpac ERP's strong integration with Sage CRM has unified the disparate systems to create a single platform, thereby ensuring seamless flow of information from one system to the other. Sage Accpac ERP maintains inventory of vouchers and tracks flow of vouchers through two levels of distribution. Whereas Sage CRM is tightly integrated with user profiling system and content management system ensuring that updates and changes in customer requirement are automatically pushed to user profiling system which send out SMS messages.

The new system provides a 360–degree view of customer database, usage patterns, crop metadata, information requirements etc, and also has improved the efficiency of the call center during service activation. Correct information as requested is provided to the farmer on time and changes, if any, with respect to information requirement is immediately taken care of. Customer complaints are addressed in a timely fashion or else escalated to senior management. Management enjoys a consolidated and comprehensive view of the various processes, financial, and inventory status, helping in making informed business decisions.

Benefits

Sage Accpac ERP enables automated voucher code assignment whereby the voucher number containing the state-specific serial coding is sequentially generated for a given batch. The secret code is randomly generated to ensure that tamper-proof, error-free vouchers reach the farmers.

The complete repository of information regarding the crops, their many varieties, the various districts and villages, and the many small and medium markets, is contained in the content management system that is constantly updated. Sage CRM is tightly integrated with the content management software so that the entire repository of information on crop varieties and local markets is available in the system at the time of activation. This also helps the executives validate information provided by the customer at the time of activation with the metadata that is reposed in the content management system, which also automatically shows up other relevant information such as the city that the farmer's taluka belongs to, the crops grown there etc.

Sage Accpac ERP integrated with Sage CRM has connected RML's front and back office operations, thus providing the company with total visibility and better control across their business. It has also ensured that the correct information reaches the farmer on time and customer grievances are addressed seamlessly.

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EPICOR AT HOWE CORPORATION

Company Profile

Based in Chicago, Illinois, Howe Corporation is the leading manufacturer for refrigeration and ice machine equipment. Founded in 1912, Howe is a family-owned company with about 50 employees and has a reputation for innovative design and quality service. From the company's first patent for an industry-changing "safety head" discharge valve, to a pioneering design in force-feed lubrication, and a landmark multi-cylinder compressor configuration, Howe has always been committed to improving the *status quo* in its industry.

Problem/Situation

To support Howe's unmatched commitment to quality and service, the company needed a collaborative business architecture and modern manufacturing platform to streamline business processes and serve the customer needs in a better manner, while also staying competitive in the industry. It also wanted to streamline data flow from the shop floor throughout the organization.

Solution and Implementation

Howe made the decision to move to Epicor's next-generation solution—built on a second-generation service-oriented architecture (SOA) and designed for growing companies in domestic and global markets. Howe went live with Epicor 9 in August 2009, utilizing the full suite of Epicor's enterprise-class solution, thereby dispelling the myth that Epicor's next-generation ERP solution is too big for small businesses. Howe's 50 employees are well-trained and successfully use Epicor.

Benefits

After switching to Epicor, Howe achieved its business goals of staying up-to-date with newer technology and increasing cost savings. "We now have better control of our inventory so we know what's needed and what's currently available," explained Andrew Ortman, Sales and IT manager. "Epicor moved us away from constrained scheduling methods and towards a robust forecasting and scheduling process that suite both day-to-day and long-range business needs."

Epicor also allows Howe to respond faster to customer queries. In the past, Howe had to print a pricing quote, scan it, and finally e-mail or fax the quote to the customer. Now with Epicor, the company can send estimates directly from the screen in which it was generated. "It saves time and is more efficient," said Ortman.

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SAP AT TATA IRON AND STEEL CO LTD (TISCO)

Company Profile

Established in 1907, Tata Steel is Asia's first and India's largest private sector steel company. It is located in Jamshedpur, India. Tata Steel is among the lowest cost producers of steel in the world and one of the few select steel companies in the world that is EVA+ (Economic Value Added).

The Problem/ Situation

Tata Steel has adopted ERP technology to take a lead in the competitive steel industry and through constant learning, innovation, and refinement of business operations, it has transited seamlessly from a production driven company to a customer driven one. The existing technology was a simple replication of the manual system. Not only did it operate as individual islands of information, but the technology had outlived its lifetime and was completely obsolete. The employees and management at Tata Steel faced a cumbersome task exchanging and retrieving information from the system. Further, the reliability of information obtained was questionable because of the inconsistency and duplication of data from different departments. To add to it, there was no built-in integrity check for various data sources and at many times the information against certain items were found missing.

The Solution and Implementation

The management at Tata Steel wanted the software to flawlessly integrate with its existing information system and further provide compatibility with its future implementations. After an in-depth study of functionality, cost, time, compatibility, esteem, operability, support, and future organizational requirements was done, SAP topped the list of contenders.

The implementation of SAP software was associated with certain strategic goals in mind. With this implementation, TISCO wanted to bring forth a culture of continuous learning and change. This would enable TISCO to achieve a world-class status for its products and services and strengthen its leadership position in the industry. Besides this, TISCO also wanted the software to result in quick decision-making, transparency and credibility of data, and improve responsiveness to customers across all areas.

TISCO deserves a lot of credit for implementing ERP because of the fact that many organizations in the global level have given up the very idea of ERP due to the fact that there are many failures associated with it even in the implementation stage. ERP implementations that were done in a wrong manner have caused more havoc to organizations, than bringing profits. This being the case, it is natural to expect a large company (in terms of size and volume of operations) like TISCO to discourage the idea of ERP. However TISCO proved to be different from the others by choosing ERP at the right time and implementing it in a proper manner. In the process they have also reported a whopping profit and reduction of costs. Another amazing fact is that they implemented it into the whole system in one single spree—big bang approach. The method of implementing it in one spree carries a lot of risks especially for a bigger company. In fact, the success rate of this method itself is low in general and very low when bigger companies are concerned. In case of the rare success, organizations will experience effective results in their enterprise operations. TISCO has achieved that by the way of

meticulous handling and professionalism. The net results of their ERP software have been described as path breaking and a trendsetting one.

According to Mr B Muthuraman, MD, Tata Steel, "implementing any ERP system is a challenge for an organization because of the declining success rate of ERP implementations world-wide. The challenge is compounded if the ERP provider is a world leader—SAP (www.sap.com). At Tata Steel however, the challenge for us did not lie in successfully implementing SAP or in rolling it out to our 46 odd geographic locations across the country under a big bang approach in just eight months. The challenge lay ahead in building a conducive environment such that SAP was embedded in the hearts and minds of the people and the customers of Tata Steel, for we all looked forward to knowledge-based, successful organization."

The path was set to achieve success through SAP. All the branches, which had huge numbers of transactions and complexity, were identified as a HUB, while the smaller branches along with the consignment agents were defined as SPOKES which were attached to these branches. In January 1999, the team from TISCO was decided and christened "TEAM ASSET" an acronym for Achieve Success through SAP Enabled Transformation. The TEAM ASSET had two simple axioms: "go-live date—1st November 1999" and "there are only 24 hours a day." TEAM ASSET with the support from PriceWaterhouseCoopers (www.pwc.com) and SAP successfully lived up to the axiom and truly demonstrated leadership skills by going live across 46 locations within a record time frame of eight months.

Preparatory task force activities were conducted and core business processes were mapped according to SAP modules. Also, a parallel activity called "change management" was initiated within the company. The prime objective of "change management" was to reach out to people involved non-directly in the project and apprise them of the developments taking place. "We wanted that Tata Steel be the number one in the steel industry…we wanted to be the first to have the latest systems…" said Mr Sandipan Chakravortty, GM (Sales), TISCO.

Tata Steel planned a big bang approach of going live with all the modules at the same time, in a span of just eight months. Driven against the speed of time, the pace of implementation was fast with all activities backed by a lot of thought process and meticulous planning. On 1st November 1999, Tata Steel pulled off a big bang implementation of all SAP modules at one go across 46 countrywide locations, as per the set deadline.

The Benefits

The introduction of SAP solutions within Tata Steel has led to efficient business processes, enhanced customer service, reduced costs, improved productivity, accelerated transaction time, workflow management, and reduction in the number of credit management errors. Other benefits include:

- The company has spent close to Rs 40 crore on SAP implementation and has already saved Rs 33 crore in 2 years
- The manpower cost has reduced from over $ 200 per ton to about $140 per ton in two years
- The outstanding overdue has been brought down from Rs 5170 millions to Rs 4033 millions in one year
- The inventory carrying cost has drastically deflated from Rs 190 per ton to Rs 155 per ton in one year
- In addition, there have been significant costs savings through management of resources with the implementation of SAP like improved customer management, faster and better decision-making, lean and streamlined business process that reduces the levels of legacy system and provides consistent business practices across locations, and excellent audit trail of all transactions.

Sources

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RAMCO AT ADANI LOGISTICS LTD (ALL)

Company Profile

Adani Logistics Limited (ALL) is a part of the $25 Billion Adani Group, with interest in Port, SEZ, Logistics, Energy, Power, Oil & Gas, Real Estate, Edible Oil and Agro. The Group operates various ports in India including the largest private port at Mundra. Mundra port handles close to 50 million metric tons of cargo ranging from bulk cargo like coal, wheat, fertilizer, steel, edible oil, chemical, POL to container cargo and automobiles.

ALL provides integrated logistics solutions for movement of cargo. It has secured an all-India license to manage container train operations on Indian railway. Developing facilities for movement of goods in container by train, road, and sea, ALL is also developing Logistics Park for providing various ground facilities, including:

- Aggregation, warehousing, holding, inspection, custom bonding
- Stuffing/De-stuffing of export import (EXIM) and Domestic cargo
- Loading/unloading onto railway wagons

ALL operates regular train services from National Capital Region and Rajasthan to Mundra and Jawaharlal Nehru Port Trust (JNPT), Mumbai, by deploying a fleet of 6 rakes. Additional rakes are being included as per requirement.

Problem/Situation

As India's first private container train operator to have its own inland container depot with a capacity to handle up to two lakh twenty foot equivalent units annually, ALL has its Logistics Park spread over 750,000 sq meters with a bonded warehouse of 5000 sq meters, two railway lines, three electronic weigh bridges, and container repair facilities. For such a large, widespread operation, their constant challenge was in integrating their road, rail, and sea operations, especially in the light of the huge quantity and frequency of transactions.

Their second challenge was the lack of an efficient system to track consignments which often resulted in extra work for the staff while tracking delayed shipments. This was also affecting customer relationships in the long-term.

Their third challenge had to do with consignment re-handling. As it happens, at container terminals, several activities continuously take place, i.e. arrival of a ship (train or vehicle), unloading and then reloading the carrier, transportation of containers from the terminal to a warehouse where containers are stacked for disbursement. The quality of information prior to arrival of a consignment and post arrival has serious cost implications. For example, optimizing carrier space would mean more earnings than having a half capacity carrier as the operational costs involved in transportation remain fixed, immaterial of the size of the load. Not having a seamless integrated system with updated consignment information in real time was another challenge.

The operations staff, the warehouse, the logistics people used FoxPro and Excel sheets to capture data which was then e-mailed or faxed. This resulted in delays as well as version control problems. Documents related to consignments were also be found lost or misplaced during transactions.

Solution and Implementation

ALL wanted ERP software that would faultlessly integrate its multi-locational operation and provide information, in real time, on its carriers. It wanted a next-generation trace and track system which would ensure that carrier space was optimized at all times resulting in cost benefits as well as improved customer relationships. Senior management at Adani also wanted to be kept abreast of information and sought an ERP which would provide them business intelligence and data in real time on their logistics business. With future expansion plans, the system should have the capability to expand without them having to invest in anything new.

ALL people were efficient in their areas of expertise and they were used to storing information in Excel sheets and databases. The ERP had to "talk their language" and not be too technical to ensure that the staff felt comfortable using it. As time is equivalent to money in the logistics business, they were looking for a quick solution to all their challenges.

Based on Ramco VirtualWorks™, Ramco 3PL and Transportation provides companies with the flexibility they need to rapidly respond to evolving corporate imperatives, regulatory changes, and market conditions. Rather than re-deploy enterprise systems as the company reacts to these changes, the underlying platform can leverage business process models to quickly compose new business assets for true "change on demand". Ramco's solution comprised of:

- Inbound logistics
- Outbound logistics
- Warehouse management
- Vehicle management
- Inventory
- Human capital management

Benefits

The following were the benefits of the ERP implementation:

- Instant availability and accessibility of information at all processing desks by providing improvement in advance planning which has resulted in 25% cost savings across all operations
- Reduction of processing and documentation time/paperwork resulting in simplification of procedures
- Better cargo and space management in rack planning which has resulted in nearly 17-18% cost savings
- Complete control of container/cargo movements
- Fast and efficient load/discharge operation improved productivity in both rail side and yard side with minimal handling

Sources

1. Ramco Systems (www.ramco.com)
2. Adani Logistics Limited (www.adanilogistics.com)

ORACLE JD EDWARDS AT OSPAP

Company Profile

OSPAP is the largest wholesaler dealing with paper and paper articles in the Czech Republic, and is a subsidiary of PaperlinX. It has its own selling and warehouse premises at its disposal, which are evenly distributed all over the territory of the Czech Republic. The conceptual assessment of the market, know-how of a multinational company, logistics at the European level as well as training of its staff towards customer-oriented thinking is aimed at a clear target—perfection of services and building up an image of a reliable partner. OSPAP employees more than 250 employees.

Problem/Situation

OSPAP used an old ERP system without any support for logistics and warehouse operations. It was determined that the Oracle's JD Edwards EnterpriseOne with warehouse management module will help the warehouse operation realize significant productivity gains and efficiencies. An advanced mobility solution with the use of Motorola handhelds with barcode readers would streamline processes, improve productivity, and increase efficiencies to deliver a higher return on investment.

Solution and Implementation

OSPAP chose BSC Praha, an Oracle Certified Advantage Partner, as the ERP implementation partner. BSC Praha executed the complex implementation of Oracle JD Edwards, the wireless systems engineering and integration

services of mobile handhelds terminal. After the wireless site survey, wireless network in all warehouse location of OSPAP was realized; BSC Praha configured all handheld clients to communicate with the Oracle JD Edwards through a Citrix server. This provided a direct connection between Oracle WMS and the Motorola handhelds with Citrix online terminal client, empowering warehouse workers to perform transactions right from the shop floor. The following Oracle JD Edwards products were used:

- JD Edwards EnterpriseOne with financials, procurement and subcontract, management, warehouse management, inventory management, and sales order management modules

Benefits

The benefits of the implementation were:

- Deep integration with all implemented processes
- Simplified IT management by implementing single, centralized solution of ERP JD Edwards
- Uninterrupted deliveries of goods from central warehouses to the standby warehouses of OSPAP distributors on a permanent basis
- Oracle JD Edwards WMS provide to OSPAP the flexibility to ship orders on a 24×7 basis and to automate the prioritization of orders, which has increased customer satisfaction

Sources

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2. Oracle JD Edwards EnterpriseOne (www.oracle.com/us/products/applications/jd-edwards-enterpriseone/overview/index.html)
3. PaperlinX (www.paperlinx.com.au)
4. BSC Praha (www.bsc-ideas.com)

3I INFOTECH AT JAGAL PHARMA

Company Profile

Jagal Group is a leading Nigerian conglomerate with operations in Oil & Gas, Real Estate Development, and FMCG manufacturing. Jagal Group spun-off Jagal Pharma—it's vertically integrated manufacturing subsidiary in 1985. Twenty five years on, it is today one of Nigeria's fastest growing soap manufacturers with its line of medicated soaps and efficacy products such as Tetmosol Citronella, Tetmosol Aloe Vera, and Tetmosol Lemon Fresh being household names made through its FMCG division. Furthermore, with the IMF projecting an 8% growth rate for the Nigerian economy in 2011, clearly Jagal Pharma does not need to look far for growth.

Problem/Situation

To tap into this huge domestic opportunity, in late 2010, Jagal Pharma embarked on a strategic IT initiative that would align its operations, manufacturing, and finances with its long-term business objectives. High on the agenda was to implement an end-to-end enterprise solution that streamlines the production process, optimizes capacity, and increases the overall efficiency. This was much needed, considering the challenges they were facing. The company went through the usual due diligence route of evaluating various ERP vendors and selected 3i Infotech's ORION which well-fitted their requirement.

Solution and Implementation

Jagal Pharma implemented 3i Infotech's ORION Enterprise running off an Oracle 10g database and distributed architecture. The highly scalable Orion Enterprise 10.6 has been successfully implemented and has become an integral part of the Group. "On the whole, we are very satisfied with Orion. It is a great solution for our current

and future needs. We are currently evaluating it for other divisions in the Group and customizing it further," adds Shah, CFO of Jagal Pharma.

With 100 employees and another 600 in subcontractors operating from its Oregun, Ikeja, Lagos facility, nearly 700 users interface with Orion in some form or the other. Jagal Pharma has seen increased plant throughput, improved productivity, and reduced costs via streamlined operations and automation of key processes. The soap manufacturer now has enhanced quality management and improved delivery performance, with the help of Orion's in built advanced inventory management and process management tools.

Benefits

The benefits of the ERP implementation include:

- Increased plant throughput by reduced costs via streamlined operations and automation of key processes
- Enhanced communication between the warehouse, logistics, manufacturing, and distribution departments
- Better quality management and improved delivery performance

Sources

1. Jagal Group (www.jagal.com)
2. 3i Infotech (www.3i-infotech.com)

IQMS AT STURGIS MOLDED PRODUCTS (SMP)

Company Profile

Sturgis Molded Products Company (SMP) is a one-stop shop for cost-effective, "total solutions molding". In addition to providing full service tool production, SMP also provides innovative plastic injection molding solutions to medical, automotive, consumer, industrial, and heavy truck industries. Widely recognized for its expertise, SMP offers superior tool design, production, prototyping, engineering and scientific molding, product launch support, and as well as full a number of quality processes such as metal-to-plastic conversion, insert molding, and in-mold film processing.

Problem/Situation

SMP serves a number of high demand markets, including the medical, automotive, consumer, industrial, and heavy truck industries; providing quality molded parts and components according to a diverse range of customer specifications and shipment protocols. Within this dynamic framework, SMP must be meticulous in its manufacturing performance and nimble in its ability to optimize plant operations. This is why in June 2003 SMP sought to upgrade its dated , multi-system ERP software.

"We were getting to the point where our previous system could not support company growth," said Carol MacDonald, IS manager at SMP. "We also wanted to move to a true Windows based solution and add a quality system and preventative maintenance software."

However, after assessing the cost to retrofit its old ERP system and acknowledging the number of third-party vendors it would take to fulfill the company's growing business needs, MacDonald and others at SMP agreed that the company needed a single source solution that would enable it to exceed its customers' quality and delivery expectations, while gaining operational efficiencies that would directly benefit SMP's bottom-line.

Solution and Implementation

SMP considered several ERP options before purchasing EnterpriseIQ along with the Electronic Data Interchange (EDI), warehouse management, and real-time production monitoring modules. SMP agreed to the fact that EnterpriseIQ covered all of its ERP needs with one cohesive system and that an additional functionality could be added as needed without the use of third-party software. The company went live with IQMS in May 2004,

and has since then seen a benefit in almost every sector of its business, from tooling and production to customer support and product delivery.

Another critical area where SMP sought to gain efficiencies was in the company's ability to deliver improved EDI capabilities. In the past, SMP had to manage a manual import/export process between its EDI and ERP applications, a task that lumbered under any variances or changes a customer might request.

The solution was implemented using EnterpriseIQ™ ERP software system, including real-time production, EDI and warehouse management modules. The database used was Oracle and it was installed on a windows based server platform.

Benefits

The IQMS-EDI module enabled SMP to greatly accelerate EDI turnaround through automation and it has given SMP the flexibility to customize the processes and data reporting to fulfill individual specifications. With EDI in place, SMP has more control over the order process, thus allowing it to save as much as 95% in expedited freight costs, as the company can now manage the customer change requests in a better manner.

The IQMS ShopData feature and warehouse management module eliminated the guesswork, making it easy to simultaneously manage barcoding for multiple customers. This improved the labeling errors and made it an error-free process.

As a single source solution, EnterpriseIQ requires data to be entered into the system only once. This has allowed SMP to eliminate excess data entry and improve the speed and accuracy of internal reporting. With efficiency gains in these areas, SMP has cut its month-end close time by more than 75%. EnterpriseIQ has also enabled SMP to gain efficiencies through better preventative maintenance, reducing repair time to as much as 75% to gain 20% more press time.

The implementation of EnterpriseIQ has helped SMP to obtain ASN (Advanced Shipping Notification) certification from Nissan Service North America division in February 2006.

Nissan certification is just one of the benefits SMP has realized since implementing EnterpriseIQ. With the system in place, SMP has eliminated excess data entry, accelerated EDI turnaround, improved internal and customer communications, and reduced the expedited freight costs by almost 95%.

Sources

1. Sturgis Molded Products Co. (www.smpco.com)
2. IQMS (www.iqms.com)
3. Automotive.com (www.automotive.com)

ORACLE JD EDWARDS AT FELSINEO

Company Profile

Felsineo operates in the Food Sector both in Italy and abroad. Founded in the 1940s, Felsineo was initially a small cured meat producer with a range of products. In the 1970s the focus shifted exclusively to mortadella (a large Italian sausage) and the company has become the market leader in Europe since the early 1990s. Felsineo unites the traditional aspects of this unique cured meat with the most advanced technology. The whole production process is analyzed, controlled, and verified on a day-by-day basis by internal systems and independent control structures. This highly sophisticated work method has allowed Felsineo to obtain top quality certifications at a European and global level: Vision 2000, BRC, IFS, ISO 22000, and ISO 14001.

Problem/Situation

Felsineo faced the following challenges:

- Renewing the technological hardware architecture and updating the JD Edwards release to the new version, 9.0

- Extending the use of the standard features of version 9.0 and removing customizations
- Achieving improved system performance and optimizing company resources
- Developing a more reliable, modern, and logical integration model with external systems

Solution and Implementation

Felsineo chose Sinfo One SpA, an Oracle Gold Partner, for implementation. The latest version (version 9) of the Oracle JD Edwards EnterpriseOne was used. Through several stages of inspection and a detailed design planning, the task was completed with reduced efforts and in a shorter time span. An extremely competent and cohesive work team and the involvement of key users have allowed Felsineo to achieve the set objectives without any problems. The solution included:

- Speeding up of all business processes with a particular focus on those related to dealing with client orders
- Implementation of a few specific JD Edwards EnterpriseOne 9.0 modules to replace customizations and external solutions (dual units of measurement, prices and discounts on sale orders, advanced batch management)
- Better integration with external systems and remote access through the application's web management
- Improvement in the quality and distribution of the main documents related to business processes (invoices, delivery, notes) through the use of Oracle BI Publisher, embedded in JD Edwards EnterpriseOne 9.0

Benefits

The benefits included:

- The management is in control of the entire process all the time
- The time-to-market has reduced
- The implemented solution is strategically important for Felsineo in that it acts as a guarantee for ensuring an extremely short time-to-market, typical of this sector

Sources

1. Felsineo SpA (www.felsineo.com)
2. Sinfo One SpA (www.sinfo-one.it)
3. Oracle JD Edwards EnterpriseOne (www.oracle.com/us/products/applications/jd-edwards-enterpriseone/overview/index.html)

MICROSOFT DYNAMICS AT GODREJ INFOTECH LTD. (GITL)

Company Profile

Godrej Infotech, formerly a division of Godrej & Boyce Mfg. Co. Ltd., commenced operations as a separate corporate entity on April 1, 1999. Godrej Infotech is a part of the diversified GODREJ group, established in India in 1897. The company has three decades of experience in providing cost-effective and high-quality IT solutions. Headquartered in Mumbai, Maharashtra, it has sales offices in Delhi, Pune, Chennai, Bangalore, Sharjah, and Dubai.

GITL is assessed at SEI-CMM Level 4 which means its quality processes are well-defined and professionally managed. In addition to SEI-CMM Level 4, they also have ISO-9001:2008 Quality Systems Certification for Analysis, Design, Coding, Testing, Delivery and Maintenance of Commercial Application Software AND ERP Consultancy, and Operations and Technology Services (Exclusive of Design).

The company places a high premium on its people, quality, and business values. GITL develop its employees through continuous training and provide them with opportunities to work on state-of-the-art technologies. The employees are encouraged to develop their skills and to nurture the pursuit of professional excellence.

Problem/Situation

GITL initially used an in-house developed Customer Relationship Management solution, e-CRM, with Microsoft SQL Server 2005 as the backend database running on Windows Server 2003. With time, the homegrown CRM solution could no longer be supported. It had shortcomings that the company found necessary to overcome.

The adoption was low because of the lack of flexibility and absence of a central customer database. This led to duplicate or inaccurate customer profile information and several master data issues, resulting in inaccurate data for decision-making. "We had to invest a substantial amount of time looking up information from innumerable databases. More than 40% of our endeavors would get stuck at some point because of mismatched master data and the absence of standard processes," clarifies KP Vinod, General Manager, Microsoft Business, GITL. In addition, the system lacked a reporting mechanism. It was time consuming and a daunting task to prepare reports on key business metrics.

Longer sales cycles, inaccurate sales opportunity forecasts, difficulty in identifying obstacles, inability to quickly visualize the business key performance indicators (KPIs), absence of a comprehensive overview of the business from marketing results, and sales performance were some of the drawbacks that adversely affected the business at GITL.

Solution and Implementation

To revamp the inept and ageing IT systems and processes at the company, GITL designed its new CRM strategy for future growth. It wanted to move to a CRM solution that required less customization and supported the company's long-term vision. Impressed with the 360–degree customer view and flexibility offered by Microsoft Dynamics CRM, GITL decided to implement the same. "We decided to deploy Microsoft Dynamics CRM 2011 partly due to hi-tech functionalities embedded in it to fit business requirements, and partly to improve user adoption due to a familiar look and feel of the solution," says Ajay Pimparkar, CEO, GITL.

GITL, Microsoft Dynamics' partner in India, deployed the solution at its head office in Mumbai in April 2011. The solution went live within a short period of five weeks and covered sales and marketing. The solution directly generates weekly, monthly, or yearly sales performance reports. These reports also classify opportunities by product. In addition, information such as marketing closed date with respect to forecast date, etc, is available, which helps in realistic forecasting.

Besides this, dashboards and reports are configured and customized for a real-time view of the sales funnel, including forecasted and actual revenue for a given period. The dashboards further track the top opportunities and key sales performers. For each sales person, the solution tracks the targets versus achievement. Managers can slice the data by sales person, leads, and opportunities.

Portal integration is another important aspect where the "Contact Us" page integrates with the Microsoft Dynamics CRM to capture and generate leads directly, turning it into a highly effective sales and interaction mode. Additionally, the ability to access CRM via mobile phones helps the sales team to immediately generate leads and later upgrade, qualify, and assign the same. Use of Form level and Field level security features has been invaluable in facilitating a focused approach for employees.

Benefits

Microsoft Dynamics CRM aligns with the organization's long-term strategy and produces a broad spectrum of results. It drives growth, helps to increase revenue, and boosts customer satisfaction. It also enables significant savings in operating costs. The benefits of the implementation were:

- **Redefinition of operational excellence –** Dynamics CRM has reshaped business processes to meet customer expectations. The revenues increased due to the improvement in the lead to opportunity conversion by more than 75%
- **Improved frontline efficiency and effectiveness –** Dynamics CRM balances effectiveness and efficiency by enhancing service levels and reducing costs and errors. It deploys new channels to reach new customers, penetrates under-served segments, shortens the sales cycle, and empowers employees to best serve the customers

- **Reduced reporting time by more than 50% –** Microsoft Dynamics CRM allows rolling out dashboards that let the management drill down into information, replacing the erstwhile spreadsheet reports
- **Increased user adoption rate –** Familiarity in look and feel to Microsoft Outlook attracts users, resulting in rapid adoption of the Dynamics CRM solution

Sources

1. Godrej InfoTech Ltd. (GITL) (www.godrejinfotech.com)
2. Microsoft Dynamics (www.microsoft.com/en-us/dynamics/)

SSA GLOBAL AT INALFA ROOF SYSTEMS

Company Profile

Inalfa Roof Systems was founded in the Netherlands in 1946 as a manufacturer of metal goods for wholesale companies, producing items such as knitting needles and curtain rails. After successfully manufacturing heaters during the next several decades, the company shifted creatively to produce formed metal parts for a variety of customers. Now, Inalfa Roof Systems is one of the world's biggest providers of vehicle roof systems, and develops and assembles innovative car and truck roof systems for almost all vehicle manufacturers. With 11 plants all over the world, Inalfa Roof Systems employs around 1700 people worldwide.

Problem/Situation

In 2003, Inalfa decided to utilize SSA ERP integrated engineering and SSA PLM solution sets throughout the company. The strategy was to design the system first for its European data center in Venray, the Netherlands; next for its Auburn Hills, Michigan based North American location; and eventually expand into Asia. Inalfa provides its customers with a multitude of engineering capabilities, from design to integration of roof systems into automobiles. As a result, product development features in SSA PLM sparked the company's interest.

Solution and Implementation

Inalfa choose IBM e-Server hardware platform and IBM POWER processors. This decision was taken considering the potential benefits—such as optimized database performance—of having the same manufacturer for both the disk storage and servers. Since remote facilities within Inalfa would be accessing the system, the company needed to determine how much performance degradation and communication lag time it could withstand.

Inalfa then decided to bring in IBM premier business partner Sirius Computer Solutions to help design, configure, and implement an IBM solution to support the applications and meet its data-recovery requirements. The largest re-seller of IBM e-Server systems, Sirius has extensive experience designing IT infrastructure solutions for SSA Global applications (now Infor) that incorporates IBM servers, storage, and software.

The Auburn Hills site began to monitor the progress of the project rollout in Europe, eventually taking over implementing the solution and expanding the kernel of the project to a worldwide reach. As the Netherlands based implementation was wrapping up its final processes, the Auburn Hills facility began its initial hardware rollout in mid-2005.

Thus the successful combination of the user, package vendor, hardware vendor, and external consultants—Inalfa, SSA Global, IBM, and Sirius Computer—ensure smooth and successful implementation.

Benefits

The IBM and SSA Global solution has equipped Inalfa with the ability to:

- Streamline processes involved in moving from design to market

- Design products faster and more reliably
- Respond quickly to changing market conditions
- Leverage metrics to ensure and track competitive quoting capabilities
- Facilitate decision-making by providing management with accurate, timely information
- Enhance customer responsiveness
- Reduce operational costs and improve efficiency
- Adopt best practices

Sources

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2. SSA Global (www.ssaglobal.com)
3. Infor (www.infor.com)
4. IBM Corporation (www.ibm.com)
5. Sirius Computers (www.siriuscom.com)

INFOR VISUAL AT EBERHARD MANUFACTURING COMPANY

Company Profile

Eberhard Manufacturing Company was founded in 1879 in Cleveland Ohio, USA. For more than 140 years, Eberhard Manufacturing has been a leader in providing high-quality industrial hardware. Today the company is a leading manufacturer of industrial, vehicular, military, and specialty hardware for trucks, trailers, fire and rescue equipment, marine, utility and other vehicles, as well as toolboxes, electrical and industrial enclosures, and panels. With over 7000 products available, Eberhard offers a wide choice of variations and options, many not available from any other source.

Problem/Situation

Eberhard had a legacy system that did not integrate the various departments and created the silo effect. This created problems like improper planning, late shipment, shortages of raw materials, etc. So the company decided to go in for an ERP system to do the following:

- Reduce very long lead times
- Eliminate late shipments
- Increase inventory turns

Solution and Implementation

The company chose Infor's ERP solutions—Infor VISUAL and Infor VISUAL Easy Lean. Infor VISUAL is designed for order-driven manufacturers in various industries, including discrete manufacturing, aerospace and defense, automotive, and industrial equipment and machinery.

Infor VISUAL Easy Lean is a fast-implementing solution from Infor that provides the protection you need for your planning and execution processes. It is a scheduling method that works with Infor VISUAL. With a few small changes to your traditional planning methods, such as setting up shipping and inventory buffers, you can gain visibility into your materials and production. This visibility allows you to make better decisions, release inventory at optimal times, and smooth production flow. It helps you avoid chaotic situations on the production floor, take on increased business, and ultimately drive more money to your bottom line.

The implementation was done by Infor's consulting team and the implementation was completed on time. "Infor's consulting team loaded the data needed to allow us to hit the ground running, and they were available to help until we were fully self-sufficient" says Ed Hongosh, Process Flow Manager, Eberhard Manufacturing Company.

Benefits

The benefits included the following:

- Saved $700,000 over a 2- to 3-month time period through improvements in inventory
- Reduced lead times from the original 6-8 weeks to 1-2 weeks
- Improved on-time deliveries from 70% to 95%
- Increased inventory turns over a 2– to 3–month time period from 2.5 to 4.1

Sources

1. Eberhard Manufacturing Company (www.eberhard.com)
2. Infor (www.infor.com)

PLEX ONLINE AT AVON GEAR COMPANY

Company Profile

Headquartered in Shelby Township, Michigan, Avon Gear Company manufactures precision-machined components and subassemblies for heavy industrial equipment manufacturers. Since its beginnings in 1974, the company has experienced steady growth. In the last 10 years, the company saw an average annual growth rate of 20%, particularly impressive given the economic downturn in the manufacturing industry.

Problem/Situation

In an ongoing effort to make processes and operations more efficient, Avon Gear Company decided to implement an ERP system, called MONITOR ERP System, to integrate data from several disparate sources. Before deploying the ERP system, all of Avon Gear's departments, including engineering, production, quality, and accounting, had their own Access databases and Excel spreadsheets. The databases were not integrated with each other, which made tracking, retrieving, and communicating critical data very difficult and time-consuming.

Avon Gear Company's initial ERP solution did not effectively integrate information or make it easily accessible. Only a handful of people in the company could make changes and look up real-time inventory information. This contributed to errors in data entry, tracking, and status reporting. The company needed a solution that could seamlessly integrate across the enterprise and provide easier access to real-time information. After reviewing and testing several options, they decided to implement Plex Online, a Cloud Software as a Service (SaaS) ERP. Avon Gear Company made this choice based on the solution's ability to meet its requirements, its reputation in the industry and its ability to connect and manage all areas of the manufacturing operations.

Solution and Implementation

Comprehensive, accurate, and timely information is needed for efficient management of costs and resources. At Avon Gear Company, the previous ERP solution couldn't generate detailed data such as the cost, production time, and quantity of parts produced in each of the various work centers on the shop floor. Plex Online tracks and records all physical events such as production, inventory status changes, receiving, subcontracting, shipping, and other data on the shop floor. This ability to generate in-depth information in real time has made tracking activities and costs easy.

Employees are able to log in individually at their work centers and record production details in real time. In addition to tracking, employees are now able to identify and label defective parts earlier and send them for correction before they move farther along the manufacturing process.

Shop floor managers now have the tools to better calculate costs by retrieving important information such as:

- The quantity of parts produced
- Production time for each part

- Time for total production
- Quality of the produced parts
- Number of parts with issues
- Time spent by the operator and the associated cost

"Such drill-down data helps us from a cost standpoint," said Matt Korth, Engineering manager at Avon Gear Company. "We run the costing function to get the cost associated with each part and each activity. We know where and how to utilize our resources efficiently and are able to make better business decisions."

Benefits

Avon Gear Company has connected all functions of its operation seamlessly with the implementation of Plex Online Cloud ERP. Its ease of use and the access it provides to real-time operational intelligence have empowered employees to be more efficient.

"We have accurate data, such as inventory numbers and the production percentage of parts at our fingertips at all times. Plex Online allows us to track production numbers, costs and capacity easily and quickly. Plex Online allowed us to manage operations efficiently with the minimum resources required" explained Korth. Other benefits included:

- Improved accuracy and efficiency of the production processes across the company
- Inventory costs reduced and the shortages became nil. Inventory count which was off by an average of 7% has come down to 2% with better tracking and inventory management functions
- The availability of real-time data enhances the reporting and forecasting capabilities of managers
- On the shop floor, the production status screens at each work center is automatically updated every three minutes, allowing the foreman to check the status and catch any issues in a timely manner

Sources

1. Avon Gear Company (www.avon-gear.com)
2. Plex Online (www.plex.com)

IFS AT TOSHULIN

Company Profile

TOSHULIN, a.s. is an engineering company with a long history in the machine tool market, which over the years has demonstrated its ability to adapt not only to changing market conditions, but in particular to increasing customer demands for quality, accuracy, and reliability of the machines supplied. Throughout its existence, the company has supplied more than 13500 machine tools to 60 countries. The company's production program comprises vertical lathes and vertical machining centers of several model series. The lathes are available with table diameters from 800 to 5000 mm and are equipped with cutting-edge electronic components that guarantee high performance, reliability, and precision machining. All of these types of machine are used in difficult and complex industrial applications.

Problem/Situation

Toshulin is an engineer-to-order (ETO) manufacturer. Although production is based on standard designs and components, machines are often adapted, sometimes up to 60%, to customer requirements. Long production cycles of 6–14 months mean that changes in the customer's specification are quite common. Sometimes on signing a contract, a customer will submit only a few requirements with detailed specifications, which are later elaborated in collaboration with the Toshulin design department. As a result, the workload within the company changes significantly. Each milling tool requires individual delivery of materials and components, as well as specific manufacturing capacity. Although the company used IT tools to control the process; special needs,

company production processes, production management, supply planning, and optimization capabilities proved to be complex and not always fully covered by the existing system.

Draft designs have shown that, despite the fact that engineers use IT tools and a substantial part of the documentation is already available electronically, support of the design work is the hardest part of IT use. Each project is a conceptual work, requiring problems to be identified and addressed. Frequent changes in projects due to customer expectations or technical problems also hamper the development of a precise timetable for a particular project work. As a result, the manufacturing department works under constant pressure.

Solution and Implementation

Toshulin has been using the information system supplied by Altec, IFS' implementation partner, since 1994, when the first contract to supply IS Dialogue was signed between the two companies. In 2003, it was replaced by IFS Applications. In collaboration with IFS and Altec consultants, the implementation of the new business applications was preceded by a defined and detailed assessment of the Toshulin production structure.

The results revealed two bottlenecks. The first was the market, due to the highly specialized nature of the product and unpredictable trends. The second was the design department and issues related to coordinating customer change requirements and solving the technical problems. Toshulin therefore decided to apply a manufacturing management solution based on IFS Applications and the Seiban model for dynamic order processing (DOP), where all activities related to the order are assigned to one DOP header (Seiban). This simplifies the creation of tree structures for orders as well as implementing change requests, performance monitoring, and management control over the manufacturing process.

In line with the original assessment, the entire manufacturing process was rebuilt to meet the requirements of the design department. Scheduling with resource constraints was completed and more attention was now paid to deadline management in the design department. Milestones and checkpoints in the manufacturing process were modified. The order planning method has also changed. In addition to IFS manufacturing and IFS distribution, the company has also implemented IFS financials, IFS maintenance, IFS sales and marketing (CRM), IFS quality management, IFS document management, and IFS business modeller. "The key changes took place in planning and the processes," Martin Kvapilík recalls.

Benefits

By rebuilding the manufacturing process and implementing manufacturing solutions, the lead times for certain DOP orders have been reduced by about 50%. Other advantages include:

- Better management of production lead times
- Better order planning
- Simpler manufacturing processes
- Improved production

Sources

1. IFS (www.ifsworld.com)
2. Toshulin (www.toshulin.cz)

QAD AT PANALYTICAL

Company Profile

PANalytical is the world's leading supplier of analytical instrumentation and software for X-ray diffraction (XRD) and X-ray fluorescence spectrometry (XRF), with more than half a century in the industry. The company's systems and software are used for material analysis and characterization in scientific research and development, industrial process control applications, and semiconductor metrology. Organizations all over the world rely on

PANalytical's solutions for analyzing materials like cement, metals, nanomaterials, plastics, petrochemicals, industrial minerals, glass, catalysts, semiconductors, pharmaceutical solids, recycled materials, environmental samples, and more.

PANalytical has laboratories and research sites in Japan, China, the USA, and the Netherlands, with a sales and service network that spans more than 60 countries. Headquartered in Almelo, the Netherlands, the company employs over 850 people worldwide, and is certified in accordance with ISO 9001:2000 and ISO 14001.

Problem/Situation

As its business grew and became more global, PANalytical faced growing complexity in its Information and Communication (ICT) infrastructures. This made it close to impossible to optimize and standardize business processes, and raised issues of data integrity across the organization.

Over 1000 customized applications existed from when PANalytical was part of Philips. The customizations had been necessary to integrate PANalytical's QAD systems with the Philips core system. But the most critical issue was managing data: Over time, PANalytical had accumulated 17 different databases and multiple versions of its QAD software distributed across its 33 sites.

"PANalytical being a global company with organizations all over the world, using different base currencies, general ledger structures, statutory reporting, and so on; for each organization a separate database was implemented. Standardization of data and data structures was very weak," says Global Information and Communication Technology Manager Rine van Iperen.

Solution and Implementation

The introduction of domain functionality with QAD Enterprise Applications version MFG/PRO eB2.1 made it possible for PANalytical to successfully consolidate multiple databases to one, and to eliminate all but a few essential customizations.

QAD-shared service domains allow enterprises to standardize and centralize critical business processes, while preserving other location-specific functions. Each domain can represent an individual business unit, with its own base currency, chart of accounts and unique configuration for manufacturing, distribution, service, and financials. Yet the domains operate within a single database, making it easy to share data and administrative functions.

PANalytical implemented its new QAD system in a "big bang" scenario, delivering it to all of its sites around the world. In partnership with QAD Global Services, PANalytical successfully consolidated two manufacturing sites, 31 sales offices and 17 databases. The project included a strong focus on centralized data management, process improvement, and the implementation of global working procedures, therefore resulting in a standard, non-customized implementation of QAD Enterprise Applications (version MFG/PRO eB2.1), running on one virtual machine.

"We chose QAD because their professional people know what they are talking about. We chose QAD Global Services, as we wanted to have a closer relationship with the original vendor of the system than we would be able to have with a systems integrator," says Van Iperen.

Benefits

Now, all data is maintained in one Master Data Domain. From this domain the data is synchronized to conform to the predefined rules of the domains were the data is needed. The company-wide standardization, clean-up and consolidation of data enhanced accuracy, quality, and processes throughout the enterprise. PANalytical leveraged QAD to reduce manual processes and create efficiencies across its operations:

- Cut number of databases from 17 to 1
- Decreased customizations from 1000 to 30
- Eliminated manual purchase and sales orders
- Automated the invoicing and other information transfer between supply centers and sales offices

- Reduced external documents from 350 to 15 parameterized documents that cover all languages
- Integrated forecasting at supply centers
- Automated purchase order requisition using QAD QXtend
- Trimmed number and cost of IT resources

Sources

1. PANalytical (www.panalytical.com)
2. QAD (www.qad.com)

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