Fresh Fingerprints

Cases of Innovations in
Public Service Delivery

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To

The Common Man

Preface

"In a gentle way, you can shake the world."   **Mahatma Gandhi**

Analysts of public management have often observed that public service is not an edifice to be erected and admired, but an organic being that requires constant nurturing and care. We have, over the last six decades, set up an elaborate public service infrastructure in the country which has delivered in large measure. The performance bar, however, continually gets pushed higher, fuelled primarily by enhanced societal awareness, increased aspirations of the people and their exposure to international service delivery standards. We are facing the phenomenon of an ever shifting goalpost! There is a risk that further improvement in public services will reach a plateau if we continue to rely on traditional tools, techniques and systems for managing these services. The time has come to look around for new methods, tools and strategies to catapult us to the next orbit. One of the most exciting opportunities today is provided by the rapid technological advances in Information and Communication Technology (ICT), which has given us an alternative mechanism to reform, may even transform, the governance landscape.

It is often said that ICT is all about "possibility", more so in the domain of e-Governance, where the use of ICTs has converted many possibilities of revolutionising the delivery of public services into reality. However, e-Governance is not a magic wand; its success depends on a host of enabling factors being in place. In our experience, this journey is fraught with many difficulties—complex project conceptualisation, limited resources, competing technical paradigms, organisations' inherent resistance to change etc. Amidst such challenges, there are some e-Governance projects that succeed and make a far reaching impact in the way a government functions, which captures our imagination. The cases listed in this compilation highlight the contention. While technology provides the context, effective transformation requires deft combination of several key ingredients relating to ideas, people, processes, resources etc., which may be evinced from our multifaceted analysis. One factor which is universal across all

the successful cases listed in this book, is the realisation that e-Governance is not about technology; it is about leadership evidenced both through political will and administrative action. Leadership's role is in providing a compelling vision, garnering resources, sustaining momentum during the arduous implementation phase, building highly motivated implementation team and facilitating transformation of the agency structures, operations and culture.

Continuous change is important for sustenance. We are in an age where the citizens' ever-rising expectations level and the continuous shifting of the governance goalpost compels us to innovate. It is the fundamental element needed to revitalise and restructure the public service. It is the process through which economic and social value is extracted from new ideas. Therefore, innovation is the next logical and necessary step in the movement to reform government.

WHY INNOVATION MATTERS?

"No problem can be solved from the same level of consciousness that created it. You have to rise above it to the next level. This is possible through Innovation."

Albert Einstein

Innovation may be defined as a set of acts aiming to do something better, reduce costs, meet a new need or respond to new challenges. It is not always about doing different things; it is about doing the same things differently. It is not always about using innovative technologies. It is more about using the existing technologies in a novel manner. It involves raising new questions, creating new possibilities, choices and alternatives, regarding old problems from a new angle and is different from improvement which is achieved through better analysis, decision-making and more efficiency. It means trying something new and radically different which is intended to transform, rather than to provide an incremental benefit.

However, traditionally, innovation has been associated with the private sector, where the impetus for such an activity is significant and is provided by powerful motivators like factors affecting organisational survival and strength, increased profits, reduced costs, better value or quality products and services and improved market share. While in public service organisations, innovations have historically not been a conscious priority, maybe as they were not perceived to be critical determinants of their survival. This may be attributed to the fact that as compared to the private sector, these are far more complex eco-systems, operating under a very different set of pressures, interests, restrictions and demands.

While there is no denying that some concerted efforts have been made to improve the delivery and outcomes of public services such as for enhanced

educational attainment, land records reforms etc., there are other areas in which there is a great scope for improvement, e.g. people/communities at risk of poverty and social exclusion, digital divide, etc. There is a strong belief among the policy makers that in order to address the problems that in the past have proved intractable in these areas, innovative approaches to policy, practice, provision and delivery are required. The possibility of attaining a high social impact is a powerful motivator in this sector. There may be other motivators as well, like more effective response to altered public needs and rising expectations, reducing costs and increasing efficiency, especially in view of the limited resources, or leveraging on the potential of ICTs.

✿ THE NEW PARADIGM

Whenever we talk of "innovations in public sector", the die-hard cynics' predictable reaction is to dismiss it as an oxymoron! How can a government be 'innovative'? It is a contradiction in terms. The general perception is that the Indian Government is a mammoth sluggish creature that is tied down in bureaucratic red tapes and is strongly resistant to change. We hope that this book would be a myth-buster—the myth that the government *never* works, its response time is *always* very slow, it can *never* be effective or efficient and so on. This is an attempt to give the other side of the story, to showcase the innovative and inventive spirit of the government by producing authentic evidence to support our claim that it does work… and how! No doubt, the challenges are huge and sometimes seem insurmountable, but we would like to say that when the going gets tough, the innovators get going!

In the present collection of projects, the solutions to a perceived problem have been creatively crafted, keeping in mind the ground realities and the non conducive organisational environment. The trigger normally is the presence of a problem, coupled with an urgency to solve it. When organisations launch on this path of technology-enabled innovation, defining what innovation means for the agency and drawing practical insights from successful innovations provide a good foundation for the initial steps. While it is widely perceived that the government organisations have built-in characteristics that make innovation difficult, especially relating to the strong desire for control, absence of driving forces, complacency due to its monopolistic role and reluctance to allow failure, combined with cumbersome and complex processes, it has also been seen that these inhibitors can be overcome. A set of useful lessons have emerged from such successful efforts of the government, in particular the strategic, non technical and behavioural aspects that have been essential for such successes.

☙ Why is This Book Significant?

Our long and intense association with e-Governance[1] has provided us with a deep insight into what makes a successful innovation. While examining and evaluating more than 1000 e-Governance initiatives from all over the country (from State Governments as well as the Central Ministries of the Government of India), we handpicked 14 projects for the innovative and inventive spirit of the government which they show-cased, for this book. Most of these projects have been recognised in various forums, like being awarded the National Award for e-Governance or the PM's Award for Excellence in Public Administration. This is a very niche, albeit powerful, sector and there is hardly any authentic government data or information available on this subject. Furthermore, public curiosity about this sector is building up, as are their expectations. In building up this work, we have tried to elicit contributions directly from the project champions and drawn insights which can be useful to others in this sector.

We must affirm, celebrate, disseminate and encourage innovations … which should explain the motivation for this book. The perspective on how to improve public services through innovations is not easily available, despite the fact that it can be a key contributor to the national growth and to the welfare of individual citizens, especially in a resource starved country like India. Context specific innovation linked to outcomes is the way forward. Therefore, the contributions of the public sector change agents need to be acknowledged and applauded, as having the potential to provide a beacon of light illuminating the path of good governance, for others to learn from and to emulate.

This book aims at providing the readers with some insight into some of the innovative e-Governance projects from all over the country, and to judge for themselves how best the lessons from such experiments and implementations can be used. The collection comprises mostly of award winning initiatives taken by the government in diverse sectors like education, health, agriculture, forests, roads, disaster management, tax administration etc. The common thread running through all the diversity is the spirit of inventiveness and innovation, which distinguishes the projects from the other "business as usual" ventures. All in all, the collection articulates a diversity of perspectives, ranging from the description of technical architectures to an appreciation of triggers for societal change. It is by

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no means an exhaustive account, but it does reflect the varying levels of progress and aspirations across the country.

❧• ACKNOWLEDGEMENTS

One of the most important functions of leaders in a government is to foster a climate of innovation. We are deeply appreciative of the stellar work done by the teams associated with each and every project that has been showcased in this book. But these would not have been possible without the relentless efforts of the champions, who played a very significant and defining role in making these, their success stories. All our contributors are busy professionals, champions of their respective projects. They have fought against all odds to overcome challenging situations and ably led their teams to achieve the desired results. They may even be called the "change agents" or the "master innovators".

While acknowledging their deep commitment to good governance, we are also very grateful to the project champions for taking the time to record their experiences to enable us to share them with everyone. Many other individuals have also provided their sustained and intense involvement in making the publication of this compilation a reality, and we wish to thank them for their efforts.

We hope that the case studies will provide a holistic and meaningful characterisation of real life challenges as well as operational guidelines, with the aim of generalising, and not particularising analysis. We strongly believe that the dissemination of good work is a felt need of the times, as it has the potential to ignite the young minds and release the innate dynamism of the future generations. We hope the reader derives as much pleasure and satisfaction in reading about these efforts, as we did in compiling and analysing them.

LEKHA KUMAR
ANJALI KAUSHIK

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Introduction

"I've come to believe that each of us has a personal calling that's as unique as a fingerprint- and that the best way to succeed is to discover what you love and then find a way to offer it to others in the form of service, working hard, and also allowing the energy of the universe to lead you."

Oprah Winfrey

While many attempts have been made by the governments in recent years to improve delivery systems through innovative methods, we are still at a very nascent stage as far as the delivery of services is concerned. Despite the 9%+ growth of the Indian economy, most experts are convinced that the future of India depends on its ability to mainstream the marginalised on an urgent basis. Various studies have confirmed that the biggest stumbling block in this arena is the lack of an effective service delivery system that can ensure the provision of basic facilities to the poor and the marginalised sections of the society in an effective, transparent and equitable manner. Although there have been intensive discussions on new and efficacious delivery systems, one has to admit that there is space for more ideas to be generated, and more successful experiences to be shared and spread. Even though we may say that the state has, to a large extent, met the challenges of development of infrastructure and creation of assets since independence, and that the administrative agencies have been fairly successful in achieving the difficult logistical goal of creating nation-wide networks of service delivery, the journey ahead is still very long and arduous. In fact, the efforts of the Indian State in reaching out and providing the citizens with physical access to the core public goods and services, has itself created pressures and demands for better quality and

increased access, thereby placing the spot light firmly on "systematic gaps" in the existing service delivery systems. For instance, the very existence of a road, a school or a health centre has led to demands for better services and better maintenance of these facilities. Recent studies have shown that with rising incomes resulting from economic growth, citizens in the urban as well as the rural areas are increasingly approaching the private sector for provision of basic services, and are even willing to pay substantial fees for quality services. Simultaneously, the deepening of democracy has led to the empowerment of new social groups and the increased expectations of upward mobility, leading to demands for making public service delivery more inclusive.

CONTEXTUAL BACKDROP

"Where there is no hope, it is incumbent on us to invent it."   **Albert Camus**

Successive governments have been making efforts to reinvent themselves and keep pace with the rising demands from the citizenry for quality and inclusiveness in service delivery. Being more often than not supply oriented, state driven and having internally focused systems, governments have been facing the challenges of making the most efficient use of resources, while paying adequate attention to concerns for quality and citizen satisfaction. We therefore, felt the need to closely examine the processes of policy implementation and service delivery, identify roadblocks and bottlenecks, and identify those interventions which have come up with innovative and viable approaches and strategies, which were able to maximise policy outcomes.

Effective policy implementation is a function of the interplay of three key elements namely the institutional arrangements, the framework of rules and procedures and service providers. In the context of a dynamic political, social and economic environment, these three elements of governance need to constantly reinvent and adapt themselves to perform better and remain effective. Their capacity to do so not only depends upon their internal qualities, but also upon the pressures emanating from their external environment, most notably from the political system and the civil society.

It is in the backdrop of these remarks that we would like to introduce the main context of this book, that is, innovations in the public services through appropriate interventions in the service delivery institutions and mechanisms in the domain of governance. While there have been dispersed attempts in this specific area, not much has been done in cumulating the same or developing them into a body of transferable knowledge. These disparate attempts therefore fail to inspire, or to inform national policy or offer themselves for replication by practitioners. Hence, one of the guiding principles of this book has been to cumulate and aggregate our

key learnings for dissemination to a larger audience, through a systematic process of documentation and analytic procedures.

Innovation as a Concept

"There's a way to do it better – find it."   **Thomas Edison**

How does one define "innovation" in the present context?

A review of the literature on innovation brings out different definitions of innovations from different perspectives. As early as 1965, Thompson defined innovation as "the generation, acceptance and implementation of new ideas, processes, products and services". The word innovation is derived from the Latin word 'innovare', which means 'to take something new'. Different researchers have given different interpretation to this word. In certain contexts, the words creativity, invention, innovativeness and innovation heve been used interchangeably. To start with, it is important to clearly distinguish these terms since these terms could be misunderstood. Going by standard dictionary definitions, *'creativity'* is the process of generating new idea or a thing while *'invention'* is defined as an idea or a thing that has been invented. *'Innovation'* has been defined as the introduction of new things, ideas or ways of doing something. Therefore, while creativity is about the *imagination* of a thing or an idea, invention is the *physical manifestation* of that thing or idea. However, innovation is broader and involves the *exploitation* or application of creative ideas to a specific context. Roberts (1989) defined innovation as a summation of invention and exploitation.

An invention does not become an innovation unless it is implemented or utilized. Also, creativity is a necessary but not sufficient condition for innovation (Amabile et al., 1996). Innovation is a broader term, which involves the process of both generating (creativity) and applying such creative ideas.

If innovation is seen as a process, then the requirements at the idea generation stage would be different from idea implementation stage. While the initial stage may require higher integration and exchange of ideas, the implementation stage may require risk taking ability. We would be discussing these kind of differences and requirements as we move along this chapter.

Innovativeness is an antecedent to innovation. Innovativeness is the process in which new ideas are generated and applied to come up with inventions that if put into organizational system as a whole will form innovation (AbuJarad and Yusof, 2010). Therefore, innovation is a broader concept that incorporates creativity, innovativeness and invention.

Apart from being creative and effective, good innovations should have the potential to be sustainable, scalable and replicable. The creative usage may be assessed in terms of the methods, processes, practices and sectors. For innovation

to occur, something more than the generation of a creative idea or insight is required: the insight must be put into action to make a genuine difference. Therefore, we would like to define innovation as

Innovation = Creativity + successful execution + effectiveness + sustainability + replicability

According to Mulgan and Albury (2003), successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes like efficiency, effectiveness or quality. Leadbeater (2003) elaborated this idea slightly differently, when he observed that the process of innovation is lengthy, interactive and social; many people with different talents, skills and resources have to come together. Both the approaches have merit. Innovation is both multifaceted and complex. It is a harmonious interplay of a wide array of factors and variables which, if optimal, brings about changes that may be incremental or radical and transformational. While the focus in this book would be on the impactful efforts, it is important to recognize the incremental innovations as critical to the pursuit of improvements in the public sector. Their contribution may be small, but they support a continuous process of improvements, which may lead to the tailoring of services to individual and local needs, as opposed to the "one-size fits all" approach, or even bring down costs. The more radical or transformative innovations that have the potential to bring about significant enhancement in performance for the organisation and alter the expectations of service users, are less frequently seen. Most rare, though, are the dramatic systemic innovations that give rise to new workforce structures and organisations, or transform entire sectors, or change the relationships between organisations. Typically such metamorphosis is extremely difficult to bring about, and takes decades to have its full effect, requiring fundamental changes in the organisational, social, legal and cultural arrangements.

Gartner (2007) defines innovation in the public sector as a change that bridges the gap between performance (of the existing activities, services, results or outcomes) and expectations (of the customers or the stakeholders, now or for the future). This definition brings the organisational focus onto what needs to be changed in order to bring some aspect of its performance in alignment with the expectations of the customers or the stakeholders—a useful "creative tension" for stimulating innovation.

❧ INNOVATION AND PUBLIC SECTOR

Today, we are attempting to harness ICT and other tools in new and imaginative ways to transform, not just *how* the government works, but *what* it actually does—

our focus has shifted from merely providing the public services online, to using this opportunity to transform what the government does as well. The reforms in the public services in India over the last two decades have shifted the focus of governance from a traditional model of "command and control" to an intensely citizen focused model. This new approach to public administration has provided an opportunity to exploit new technologies to improve, nay even transform, the efficiency and effectiveness of public service delivery—to change the government in a wider sense into an effective, agile and responsive organisation with a common shared view of the needs, the rights and the responsibilities of the citizens. There are, in fact, a number of reasons why this "citizen centric" approach is required: for effective servicing of the citizens and accountability, for providing easier access to information for the citizens and for leveraging technology for the economies of scale and shared services. The scale of change implied by e-Government and the potential impact it could have on the public services means that it should be approached in a structured way with a clear vision of what the "transformed" corporate public service would look and operate like, and with agreed principles and strategies to underpin the change process.

Modernising the government is also about more transparency and inclusiveness. It is about a bigger concept of service—about responsiveness and doing right by the citizen—about a more inclusive and democratic system. Perhaps most importantly, it is about simplicity—about removing the complexity of the government and about liberating the citizens to use their talents and skills in an ever changing and increasingly competitive world. Another common error is as implied in the very use of the term "e-Government", which has tended to marginalise it as something removed from the organisational reform, by focusing perhaps too much on the technology itself rather than on its uses. So, in India we are talking less and less about the "e", and more and more about innovation and modernization, because, like it or not, "e" is now a part of most aspects of life. Technology should be invisible to the user—it should be a second nature to us to be able to use and exploit it with ease, like using the ATMs or mobiles or the online booking of railway/airline tickets. The use of technology *per se* does not imply reform or innovation. It is the context, the ingenious combination of several factors that lead to a dramatic result that is important here.

To our minds, innovation is the key—a critical activity for the public sector. Even minor changes to the existing services or processes have the potential to magnify improvements in the delivery of services. Therefore, the social impact is high. The honourable President Mrs Pratibha Patil, in her address to the Parliament on 4th June 2009, dedicated the next ten years to innovation, announcing the coming decade as a "Decade of Innovation". "*It may be a symbolic gesture but an important gesture to drive home the need to be innovative in finding*

solutions to our many challenges", Mrs Patil said on that occasion. The Prime Minister Dr Manmohan Singh, approved the establishment of the National Innovation Council in August 2010, with a mandate to prepare and enable a road map for the **"Decade of Innovation (2010-2020)",** by evolving an Indian model of innovation, focusing on inclusive growth and creating an appropriate ecosystem. He also earmarked a fund of $1 billion to promote new ideas for promoting inclusive development and innovations in the country. The twelfth Five Year Plan also identifies strengthening the innovation ecosystem in India for inclusive and sustainable growth as a key focus area. These examples only demonstrate the increasingly significant role which innovation is expected to play in the government in the times to come!

It is interesting to note that the year 2009 was declared as the "**European Year of Creativity and Innovation**," which aimed to raise awareness of the importance of creativity and innovation for personal, social and economic development; to disseminate good practices; to stimulate education and research and to promote policy debate on related issues. The activities of the European Year of Creativity and Innovation 2009 were aimed at the young people, educators, firms and policy makers. The general public and civil society organisations were encouraged to mobilise and get involved at the European, national and local levels.

CAN GOVERNMENT INNOVATE…?

"We are still masters of our fate. We are still captains of our souls."

Winston Churchill

Many citizens believe that the notion of an innovative government is paradoxical because of its bureaucratic nature. Bureaucratic "size" and bureaucratic "structure" take away the speed, agility and adaptability. The routinisation of work in public service diverts attention from the end-results to the processes. There are no external market pressures and threats which provide the compulsion to radically transform. No one will snatch away the customer (citizen) base. The citizens remain dependent on the government for the services to a large extent. There are no profit motivations. It is true that the citizens are getting more demanding… but it is not as though you either "innovate or perish*",* as in the private sector. The stakes are not high. The budgets are fixed. The "pull" is difficult to achieve because unlike private sector, citizens have limited choices and that in itself may not be a driver for innovation. It is unlikely that the organisation would collapse due to lack of creativity and experimentation. The services are driven by the public policy with higher emphasis on socio-cultural issues such as equity, inclusion, ethics, privacy etc.

Apart from the absence of "drivers", there are structural impediments as well. Traditionally, public services are organised into "silos". This type of organisation is at best, a constraint on the integration implied by citizen-centricity, and at worst, it actively militates against such a significant paradigm shift. The systems of government that exists in many countries are based on ministerial responsibilities divided according to specific areas or service types, rather than being based on citizen requirements that require state intervention by multiple ministries to address the predicaments of citizens.

Innovation, especially which is specific and relevant to the context, is the need of the hour. It has the potential to act as a powerful enabler in helping the public sector to respond to the ever increasing requirements of the citizens, to provide accessible and new services in areas such as health, education, water, transportation, sanitation etc. at low cost. Effective innovations do not always require high investments and structured laboratories, but can even come about by exploiting the opportunities at the grass root level. It is important to keep in mind that simple things work better—that there is a certain elegance in simplicity that is hard to escape, that there is a danger of over engineering the problem, that can lead to expensive and unwanted solutions.

Some Myth-Busters

Scholars have in the past been noticeably taciturn regarding the role of innovation and entrepreneurship in public sector, which has remained conspicuously absent till recent times, but not any more. In this book, we have assembled some remarkable projects which identify the potential for innovations in contributing to the public sector. In particular, we have some key insights and analyses that help build the foundations for transforming a lethargic public sector into an agile, dynamic, innovative and highly effective partner for fostering leadership skills and changes in the global era. Scholars, policy makers and business leaders who think that the public sector is condemned to being a hindrance to innovation and entrepreneurship rather than playing the role of a leader championing change and competitiveness in a global economy, would be well advised to read these inspiring case studies. Departing from the myth of "private equal to entrepreneurial, public equal to bureaucratic paralysis", this book offers precious insights into the public sector learning, entrepreneurship, inertias, roadblocks and also the trade-offs involved in different management philosophies and performance requirements.

Innovative effort may mean the creation of new processes for the provision of services such as healthcare and education, or new possibilities in terms of the design and delivery of services, new methods to address issues related to inequality/inclusion, new ways to manage environment/ natural resources or for economic, social or even human development etc. The effectiveness may

be measured in terms of the governance and the social/economic impact. It is expected to have a transformational effect.

The Andhra Pradesh Smart Card project and the TRPS identify fundamentally, new ways of delivering the existing services. Andhra Pradesh has rolled out smart card based banking services for the implementation of NREGS (National Rural Employment Guarantee Scheme) and SSP (Social Security Pension) schemes in the state. These biometric based smart cards are linked to the core banking systems using mobile technology/ integrated point of sales (POS) machines for last mile connectivity. The entire process of transfer of funds to the banks and delivery of payments under the above schemes is automated. The technology is enabled by a business correspondent (BC) of the bank and a Customer Service Provider (CSP) at the village level under a branchless banking model, which is one of its kind in the country. This model has enhanced financial inclusion and brought transparency and accuracy in the entire process of disbursement of funds under the above two schemes.

The Tax Return Preparer Scheme (TRPS) has been launched by the Central Board of Direct Taxes (CBDT), Ministry of Finance, Government of India, for creating awareness, increasing compliance, providing tax-payer services promoting community participation for improved tax administration and also for rendering the tax collecting process citizen friendly. It was the first scheme which sought to directly reduce the cost of compliance for small and marginal taxpayers, enhance the awareness of tax laws amongst the taxpayers to promote voluntary compliance. This approach has innovatively created a structured and trained work-force outside the department, using technology tools, to assist in tax return preparation, while at the same time it is providing self-employment opportunity for the unemployed and underemployed graduates.

The National Institute of Open Schooling (NIOS) is a case where new services are developed to fulfill the existing and latent needs of the citizens. These are radical innovations as they have successfully re-defined the expectations of the citizens and the users. In 2009, the National Institute of Open Schooling (NIOS) was awarded the National Award for e-Governance. The National Institute Online (Ni On) project is a giant leap for the Open and Distance learning (ODL) systems in India. The NIOS has over 1.5 million learners, thereby making it the largest open schooling system in the world. It is a milestone in providing educational access and infrastructure resources to the unreached sections of the society through the innovative use of ICT. The following pages attempt to outline the story of Ni On, the reengineering of processes within the institution that led to revolutionising the concept of open and distance learning at the school level and making the institution contribute more effectively to the national goal for universalisation of education.

The Fire Alert and Messaging System (FAMS) of Bhopal is a case of ingenuity in forest management. The Madhya Pradesh Forest Department (MPFD) came up with FAMS to manage the problem of forest fires. FAMS helps in the exact detection of fires using Geographic Information Systems (GIS) and Remote Sensing (RS) technology, and instant messaging of fires to the frontline field staff and officers using mobile technology. This helps in the identification and delineation of fire prone forest areas. FAMS has helped to create a spatial and temporal database of fire locations and to monitor the extent of burnt forest areas, which can be used for planning resources. The system is first of its kind in India and is being replicated in other states.

Some innovations in the health sector brought up in the book stand apart for their simplicity and impact.

The Nagpur Municipal Corporation (NMC) has taken a series of initiatives to improve the delivery of health related services in the district under its program "City Health Line (CHL)". This includes providing reliable and updated information on health facilities across the district through website, call centre and through mobile SMS; availability of round the clock ambulance on an easy to dial number etc. CHL has centralised all health-related information and provides them through a one-stop window as an authenticated source. Simultaneously, it has improved upon the enabling processes. The innovation for NMC in designing the CHL program is in the simplicity of the concept and the enabling processes, and its success in fulfilling the critical health related need of the end users.

Aarogyam, or "*complete freedom from illness*", is a concept that aims at health for all in the family, especially the mother and the child in Uttar Pradesh. Aarogyam is a citizen centric health model, which provides automatic call alerts/ SMS to each family, thereby proactively reaching out to the citizens and generating a demand for health services.

The Community Health Insurance Scheme named Aarogyasri set up in Andhra Pradesh (AP) for the families living below the poverty line (BPL) provides financial coverage of ₹ 0.2 million to each BPL family and covers 85% of the families of AP. The Aarogyasri scheme is unique in its applicability and implementation, since no other state/ government agency has provided universal health coverage to the poor for major ailments. Aarogyasri is a case of major innovation as it has transformed the entire healthcare ecosystem in Andhra Pradesh through its inclusive approach. It entails constructing different relationships between the users and services along with major changes in governance and accountability.

e-SANCHAR is a case of fundamental re-thinking to enhance citizen experience and promote inclusion. e-SANCHAR is a voice to text application which has been used by the Rajasthan Government to evolve an institutional mechanism to proactively inform the pensioners on the status of their pension. A

pilot was conducted in the Shahpura sub treasury in the year 2009. The pilot was well received and has been extended across the state for the pension scheme and for other Government to Citizen (G2C) services. The project integrates mobile telephony with information technology for generating voice calls for timely transfer of information to the rural citizens such as the old, the handicapped and the widow pensioners for sanction and monthly release of pension. The application can be used in cases where direct communication with the beneficiary/target group is felt necessary.

The Jharkhand Renewable Energy Development Agency (JREDA) is a case of integrating new and traditional technologies to unlock performance and promote transparency. JREDA has extensively popularised the use of renewable energy in more than 400 villages of Jharkhand, including the use of solar lanterns, solar home lighting systems and solar street lights. The programme is made effective by the use of a web based Management Information System (MIS) linked to Google earth which captures the details of beneficiaries based on geographical co-ordinates. This has helped to develop a comprehensive MIS of beneficiaries who can be tracked on-line in real time. This method of monitoring and implementation of renewable resources is unique in India, and has brought transparency, accountability and people participation in the process of deployment of renewable energy sources in the state.

The Irrigation and Command Area Department (I&CAD) of Government of Andhra Pradesh has built an innovative Decision Support System (DSS) using mobile technology for the effective monitoring and management of water resources in the state. The DSS has improved effectiveness and decision making for the issues related to water management, and prepared the state for better disaster management, better handling of water disputes on a day-to-day basisetc. The DSS is integrated with inputs from the Remote Sensing (RS) and the Geographic Information System (GIS) based technology to enhance its comprehensiveness. The system is simple, cost effective, innovative in design and is being replicated in other states such as Rajasthan.

e-Krishi Kiran is a case of effective and creative usage of the ICT applications. The Government of Gujarat has promoted scientific farming in the state using innovative methods such as soil testing of individual farmer's field, and make recommendations for fertiliser use and cropping system based on that. The programme named e-Krishi Kiran has been pioneered by the Anand Agricultural University (AAU) with participation from other stakeholders in the state. The programme is welcomed by the farmers, as it has improved productivity and provided better economic gains. e-Krishi Kiran has made the transfer of technology to the farmers more scientific, precise, easy and need based.

The GIS Property-based Tax System, Bangalore, highlights new possibilities in terms of the design and delivery of services. The Aasthi Property Tax Information System (PTIS) application was developed by the Municipal Reforms Cell (MRC), Bangalore, together with the e-Government Foundation. It is an endeavor to make tax assessment simpler, prioritise areas on the basis of tax revenues collected or due, facilitate decision making and streamline the workflow of property tax assessment and it takes help of geo-informatics.

The Disaster Management Information System (DMIS) discusses significantly different methods for achieving the requirements of disaster management. MRSAC has indigenously developed a decision support system for disaster management using GIS and RS technology. DMIS integrates spatial and non spatial data to facilitate dynamic analysis and prompt response to disaster situations. This enables the state to face the disaster in a more effective way and builds confidence across different segments of the society. The DMIS helps in every phase of disaster management, from preparedness to relief rehabilitation for the entire state of Maharashtra.

In a developing country like India where the resources are scarce and the opportunities for deployment are plenty, a scientific approach to planning of public resources is the way to go forward. The Madhya Pradesh Rural Road Development Agency (MPRRDA) has used the GIS and RS technologies towards prioritisation and planning of roads in rural India. Better management of the essential public resources can make a substantial difference. This project brings out how technologies can be leveraged innovatively for the development of roads in rural areas.

☘ It Starts with an Idea

"Creativity is thinking up new things. Innovation is doing new things."

Theodore Levitt

We can all innovate..! The capacity to be creative is in all of us and the opportunities are all around us... Unfortunately, the monotonous pattern of our day-to-day lives kills the desire to be different and compels us to think in less and less creative ways. Creativity may lead to something new; it has a disruptive influence initially. It also implies risk taking. Fear of the unknown, risk aversion and fear of failure— all are deterrents to creativity. We often notice that in our work prioritisation, fire-fighting or crisis management figure high as we get pushed towards the more urgent issues. And in this haste, we lose the time to think, to deliberate, to envision, to dream. What we perhaps need the most is a "judicious pause…"

Innovation is not "magic"! It can be managed and made more predictable. The Eureka moments are important for creativity, but that's only a part of it. It means aiming to do something better to meet a new need or respond to new circumstances. It involves providing new choices and alternatives, and is different from improvements achieved through better analysis, decision-making and more efficiency. It means trying something new and different to radically improve the existing programs. Focusing on operational efficiencies such as cost cutting, productivity and quality can only take you some distance. For radical improvements, you need more than that.

Organisations and individuals that successfully innovate, grasp the opportunity with determination and take the initiative to leverage it. They do not wait around for things to change. They have a strong sense of empowerment which comes from being passionate about their beliefs. Passion is that singular emotion that translates creativity into action. At the same time, it is also important to have participation at all levels. The pervasiveness of commitment at all levels helps to overcome all kinds of adoption hurdles. The participatory techniques encourage the flow of new ideas/ new needs and alternate possibilities. Personal passion and advocacy have crucial roles in the development of exceptional opportunities, while effective communication facilitates creativity and motivates team.

Managing Innovation as a Process: Strategies and Constraints

"The achievement of excellence can only occur if the organisation promotes a culture of creative dissatisfaction."   **Lawrence Miller**

Selection of Ideas

The public sector organisations need to recognise innovation as a formal process and give it the same level of scrutiny and attention as other processes in the organisation. The process of innovation involves innovation 'creation' and 'implementation' processes keeping the goals and the outcomes in sight. 'Innovation creation' typically involves processes related to generation of idea and selection of idea. A government organization may start with putting the citizen needs into perspective, go through their common grievances and identify bottlenecks in the services delivered. This would provide the backdrop for brainstorming sessions in which both the organisations and the citizens may together generate ideas to meet the unfulfilled needs/grievances. This is particularly useful if those familiar with the problem look at all sides, ignore the "accepted wisdom" and try out new things. Idea generators need to be rewarded or recognised appropriately. The next step is the selection of ideas which should be a rigorous process, keeping the desired outcome in view. It would help to

have a group comprising of an assortment of experts in related fields, for the identification, selection and development of opportunities for innovation. This would foster cross-pollination of ideas and help identify individuals who have a flair for problem-solving; are keen to find new and different ways of doing things and are continual learners. Such a group may help develop an innovation portfolio and introduce academic rigour, discipline and quality to the process. For this, the selection process should have adequate diversity of opinions, both from the internal and the external stakeholders, to generate debate and to ensure that weak opportunities are not promoted and strong promising opportunities which may look weak in the innovation portfolio are not neglected. The group may develop some selection rules to decide which ideas merit further exploration and support, to recognise the value of opportunity and strategic fit with the host organisation, and whether potential benefits are commensurate with development costs.

Risk-taking ability

The adaptability of an organisation to anticipate and respond to its changing situation and environment depends on the presence of a strong driving force and its desire to take measured risks. The 'innovation implementation' stage presumes a certain amount of risk taking. Risk taking means implementing a well-reasoned idea where the benefits appear more than the losses. It is trying things out earlier, making mistakes at a low cost, refining the idea, product, or process, and re-trying. Risk-taking lies at the heart of innovation.

In bureaucratic organisations, the rules and hierarchical structures define the administrative processes which are legitimate tools for democracy and fair treatment of constituents, but often these become the reason for our excessive red-tapism. The traditional "command and control" approach of governance had little tolerance for failures, and risk-taking was consigned to the backroom. This had inhibiting consequences for innovation, which implies changing how things are done. There is an inherent tension between organising (for better control) and innovating (for other forms of improvement). In such a scenario, change is usually very difficult, as it affects power relationships, which are very strong and inhibit cross-hierarchy involvement and cooperation.

But as the focus of governance shifted towards "citizen-centricity" and organisations began to view themselves as "facilitators" and "service providers", a paradigm shift in approach took place in the 90s. The emerging interdependencies and hyperconnected environment brought in new approaches to tolerance and management of risk in relation to innovation in the public sector. Innovation is quintessentially about learning new things, which is a process involving risk, because not everything works as predicted. Innovation, by its very nature, means investigating the unknown areas in order to seek meaningful outcomes.

Typical government organisations innovate linearly and cautiously, drawn too often into safe and minor changes, but unfortunately, that is not always the best way. Organisations which are seeking to go beyond the edge of the known world must be prepared to find some paths that may lead nowhere. This tolerance and experimentation is important, as long as such paths are recognised fast enough to prevent any excessive waste of resources or other negative outcomes. Perhaps by modifying their risk management processes and attitudes, such organisations can quickly identify what is not working and close the project as soon as it has captured effective learning, thus minimising the expenditure of resources and risk exposure. At the same time, accountability, audit and inspection regimes need to be sympathetic to well judged risks.

Alignment to Development Outcomes

India has strong inherent context for innovative activity such as the presence of a competitive private sector, strong technology base, democracy, diversity, a vibrant capital market, young population, thrust on reforms and positive policy interventions from the government. India has to translate its innovation potential into cost effective, high value products and services. More so since the resources are limited, context-specific innovation linked to outcomes is the way forward. Michael Porter once said, "Innovation is the central issue in economic prosperity." But despite this realisation, innovation is often not understood properly nor managed efficiently, perhaps due to the lack of clarity on the process. First of all, the inputs that go into the innovation process at the concept stage are not clearly defined. There is a scope for creativity there. However, this creativity has to be aligned to the outcome at all times. The conceptualisation has to be accompanied with effective execution and this is where other parameters such as shared vision, inspired leadership, proper budget and resource allocation become important.

Innovation is a process, and as such needs to be aligned to the development outcomes such as better education, health, natural resource management etc., by the public sector. It also needs to be driven by intangible needs such as convenience to citizens, user friendliness, accessibility, as well as those related to governance aspects such as transparency and accountability. Technology is merely a tool. This brings us to the concept of ODI (Outcome Driven Innovation) where this process should focus more on the effectiveness of public services rather than its efficiency only.

Efficiency in techno-centric parameters may lead to effective governance if applied to appropriate goals. To become a meaningful agent of modernisation of public service delivery and modern governance, e-Governance must abandon its technological bias and focus on socio-cultural transformations. The innovation process should focus on the long term impact on development through

public services such as eradication of poverty, universal primary education, empowerment of women, environmental sustainability etc. The aspiration to reinvent requires you to realign your aspirations with the stakeholders-and that is where the entire process is outcome driven.

For Fire Alert and Messaging System (FAMS), the damage from forest fire for each incident and the accurate reporting of fire incidents were identified as the key outcomes. The damage from forest fire (in terms of burnt area per fire) has reduced by up to 40% for each fire incident after the implementation of the FAMS project. This is because timely information on the fire helps to respond faster and reduce damage. Also, the system is able to report more than 95% of the fires in real-time and send online alerts. This has improved sensitivity to the forest management. The system maintains database of fire locations which is used to identify fire sensitive zones scientifically and management planning of fire control operations.

The activities of the Aarogyasri Healthcare Trust and the awareness campaigns by the district administration have helped in early detection and disease prevention. They have also helped build health awareness in the State. As the entire patient data of people attending the health camps, treatment at network hospital, and treatment details of the beneficiaries approved under the scheme are captured online, the creation of this huge database of the population has enabled the state to use it for disease-mapping and further planning.

Exploitation-Exploration Dilemma

As we walk down this lane, we face many dilemmas and perils, each having its own story to tell. History is an extraordinary teacher; its most important lesson perhaps is the identification of the fountainhead of wealth and progress. While reviewing the tides of civilization from the ancient times to the present, we reach an irrefutable conclusion: freedom and knowledge. A mind that is free to explore, experiment, and learn, drives wealth creation and progress through the acquisition of knowledge. An enslaved mind does not.

Roger Martin (2009) uses the concepts of exploitation and exploration to differentiate two different cognitive and behavioural frameworks. Exploitation is about *milking* the current state of knowledge. It includes honing and refining current formulations; however, its primary concern is obtaining big results within the current knowledge frame. Exploration, on the other hand, is more about discovering new frontiers, new knowledge. It is about graduating from the current knowledge level to the next orbit. While exploitation begets mastery over existing base, exploration feeds on originality and innovation. Without exploration, innovation is not possible. In an exploration depleted environment, when the exploitation-related progress has reached a plateau, personal and professional

growths also come to a complete standstill. The way forward, therefore, is clear. For bureaucracies, however, making incursions into exploration, or even minor experimentations, may not always be easy. *Sometimes a delicate mix of ingenuity with a dash of audacity and risk-taking is required to break the bureaucratic spell.* It has often been observed that some of the most daring bottom-up innovators manage to use every single opportunity to advance their innovation agenda. They do not hesitate to use all tactics within their control and more, whether it is just by being alert and listening attentively to others, keeping their minds open and stimulated or seeking exposures to new experiences.

If You Want to Think Big, Start Small

This is the eye-catching title of chapter 38 from Alan M. Webber's "RULES OF THUMB; 52 Truths for Winning at Business Without Losing Yourself", where Alan tells us about the now legendary story of Muhammad Yunnus and how it all began. From a small $27 loan to liberate 42 people in the village of Jobra, India from loan sharks, the endeavor fusilladed into the Grameen Bank and a Nobel Prize. In Alan's words, "... *Yanus didn't set out from home one morning with the goal of ending poverty in Bangladesh or raising tens of millions of people around the world out of poverty. He wasn't thinking about starting a bank or a social movement. He certainly wasn't game-planning to win the Nobel Peace Prize. He saw a woman in a village who needed help and, decided he could not not help her.*" Rule 38: *If you want to think big, start small* is the mantra for all grass-root innovators. The moot point is: if you feel passionate enough about something and have the drive, just do it. Welcome experimentation, welcome risk-taking. Do not over-analyse or over- engineer a solution or wait for perfection to happen. Alan's advice is succinct and crisp: "*Start small. If it works, keep doing it. If it doesn't work, change what you're doing until you find something that does work.*" Grass-root innovation is all about starting small. We need to constantly remind ourselves, in the heat of the battle, to never underestimate the repercussions of small actions. When deftly positioned, it resonates powerfully.

Top-down vs. Bottom-up Approaches

There can be many ways to trigger changes in the public sector. In what has been loosely termed as the "top-down" approach, the basic ideas, directions, project objectives, guidelines, information, plans and fund processes—all are provided by the top management. Clear and concise communication of the project leader's expectations to each participant is important, as any ambiguity would open the door for confusions and potential failure. The specific change is prescriptive and is usually driven by regulation. The processes are likely to be tightly controlled, inflexible, imposed. Since consultation is usually limited, there may be a distance

from the ground realities, which may lead to bottlenecks and wastage. It may fail to inspire or motivate the implementing team, and may leave behind a litany of missed deadlines and budget overruns. But on the positive side, being centrally driven, it may have better co-ordination, vision and overall supervision. This system is seen as idealistic at best, and difficult to use or impracticable, at worst.

The "bottom-up" approach, on the other hand, implies proactive team involvement in the entire lifecycle of the project execution process—from the genesis of an idea to its incubation and its eventual roll-out. Team members are deeply involved and may even plan the course of action and decide the milestones. It has the advantages of being flexible, agile, team-driven and collaborative. The bottom-up (local innovation) is a decentralised process as the innovation comes from the employee/citizen and is validated at the field level. Sometimes the advantages of relevance to context, need-based results far outweigh any inefficiency that may be created by duplication, lack of co-ordination or "frog-in-the-well" approach. Sometimes it is also observed that better connections with the citizens is key to making this process more sustainable, to have continuous stimuli for course-corrections and steering efforts in the right direction. In any case, this is really about letting people inside and outside government have the freedom to speak, interact. It is about giving them the tools, the ability to use them and the time to make innovation happen.

Citizen Engagement

Technological advances provide the opportunity to the governments to organically and systematically open spaces for the voices of citizens to be heard and their proposals channelled into solutions that are appropriate for the majority. This requires serious considerations to be given to the feedback and flow of information between the citizens and the government. Through effective citizen participation, it is possible to open channels to jointly build fairer service delivery systems and development conditions as well as an environment conducive to the full enjoyment of human, social, political and economic rights. Clearly, the promotion of access to information, transparency, accountability, and the battle against governmental and institutional corruption through the use of ICTs, provides opportunities for a more active, intentional, prepared and participative citizenship as well. This also enables their participation in the individual and the state decision-making processes, which reinforces democracy and generates an era of openness as opposed to one of secrecy. If we succeed in enhancing the capability of citizens to engage with the governments—by increasing their levels of awareness, their capacity for participation and social action or control, their monitoring or oversight—we would open up another channel for idea generation, which could tilt government decisions in favour of the collective well-being.

SUCCESSFUL EXECUTION

The successful execution of an innovation is equally important. Many a times, it is the faulty execution and not the flawed strategy that beats you. Execution is about creating a group of shared priorities and channelling the combined passion and energy of a workforce toward the few things that would make the biggest impact on an organisation. For this, a shared understanding of the organisation's priorities is important. The complexity of multiple goals can also be overwhelming. The first need for improving the organisation's performance is to identify and communicate a few select goals at every level. This needs to be followed by a "strategy to behaviour translation" at every level. A knowledge community can facilitate informal interactions with the various stakeholders with sharing of best practices and critical reviews of initiatives and programmes.

The NI-On project revolutionised the concept of open distance learning in India. The NIOS helped improve governance through innovative design of educational processes. Its pan India network today provides easy access to education to those who have dropped out of the mainstream of education. It plays a critical role in the government's role of bridging the digital divide and stands apart as a case of flawless execution.

Critical Success Factors

Almost a decade ago, Borins (2001) undertook an exercise, which was unique at that time, of conducting the largest empirical study of innovation in the public sector to date that also provides a cross-cultural perspective on innovation, surveying over 300 such government programmes around the world. His research has been able to provide an evidence-based analysis of what makes successful innovations in the public sector. Of the 300 programmes covered by his study, five shared primary characteristics which emerged as the key building blocks and tools for change of successful innovation: (i) systems approach, which encapsulates systemic analysis and inter-organisational co-ordination with the provision of multi- faceted comprehensive services; (ii) use of new technology to catalyze this effort; (iii) process improvements for making the public sector processes faster, friendlier and more accessible; (iv) involvement of the private and/or voluntary sectors in various partnership models to achieve public purpose; and (v) empowerment of communities, users/citizens and employees in improving public services and policy making, making it more participatory. Borins further goes on to prescribe the enablers which support innovation culture in public sector, which are—support from the top, encourage and value innovative individuals and teams, earmark resources for such activity, ensure

diversity of staff in terms of backgrounds and competencies to foster debate and discussions for stimulating minds, and learn about such novel efforts from the external environment, through benchmarking, professional networks, etc. These findings are valid even today.

While analysing the "enablers" for good innovations, it is observed that while support from the top is extremely critical, project champions too play a distinct and significant role. Although innovation is contingent not only on individuals but also on a much wider range of factors such as organisational design, structures, cultures, working practices, etc., evidence does suggest that some individuals are more adept at introducing and supporting innovation. "Innovation Champions" are usually individuals who view their role broadly and have a good grasp of the issues that affect their organisation; can convey belief in and enthusiasm about the proposed idea; have extensive strategic and relational knowledge and are able to enlist the support and involvement of key stakeholders; use both internal and external sources to scout for ideas as well as formal and informal selling channels; and see new ideas as opportunities and not as threats.

Another important factor is the presence of full range of requisite skills at each stage of the innovation cycle. For example, at the first stage of generating ideas there is a need for enhancing one's understanding of citizens using a variety of applied sciences, modelling and "what if " scenario building, as well as learning through listening and partnership working. At the stage of managing innovation, the skill range required is rather different, in that, one should provide leadership and vision, develop reflexive practitioners, build innovative clusters and networks, expand one's understanding of organisational culture, structure and dynamics, use systems theory to analyse complex changes, etc. Project planning and risk management skills are also crucial at this stage. Then again, at the stage where innovation is being diffused and lessons drawn and adopted, the skills required include diplomacy and persuasion, communication and marketing (including social marketing), creating conditions for incentivising the uptake of success stories and assessment and evaluation to identify and measure this success.

The requirements at the 'innovation creation and implementation' and 'innovation adoption' stages in an organization are different (AbuJarad and Yusof, 2010). The culture in innovative firms (firms that come with a new idea and implement it) is different from the culture in firms that adopt innovation. The culture for innovation adoption may not be risk ready because of the adopted innovation's demonstrated success beforehand. The flow of information within the organization that adopts innovation is relatively less than in organization that creates innovation. The requirement of integration between different departments and exchange of ideas is higher in case of innovation creation than in case of adoption of innovation.

It is also strongly advised to have a fresh perspective by looking at the best practices, whether within the country or internationally. The external outlook facilitates learning from other innovators through benchmarking, networking, scanning of external environment and customising to our context-specific requirements. For any such effort to be based on ground realities and addressing a felt need, it is crucial that due attention is paid to the views of all stakeholders, including users, staff and middle managers. To the extent possible, involve the end-users at all stages, for example, in the design and development of prototypes for the early identification and remedy of faults.

The ability to spot gaps in service provision or modes of delivery is essential to spark off public service innovation. This must be combined with an ability to act, that is, either through a clear legislative framework or a programme design which empowers actors to be creative in implementing a policy. This could translate into using the right political circumstances when they present themselves or the good offices of a political leader with a reform agenda, which would adopt and spearhead the new idea. If the project so requires, necessary changes must be introduced in the relevant legislation or regulations, for ensuring compliance. Many a times, this one step acts as the catalyst for the re-engineering of the government processes, in one single stroke. This is what happened in Karnataka while launching the successful project of *Bhoomi*. However, this should be viewed as just one cog in the wheel, as one needs to develop adequate control mechanisms and support governance structures with defined processes and procedures, agreements and other legal arrangements. Effective cross-departmental or cross-service collaboration also facilitates the introduction of innovative services, especially when combined with effective communication between all levels of engagement with service users on the ground in order to provide services tailored to their needs.

Capacity Building

One of the main concerns while dealing with wide scale implementation and management of e-Government projects, is the presence of adequate level of human capacity in terms of the availability of skills and capacities within the government, in the private sector as well as e-literacy of the citizens. The experience of implementing e-Government projects has shown that the human element is one of the most critical success factors in its success or failure. To grow and adapt to an environment where change is the only constant , the e-Government leadership must recognise the value and contribution of the people.

Many good projects have not able to see the light of the day due to lack of champions who have the right skill sets, knowledge and aptitude and leadership

qualities. Sometimes, the government staff lacks the ability to conceptualise and design the appropriate financial, technical and business models. The deficiencies in project management skill results in unrealistic scope and time and cost overruns. The lack of institutional mechanisms to drive and sustain these e-Government initiatives further complicates the matters for the government decision-makers.

But capacity building goes beyond merely training the personnel, hiring new people/consultants, setting up new institutional mechanisms or delivery structures or partnerships, undertaking study tours to learn best practices, skill development of staff on new hardware/software, enhancing the existing skills and competencies, building core competencies which are knowledge-based (technical and professional skills like financial management, change management and process reengineering, program/project management), building skill-based communication (ability to share that knowledge), or building interpersonal skills (ability to motivate in a group leadership and teamwork environment). It is about the larger goal of nurturing ICT sensitised and equipped businesses and corporate sector with a social conscience. And more importantly, it is about empowering our nation through ICT literate citizens to eventually leverage on the e-Government solutions to make their lives comfortable and build a renewed relationship with the government.

Horizontal Transfer

From a national perspective, there is a case for advocating a centralised approach for areas having similar processes or outcomes, where the Central Government conceptualises the project and defines its scope and the implementation is handled by the states or local agencies after making changes for local variations. This approach conserves the planning resources, introduces consistency of quality and design and leverages the collective knowledge with an international perspective. Alternatively, in another approach, the trigger is provided by the states or local organisations which develop new ways of dealing with old problems. There is, however, some merit in the second approach also, as it leads to diverse experiments—which are essential for introducing variations and robustness. This is especially important for India, where diversity flourishes at the local level—in language, culture and resources. The replication potential of some decentralised innovations at the local/state level may be very high. For example, the Madhya Pradesh Forest Department FAMS application has been adopted by the Forest Departments of Himachal Pradesh and Rajasthan. Organisational mechanisms such as conferences and workshops can facilitate this dissemination and diffusion.

We need more and more such cases for adoption and replication across all states, for horizontal tranfer, to extend the outreach to all citizenry as they demand higher quality and more efficient and effective services.

The Mobile Technology based Reservoir Management system in Andhra Pradesh has altered the way water management is monitored across the state and is now being followed in Rajasthan. The immediate benefits include enhanced accountability of the field level engineers in providing water to the tail-end areas and substantial reduction in the number of complaints from the users. A feeling of satisfaction and inclusion prevails, as farmers now receive information, which was not available to them earlier. This sense of ownership has enhanced the responsibility towards better water management amongst farmers.

Neither the centralised nor the de-centralised approaches can be categorised as good or bad. A balance between the two approaches, adopting the best elements from both, would work well for the government. While centralised control and inter-organisational collaboration are advocated, there is some merit in utilising the collective wisdom of the internal team and facilitating delegation. Similarly, clarity of project goals and visibility of internal organisational processes are both crucial to success. The centralised approach confers the advantages of standardisation, economies of scale and eliminates the wastage of scarce resources in duplication of efforts. Any decision to combine both may depend on the capabilities of the organisation concerned as well as the replication-potential of the initiative. Some new concepts have already been recognised for their possible multiple uses. For example, Chattisgarh and Gujarat have state level GIS centres which identify opportunities for the deployment of this technology in various sectors across the state. Madhya Pradesh is also establishing a similar centre. Similarly, it is also proposed to establish a core group for GIS at the Central Government level for the same purpose.

☙ INSTITUTIONALISATION MATTERS

Fuelled by Ideas, Driven by Culture

"We are what we repeatedly do. Excellence, therefore, is not an act but a habit."

Aristotle

Fostering a culture of "thinking-out-of-box" has been prevalent in the State Government of Gujarat, which had introduced a scheme called "Swatah Sukhaya" meaning "that which gives pleasure or satisfaction to self " several years ago. Under the aegis of this scheme, young bureaucrats of the Gujarat Government were given a small fund for experimenting with any novel method for enhancing public service. The efforts that were adjudged the best every year were presented before the entire administrative machinery of the state, including the Chief Minister and his cabinet, in their annual "Chintan Shivir" or retreat camp. They

were also awarded in this forum. This had proved to be a very effective incentive and had fostered the culture of innovation in this state.

For developing an innovation culture, a well-reasoned level of risk-taking has to be accepted. Can we have a formal mechanism for incubating, prototyping and managing risks? Lack of adequate testing can be costly. However, prototyping and piloting become more complex, larger the system and more inter-connected its elements. Can we have a formal experimentation and innovation fund, like the venture capital, which supports good ideas and recognises the innovators in government?

Recognition

Innovation is a process, but it is not self sustaining; rather it requires extensive leadership to establish the organisational capacity to foster idea experimentation and tolerate "smart failures". It is important to create an innovation-centric culture in which everyone shares the freedom to learn from mistakes and succeed. This has to be a learning culture as well, with clarity on what gets rewarded. There is a clear connection between effective recognition and business outcomes. Recognition must be timely, specific and frequent. Transparency in these processes and decision making must be ensured.

✦ KEY TAKEAWAYS

Documentation and Experience-Sharing

Even though we focus on various aspects of innovation like generation of ideas, its incubation and pilot-runs to manage associated risks, roll-out, scaling up and replication, the most neglected elements in the entire process i.e., analysis and evaluation, are experience-sharing and debate. Innovation requires robust system of evaluation of innovative policies and programmes, for which appropriate metrics and approaches must be developed. One key aim here should be to promote both real-time and double-loop learning as far as possible, so that the main lessons drawn from a particular innovation are fed back to and inform policy and practice in an effective and timely way.

There is also a need to develop organised knowledge management systems and processes which give information on what worked and what did not work. New ideas emerge most frequently as a result of collective knowledge. Failures also have many lessons to teach, and their analysis contributes significantly in making a success story. The internal and external networks of an organisation have to be well-developed for information to flow freely, both within and outside. Networking and sharing of knowledge is another valuable technique for

uncovering and incorporating innovative ideas, albeit many in the government have difficulty with this method of hybrid thinking. It complements logic-based methods with intuitive methods that may work well in complex situations. They are particularly useful in situations where there is a desire to increase understanding, empathy and informal learning by individuals and allow them to share experience-based insights, to generate meaningful outcomes. As organisations' experiences with innovation processes matures, it becomes apparent that a richer stream of ideas results. People have the opportunity to co-create outcomes by seeing, commenting upon and refining the experiences of others. This strategy of ideation and collaboration exemplifies integrative thinking characteristics and promotes horizontal transfer.

Making People Aware, Making People Adopt

A recent study in the Delhi region has revealed that while most citizens were aware of computers, internet and credit cards, only few, specifically the corporate employees and students, were aware of and were using the online government services, and that too mainly one service, i.e., online railway booking! It is interesting to note the crucial role of citizens' awareness, which has worked as a tremendous pressure point for building up the momentum and ensuring the continuity of the services. Today, the online railway booking service has crossed its critical mass and taken off on its own orbit so comprehensively that if there is any slowdown or disruption in these services, it would lead to a huge public outcry. This pressure of citizens' expectation and demand is needed to be built up not merely for the effective utilisation of services, but also for its continuity and efficiency.

So while we talk of awareness building through multiple channels (including TVs, radio, newspapers/magazines, e-mails, SMSs, advertising across the counters or on billboards, on the paper bills etc), the government also needs to teach the citizens how to use these services. The Tax Return and Preparer Scheme is a case of effective government interventions to create awareness and promote compliance at the level of small tax payers. Such initiatives can improve the uptake of government services.

Whenever the citizen chooses electronic delivery of government services over their traditional delivery, it may be considered as a *technology adoption* decision. Among the many variables that influence the adoption or rejection of information technology, two are especially important. First, people tend to use an application to the extent they believe it will help them perform their job better— which may be referred to as "perceived usefulness". Second, even if the potential users believe that a given application is useful, they may find the system is too difficult or too complex to use and that the performance benefits of the usage are outweighed by the effort of using the application- which may be their "perceived ease of use" or

"user-friendliness". (Davis, F. Technology Acceptance Model 1989). Both these factors require the focused attention of the implementers.

Apart from improving perceptions of the reliability and appropriateness of the information, the government could use the service encounter as an opportunity to make an impression in the minds of its customers as they evaluate service quality. The way in which customers are treated has a direct impact upon their perceptions of satisfaction with how the service was performed, especially as they compare it to the situation in the past. It would be an astute move for the governments to use this to their advantage.

System-Driven

This would also address another common phenomenon observed in many e-Government projects, which is over-dependence on an individual, the leader. It is often seen that behind the premature closure of many successful ventures, the factor responsible is the departure of the project champion. In such a scenario, the successors have a very natural human tendency to either ignore or denigrate the work, and move on to different areas. As transfers of officers is the normal way in bureaucracies and due to the frequency of this eventuality, it is important to recognise it as a "phenomenon" which requires to be addressed. Therefore, for the sustainability of these projects, there is a case for setting up permanent institutional arrangements, just as there is a case for building an unequivocal citizens' demand for the same. This would enable us to transition from an "individual-driven" era to a "system-driven" one, wherein the project has crossed the critical threshold and picked up its own momentum.

As the e-Government process matures, a responsible government should adopt a future-oriented perspective on the sustainability of the e-Government strategy, for meeting the demands of its citizens through a long-term commitment to e-Government development. Project design and planning standardisation are the necessary conditions to achieve sustainable and viable e-Government solutions. The implementation needs multi-faceted cooperation of many actors and stakeholders, including policy makers, public officials at different levels, technical experts, and project managers. In this quest for sustainability, the non technical elements of project implementation are most important and include knowledge transfer, proper engagement of actors, correct analytical planning, ability to diversify, and relation to the ultimate goals.

Policymakers should bear in mind that the sustained implementation of an e-Government initiative also depends on the resolution of the other critical areas like the political, legal, and economic issues. This implies that the design of an e-Government implementation policy is not the sole responsibility of technocrats, system developers and information planners. It is important that

they respect the multi-layered and complex character of these policies, which calls for the involvement of other professionals and stakeholders. Policymakers should focus not only on the content of agreements but also on the structure and quality of the relationship between the project's participating actors. They need to be aware of the political nature of infrastructure development because the design of an e-Government infrastructure may imply that the access, distribution, and use of information (and thus, power) may change.

Collaboration and Consolidation

Work handled by government departments or ministries in most countries has traditionally been organized on functional basis, a structure which has allowed a culture of siloed information and siloed thinking to develop, where collaboration across organisations has rarely happened. This manifestation of silo syndrome breeds insular thinking, redundancy, and suboptimal decision-making. Managers focus on guarding turf rather than on sharing and cross-pollination of ideas, which can lead to positive consequences. Silo syndrome is a vicious cycle that can cost an organization in agility, productivity, and responsiveness, and may have many adverse side-effects not merely for the organisation but even for the country as a whole.

The need to break these silos, wherever required, cannot be over- emphasized. The time has come when a serious and focused attention needs to be given to this issue. By promoting horizontal thinking, we can create the most fertile ground for innovative thinking, which lies at the borders between sectors. But these grounds become fertile only if the borders are permeable rather than impenetrable. When creative people from different disciplines are brought together to discuss challenges, the infusion of different perspectives to resolve any issue, prepares an innovative-ideas-breeding ground. This is a pattern, repeatedly observed. Technology may have provided the opportunity for governments to re-invent themselves, but interestingly enough, it is not technology that affects innovation. It is the humans and the organizations we are a part of, that are both stubbornly resistant to experimentation and change and collaborations.

The collaboration efforts can have multiple facets. They can be related to cross-sectoral collaborative organization of government businesses, with the citizen at its centre, kind of approach. These efforts could be focussed on putting appropriate linkages and information sharing in place between government and organisations to provide seamless single-window services to the end-user. The efforts may also be used to work on cross-sectoral application of technologies and defining processes, through standardization techniques.

To harness the full potential of relevant technologies, governments should identify those technologies that have application across sectors. For example, we see the creative use of GIS mapping technology in the Decision Support System

developed by the Irrigation and Command Area Department (I&CAD) of Government of Andhra Pradesh, integrated with mobile technology and remote sensing (RS) technology, for effective management of water resources of the state. GIS and RS technologies are also used in the Property-based Tax System of Bangalore, Disaster Management Information System of Maharashtra and Rural Road Development Agency's project in Madhya Pradesh. This illustrates the sector agnostic nature of technology. Similarly, use of mobile telephony, e-mails or social media for quick and direct communication with the citizens is another example of cross-sectoral use of technology, which should not just be recognized as such, but also actively promoted by the governments to extend its outreach. Agencies or institutes should be set up to develop processes and tools for its multiple usages regardless of the sectoral silos or state boundaries and simplify its adoption by formulating simple guidelines.

Another dimension to this problem is the fragmentation and duplication of the good efforts, which needs to be collated and consolidated to be effective. This may be done trough proactive collaboration, by building multiple networks and channels to facilitate flow of communication, information and data sharing. For example, many areas of service delivery are common to all the States, but the quality of its delivery varies hugely across them. Some states have already successfully implemented user-friendly applications which are transforming the lives of their citizens by providing efficient and cost-effective services, while others are struggling. If we are to ensure a basic minimum common level of public services all over the country, we must consolidate our efforts. The remaining states would do well to follow the well-trodden paths engineered by those who have ventured forth earlier and emulate them.

Furthermore, the different organizations should look at their inter-linkages, and open communication in areas where considerable value would be added to their endeavours if they can share relevant data and enrich the user experience. Whenever possible, provide a one-stop-shop to the citizen, who is the center of all these efforts. Once we align the government business to meet the citizen's needs and ensure uniformity, it would be within the realm of possibilty to build national data grids, which are fed data by all the states-and this data could be processed to inform the policy decision making at the national level or even help assess the fund requirements of the states by the Centre.

The foundation of any successful venture is the focus on the final outcome. When individual organisations transform- the state grows, the nation progresses.

Summary Riposte

Senior leadership must take responsibility for creating an "ambidextrous organisation"- which is not only effective in getting today's work done, but also in

anticipating the future! This is a tall order and requires smart strategies. To begin with, focus on what matters, that is, use the innovation to address a real political and business priority, steer it in the appropriate strategic direction. There should be a strong sense of ownership and committed leadership by at least some of the key stakeholders. The key is to focus on satisfying key user needs. Minimise or contain real and perceived risks associated with the failure of the initiative. One of the strategies could be to limit the scale or scope of the innovation, so as to not attract strong attention and resistance until signs of success can be shown. This usually takes the form of a pilot or a trial to test out, prove and adapt the initial ideas appropriately, with the intention of then extending the innovation.

Next challenge is in team-building. Create a core of committed team members who are passionately committed to what they are doing and believe in creating real value. Such people put in extraordinary efforts to succeed, showing great persistence and resilience in addressing the sometimes enormous obstacles to acceptance and change. Avoid areas of "rule and hierarchy" domination, as sometimes it is easier to get an innovation in place when it involves adding a new practice, rather than trying to change an existing one. Another important facet is to develop a consistent process to foster innovation, to recognise the opportunity in an idea and to nurture it. The organisation may not always know where it will come from, and sometimes, worthy innovations are discarded because they went to the wrong person to begin with.

It would be useful to remember that it is not always about technology. Successful innovations almost always require organisational and process changes rather than simply technological change, and it is vital that the implications beyond technology are clearly understood. Technology is more an enabler of innovation rather than the innovation itself.

🍃 Fresh Fingerprints…

"A journey of a thousand miles begins with a single step"   **Laozi**

The present collection of case studies chronicles the experiences from the government, and provides keen insights for anyone who wants to understand the complex dynamics and interplay of different factors within the public sector- whether he is a practitioner, an academician, a policy maker or just an interested person. It is observed that even though a substantial body of research exists in the area of innovation, there is a significant knowledge gap on the public sector, perhaps due to insufficient quality research on the subject. Good and comprehensive research on the public sector domain, especially on the role innovations can play, is the need of the hour. The government's scale of operations and its reach, and the impact it can have on the society at large, particularly on

its vulnerable sections, underscores the need for this effort. In this backdrop, this collection of authenticated innovation case studies, from the project champions themselves would be the elixir that can inform all and rejuvenate countless other projects.

Mahatma Gandhi had once remarked, *"The difference between what we do and what we are capable of doing would suffice to solve most of the world's problems"*. This book documents how Gandhi's advice has been internalised by a few. The discerning observations and wisdom from these projects, the analysis of "hows" and "whys" and "why nots" and "whens" of an innovation, the diagnosis and the prognosis, makes for fascinating reading. What are the critical success factors? When is the critical mass achieved? We discovered a complex interplay of a host of issues like political support, able leadership, team-building, ideation, right skill sets, resources, legislation, policies, infrastructure, appropriate focus and many others, which unravel as you go through these cases.

We invite you to unfold this treasure and take time to savor the journey of the personal calling of each individual, that is as unique as a fingerprint - and to discover what they have believed in, and how they then find a way to offer it to others in the form of service, working hard, allowing the energy of the universe to lead them...

Fire Alert and Messaging System

Anil Oberoi, IFS

Forest fires not only cause immense damage to forest and wildlife but also threaten the biodiversity. Thus, management of forest fires is vital to the forest department. The Madhya Pradesh Forest Department (MPFD), devised a solution through the Fire Alert and Messaging System (FAMS). FAMS helps in identifying the exact location of the fire using the Geographic Information Systems (GIS) and Remote Sensing (RS) technologies. Then, it uses mobile technology to send instant messages of such an occurrence to the frontline field staff and officers. It helps in the identification and delineation of fire-prone forest areas. FAMS has helped to create a spatial and temporal database of the fire-prone locations and helps to monitor the extent of the burnt forest area which can be used for planning resources. The system is the first of its kind in MP and is being gradually replicated in other States.

1.1 HISTORY

Forest fires pose a threat not only to the biodiversity but also to the economic health of the countries where they occur. Although they may vary in intensity and impact, they often result in significant degradation of forest lands, exacerbate poaching and wildlife trafficking, threaten the livelihoods of forest-dependent people, and may be closely associated with organised crime rings that contribute to official corruption. In its most extreme form, forest fires result in the large scale destruction of forests and the release of significant amounts of carbon into the atmosphere.

As per the latest "State of Forests" report of the Forest Survey of India, the actual forest cover of India is 19.27% of the geographical area, corresponding to 63.3 million hectares (ha). Only 38 million ha of forests are well-stocked with a crown density of above 40%. This resource has to meet the demands of a population of 950 million people and around 450 million cattle. On a larger map, our country has to meet the needs of 16% of the world's population from 1% of the world's forest resources. The same forest also has to cater to 19% of the world's cattle population.

The forests of the country are therefore, under tremendous pressure. Forest fires are a major cause of degradation of India's forests. While the statistical data on losses due to fires is inadequate, it is estimated that the proportion of forest areas prone to forest fires annually, ranges from 33% in some states to over 90% in some others. About 90% of the forest fires in India are created by humans. In India, forest fires occur mainly during the period from February to mid June. India witnessed the most severe forest fires in recent times, during the summer months, in the hills of Uttar Pradesh and Himachal Pradesh.

The Forest Survey of India's data on forest fires, marks around 50% of the forest areas in the country as being fire-prone. This does not mean that the 50% of the country's forest area is affected by fires every year. Only 6.17% of the forests are prone to severe damage due to fire. In absolute terms, out of the 63 million ha of forest land, an area of around 3.73 million ha can be presumed to be affected by fires annually. In monetary terms, this loss is estimated to be approximately ₹ 10 million annually.

The State of Madhya Pradesh has the largest forest area in the country, spread over approximately 95,571 sq km. This is around 12% of the national forest area. The records of the active fire locations and the area burnt, are neither reliable nor do they reflect the ground realities. Though the strategy to combat forest fires is well-defined in the state forest manual, the means to effectively follow the strategy were never made available. Therefore, combating wild fires remained a neglected area. Since the focus of forest management was only revenue realisation, only the highly productive forests were protected from fires. The responsibility to protect the rest of the forests rested with the local villagers who were duty bound to assist the forest department without any remuneration, when a fire occurred. As time passed, people became conscious of their rights and privileges and the system became ineffective. The department issued instructions from time to time as per the changing scenario. However, the many administrative, technological, and socio-political loopholes did not allow the fire control measures to be implemented.

In 1999, the Supreme Court of India, in a writ petition by an NGO, prohibited the felling of trees throughout the nation. In a landmark judgment, the Court ruled that no work in the forests would be allowed unless a working plan for the management of forests was approved and ample resources were made available for the protection and preservation of the forest development activities. This brought a paradigm shift in forest management and the focus shifted from revenue generation to forest protection. As a result, fund flows for the protection activities grew enormously.

1.2 Problems in the Conventional System of Fire Handling and Detection

The conventional system required the registration of the occurrence of fire as a preliminary offence report, because fires were generally regarded as being man made. Then the case would be investigated and action taken depending on the outcome of the findings. If the offender could not be traced, the loss from the fires would be recovered from the concerned forest guard. In order to save themselves from the penalty, the frontline officials started the practice of hiding fires and avoiding the registration of their occurrence. Slackness on the part of the supervisory staff to detect and check the documents with respect to the registration of fires, gave confidence to the lower functionaries to not disclose the fires. Consequently, over the years, fire management became a casual exercise with inadequate resources. Rather, fires became a tool to hide the illicit felling and removals from the forests. Compilation of fire data at the regional and the State levels was never endeavoured. Moreover, lack of accurate detection of fires and their reporting to the nearest base camp to initiate control operations, were also major constraints in the effective management of fires.

In the legislative and parliamentary sessions, questions are usually asked to the State Forest Department about the number of forest fire incidents and the losses due to them. Every time information is sought from the field officers, and seldom is reliable or authentic information received within the specified time period. Sometimes even the compiled information is different for the same period. The reason is simple. No proper database is maintained and updated nor are any proactive initiatives taken to compile this data at the State level. Retrieving or building information from the records which are not readily available, is a time consuming exercise. It is also not reliable because many a times, fire is used as a tool to hide illegal activities.

Given the vested interests, lack of facilities, complex and cumbersome processes, and the   slackness of the management, official record keeping, not only of the forest fires but of other important forest-related data, remained a distant dream or a nightmare for the forest officials.

✿ 1.3 Planning of the FAMS Application

Detection of forest fires in their early stages and reduction of the response time to combat fires, remains the main concern of the natural resource managers. The requirements of forest fire management stand at three different levels namely, pre-fire (preparatory planning for fire control), during-fire (fire detection, spread and control planning) and post-fire (damage assessment and mitigation planning). These requirements can only be met from the comprehensive, spatial and temporal data of different dimensions, obtained from the satellite and ground-based sources. The role of various scientific organisations and forest departments is therefore, very critical. No integrated effort has ever been made to bring all the available resources together, on a single platform, to assist the user groups to effectively control forest fires.

Traditionally, formats were prescribed for monitoring all the major forestry activities. The different types of information to be maintained by different levels of administrative units were mandated. The information was properly and regularly updated and made available as and when required. With the passage of time, the process of seeking information gained momentum. The last decade witnessed a general increase in awareness. Thus pressure started building on the Department to maintain more and more information in a variety of ways. There were no changes in planning the data structure of the department and the historical system almost collapsed at all the levels of administration. Consequently it started taking a long time to compile or construct any data. Only the most urgent type of information, such as the information required by the Assembly or the Parliament, used to be compiled. As a result, regular updating of information in traditionally prescribed formats suffered. In fact, some of the important information formats went completely out of use. The most striking such format was the APO, i.e., the "Annual Plan of Operation".

The turning point for the forest department was when the IT wing of the department thought of creating an automated computer-based data structure, and the automation of all the key processes of the department became the focus. A decision was taken to organise forestry information in an integrated manner by using the latest technology available. The ICT initiatives were so planned that they ensured smooth integration of multiple technologies such as RS, GIS, GPS, mobile computing and so on, to the best advantage of the department.

Many organisations were consulted. The Madhya Pradesh State Electricity Development Corporation (MPSEDC) and the Madhya Pradesh Agency for Promotion of Information Technology (MPAPIT), two State-controlled organisations, were explored, but nothing concrete came out of it. In the mean time, the concept of e-Governance was floated by the Central Government.

The requirement of the entire department was estimated and a holistic, modular approach and solution was created, giving the major forest management processes, priority. It was decided to have a web-based and workflow-based system, though the connectivity aspect in the country as a whole, was not very good at that time. In order to execute the ICT initiatives, the following three major work groups were identified:

- Development of applications and creation of a data centre
- Development of a computer-based communication network and
- Sharpening of the ICT skills of the manpower

MPAPIT appointed consultants, to carry out some studies for a period of 14 months, costing a little over ₹ 10 million. However, the proposal never saw the light of the day. At this time, the IT wing of the MP forest department took a bold and conscious decision to proceed alone. The head of the IT wing had a good working knowledge of all the aspects of ICT which was acquired during his tenure in ICFRE, Dehradun. It was there that he had established the first wide area network of ICFRE institutions, in the year 1995. This proved to be a big strength in planning the application.

The main objective of the ICT application in the department was to organise the planning, implementation, and monitoring of forestry and other related operations through the systematic collection, storage and retrieval of MIS and Geo-spatial data using a computer-based communication network.

1.4 Development of the FAMS Application

The MPFD used various technologies, integrated in such a manner that they worked in tandem and provided a seamless environment, which was not only secure, but also easy to operate and maintain. The best solution in such a scenario was to create a web-based application framework, which would suit the State Government's broad vision of providing information at the click of a mouse, for the stakeholders.

Web-based applications are generally made in a "client-server" framework. The remote client logs on to a server in a data centre, through the Internet, Intranet or Virtual Private Network (VPN), and undertake his/her business based on workflows. In case of the MPFD, all circle level, divisional level, and range level offices constitute remote clients, while the server is at the HQs. The group of servers in the HQs is the "Data Centre". There are more than 900 remote clients, of the rank of Range Officers and above, using the various applications and workflows, to carry out their functions.

In view of the above, the "Connected Architecture Framework" has been used for the MPFD Server Farm, with an objective to provide a single window access to the

information and services rendered by the various functionaries of the department and to establish a collaborated environment within it. Updated information on the guidelines, procedures, policies, and contacts are now available for the existing employees and other stakeholders. A server farm has been created, connecting various role-based servers (GIS, web, application, database, mail messaging, workflow and so on) to provide integrated accessibility to the departmental users.

1.4.1 Design of the Communication Network

For the success of the client server architecture, it was essential that all the remote users, that is, the functionaries, have computers or at least have access to a computer connected to the State Server Farm. The choice with the MPFD was to either build its own VPN or Virtual Private Network, or use the services of an Internet Service Provider (ISP). MPFD chose the second option since the first one was not only very expensive but would also take a long time to become operational. However, the option selected by the MPFD had some inherent limitations, as no ISP could provide complete connectivity in forest areas. A quick survey was conducted and it was found that Bharat Sanchar Nigam Limited (BSNL) provided connectivity in almost 60% of the villages in forests. Moreover, due to the policy of the Central Government, they were rapidly spreading their network and had prospective plans to cover the entire State of Madhya Pradesh within a year. Therefore, a conscious decision was taken to establish a computer-based communication network using BSNL's services, and a Memorandum of Understanding (MoU) was signed for connectivity at a highly concessional rate. It was also decided to go in for a different kind of technology to provide connectivity in such remote locations where there was no chance of any ISP providing connectivity in the future. The Motorola Canopy Technology was selected to provide last mile connectivity in the remaining areas.

In all there are 43 conservators, 94 deputy conservators, 157 assistant conservators at the forest level and 602 offices at the range level of the MPFD, spread all over the State. To establish a complete communication network from these offices to the HQs (through the State Server Farm), every office would require a computer, a telephone line and internet connectivity. This was a mammoth task and required huge money. Therefore, the implementation was phased out. In the first phase, all territorial and wild life offices which accounted for almost 80% of the MPFD offices, were covered, while the rest were covered the following year.

🍃 1.5 Capacity Building

The following training facilities were created to effectively train the vast manpower resources:

- An IT lab was set up at the HQs, using the latest state of the art technology. This was meant to train the personnel of the IT cell and master trainers. The lab was well equipped to accommodate 30 trainees at a time.

- 16 Regional Centres were set up for the monitoring and supervisory staff. Training at these centres was given from the HQs directly, using a live interactive environment through the Video Conferencing System (VCS). Up to 480 officers could be accommodated in a single training batch.

- 54 Satellite Interactive Terminals (SITs) were established at the divisional level to provide training to all the frontline executives and the ministerial staff. These centres would use the EDUSAT facility of the Indian Space Research Organisation (ISRO). Teaching in these SITs was centralised from the HQs, to maintain uniformity and optimum utilisation of resources. A live and interactive training environment which could accommodate up to 4000 staff in one batch was created. This would ensure quick ICT capacity building of the large numbers of staff.

1.6 FAMS—Objective and Scope

As far as the development of applications was concerned, FAMS naturally became the first choice to begin with. In order to ensure effective fire management, the IT wing of MPFD developed the FAMS with the following objectives:

a. Creating a spatial and temporal data base of the active fire locations.

b. Instant messaging of fires to the frontline field officers.

c. Identification and delineation of the fire-prone forest areas.

d. Monitoring burnt area, loss of life, and property.

1.7 FAMS—The Process

The Fire Alert and Messaging System (FAMS) is a small but very useful computer program which combines RS, GIS and MIS technologies. It makes use of the processed, remote sensing data of the active fire locations and sends alerts to the concerned field staff, right from the beat guard to the conservator of the forest, using short message service (SMS) and e-mail. The system also maintains a database of fire locations which can be used to identify the fire sensitive zones scientifically and in management planning of fire control operations. The response module is designed to collect the field status reports of each fire location.

A similar system, called the Fire Information Resource Management System (FIRMS) was developed and maintained by the University of Maryland and NASA to provide various services relating to fire information and resource management. The FAMS system in India was actually an extension of the services of the FIRMS.

The FIRMS delivered MODIS (Moderate-resolution Imaging Spectro-radiometer Satellite-derived Information) data to various organisations dealing with natural resource management, in more than 90 countries, through e-mails. MPFD went a step further by communicating this data on a real-time basis to the front line staff, engaged in combating fire thereby minimising the response time. The GIS, RS and communication technologies were also integrated into FAMS to deliver instant fire alerts. The system is a prime example of the use of integrated technology in the management of forest resources.

The FAMS process is depicted in the diagram (Figure 1.1) on next page.

FAMS downloads the RS data automatically and processes it. To identify the active fire locations in the forest administrative units, it uses a spatial query over a digitised map of the forests. The system is designed in such a manner that it automatically sends an SMS immediately to the concerned frontline field staff (beat guard, range officer) and other monitoring authorities. The field officers can view the location of the fire on Google maps on their computers, using the dash board available on the departmental website. They can thus plan fire control operations efficiently and mobilise resources at the active fire locations.

After taking the necessary control measures, the field status report is uploaded by the field staff through the computer at the range office. A full report of the location of the fire and the action taken for extinguishing it has to be provided online by the field officers. This ensures prompt action and informed decision making by the different role players in the department.

1.8 How and Why is it an Innovation?

FAMS has brought about a marked improvement in the temporal and spatial database creation process and fire combating performance of the State of MP as compared to other states in the country. MP is the only state that is now maintaining fire data on line on a real time basis, on a dash board. Earlier, fire detection was the job of the field staff and the report was sent to higher authorities. Now, the process has reversed with fires being detected by the satellite and the information being sent to the frontline staff via SMS.

FAMS has altered the expectations of the stakeholders. Earlier there was no information flowing to the stakeholders and they themselves were to detect fires. They can now receive an SMS alert about a fire in their area, on their mobiles. It saves a lot of their time and they feel a part of the team.

FAMS has created a new workforce structure and brought about a judicious redeployment of manpower and other vital resources. It has generated a new relationship between the various wings of the organisation. Earlier all the important wings, especially the production and the wildlife wings, would work

SERVER AT HQ	Active Fire Location (RS Data) Downloaded from MODIS	GEO location of active Fire
	Data processing using customized software	Built using visual basic an ESRI MapObject
	Fire alert messges on SMS	
	GSM/ WWW	
SERVER AT HQ	Receiving by targeted field officer	
	Fire location can be viewed on google map	ASP.net web application
	Action taken & feedback to HQ	GEO position/GIS/images/ text/numeric
	WWW	
SERVER	Main database (SQL server)	

Figure 1.1 *FAMS—The Process*

in isolation whereas now, both these wings work hand in hand. They look up to the alert messages, which is a common service to all the stakeholders including the forest villagers. Thus a greater fraternity and bonding within the organisation has been created.

FAMS is completely a new and innovative need-based idea. It combines the old and new elements in a simple manner. The technology is new, while the strategy and the work force are old. It has helped to solve the problem of managing and controlling forest fires.

FAMS has opened new possibilities in terms of the design and delivery of services. It is a completely new and novel service which has brought relief to both the frontline staff and managers, and also the decision makers. The frontline staff is now assured that whenever there is a fire they will be informed instantaneously, while the managers are assured that the database of active fire locations is being compiled and maintained at no extra effort of theirs.

FAMS has paved new ways to manage the environment/natural resources. It has shown that the integration of various technologies can ease out the monitoring of land-based key programmes and services of the government sector.

1.8.1 Processes and Methods which Facilitated Innovation

The summer of 2004 witnessed rampant forest fires, occurring repeatedly and covering vast areas, because of insufficient rains in the preceding year. These fires

caught the attention of the Chief Minister and the Chief Secretary of the State, during their extensive travels to study the effect of drought conditions across the state. The matter was referred to the Forest Department, but nothing much was done, except to tackle the fires, as and when they occurred. However, this highlighted the need to develop some mechanism to detect forest fires in their nascent stage and to reduce the response time to combat fires, so as to reduce the resultant losses.

A series of consultations with different groups including the staff and the Joint Forest Management Committees (JFMC) was initiated to understand the requirements to combat fires. It was clear that only if precise information about the occurrence of the fire could be delivered to the beat guard and the JFMCs in a short span of time, the fire could be restricted.

The next legitimate step was to find out if there was any real-time solution to knowing the location of active forest fires. Various forestry institutes, dealing with forest fires, were contacted and an intensive search was done on the Internet to get useful information. It was found that the National Remote Sensing Centre (NRSC) was using MODIS data of active fire locations and sharing it with the Forest Survey of India (FSI), which in turn disseminated the data to the various states. However, the data from NRSC to FSI was being sent via e-mail while the FSI was sending it to the states through fax. There was a considerable delay of 3 to 4 days and sometimes a week in this process. Therefore, the information lost its relevance. Further investigations revealed that the MODIS data was being obtained by the NRSC from the University of Maryland (UoM). Therefore, it was felt that if the FSI could also get data directly from Maryland, the delay could be curtailed to a large extent. The proposal was placed before the University of Maryland and they readily agreed to provide the data free of cost. So the problem of data acquisition was almost solved.

However, things were not as easy as they seemed. The real problem arose once the MPFD started receiving data from the UoM. The biggest question was what to use out of the unfiltered data that was provided for the whole country and how to use it. For the MPFD, the focus was only on the forest area of MP. Using the digital boundary map of states which were readily available, the MPFD had to filter the active fire location points in MP. But the concern was confining the fire locations to the forest areas only. For this purpose, a digital boundary map of the forest area was required which had never been thought of by anyone. Attempting this job was the most difficult phase of the project, as this involved the acquisition of all of the 4000 odd numbers of roster maps from the field and digitisation of the outer boundaries of the forests.

A huge operation was launched to achieve this task and the digitisation was completed in a little less than three months. The MPFD not only digitised the

external boundaries of the forest areas, but also that of all the administrative units. This proved to be a wise step at a later stage.

Having done this, the next problem was how to send this information to the field officers and up to what level. Many alternatives were thought out, but in every alternative, the time factor was the main issue. No cost-effective and reliable solution could be found to send the information to the concerned frontline staff in the shortest possible time span.

In the meantime, Dr Madhavan Nair, Chairman, Indian Space Research Organisation (ISRO) was requested to provide the MPFD with some gadget that would help to transmit messages to the frontline staff. Initially, he directed the Space Application Centre at Ahmedabad and then the one at Delhi, and requested the Earth Station in Delhi to assist them. These organisations provided two different sets of equipments but neither was up to the expectations.

What happened next helped the project move further. Search on the internet revealed a practice being followed in China, where GSM connectivity was used to transmit messages. The same day an advertisement appeared in one of the leading dailies, showcasing 6500 IPAQ models of the HP Personal Digital Assistant (PDA). PDA was a GPS-enabled smart phone and had multiple functionalities. The MPFD found it to be the most useful equipment as it could act as a hand-held computer, a communicator with GSM and GPRS facilities, a geo-locator, a camera both for still and video photography and was also capable of hosting both the MIS and GIS applications.

It seemed the ultimate solution was here. A mobile or a PDA with GSM connectivity to transmit messages would be used. Two PDAs which were imported and a few personal mobiles were used for testing purposes. However, the job looked difficult. An integrated application would have to be developed which would not only take care of swapping information with the UoM with respect to the active fire locations, but would also filter the data on a digital map and then, on a forest map of MP. Digitisation of boundaries of the field administrative units came in handy here, as it linked the location of the active fires to the frontline staff.

Although the application was successfully developed in house, making it operational required procurement of a server and mobile phones or PDAs. The server was procured but purchasing mobile phones and PDAs in good numbers, required finances and above all, the sanction of the Finance Department. After a long wait the sanction was obtained. However, the budget from the State sector was not available. The MPFD referred the project to the Ministry of Environment and Forestry (MoEF). A series of meetings were held, a number of presentations made and demonstrations given, including one in a national conference on forest fires, in the year 2006. At last the MoEF provided 75% of the finances and the State agreed to bear the balance 25%.

Thus the FAMS came into existence after a phase full of uncertainties and anxieties. But patience and perseverance paid rich dividends and a very simple yet novel product was delivered to assist the frontline foresters and forest dwellers to combat forest fires.

🍃 1.9 IMPLEMENTATION PROCESS

Once developed and successfully demonstrated, the on-field implementation was a cumbersome process. It was difficult to make the staff understand that alerts would be coming to them on a mobile phone which would show the location of the fire in their belt and that they would have to only make a note of it and take effective measures. Moreover, everyone up the administrative ladder would assist them in planning a fire combat strategy. This was something unheard of in a system which always held the frontline staff responsible for any fire and punished them. A lot of consultations followed, in order to appropriately delegate process functionalities, so that confidence could be generated among them, to use the system well.

They were also skeptical as to whether mobile phones or PDAs would be given to them, since not even senior officials in the State were given this facility. Everyone thought that the whole process was only a dream which would never be realised. However, when the first public event was held to distribute mobile phones and PDAs to the frontline staff, the press and the media covered the news in a manner never witnessed in the history of the forest department. The message that the Government had taken the charge of managing forests in a planned manner and that it was serious in its commitment, was communicated to the nation.

🍃 1.10 CONSTRAINTS AND CHALLENGES

Obtaining the administrative and financial sanctions for the project and seeking budget allocations were the major bureaucratic hurdles. It took almost 2 years to get all the necessary sanctions.

The procurement of highly technical equipments was another big obstacle. The NIC and the MPSEDC, Bhopal, extended their full support to procure these high end equipments.

The most gigantic task was the digitisation of forest maps with administrative boundaries. The job was done in-house in only three months. The ESRI technology was used to digitise the maps, as the licenses were already available with the department. These had been procured under the World Bank Forestry Project and were lying idle since then. The MPFD recruited a few contract employees to undertake this mammoth task.

The application was also developed in-house. However, the selection of technology and skilled manpower became a major bottleneck. The MPFD took a conscious decision to use Microsoft technology to build the applications. The manpower required to develop it was available locally and the MPFD IT was familiar with the ASP.net and Visual Team Suite.

Making the comparatively technology ignorant and aged frontline staff competent enough to use high end devices and computers, was another major hurdle. Using mobile phones was not a problem but handling the PDAs posed a big challenge. Entering of the feedback data by range clerks was crucial but the MPFD handled the situation in a professional and well planned manner. The process of capacity building was single handedly dealt with by the IT wing. A series of workshops were organised at the circle and division levels. The training content and the mode was kept lively, simple and user friendly. The training notes were kept short and pictorial to facilitate understanding. The video conferencing and EDUSAT facilities with 52 satellite interactive terminals came in very handy, to address and train a large audience.

1.11 IMPACT OF THE FAMS

The project today covers about 31% of the total geographical area of Madhya Pradesh (95,000 sq. km). The new system of fire alerts has enhanced accountability at all levels and has helped in getting informed decisions by the management. It has helped bring about quick response to the fire and reduced damages due to it. Although more than 10,000 officers and staff of the Forest Department have directly benefitted from this project, the real beneficiaries are the residents of the 14,000 villages in and around the forest areas of Madhya Pradesh and the millions of people living in the river valleys in the central plateau region, who are dependent on these forests for their livelihood.

The FAMS revolutionised the monitoring and record keeping of forest fires. The tendency to hide information for lack of a means to verify the same by seniors was done away with.

After the implementation of FAMS, all the data relating to the active fire locations was automatically compiled—in temporal as well as spatial forms. The number of fire cases reported previously was far less than the actual fires that occurred, as is evident from the data in Table 1.1. Now it was possible to seek retrospective data and compare it with the data collected manually.

The system maintained a database of fire locations which was used to scientifically identify the fire sensitive zones and effectively manage the fire control operations.

The effective monitoring of forest fires has resulted in increased sensitivity to the issue of managing forests against fire damages. Now the management is able

Table 1.1 *Reported vs. Actual fires*

Year	Reported Number of Fires	Actual Fires Detected/Reported by FAMS
2003	451	1379
2004	547	2987
2005	785	2384
2006	752	1588
2007	1313	1704

Figure 1.2 *Identification of Fire Prone Locations*

to take informed decisions. The planning of resources and allocation of funds are being done more accurately. Data on forest fires has helped in advanced planning with participation from all the stakeholders, including the local community.

An evaluation of the FAMS based on development indicators showed that it was possible to introduce and track such indicators in the e-Governance initiatives. The system accuracy has so far been more than 95%. In 2007-08, the total number of fire cases were 4013, of which, the system accurately gave feedback for up to 3837 cases, well within time (95.6% accuracy).

1.12 FUTURE ROADMAP

After the successful implementation of the FAMS, a number of applications were developed in-house by the MPFD. The infrastructure created for the FAMS project was used for all the applications developed later. In all, there are at present 12 such applications in various stages of use. Prominent among them are:

- Forest Offence Management System
- Forest Dwellers Survey System

- Forest Financial Management System
- Wildlife Management System
- Forest Planning and Geo-mapping System
- Forest Mail Service
- Forest Employees Database Verification System
- Employees Work Repository and Assessment System

This application is capable of being replicated in any state with small modifications, normally related to localisation and customisation. Of late, there has been another development. As a kind of recognition of the ICT initiatives in the MPFD, the MoEF, Government of India has constituted a core group on the use of Information and Communication Technology in the forestry sector. Led by Shri Anil Oberoi, Additional Principal Chief Conservator of Forests (APCCF-IT), Madhya Pradesh, who was the leader of the IT team in the MPFD that prepared and implemented the above model. This core group would take its cue from the MPFD model and proceed to replicate the same in other state forest departments and also at the national level.

1.13 Conclusion

The FAMS is a highly sustainable system as is evident from the fact that it has been operating since the last five years without any hassles. Its operation and maintenance costs are meager in comparison to the benefits that accrue. Today, the FAMS has become an indispensable system for the Department. It is capable of being implemented nation wide because of its in-built capacity and simple integration of various technologies.

Case

2

Health Insurance for the Masses— The Aarogyasri Experience

Babu A, IAS

Aarogyasri means eradication of all diseases. And this is exactly what the Andhra Pradesh (AP) aims to do with the Community Health Insurance Scheme named Aarogyasri. Designed for families living below the poverty line (BPL), the scheme provides financial coverage of ₹ 0.2 million to each BPL family. It also covers 85% of the families in AP. The Aarogyasri scheme is unique in its applicability and implementation since no other state/ government agency has provided the poor with universal health coverage for major ailments. The AP Government pays the premium for the scheme, which is linked to a network of hospitals and doctors. Patients are also facilitated through health workers and a call centre.

2.1 HISTORY

By 2007, it was felt that BPL families in Andhra Pradesh needed better financial protection to treat serious ailments such as cancer, kidney failure and heart disease among others. The existing network of government hospitals seemed to fall short in terms of the availability of specialist doctors to meet this state-wide requirement. Consequently, these poor patients would visit private hospitals and incur huge costs. This vicious cycle of events would result in destitution and increased indebtedness. In many cases, patients died in harness unable to gain access to medical treatment beyond their means. Mounting medical expenses was thus identified as one of the causes leading to the pauperisation of the farming community.

On April 1, 2007, the Aarogyasri Health Care Trust implemented a Community Health Insurance Scheme, Aarogyasri-I, in the three districts of Mahboobnagar,

Ananthapur, and Srikakulam. The scheme has since expanded to cover the entire State with some modifications being made in a phased manner. The Trust also established a network of hospitals, fixed the diagnostic and treatment protocols to reduce the administration costs. The government and private hospitals had to fulfill the minimum qualifications with regard to the laboratories, the equipment, the operation theatres, the availability of beds for inpatients and a known track record in the treatment of the diseases specified for treatment under the scheme. The premium under the scheme was fully borne by the Government.

2.2 About Aarogyasri: Features and Phases

The Community Health Insurance Scheme has been organised in two phases. Aarogyasri-I and II differ in terms of the diseases covered under the scheme. While the front-end of both Aarogyasri-I and II with regard to the network hospitals, Aarogyamithras, Health Cards etc., are one, the pre-authorisation and claims settlement for Aarogyasri-I is undertaken by the relevant insurance company, while for Aarogyasri-II, it is undertaken by the Trust directly, and funded by the Chief Minister's Relief Fund.

The salient features of the scheme are:

- The scheme provides each family financial protection up to ₹ 0.2 million in a year for medical treatment. All BPL ration card (white card) holders are eligible for this benefit. In Andhra Pradesh, with a population of more than 70 million, 85% of the families (20.3 million) are white card holders. The diseases covered by this scheme include ailments related to the heart, lungs, liver, pancreas, including cancer, neurosurgery, renal and pediatric surgery, plastic surgery, burns and poly-trauma cases (330 major procedures).

- The entire operation is cashless for the patient from the date of reporting to the hospital till discharge. Free diagnostic and treatment facility is provided to all the patients, irrespective of surgery. Hospitals linked to this scheme have to conduct at least one free medical camp in a week, thereby taking advanced evaluation to the patient's doorstep.

- The cashless arrangement with network hospitals is one of the key elements of the scheme, whereby beneficiaries once registered in the network hospital do not have to pay at all for the treatment. The scheme involves a package rate, which in addition to the actual cost of treatment includes the cost of conducting heath camps, screening patients, diagnostics, testing and treatment, food, transport, and follow-up procedures.

- An insurance company undertakes health insurance and provides risk cover, on payment of the premium. Selection of the insurance company is done through a process of competitive bidding (technical and financial) and quote of the lowest premium.

- The scheme offers coverage for meeting the expenses of hospitalisation and surgical procedures of the beneficiary members for up to ₹ 0.15 million per family per year subject to limits, in any of the network hospitals. The benefit for the family is on a floater basis i.e., the total reimbursement of ₹ 0.15 million can be availed of individually or collectively by the members of the family.

- A separate fund is maintained as Buffer/Corporate floater to take care of expenses; if these exceed the original sum i.e., ₹ 0.15 million per individual/family. In such cases, an amount up to ₹ 0.05 million per individual/family is additionally provided.

- Participating hospitals are required to be empanelled online with selected insurance companies, based on pre-fixed criteria such as the availability of infrastructure, equipment, and qualified personnel. The choice of the hospital for treatment from among the empanelled hospitals is given to the patient. Patient facilitation is done through a dedicated team of Aarogyamithras (health workers), 24 × 7 call centres (toll-free number 1800-425-77-88), and a help desk at each network hospital. Treatment is to be provided in hospitals as per pre-fixed medical protocols.

- All Primary Health Centres (PHCs), which are the first contact points, are assigned an Aarogyamithra (health worker) selected by women self-help groups to help the illiterate patients.

- The scheme is implemented online through an IT portal for efficiency, transparency, and accountability. The workflow and design for this portal has been developed in-house by the Trust and an IT company is engaged to develop and maintain software, hardware, and all the data and the medical records pertinent to the scheme.

Since the coverage of diseases under Aarogyasri-I is restricted, a large number of poor patients continue to request assistance from the Chief Ministers' Relief Fund (CMRF) for the treatment of other ailments. An assistance of ₹ 42.5 million has been provided so far in 0.125 million such cases from the CMRF in the last four years to meet part of the treatment costs. However, this did not help 30% of the rural poor, who were unable to meet the balance expenses. The Trust, therefore, constituted 31 teams of specialist doctors from both the government and the private hospitals who analysed all the diseases afflicting the poor patients.

Aarogyasri-II was launched in Andhra Pradesh on April 17, 2008 at Nellore for cashless treatment of these additional diseases (389 surgical and 144 medical) to enable many more BPL families to avail of cashless treatment and lead a healthy life. In addition, based on the feedback received, the coverage under the scheme was extended to 77 newer procedures, particularly in obstetrics, ophthalmology, ENT and cardiology along with life-saving areas in trauma and critical care. It has now been extended to fund the "Behind the Ear Analogue Hearing Aid" for the hearing impaired.

They listed more than 2100 medical and surgical procedures, and finally used the criterion of emergency and life-saving procedures that needed specialist doctors. A shortage of such doctors in the government hospitals was noted as the panel finalised a further list of 533 diseases for inclusion in the Aarogyasri scheme (now named Aarogyasri-II).

To optimise the benefits of the surgery/therapy availed of under the treatment, the scheme provides packages for one year cashless follow-up services (consultation, testing, and treatment) to the beneficiary in 121 of the identified procedures.

The Government decided eventually to retain 20% of the earnings of the government hospitals to create a revolving fund to regularly assist these hospitals in improving their infrastructure and decided to utilise a part of the amount that accrued to install haemodialysis machines in 12 tertiary care hospitals on a Public-Private Partnership (PPP) model.

2.3 The Aarogyasri Scheme: It's Different

The Aarogyasri scheme is unique in terms of the scale, since no other state/ government agency has provided universal health coverage to the poor for major ailments. The scheme offered new methods and processes to address issues related to inequalities in healthcare treatment in the State.

The choice of hospitals for treatment lies with the patient. The entire process from the time of conducting the health camps to the screening, testing, treatment, follow-up, and claims payment is transparent through an online web-based process to prevent any misuse and fraud. The scheme is complimentary to the facilities available in the government hospitals, and when put together, fully meets the medical requirements of the BPL population. The government hospitals treating Aarogyasri patients are entitled to receive the same payment as the private and corporate hospitals. The government hospitals and institutions have obtained approvals worth ₹ 1560 million till date under the scheme. 65% of the revenues go into the Hospital Development Society and the remaining 35% to

the team of treating doctors and paramedics as incentives. This system motivates more and more government hospitals to participate in the scheme and utilise the revenue earned to improve their facilities to provide and reform the quality of tertiary medical care. Several states and foreign dignitaries have visited the network of hospitals under the scheme and appreciated the efforts it entails. The scheme has provided much needed help to the poor families for the treatment of serious ailments, thereby, saving them from a debt trap. It has also brought advanced surgical treatment within their reach and helped many invalid young and elderly patients to resume their livelihood.

2.3.1 Progress Report (As on 08.02.2010)

Since the inception of the scheme (Aarogyasri-I from April 1, 2007 and Aarogyasri-II from July 17, 2008), 15,909 medical camps were held by the network hospitals in the rural areas and 2.782 million patients were screened here. So far 0.774 million patients have been treated as out-patients and 0.596 million patients have been treated as in-patients in 340 network hospitals under the scheme. About 0.515 million patients underwent surgery/therapy and the amount claimed has been ₹ 15352.2 million.

2.3.2 Enhancing the Quality of Service Delivery

In order to ensure quality medical care to the beneficiaries under the scheme and to avoid unethical practices by network hospitals, the Trust incorporated some stringent measures as follows:

2.3.2.1 *Strong IT back-up and completely paperless transactions bringing in efficiency, accountability, and transparency*

A web-based, real-time workflow was designed and implemented for the scheme. The massive nature of the programme covered approximately 80 million of the BPL population through a network of 1570 PHCs and 400 network hospitals. Patient referrals, registration, treatment, diagnostic protocols, reviews and pre-authorisations, claims settlement, facilitation through the 24-hours call centre, health camps, follow-ups etc., were done on 24-hours round-the-clock basis which warranted a web-based, real-time workflow.

2.3.2.2 *Standardisation of empanelment of network hospitals*

The Trust created a post of Chief Medical Auditor to continuously monitor the quality of medical care being provided to the beneficiaries of the scheme. To ensure the above, the Trust constituted an Empanelment and Disciplinary Committee (EDC) under the chairmanship of the Chief Medical Auditor of the Trust. The Committee ensured that the hospital had adequate infrastructure, manpower, equipment etc., as per the standards listed for the empanelment of

the hospital under the scheme. Further, the process of empanelment was taken online to introduce transparency in the procedure.

The Empanelment and Disciplinary Committee (EDC) under the chairmanship of the Chief Medical Auditor of the Trust also looks into all the complaints against the hospitals, received from various sources such as patients, the 24-hour call centre, field staff, reports of surprise inspections to the hospitals by the Trust/insurance officials, press clippings etc., and recommends action against the network hospitals based on the severity of service-deficiencies after due verification.

On approval of the recommendations of EDC by the CMA, necessary steps are initiated by the Trust. All this is done in a transparent manner through an online workflow. Further, the hospitals are given a time-frame within which, to take necessary corrective measures before being considered for revocation of disciplinary action.

2.4 THE AAROGYASRI HEALTH INSURANCE PROCESS

The first point of contact for the patient to avail of health insurance under the Aarogyasri scheme is the Aarogyamithra (health worker) stationed in an Aarogyasri kiosk. The Aarogyamithra registers the patient after the verification of the data in the health card/white card. The Aarogyamithra in coordination with a medical coordinator, facilitates free consultation and cashless evaluation of the patient. After evaluation, the patient is pre-authorised online. The pre-authorisation is scrutinised at four levels before being approved.

The hospital uploads the details of the surgery and other clinical notes on the website. The hospitals can initiate the procedure for claims only when ten days have elapsed post discharge. The claim is scrutinised at different levels before being cleared for payment.

2.5 SOCIAL AUDITING AND OTHER MONITORING MECHANISMS

The uniqueness of the Aarogyasri scheme lies also in the social auditing processes built around it. The Aarogyasri health insurance cases are submitted through a Social Audit Mechanism.

- A letter from the Honourable Chief Minister is dispatched directly to the address of the beneficiary soon after the patient is discharged (as evident from online details). The letter enquires about the patient's present status of health after treatment under the scheme. It provides details of the claim such as the disease suffered, the surgery/therapy undergone, the package amount approved etc., and enquires about the satisfactory services ren-

dered. A self-addressed postage-paid inland letter is attached to this letter inviting specific feedback from the beneficiary about the quality of services, the behaviour of the Aarogyamithra and the hospital staff, and his opinions on the scheme etc.

Additionally, the following mechanisms are built to ensure smooth running of the scheme:

- Field Verification of Cases: District Offices are established under the Trust in all the districts and a Medical Officer is appointed as the District Coordinator. In addition, the insurance company establishes an elaborate field mechanism at various levels starting from the Aarogyamithra to the District Medical Officer. With the help of the District Coordinators of the Trust, the District Medical Officer of the insurance company and other field staff maintain a constant vigil on the services of the network hospitals.

- Surprise inspections are conducted at the network hospitals, regular district level reviews, daily inputs from the district level field staff, suitable complaints and grievance redressal mechanisms, health camp monitoring, patient follow-up monitoring, the verification of emergency pre-authorised cases etc., are suitably undertaken.

- Complaints and Grievance Redressal: A comprehensive complaint cell and grievance redressal mechanism is put in place through an online system with clear SLAs in order to ensure fair and timely redressal of grievances. These complaints and grievances are monitored by the committees at the highest level within the Trust on a daily basis.

- Toll-free Number: A toll-free number 1800-425-77-88, is made available to register all the complaints. The insurer keeps track of the complaints and reports on the action taken to the Central Committee. The beneficiaries also send telegrams to the CEO of the Trust/CMD's Secretariat/Zonal Office of the insurer. The details of the toll-free number are made available with the PHCs and other government hospitals. A separate set-up under the supervision of the Chief Operating Officer of the insurer at the corporate office is established to deal with the grievances.

- 24-hour call centre: A 24-hour call centre with 120 trained executives is established at the NIMS, Aarogyasri-II and also at Malakpet to provide services for the guidance and benefit of the beneficiaries. The toll-free help line number is 1800-425-77-88 and this is integrated into the call centre. The call centre functions on a 24*7 basis. Call centre executives can answer in both English and Telugu. The action taken on every call is routed through an escalation matrix which ends at the level of the CEO of the Trust. The following services are provided by the call centre:

- Answers to queries related to the coverage and benefits under the policy.
- Information on the insurer's office, procedures, and products related to health.
- General guidance on the services.
- Information for cashless treatment subject to the availability of medical details required by the medical team of the insurer.
- Guidance to the patient regarding the service provider.
- Guidance to the patient about the availability of beds in the hospitals.
- Complaint booking.
- Monitoring of field staff attendance and movement.
- Guidance to network hospitals.

- In-house Vigilance: Additionally, with an in-house vigilance team headed by the GM, Vigilance is established as part of the scheme. The team continuously monitors the services through surprise inspections, interaction with the beneficiaries, and by acting on specific complaints.

- Facilitation Services: The following facilitation services are provided to the beneficiary to guide, counsel, facilitate referral, and ensure quality medical services under the scheme.
  - 24-hour toll-free call centre number
  - Aarogyamithra at PHCs and government hospitals
  - Aarogyamthra at network hospitals
  - District level grievance cell
  - Central level grievance cell
  - Services of a Medical Coordinator
  - Health camps
  - Health cards

- Follow-up Services: The Government/Trust have also resolved to provide follow-up services for a period of one year through fixed packages to those patients who require long-term follow-up therapy in order to get optimum benefit from the procedure and avoid complications. Thus, the Aarogyasri Scheme aims at providing coverage for the follow-up services, wherever specifically needed by providing system-/disease-specific packages for follow-up consultation, investigations, drugs etc., for one year. The technical committee of the Trust in consultation with the specialists, identified 121 specific procedures and formulated the following guidelines. The package covers the entire cost of follow-up i.e., consultation, medicines,

diagnostic tests etc. The follow-up treatment is entirely cashless to the patient and starts on the eleventh day post discharge continuing for one year.

2.6 Impact and the Winds of Change

The scheme has had a profound impact on the overall health scenario in the state.

2.6.1 Changing Tertiary Care Profile

As the scheme progressed, the pre-load of diseases came down, particularly in relation to the high-end diseases like cancer and others related to cardiology, neurosurgery cancer etc. Figure 2.1 indicates the change in disease load of the top-five performers (category-wise) of the three pilot districts where the scheme completed 33 months of implementation.

Figure 2.1 indicates the perceptible reduction in disease-reporting from the three pilot districts of Anantapur, Mahboobnagar, and Srikakulam under the scheme. As is evident from Figure 2.1 below, the disease-reporting in procedures involving cardiac and cardiothoracic surgeries, genito-urinary surgeries, neurosurgery, plastic surgery, and surgical oncology which were introduced in April 2007 in the above districts is showing decreasing trends. This may be attributed to the decrease in pre-load which is contributed by the procedures under the scheme such as valve replacement surgeries and congenital cardiac defects, renal stone procedures, undetected cancers, and certain congenital defects which have long-term morbidity.
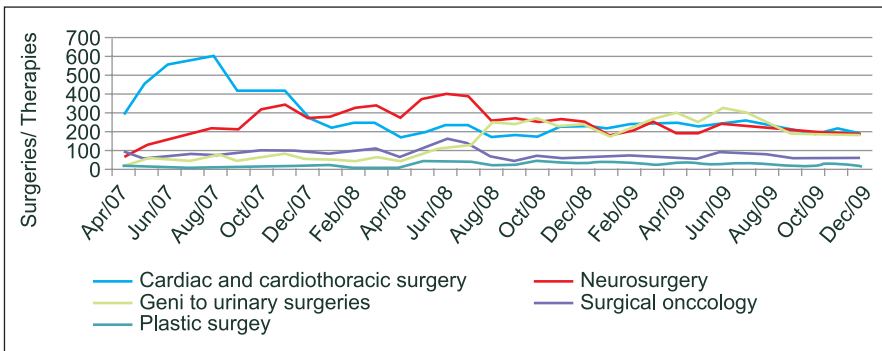
Figure 2.1 *Changing Disease Load of the Top-5 Performers in Anantapur, Mahboobnagar, and Srikakulam*

2.6.2 Changing Disease Predominance

The scheme also ushered in changes in disease predominance and priorities of disease treatment as shown in the profile of the three pilot districts depicted below (Figure 2.2):
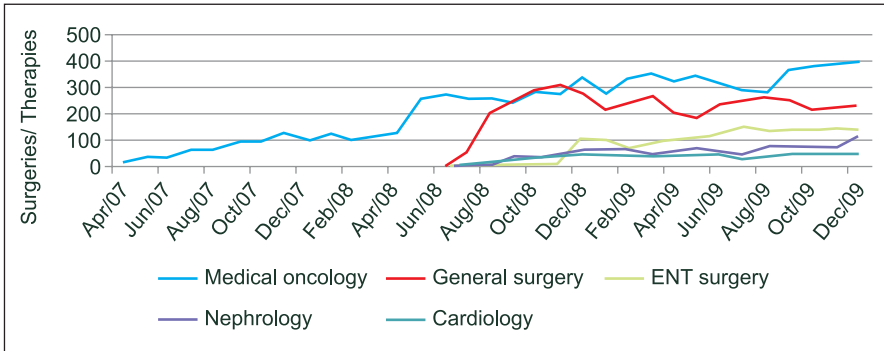
Figure 2.2   *Changes in Disease Predominance and Priorities of Treatment*

Figure 2.2 indicates the upward trend in disease-reporting of cases pertaining to the specialties of medical oncology (chemotherapy), general surgery, ENT, nephrology, and endocrinology in the three pilot districts of the scheme. The increased reporting may be due to the following factors:

- The treatment procedures in specialties like general surgery, ENT, nephrology, and cardiology were introduced into the scheme only in July, 2008. Hence, pre-load still contributes to the disease load.

- The increase in the numbers of medical oncology cases may be due to the number of repetitive chemotherapy cycles being administered and the packages becoming more elaborate from December, 2007. Thus the pre-load is yet to impact on disease reporting.

- This is a relative phenomenon as the disease load of procedures introduced in the beginning seems to be on the decline.

2.6.3 Cost of Average Treatment

As the scheme progressed, the cost of average treatment reduced because of: changing profile of disease predominance, changing priority of diseases, inclusion of more systems, and a decrease in the average cost of procedures.

It can be concluded from the above trends that as the scheme progressed, the coverage became diversified to encompass other diseases and procedures thus keeping the cost of the scheme at the same level as it is now.
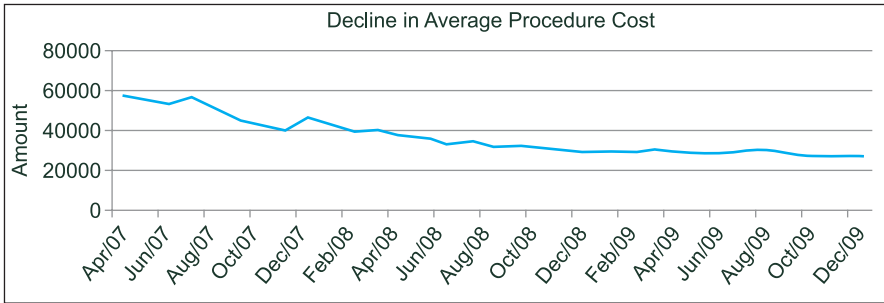
Figure 2.3   *Declining Average Cost of Treatment*

2.6.4 Up-gradation of Hospitals

The stringent method of empanelment adopted by the Trust yielded the desired results of up-gradation of hospital establishments in the State in order to be eligible for empanelment. The empanelment procedure defined diagnostic and treatment protocols, capturing of admission notes, daily clinical notes, operation notes, discharge summary, and the uploading of diagnostic reports including films, Webex recording of Angiographic and laparoscopic procedures and other photographic evidences having profound regulatory effects on the hospitals.

2.6.5 Improvement in Quality of Services

Continued monitoring of the services both online and in the field by an elaborate field mechanism coupled with disciplinary action against the erring hospitals, greatly contributed to improvement in the quality of treatment under the scheme. The scheme also helped establish medical protocols tailored to local situations. Though established international diagnostic and treatment protocols were available, the hospitals could not follow them given the non-availability of infrastructure, affordability of the patients, and the lack of monitoring by the authorities. The scheme took into consideration the availability of local infrastructure and standard medical practices and successfully redefined medical protocols with the help of the senior specialists in each field.

2.6.6 Employment Generation

The scheme has displayed a potential for generating indirect employment as the insurance company, network hospitals, and other stakeholders employ a number of people in different cadres such as the Aarogyamithras, medical coordinators, duty doctors, paramedical technicians, staff nurses etc.

2.6.7 Health Awareness

Since its implementation, the scheme has organised 15,909 health camps in the rural areas screening 27,82,303 people and also played a key role in bringing health awareness amongst the population. Counselling by the field staff and the paramedical staff has been seen as contributing to raising health awareness among the rural poor. As pre-evaluation of the patient is also cashless under the scheme, people are motivated to approach the network hospitals as and when they suspect themselves of suffering from the symptoms of identified diseases.

2.6.8 Changing Scenario in Government Hospitals

Hospitals from the government sector with requisite infrastructure are empanelled to provide services under the scheme. All the network hospitals including the government and the private hospitals thus empanelled are entitled to the same package amount on providing services. This helps the government hospitals earn the much-needed finances for improving the infrastructure, providing quality care to the patients, and improving their performance by recouping the deficient services through outsourcing and by providing incentives to the performing teams. As of today, 95 government hospitals, 26 tertiary care and specialty hospitals under the control of the Director of Medical Education and 69 APVVP Hospitals (District Hospitals, Area Hospitals and CHCs) are empanelled under the scheme. Till 08.02.2010, 97,378 cases worth ₹ 271.60 crores were pre-authorised for the government hospitals under the scheme.

2.7 Extended Role of Public-Private Partnership

The successful model of PPP in implementing the Rajiv Aarogyasri Community Health Insurance Scheme ushered in a new era of Public-Private Partnership leading to the establishment of the much-needed haemodialysis facility in the government hospitals as the Government decided to install 111 haemodialysis machines in identified government hospitals under this scheme using the revolving fund generated by deducting 20% of the earnings of the government hospitals under the scheme to cater to the needs of poor patients of the State suffering from chronic kidney disease and requiring haemodialysis. To implement the above project on the lines of BOOT (Build Operate Own and Transfer) it was decided that the participation of the government hospitals, the Director of Medical Education, APHMHIDC, and the Aarogyasri Health Care Trust representing the Government and the company manufacturing and providing comprehensive services representing the private partner was imperative. The APHMHIDC identified B-Braun & Co., as the agency to implement the scheme by following an open bidding process. As per the scheme, the public partner (government hospitals) would have to provide space, water, electricity, services

of the nephrologists, and other supportive services under the scheme. The private partner (the company) would install the HD machines, RO plants, services of duty doctors, technicians, and nursing staff and create patient and attendant amenities as per the specifications issued by the government.

2.8 FINANCIALS OF THE SCHEME

The scheme started with three districts on a pilot basis and extended to all 23 districts in the State through five phases. The coverage under the scheme started with 163 procedures in 5 systems which was extended to 942 procedures in 31 systems. In order to ensure best price for the scheme, the Trust adopted an open bidding process to identify the insurer for each phase of implementation. The policy of the Trust yielded best results as the premium was factorised to the number of procedures and compared to quotes received for each phase as depicted in Figure 2.4 below.
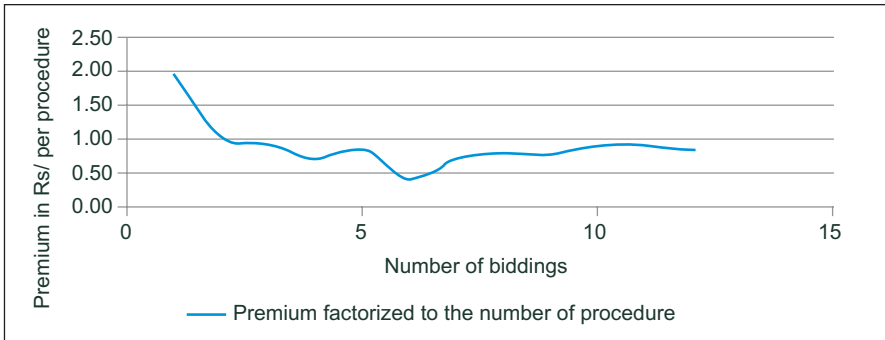
Figure 2.4   *Premium Factorised to the Number of Procedures*

This reduction in the premium thus gained was effectively utilised to add additional procedures thus resulting in extensive coverage of diseases and reducing the average cost of procedures.

2.9 CONCLUSION

The activities of the Aarogyasri Healthcare Trust and the awareness campaigns by the district administration have helped in early detection and disease prevention. They have also helped build health awareness in the state. As the entire patient data of people attending the health camps, treatment at network hospital, and treatment details of the beneficiaries approved under the scheme are captured online, the scheme has enabled the creation of a huge database of the population which can be used for disease-mapping and further planning.

Case

3

Promoting the Cause of Renewable Energy in Jharkhand

S.E.H. Kazmi, IFS

The Jharkhand Renewable Energy Development Agency (JREDA) has extensively promoted the use of renewable energy in more than 400 villages in Jharkhand in the form of solar lanterns, solar home lighting systems, and solar street lights. The programme has been made effective through the use of a web-based Management Information System (MIS) linked to Google Earth, which captures details of the beneficiaries, based on their geographical co-ordinates. This has helped to develop a comprehensive information bank on the beneficiaries, who can be tracked online, on a real-time basis. This unique method of monitoring and using renewable resources has brought about greater transparency, accountability, and peoples' participation in the process of deployment of the renewable energy sources in the state.

3.1 HISTORY

Energy is the key input for the socio-economic development of any nation. Today, rapid industrialisation, urbanisation, and mechanised techniques of farming, have created a high demand for energy, in all forms. To meet this ever-increasing demand, fuels such as coal, oil, and natural gas have been over-exploited in an unsustainable manner. The over-exploitation of natural fuels has given rise to serious environmental problems such as global warming and changes in climatic conditions. While fuels like petroleum, are in short supply and we need to depend on imports, our country is fortunate enough to be blessed with plenty of natural sources of energy such as solar energy, wind energy, biomass, and hydro power. Not only are these energy sources environment-friendly and non-depleting

in nature but they are also available in most parts of the country throughout the year.

Renewable energy is the energy generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which can be naturally replenished. About 18% of the world's energy requirements are met by these renewable energy sources. A gradual shift to the renewable, non-depleting, non conventional energy sources is inevitable in order to meet the increasing demands for energy and strike a balance.

The first oil crisis, faced by India in 1973, highlighted the need to develop alternative renewable energy sources. To boost the development of these resources, the then Prime Minister, Smt. Indira Gandhi, created a separate Department for Non-Conventional Energy Sources in 1982, under the Ministry of Energy. In 1992, this was converted into a full-fledged ministry and in 2006, it was renamed as the "Ministry for New and Renewable Energy (MNRE)".

India has a large rural base. Electrification of the rural areas is still incomplete. Renewable resources play a significant role in accomplishing this objective. Solar Domestic Lighting Systems, subsidised by various State Nodal Agencies/ MNREs have become increasingly popular in villages. The MNRE has also taken up initiatives for the exploitation of energy from non-fossil sources, such as the use of solar energy through solar thermal and solar photovoltaic programmes, bio-gas energy from bio-wastes and bio-mass, wind energy through wind mills, pumps and aero-generators, hydro-energy from small/mini/micro hydel projects, geothermal energy, and so on.

After the creation of the new state of Jharkhand, the Jharkhand Renewable Energy Development Agency (JREDA) was established in the year 2001. Registered under the Societies Registration Act, 1860, this agency was under the administrative control of the Department of Energy, Govt. of Jharkhand. The main objectives of the JREDA were to explore, exploit, promote, and popularise new and renewable energy sources through planning, investigation, research and development, field testing, and demonstration. The use of renewable energy sources was to be encouraged by offering incentives to the users, in the form of subsidies, for participating in various programmes undertaken by the MNRE, Government of India and Department of Energy, Government of Jharkhand.

In 2001-02, when the Agency started its work of promoting the cause of renewable energy, it had only a small budget of ₹ 30 million and a few schemes on hand. However, over the years, the growth and popularity it achieved was phenomenal and by **2007-08** its budget had grown to ₹ 650 million.

During this short span of six years since its inception, the JREDA had distributed about 0.2 million solar lanterns, 10,000 home lighting systems and 6000 solar street lights, thereby benefitting about 1.3 million poor families, residing in the remote villages of the State. It had successfully electrified 447 villages under the Remote Village Electrification Program, providing solar home lighting systems to about 37,000 families. About 3000 solar street lighting systems were also installed in these villages. Apart from these large scale programmes, its smaller initiatives such as bio-gas, *Unnat Chulha* and so on, were also received with open arms by the masses benefitting about 0.15 million people. However, there was still scope for improvement.

In January 2008, a performance audit of the working of the Agency from 2002 to 2008 was conducted. The audit lasted four months. A thorough check of records of the JREDA was carried out and joint field verification was done to examine the achievement of its objectives and the financial management within the Agency. It was observed that the activities of the Agency were confined only to the purchase, sale, and installation of systems available in the market. No research and development programmes in the field of renewable energy had been undertaken. Also, the monitoring, evaluation and vigilance mechanisms for on-field activity were found lacking. The involvement of the district administration in the monitoring process was negligible. A system of feedback, to gauge the usefulness of the system and redress the complaints of the beneficiaries, had not been developed. There was no vigilance mechanism in place within the

Apart from the above, it was observed that much of the office work was done manually and computers were used by and large for typing only. The data and other records were not maintained properly, were available only in hard copy files, which were with the office staff and had to be sorted individually by the people, as per the requirement. E-mails were not replied to. When urgent information was needed, the files or the concerned persons would be untraceable and the records were not being maintained properly. Many letters remained un-replied. The agency would not be able to furnish the required information to the government and other stakeholders in time. There were no set of standard procedures for procurement or distribution. Payments to suppliers were delayed and subjectivity was apparent. No transparency was being maintained. Due to manual functioning, it was not possible to know about or to verify any activity or performance of any supplier or the progress of any program. It was a peculiar situation. There were huge financial and physical targets to be achieved but with a staff of only four people who seemed to be working for cross-purposes, the targets seemed far fetched.

Agency, hence it could not make sure that all its operations and transactions were transparent and in the public interest. Cases of fraud and embezzlement could easily go unnoticed and the guilty unpunished, which would be against the interests of the Government.

Also the geographical area covered by the villages was vast. They were spread over 212 blocks, in 24 districts in Jharkhand and were infested with Naxalites, ready to create trouble at any time. At this stage, the JREDA decided to consciously work towards bringing in more transparency in the department. For this, it was decided to work in the public domain and a decision was taken to develop an Internet based Management Information System (MIS).

3.2 THE CONCEPTUAL DESIGN OF THE MIS: HYPOTHESIS AND PREMISES

Humans by nature are curious, and experience makes them suspicious, especially about anything new that attracts their attention. They tend to get inquisitive about things generally to get a better understanding. This problem seemed to have increased after the implementation of the Right to Information Act, 2005.

In order to be able to answer the queries of the beneficiaries, it was felt that linking two unique features—the human face and its geographical location or "residence" would be helpful. The latitude and longitude of any location on the earth are unique and non- replicable, just like the human DNA reflected by features on the face. The system to be designed would make use of this uniqueness.

1. Human DNA ⇒ Human Face ⇒ Non Replicable ⇒ Unique - Exclusive
2. Co-ordinates on the earth ⇒ Geographical locations (beneficiary's house or any place on the earth where any work is done) ⇒ Non replicable ⇒ Unique ⇒ Exclusive
3. Combine (1) and (2) at one place.
4. Result = Man and his residence = Each beneficiary and his house can be 'seen' on the website.

The following steps were followed for implementation:

- Photograph of beneficiaries obtained with a digital camera.
- Co-ordinates of his residence obtained through the Global Positioning System (GPS).
- Additional data, anticipating the queries of different stakeholders, obtained.

- Data linked internally and also with Google Earth.
- Everything uploaded on the website.
- Result
  - Anybody could see the beneficiary and other details, from anywhere in the world.
  - Anybody could reach the beneficiary's house by putting in the co-ordinates in GPS, and by pressing the "go to" key. This would give freedom for verification.

With Google Earth already in place, the JREDA had to only obtain the required data to create its web-based MIS and GIS applications.

It was decided that the scope of MIS would include all the programmes being implemented by the JREDA in Jharkhand. This would bring in transparency and reduce corruption within the organisation. It was felt that if all the documents such as tender documents, bid evaluation reports, proceedings of the purchase committee, purchase orders, cost records, the decision making processes and reports of independent evaluations could be uploaded on the website, people would be able to satisfy their curiosity from the website itself. This would save time and reduce undesirable correspondence. The JREDA also decided to get its activities continuously monitored and evaluated by independent evaluators and present its work for public scrutiny.

3.3 BRIEF DESCRIPTION OF THE PROJECT

The JREDA had a large number of stakeholders namely the MNRE, the Department of Energy, the Government of Jharkhand, the beneficiaries of JREDA programmes and the suppliers of solar systems. It tried to understand the requirements of different stakeholders and the circumstances prevailing in the state. It developed various proforma documents for beneficiary identification, third party verification, monitoring and evaluation of the JREDA programmes and so on. Important departments of the State Government such as the Forest department, Tribal and Rural Development departments, Social Welfare department and their functionaries were consulted. Opinions of journalists, politicians and common people were taken into account. Formal and informal meetings were held, telephone calls, letters and e-mails were exchanged to take into account the concerns of the stakeholders. Many organisations like the Tribal Research Institute, the Forest Department, individuals, non- government organisations and private companies were involved in the planning of the Management Information System.

The best practices of other nodal agencies were studied and the JREDA tried to improve and adapt depending upon the needs and requirements, but its

situation was very different in terms of the age of the agency and the social and geographical context.

The second step was to find people who could provide the required information from the field level. These independent surveyors were expected to fill in the proforma and submit it to the JREDA in hard and soft forms. The hard copies were sent to the record room while the soft copies were given to the website manager for uploading on the website, www.jreda.com. The website manager would resize the photographs and rename them with a unique record number. The entire exercise resulted in about 0.1 million profiles being posted on the website under all the programmes. An "expression of interest" notice was issued in the local newspapers and the eligibility criteria kept very relaxed to encourage maximum participation. All the applicants were given some job to test their competence at L1 prices and all of them performed their job well.

3.3.1 Process of Posting of Data and Photograph on the Website

1. STEP 1

	Distric	Block	Village	Panchay	ThanaN	CensusC	HouseN	FirstNar	Surnam	Tola	Catego	Father
2	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11855	KANDEY	BODRA	JHANDI BURU TOLA	ST	LT. BODHRA M BODRA
3	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11853	SURESH	GAGARI	JHANDI BURU TOLA	ST	LT. BAGGA GAGARI
4	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11854	SIBU	BARI	JHANDI BURU TOLA	ST	LT. AOR BARI
5	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11837	MADAN	DEOGAN	JHANDI BURU TOLA	ST	SIRKA DEOGAI
6	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11877	HINDU	GAGARI	JHANDI BURU TOLA	ST	LT. SUR GAGARI
7	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11858	MANI	KERAI	JHANDI BURU TOLA	ST	LT. SUR KERAI
8	WEST SINGHBH UM	MANOHA RPUR	NAWA GAON	DIGHA	352	2017001401	11876	SINGA	CHRNWA	JHANDI BURU TOLA	ST	LT. SELAY CHRPW

Figure 3.1 *Step 1—Posting of Data*

2. STEP 2

The photograph of the beneficiary was resized and renamed by a unique record number and transferred to the specified directory.

3.3.2 Main Features of the MIS

The MIS could give beneficiary-wise and village-wise reports, street light reports under the Remote Village Electrification Program (RVEP) and so on. Though the JREDA implemented many programmes like the Solar Photovoltaic Program, the Biogas Program, Construction of improved *Chulha*, Installation of Solar

Figure 3.2   *Photograph of Beneficiary*

Water Heater and some others, the RVEP remained its flagship program and was described in detail. The process followed in the implementation of RVEP was replicated in other beneficiary oriented programmes as well.

3.4 REMOTE VILLAGE ELECTRIFICATION PROGRAM (RVEP)

The main objective of the RVE Program of the Ministry was the electrification, through renewable energy sources, of those remote un-electrified census villages and un-electrified hamlets of electrified census villages where grid connectivity was either not feasible or not cost effective. 447 villages were electrified using Solar Photovoltaic (SPV) Systems, 37000 home light systems were installed in the beneficiaries' houses and about 3000 street lights were installed in remote villages, under this programme. The solar home lighting systems for two lights were designed to provide around 0.1 KWH of energy per day at a cost of ₹ 13,000-15,000 per system, per household. An investment of ₹ 500 million was made for providing solar home light systems and solar street lights, under this programme.

The first step in the implementation procedure was to obtain a "letter of confirmation" from the Jharkhand State Electricity Board (JSEB). The letter stated that the identified remote village was presently not electrified and the village could be taken up for electrification through the non-conventional methods. The next step was to carry out a beneficiary identification survey at the individual level, household level and at the community level which was outsourced. The photograph of the beneficiary and the co-ordinates of his house were obtained and stored as part of the MIS.

Figure 3.3

The profile of the selected village, the important landmarks in the village and their coordinates were noted.

Therefore, all the programmes were formulated as per the guidelines of the MNRE, on the basis of actual field data obtained from independent service providers.

On the basis of the above survey, a Detail Project Report (DPR), prepared by a professional consultant was sent to the Government of India (GOI) for approval. After a thorough and critical examination, the Ministry was satisfied that the project document was as per the MNRE guidelines and had the required data. It then sanctioned the project and released the funds. In the approval, the GoI specified its monetary contribution. Any shortfall was to be covered by the State Government. After receiving the funds, the tender document was prepared in collaboration, by Mecon Limited and the Birla Institute of Technology (BIT), Mesra. This tender was published in the national and local news papers and also uploaded on the website.

The tenders from the interested suppliers were opened by the purchase committee and handed over to Mecon Limited and BIT, Mesra for a techno-commercial evaluation. The tenders were studied and analysed by the consultants and a comprehensive evaluation report was submitted to the JREDA. The evaluation report highlighted the weaknesses of the unsuccessful bidders. The price bids of those suppliers who had cleared the techno-commercial evaluation were opened by the purchase committee. A comparative chart of the offered

prices was prepared and the supplier quoting the lowest rate was given the purchase order. The task of preparing the purchase orders was also given to the consultants. At times no single supplier would be willing to supply the total quantity mentioned in the order. In such cases the purchase order had to be split and more than one supplier had to be given the supply order, at L1 prices.

The purchase order given to the suppliers had all the necessary information including the beneficiary's name, photograph, coordinates of his house and his address. Thus the systems were installed only in those houses which had been identified in the beneficiary identification survey and whose details were available with the Government of India and also published on the website.

A professional organisation was appointed by the JREDA to carry out a pre-distribution awareness campaign. This organisation was selected after a thorough evaluation of its past performance and experience in conducting similar assignments. An independent group was selected for the generation of awareness about the project in the selected villages. Specific assurances were obtained from the villagers that the solar systems would not be sold or shifted from the beneficiaries' houses. Similarly an effort was made to make the solar systems supplied by JREDA, easily identifiable. For example, the solar plate frame was given a specific colour, for a particular programme, in a particular year. To prevent and discourage theft and other malpractices, the JREDA logo and the solar plate number were written on the solar plate, below the glass. This also made it tamper proof. The purchase price and admissible beneficiary contribution were mentioned on the solar plate, so that nobody could take advantage from a beneficiary. A warning was written on the solar plate to prevent unauthorised transfer of the system.

Third party verification of the beneficiary along with the status of the solar light was carried out to ensure better governance of the schemes. A technical audit of the solar systems by independent technical auditors from Mecon and Birla institute of Technology, Mesra, Ranchi, was also conducted. The solar systems were cleared for dispatch only after they were found to be as per the technical specifications quoted.

The Tribal Research Institute, Ranchi, undertook a social audit of the solar programmes of the JREDA. It studied the various social aspects of the program and reported that the beneficiaries were satisfied with the equipments given to them and the program was very successful and socially relevant. The report was uploaded on the website for information and comments. It was also evaluated and audited by experts from the National Council of Applied and Economic Research (NCAER), New Delhi and was found worth emulating in other nodal agencies.

The JREDA then thought of linking the data with the Google Earth software. The objective was to show the locations of the beneficiaries' houses, details of the

Figure 3.4   *Third Party Verification Format*

beneficiaries and the systems. With this in mind, again an "expression of interest" notice was published in the local and national news papers. Many companies responded, but they were all apprehensive about the law and order situation. Their worries were put to rest when the JREDA assured them that it would provide all the field related data and they would only have to look after the technical and non field aspects of the exercise. The purchase committee decided to allot the work to the lowest cost bidder and accordingly, M/s Cyber Swift, a Calcutta based firm was selected for the purpose.

3.5 How and Why is it an Innovation?

The JREDA was the first agency to use the Geographic Information System (GIS) for implementing its Renewable Energy Program, to promote transparency in governance. After the web-based MIS came into operation, the 'effects' of the Right to Information Act became negligible. Quick retrieval of the relevant information from the website gave immense credibility to the government program. Despite its small size, the JREDA implemented programmes on a big scale through outsourcing and the innovative use of information technology.

The scope of MIS was vast but the physical constraints were also many. JREDA was working in the remote villages in the Naxalite infested areas, where physical safety was always a cause for concern. Secondly, the terrain being hilly with many

seasonal and perennial streams, connectivity by road was either poor or non-existent. Reaching any location was difficult and risky.

Implementing a beneficiary oriented government program of high cost items involving 75-100% subsidy, in such an area, in itself, was a great challenge. Moreover, the numerous programmes implemented by JREDA, resulted in an increase in the number and type of stakeholders. The people were not trained to work as per the newly set mandate. However, their dedication and sincerity to learn and perform as per the new agenda was commendable.

3.6 IMPLEMENTATION OF HIGHLIGHTS

JREDA faced many constraints and challenges in implementing the above program. Naxalism is the most serious problem in Jharkhand. Implementation of any beneficiary oriented program is a real challenge to the implementing agency. It issued an advertisement in the local newspapers about the scheme, giving details of the project and the solar equipment. When the beneficiary identification survey was being conducted, various groups of Naxalites enquired about the program. However, once they understood the program implementation methodology and the people behind it, they did not obstruct the program but rather helped in its implementation. They only wanted to ensure that no money would be taken from the beneficiaries under the Remote Village Electrification Program. The JREDA published another advertisement, mentioning this fact.

After due consultation with the villagers, a prominent place in the project village was selected for writing the names of the beneficiaries and the details of the project. Similarly, the names of the beneficiaries and the house numbers were also written on the beneficiaries' houses. It was argued that anybody who did not receive the system would object to his name being written on the wall and anybody who visited the village would immediately come to know the names of the beneficiaries. This also served as another method of verification since the company which was given the task of writing the names of beneficiaries on their houses, was given the installation reports, submitted by the supplier after the installation of solar systems. Any discrepancy could be immediately pointed out by the company, which was instructed to write the beneficiaries' names only after checking the installation and details of the solar system.

The entire work was delegated to two project officers, the Accountant and the Administrative Officer. The final authority in terms of finance and administration, however rested with the CEO-cum-Director, JREDA. Thus, decision making was very quick. All the service providers were guided continuously, and communication was kept open at all times. There was no scope for any communication gap between the JREDA employees, the service providers and

the Director-cum-CEO of JREDA. The Global Positioning System, which was new equipment for all concerned, was to be purchased from Garmin Company, by all the vendors. The supplier of the Garmin GPS system was requested to provide GPS on a soft loan which was guaranteed by the JREDA. GPS training was provided by the supplier.

The data on the beneficiaries and the schemes was verified at many levels in the MIS; for instance, at the level of beneficiaries, suppliers, independent surveyors, project officers and third party auditors.

A large number of college going boys and girls were given training in the use of digital cameras, GPS, computer data-entry and so on. This opened up a big source of employment for the rural youth. Many private organisations/NGOs/ universities and public sector undertakings, developed a good rapport with JREDA and knowledge and skill was shared and multiplied.

3.7 Impact of the JREDA MIS

The MIS and the methods adopted by the JREDA had a huge financial impact. The cost of MIS implementation was negligible as compared to the money saved in the purchase of solar systems. The purchase price of the solar systems reduced considerably and the savings ranged from 25 % to 58 % for the beneficiaries, which meant about ₹ 191.5 million in absolute terms. Reducing costs was very important because the subsidy given by the Central and the State Governments was fixed. If the purchase price of solar system increased, so would the beneficiaries' contributions. For example, in the financial year 2005-06, the purchase price of a

Table 3.1 *Solar Photovoltaic Program (Solar Lanterns)*

Solar Lantern	Year			
	2005-06	**2006-07**	**2007-08**	**2008-09**
Cost per piece (in ₹)	3,825	3,691 3,420	2,977 (CFL) 1,590 (LED)	2,754
Quantity purchased	64,500	45,500	74,090 (CFL) 9,994 (LED)	50,000
Government Subsidy (in ₹)				
Primitive tribal groups (in ₹)	100%	100%	100%	2,400
SC/ST (in ₹)	3,200	3,200	3,200	2,400
General (in ₹)	2,400	2,400	2,400	2,400
Beneficiary Contribution				
Primitive tribal groups (in ₹)	Nil	Nil	Nil	354
SC/ST (in ₹)	625	491 and 220	Nil	354
General (in ₹)	**1425**	**1,291 and 1,020**	**577**	**354**
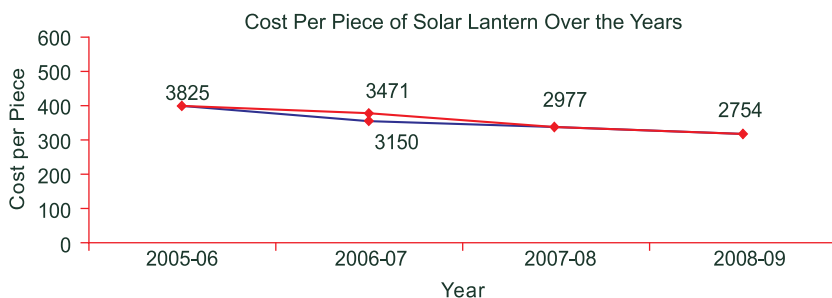
Figure 3.5 *Cost Per Piece—Solar Lanterns*

solar lantern was ₹ 3,825 and the subsidy was ₹ 2,400. Thus a beneficiary had to pay only ₹ 1,425 as his contribution. All the parameters remaining the same, in the year 2008-09, the purchase price (cost price) of the solar lantern was reduced to ₹ 2,754, thereby reducing the beneficiary contribution from ₹ 1,425 to ₹ 354 in two years. Thus each beneficiary saved ₹ 1,071. This was a significant amount by any standard. The same trend was visible in other solar products such as solar street lights and solar home lighting systems. In the year 2005-06, solar systems were exempted from sales tax. From the following year onwards, 4% VAT was applicable. All the rates mentioned for these years, in the table below, are inclusive of 4% VAT. Hence, the actual savings would be higher than that mentioned here.

Similar details are presented below for the solar street lights and the solar home light systems (also see Table 3.5). The financial impact of the MIS can clearly be seen in the following tables and graphs:

Table 3.2 *Solar Street Light*

Solar Street Light	Year			
	2005-06	2006-07	2007-08	2008-09
Cost per piece (in ₹)	29,600	27,000	24,691	22,905
Quantity purchased	1,600	3,000	2,000	5,000
Government subsidy (in ₹)	18,000	18,000	18,000	18,000
Beneficiary contribution (in ₹)	11,600	9,000	6,691	4,905

Table 3.3 *Solar Home Light*

Solar Home Light	Year			
	2005-06	2006-07	2007-08	2008-09
Cost per piece (in ₹)	14,800	14,051	12,691	11,674
Quantity purchased	1,500	2,000	1,600	2,000
Government subsidy (in ₹)	8,000	8,000	8,000	8,000
Beneficiary Contribution (in ₹)	6,800	6,051	4,691	3,674
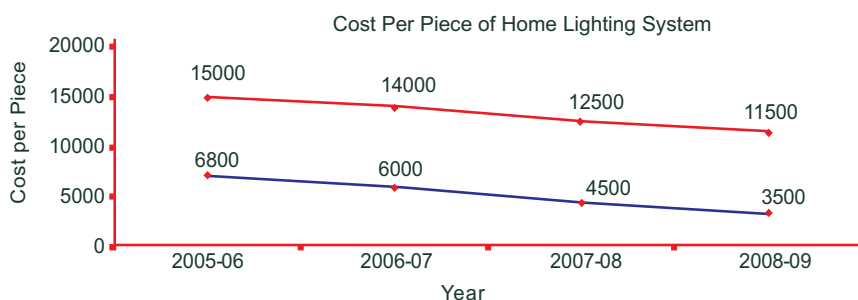
Figure 3.6 *Cost Per Piece—Home Lighting System*

Table 3.4 *Savings of the Beneficiaries*

Solar Systems	Year (All Figures in ₹ Million)			Total 2006-09
	2006-07	2007-08	2008-09	
Solar lanterns	13.0	62.8	53.5	129.3
Home light systems	1.5	3.3	6.3	11.1
Street light systems	7.8	9.8	33.5	51.1
Overall	22.3	75.9	93.3	191.5

Table 3.5 *Cost Savings which may be Attributed to the New System*

	Year				
Solar Photo Voltaic Program (Solar Lanterns)	2005-06 (₹ Million)	2006-07 (₹ Million)	2007-08 (₹ Million)	2008-09 (₹ Million)	2006-09 (₹ Million)
Actual expenditure (in ₹)	246.7	161.0	220.6	137.7	519.3
If purchased @ Y2005-06	–	174.0	283.4	191.2	648.6
Difference (in ₹)	–	**13.0**	**62.8**	**53.5**	**129.3**
Solar Photo Voltaic Program (Home Light Systems)	2005-06 (₹ Million)	2006-07 (₹ Million)	2007-08 (₹ Million)	2008-09 (₹ Million)	2006-09 (₹ Million)
Actual expenditure (in ₹)	22.2	28.1	20.3	23.3	71.7
If purchased @ Y2005-06	–	29.6	23.6	29.6	82.8
Difference (in ₹)	–	**1.5**	**3.3**	**6.3**	**11.1**
Solar Photo Voltaic Program (Street Light Systems)	2005-06 (₹ Million)	2006-07 (₹ Million)	2007-08 (₹ Million)	2008-09 (₹ Million)	2006-09 (₹ Million)
Actual expenditure (in ₹)	47.4	81.0	49.4	114.5	244.9
If purchased @ Y2005-06	–	88.8	59.2	148.0	296.0
Difference (in ₹)	–	**7.8**	**9.8**	**33.5**	**51.1**

3.8 PROJECT LESSONS

The JREDA has shown that an appropriate MIS can help monitor and regulate various subsidy oriented government schemes. Subsidy refers to a form of aid to

the poor, to increase their affordability by way of discount. Due to the high initial cost of SPV products, the government has always provided subsidies on them so that the poor can afford these renewable energy products. Hence, it is crucial to monitor the disbursement of subsidies.

JREDA had a humble beginning but soon became the forerunner in programme implementation in the renewable energy sector. Realising the importance of MIS, the MNRE, the Government of India organised a two day workshop of all the nodal agencies of India, in Ranchi. The various organisations which had worked for the JREDA, in various areas such as tender preparation, tender evaluation and collection of field level data, were requested to give a presentation to the participants, at this workshop. The participants were requested to ask questions to the partners of JREDA. The transparency, efficiency and effectiveness of the JREDA administration impressed all the participants. JREDA earned a good name, reputation and goodwill from the workshop.

The future of India and good governance lies in transparency, information technology, e-Governance, public-private-partnerships and independent evaluations. Fairness in business dealings, openness in systems and processes, fair competition in procurements, outsourcing of services and reward for "merit" will create a healthy business environment. This system has universal application and if adopted on a national scale, will result in better accountability, real transparency, efficiency and cost reduction.

This concept can be replicated in other infrastructure related areas such as planning wells/ponds and roads where the location can be described by mentioning the co-ordinates.

4

i-GeoApproach Based Application for Planning Rural Road Connectivity

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In a developing country like India where the resources are scarce and the opportunities for deployment, plenty, a scientific approach to the planning of public resources is the way to go forward. The Madhya Pradesh Rural Road Development Agency (MPRRDA) has used GIS and RS technologies to prioritise and plan roads in rural India. Better management of essential public resources can make a substantial difference to the existing situation. This project illustrates how innovative technologies can be leveraged for the development of roads in rural areas.

4.1 History

Rural connectivity is a key component of sustainable rural development in India. Roadways are the lifelines of rural development and they contribute significantly in generating increased agricultural incomes and productive employment opportunities. They are also key ingredients in ensuring poverty reduction. India essentially has a rural-oriented economy with 74% of its population living in the villages. In the year 2000, it was estimated that about 3,30,000 out of 8,25,000 villages and habitations (~40%) in the country were still not connected by all-weather enduring roads. Even the existing, constructed roads are of poor quality. A majority of the poorly connected rural communities lie in ten states, one of which is Madhya Pradesh (MP). Rapid urbanisation and consequent haphazard growth of cities has resulted in the neglect of villages. Further, there is exodus of population from the rural to the urban areas, driven by lack of adequate facilities/opportunities in the villages. Though the rural areas have shown development but

the pace of development has not been so good. This has further accentuated the rural-urban divide. There is a need for balanced infrastructure development to reduce the wide disparity between the rural and urban areas through appropriate development planning for the villages.

It was against this background of poor connectivity, that the Government of India (GoI) launched a massive rural roads programme—The Pradhan Mantri Gram Sadak Yojna (PMGSY) in 2000 with the objective of providing connectivity, by way of all-weather roads to the eligible, unconnected habitations[1]. In 2005, the GoI announced the ambitious "Bharat Nirman", a time-bound plan (2005–2009) for rural infrastructure. Under Bharat Nirman, action was proposed in the road sector with the target of connecting the remaining 66,802 habitations by means of all-weather roads. To achieve the target, it was proposed that 1,46,185 kms of road length be constructed by 2009. In addition, to ensure full farm-to-market connectivity, it was also proposed that 1,94,132 kms of the existing, associated through routes be upgraded.

About the MPRRDA

The Madhya Pradesh Rural Road Development Authority (MPRRDA) is the nodal agency in MP for implementation of the PMGSY. It is a registered society under the Society Registration Act, 1973. The decision making and prioritisation of the construction of roads in villages is governed by the geographical (spatial) attributes of roads, villages and other features (railways, water bodies, forests etc.), the nearest road, distance computation, proximity analysis and optimisation of connectivity based on index values, dependent on the development indicators. This scheme facilitates the preparation of District Rural Roads Plans at the block level in accordance with the PMGSY guidelines/norms.

MP is one of the largest states in India. The MPRRDA serves all the 50 districts of MP covering around 55,000 villages and all the roads, from the National Highways to the village roads. It facilitates computerisation of the road inventory, integration of both spatial and location specific data for planning. The MPRRDA started its work in 2000. At that stage, 5982 habitations with 1000+ population were unconnected. By 2009, 5945 of these habitations had been connected and only 37 were left. The number of rural roads that have been connected till now are 30, 931. The building of rural roads has been a systematic effort by the MPRRDA through a process of prioritisation based on the concept of utility value.

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1. Eligible means habitations having population of 500+ in all area and 250+ in tribal area.

Table 4.1 *Utility Value Calculation and How the New Application Helps in Its Calculation. The Indicators and Utility Value (UV)*

S. No.	Indicators of the Habitation	Rating of Indicators (Weight Ages)				
		2	4	6	8	10
1	Educational facility	Primary school	Middle school	High school	Intermediate	College/ Vocational
2	Health facility	Dispensary	Sub centre	Maternity and child welfare centres	Primary health centre	Hospital
3	Market facility		One day	More than one day		Daily markets + shops
4	Administrative centre		Panchayat HQ.	Block HQ.	Sub-division HQ	District HQ

4.2 THE UTILITY VALUE OF ALTERNATIVES

The business logic to decide the prioritisation of the connectivity of habitations was based on the PMGSY norms. The habitations with populations greater than 1000 (500 in case of tribal areas), were high priority. The habitations at a distance greater than 500 metres from an existing all-weather road (AWR)/connected habitation was deemed as unconnected. Upgradation of roads was considered if the habitation was connected by gravel. Optimal road link (both efficient and economic) had been evaluated based on the utility value and road index as illustrated below (refer to Table 4.1).

$$\text{Road Index} = UV/L$$

$$L = \text{Length of the proposed road link}$$

The optimal road link is the most efficient and economic route, in terms of the cost and the utility. It enables access to an existing all-weather road or a connected habitation and upgrades the existing road (Tables 4.2 and 4.3).

Table 4.2 *Example of Optimal Road Link*

Connected Habitation	Utility Value(UV)	Length (in Kms)	Road Index (UV/L)
CH1	14	3.0	4.66
CH2	24	4.5	5.33
CH3	**30**	**4.5**	**6.66**
CH4	20	5.0	4.00

CH3 is the Optimal habitation

Table 4.3 *Calculation of Road Index*

Connected Habitation	Utility Value (UV)	Length (in Kms)	Road Index (UV/L)
Umalda	12	2.0	6.00
Raksi	12	1.75	6.85
Goregaon	20	2.5	8.00

Optimal connectivity of the unconnected habitation Khapa to Goregaon village is shown in the thematic map below (Figure 4.1):
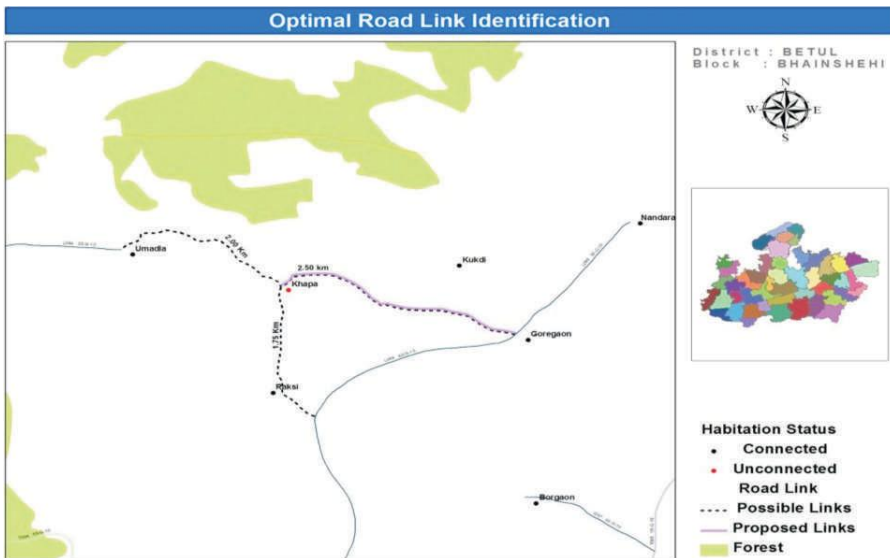
Source: (i-GeoApproach application)

Figure 4.1 *Optimal Road Link Identification*

MPRRDA is headed by a Chief Executive Officer (CEO) and the work is executed by Project Implementation Units (PIU) headed by the Superintendent or Executive Engineers. The organisation provides the flexibility of creation or disbanding of these units based on the workload throughout the state.

4.3 Objectives and Scope of the Project

The project objectives include the conversion of road maps covering the entire road network (NH to village roads) of the state of MP covering 50 districts and 53,000+ villages, into a digital form and its integration with other spatial layers (village locations, railways, major water bodies, forests etc.). It further involves the integration of spatial layers with the attribute data of roads and habitations (census, Core Network (CN-I), PMGSY road progress data etc.). It encompasses

the creation of enterprise Geo-database and the development of suitable decision support systems using the state-of-the-art technology.

🌿 4.4 THE PROCESS OF DECISION MAKING

The planning and decision making in MPRRDA is governed by the geographical (spatial) attributes of roads, villages and other features (railways, water bodies, forests etc.). Out of the multiple alignments to provide connectivity to a habitation, only one is chosen, based on the nearest road, distance computation, proximity analysis and optimisation of connectivity based on index values (weighted average) for the available facilities (education, health, communication, administrative market facilities).

At the time of PMGSY's launch there was no digital data of roads along with other geographical features and associated attributes. The core network of roads was prepared on paper maps and on individual sheets. Therefore, a continuous mosaic of the district was practically impossible. Earlier, paper maps were used for planning roads across the entire Madhya Pradesh. Paper maps were difficult to handle, maintain and update. Also, the traversing/computation of distance was not possible with expected levels of accuracy over paper maps. The updating and linkage of paper maps with other parameters for decision making was not available either. Overlaying the paper maps with other spatial layers was not possible. The proximity analysis with forests, water bodies etc. for paper maps, was also not achievable. Also, no digital data of roads along with other geographical features (habitations, locations, railways, rivers/water bodies, forests etc.) and associated attributes was available for planning. The interconnectivity between blocks/districts and possible alternatives was also not available. Traversing/computation of distance was difficult, if not impossible, with the expected levels of accuracy, and finally, paper maps were difficult to handle, maintain and update. This method of planning, decision making and the preparation of the detailed project report (DPR) for the creation of road infrastructure resulted in inherent drawbacks, which could enable a strong decision support system. Thus, in the absence of a holistic view of the network, the CEO and other executives were fully dependent on the field inputs for verification, policy framing and planning.

The governance process, which involved the use of geo-information (spatial) and communication technologies (Geo-ICTs), was termed G-Governance. The Geo-ICT encompassed synergy and convergence of technologies dealing with several aspects of the spatial data management including data acquisition, assimilation, analysis, information generation, decision support and information dissemination. Most of the economic, social and environmental processes were inherently spatial. The decision makers had to sieve through a large amount of data. The perception of the spatial information i.e., the information in map

formats, with proper scales, legends, symbolisation, colours etc. enhanced the understanding of information interrelationships and thus contributed to a more appropriate location-specific definition of development strategy. Geo-ICT became relevant when the governance of citizen-centric socio-economic development was taken into account.

4.5 BIRTH OF A SOLUTION

It is in this context that the facility called i-GeoApproach was conceived and initiated to overcome the bottlenecks of the traditional Geographic Information Systems (desktop-based), and offer web-based solutions. But our imagination did not stop at that and we decided to Geo-tag the latest conditions of road networks with their longitudes and latitudes. We used the Global Positioning System (GPS), satellites and mobile communication facilities to transfer the images of roads using personal digital assistants (PDA). Finally, to overcome the centralising tendency of e-Governance we used web technologies to facilitate remote updation by the project implementing units (PIU). Finally, the solution that emerged was the i-GeoApproach, which was the fusion of all the technological advancements in this field. It involved the digitisation of block road base maps for the creation of spatial data of the core network and the development of web-enabled Geomatics-based planning and decision support systems as per the PMGSY norms for MPRRDA. The process flow diagram can be seen in Annexure-I.

The planning of roads requires the association and integration of various activities with the spatial (geo-referenced) and non spatial characteristics. The Geomatics-based approach to planning and management solved most of these problems. The development of the i-GeoApproach to road planning involved digitisation of block road base maps for the creation of spatial data of the core network and the development of enterprise web-enabled Geomatics-based planning and decision support system as per the PMGSY norms for MPRRDA. Several special features characterising the i-GeoApproach include thematic map display, built-in traverse-aid, distance computation, display of the habitation/ road profile, query map output, nearest road from a selected habitation, map-based monitoring of the contractors/consultants' road works, etc. The i-GeoApproach helped achieve not only the desired transparency and ease in the planning process, but also facilitated an effective tool for planning rural road connectivity to the habitations. It enabled a faster response to the changing ground realities in development planning, owing to its in-built scientific approach and open-ended design.

Prior to the development of the software, the road network management was largely based on manual inputs, because the digitised data of the network was not available. However, after the software was developed, MPRRDA benefitted greatly in terms of efficient planning, reduction of the operational and maintenance

costs, as well as better monitoring and effective decision making. Distance computation now became possible and the software was capable of measuring aerial distance as well as route lengths, with its built-in traverse-aid and distance computation tool. The map output could also be printed for the desired scale. In addition to roads, there was the facility of overlay of other vital features (village locations, railways, forests, rivers etc.) which enhanced the analysing capabilities. The integration of village-wise census data on population, the availability of basic amenities (education, health, communication etc.), and road data (length, type of road, villages and population that benefit etc.) helped to calculate the utility index for each village, which in turns helped decide optimal road links. Thus, substantial savings were achieved in capital expenditure and operations cost, and the overall planning could become more accurate.

4.6 ARCHITECTURAL FEATURES

In view of the project objectives, a fusion of the web and the Geomatics technologies, a combination of what was new and what was just emerging, was utilised to develop the i-GeoApproach. The following are its architectural features:

The i-GeoApproach is a server-centric G2G application (http://gismp.nic.in/ GeoApproach) with restricted access. Given its Service-Oriented Architecture (SOA) architecture, it offers a framework for the stakeholders and the organisations (government/private) to share and utilise spatial data. The salient features include thematic map display and the display of profile on the selection of road/habitation. Road photographs also appear as part of road profiles. Standard functionalities viz., distance computation/traversing, map tools (zoom, pan etc.), layer on/off, scale dependent labelling/toggling are also available. A query shell is also provided to build both simple and complex queries using the parameters (alone or in combination) available in the attribute databases. Contractor-wise and consultant-wise package/roads can be obtained in the form of maps/reports. Searching/navigation of villages in a district are also possible. The thematic maps showing the functional aspects described above can be seen in Figures 4.2–4.6.

Documentation services facilitate the conversion of the report/map in PDF formats. These reports/maps can be sent to the desired e-mail addresses using the built-in mail client without exiting the application. These maps can be super imposed on Google. The GPS-enabled PDAs are used to track/update the road data and capture the photograph of the road. The i-GeoApproach provides an interactive and user-friendly interface and it does not require any GIS expertise for its operation. It requires about 4 to 5 hours of learning time. An e-User manual is also provided along with the software. At remote locations, only computers with high speed internet connection may be required to access the application. Various spatial layers constituting spatial data creation can be seen in Figure 4.3.

Source: http://gismp.nic.in/iGeoApproach

Figure 4.2

Source: http://gismp.nic.in/iGeoApproach
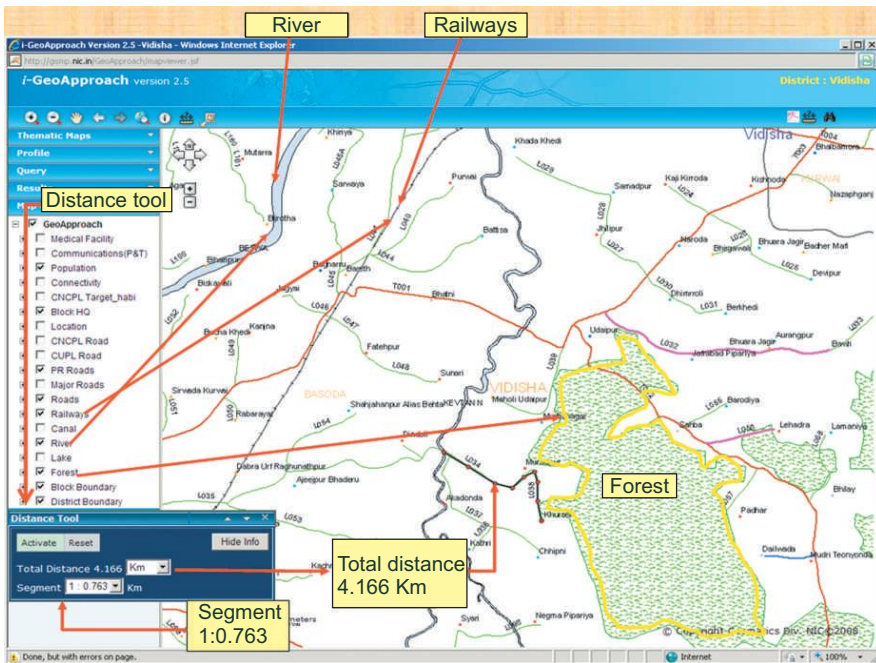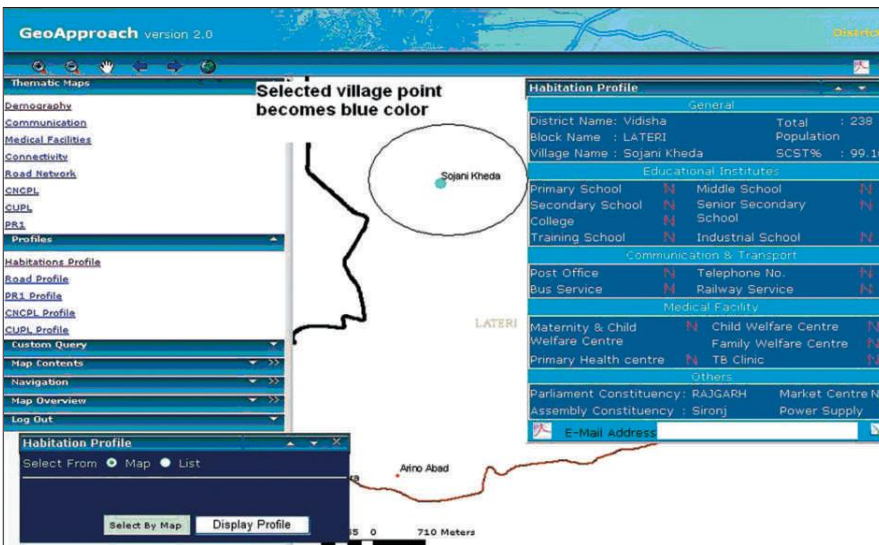
Figure 4.3 *Village Details (Select from Map Option)*
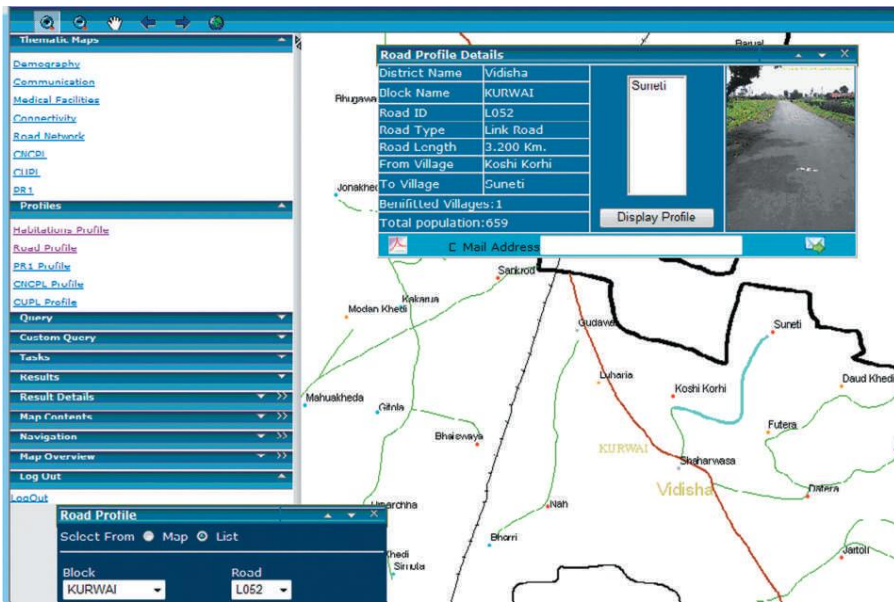
Figure 4.4 *Road Profile of Selected Road*

Geomatics is an emerging technology which is evolving and yet to mature, therefore there are many risk factors involved when citing the proposed and realised benefits. It was challenging to offer a technological solution on the latest platform because of the lack of expertise/back-end support.

There was no case study available on the web-based Geomatics-enabled SOA architecture. A series of brainstorming sessions were held amongst the team members for system design and development. Special research and development efforts were made to arrive at such a pioneering technological solution. Suitable bandwidth requirements at remote locations is still a constraint and may be resolved with the implementation of SWAN, or as and when the service providers enhance the bandwidth.

4.7 PROJECT IMPACT

Earlier, the evaluation and prioritisation of connectivity was a tedious job requiring the involvement of many employees at each level. Now the PIUs are finding it very useful for the preparation of proposals for a road. With this software being implemented, the examination of such proposals at the HQ is
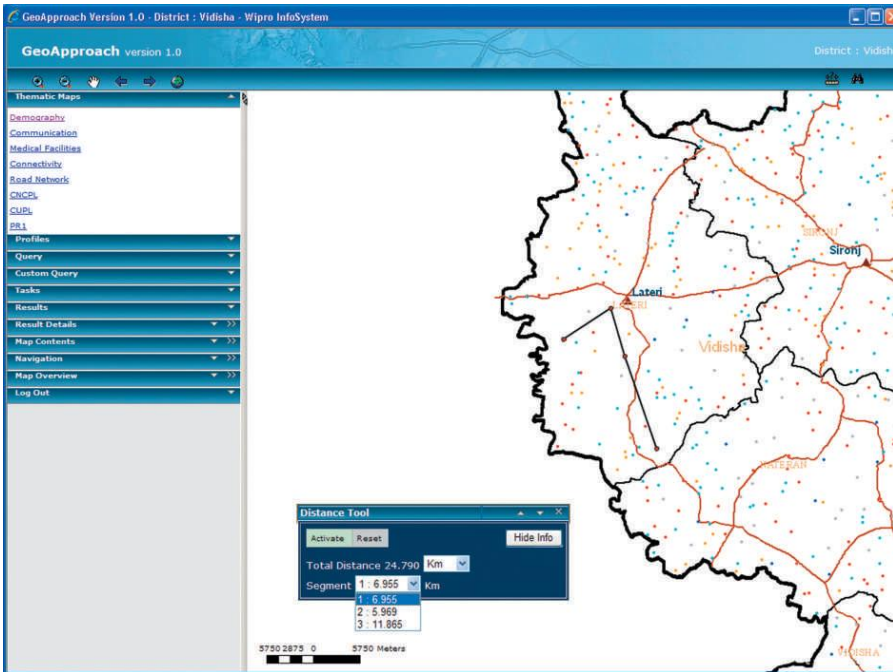
Figure 4.5   *Traversing Distance*
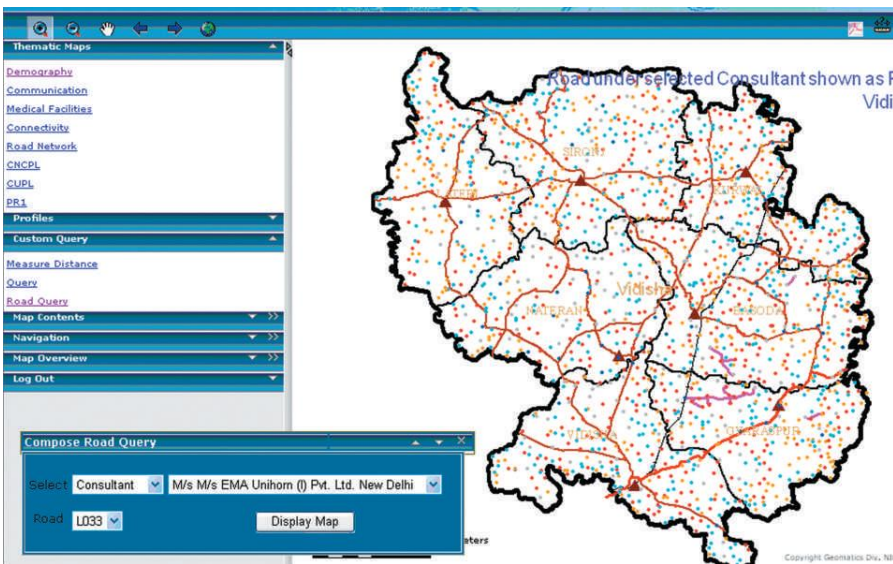
Figure 4.6   *Road Query Menu (Consultant Based)*

Table 4.4 *Statistical Impact Analysis*

Success Indicator	Response Time		Efforts	
	Before	After	Before	After
1st Stage DPR preparation for M.P. Gram Sadak Yojna under NREGA	3 months	1–7 days	600 man days	1 man day
Grievance by villager/ public representative for road connectivity to the village.	15-21 days	Click of mouse	1-5 man days	Negligible
Verification of DPR in terms of length and special features of the roads	1-5 days	Click of mouse	1-5 man days	Negligible
ADB funding requires environment (forest, water bodies) clearance	1-3 months after physical verification	Click of mouse	300-900 man days	Negligible
NOC for road works amongst various agencies	15-30 days	Click of mouse	10 man days	Negligible

	Nos.	Length in Km	Amount (in ₹ million)
Roads	2577	11871	34640
Bridges	101	–	1680

	No. of Roads	Length in Km	Amount (in ₹ million)
Forest Permission	860	3332	9990
Mining	12288	55535	133530
Realignment	64	170	510
Deviation	79	3420	10260

Source: MPRRDA

also a few clicks away. It has thus drastically reduced the response time and the functionality offered adds to savings in time, efforts and costs. It also helps the organisation to manage better with scarce resources. Table 4.4 shows the impact in measurable terms.

It can be seen from Table 4.4 that around 2500 cases of road works amounting to more than thirty thousand million rupees are carried out with the support of i-GeoApproach. Eight hundred and sixty cases of forest permissions have been verified using the system.

It has benefitted the citizens/villagers and the other organisations too. Villages benefit from each proposal that is evaluated. The active use of this software is expected to make decision making more effective, free from corrupting influences,

especially in view of its inherent capacity to make the process of decision making, rational and transparent.

This has significantly changed the mode of working. There is less paper consumed and absolutely no expenditure towards making and printing of maps. Users send the reports/maps in the form of e-mails which reduces the response time and costs. The other stakeholders (PWD, RES, NREGA, power utilities, forest, education, health, rural development etc.) are also able to enjoy the advantages. It ensures that there is no overlap amongst the agencies involved in road development/maintenance activities (PWD, RES and MPRRDA). The SOA architecture enables the availability of spatial data, including the road network, as a central repository, for use by other departments. It arrests redundancy and ensures updated data. The Power Distribution Company (M.P. Madhya Kshetra Vidyut Vitran Company, Bhopal) in MP intends to create a digital power distribution network, comprising of sub-stations and feeders. The bifurcation and re-orientation of new feeders requires detailed knowledge of road networks too. With the evolution of the i-GeoApproach, the company is able to utilise the road network as a published web service and thus able to plan its power network.

4.8 CONCLUSION

The i-GeoApproach can help achieve not only the desired transparency and ease in the planning processes, but can also facilitate the formulation of efficient and effective tools for planning rural road connectivity to the habitations. It enables a faster response to the changing ground realities in development planning, owing to its in-built scientific approach and open ended design. The web-based G2G is a centrally managed and focussed GIS application, and is a cost-effective solution that supports remote users without creating infrastructure at a remote site. The architecture is also in line with the map restriction policy of GoI with regard to spatial data security.

The MPRRDA intends to share its experiences in the design, development and implementation of the software system with other departments, and wishes to spread awareness about the tremendous benefits which are derived post software implementation. This has vastly enhanced the planning competence of MPRRDA and can be replicated in other states with untold benefits.

4.9 FUTURE ROADMAP

This innovative approach will arrest the re-creation of spatial data, its redundancy and inconsistency. For example, once the power network/forest mapping is digitised, it can be shared as a service for other planning activities. These spatial datasets will pave the way for the creation of State Spatial Data Infrastructure (SSDI) which will boost e-Governance in the state/country (see Annexure II).

Annexure – I
Geomatics Approach for Planning Rural Road Connectivity
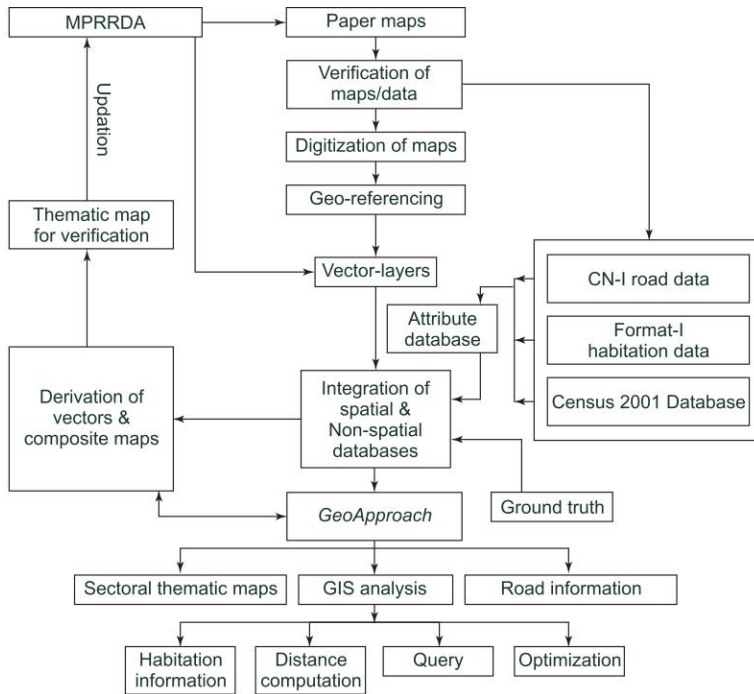
Annexure – II
Conceptual Diagram of SSDI
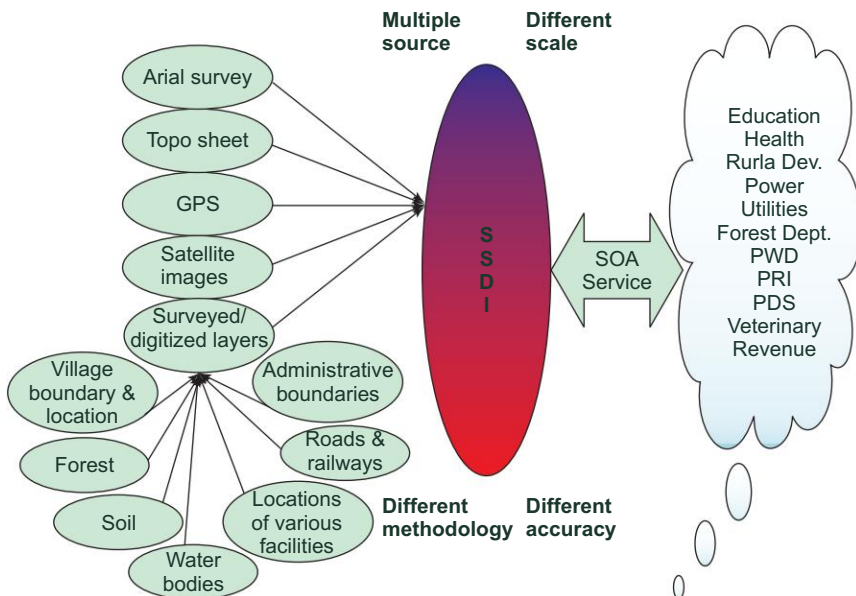
Case 5

e-Krishi Kiran—Scientific Farming through e-Extension

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There is a wave of innovation that is running through various government sponsored projects. A very enlightening example of this is the Government of Gujarat's efforts to promote scientific farming in the state. The programme named e-Krishi Kiran has been pioneered by the Anand Agricultural University (AAU) and has many stakeholders from the state participating in it. It has been well appreciated by farmers because of its favourable results, like improved productivity and better economic gains. e-Krishi Kiran has made the transfer of technology to the farmers more scientific, precise, easy, and need-based.

5.1 History

The Green Revolution in India brought about an increase in the agricultural production and a feeling of self sufficiency to prevail in the country. However, in recent times, the production of food grains has stagnated to around 200-210 million tons. By 2025, it is expected that the country will require 300 million tons of food grains. In this context, it is important to promote the adoption of scientific farming among the farmers. It is also critical to ensure an all round inclusive growth for the farmers, which is aimed at achieving economic prosperity.

The Government of Gujarat, after a thorough assessment of this fact, decided to embark on a massive programme that would address few crucial areas in agriculture that required immediate attention. It took up an awareness-cum-implementation plan across the state, aimed at every individual farmer, in contrast to the current methods of implementing various programmes routinely at the district level. Three issues were identified: (i) the need to promote optimum

fertiliser usage and efficiency in usage through the soil-test method, by analysing the soil in every farmer's field; (ii) the need to develop a crop plan for the rain fed areas which registered low and uncertain productivity and remained a major contributor to poverty among the farmers; and (iii) the need for a more elaborate database, its quick utilisation and networking to enhance efficient and extensive services at various levels of the Department of Agriculture and Cooperation viz., village, taluka, district, and the state level offices. The vast nature of the plan immediately necessitated the use of IT as an appropriate tool to achieve the goal. The programme of issuing cards to the farmers for soil-test-based fertiliser usage and other useful information was initiated, and it was referred to as the "Soil Health Card".

Even though several additions were made and an all-inclusive IT programme emerged, the original title changed to e-Krishi Kiran, which has today, become popular among all the sections of society in rural Gujarat. A visit to the web site http://ekk.gujrat.gov.in or http://ekk.aau.in or http://shc.gujrat.gov.in or http://shc.aau.in illustrates the above details. The website is in Gujarati, however, the English translation is offered by means of a tool tip for the keywords.

5.2 Planning e-Krishi Kiran

India has a number of scientifically proven, location specific technologies available. However, there exists a need to transfer these technologies to the farmers swiftly, so that the productivity and the quality are enhanced. Further, these technologies need to be tailor-made for the agro-climatic conditions pertinent to each farmer's field. Presently, a transfer of technology involves training the extension personnel and the farmers. But there are limitations to directly connecting with individual farmers. The mode of transmission is also tedious and time consuming, since it involves the scientists and the Agricultural Department as well as entails dissemination down the line from the state to the district and then to the taluka level before finally reaching the villages at the bottom of the ladder. It is true that the extension work through radio and television has made an impact, but the recommendations provided can only be general and not specific to individual farmers.

Therefore, the Gujarat Government introduced an "e-agricultural extension media" through the e-Krishi Kiran programme. Since the inputs have been provided as specifically as possible at the levels of the farmer/village/taluka by the scientists through various software programmes, the computer is able to automatically generate and provide specific technologies as output, to the farmer.

Thus, through the e-Krishi Kiran programme, the Government of Gujarat has attempted to promote scientific agricultural technologies by enabling the farmers to derive the required specific information through the use of IT.

5.3 What is e-Krishi Programme?

The main objective of the e-Krishi Kiran programme is to promote scientifically sound agriculture. For example, to achieve scientific fertiliser usage, soil samples from individual farmers are collected, analysed in the laboratories, and on the basis of the available nutrients present in the soil, the farmer is intimated about the fertiliser rate for the crop that the farmer grows. Similarly, based on the **soil moisture index-based approach**, suggestions for more profitable rain-fed crops are made.

The working objectives of the programme can be enumerated as:

- To analyse the soil samples of the farmers' fields across the state, covering all the villages simultaneously.
- To advocate soil-test-based fertiliser rates for different crops grown by the farmer on the basis of the analytical results of soil on his farm.
- To suggest possible new rain-fed crops/cropping systems that can give higher income, based on taluka-level data on the available soil moisture, harvest, and utilisation of run-off water, suitability of crops and crop growth periods based on the moisture utilisation of the crops.
- To provide online, all the scientific recommendations and information for the benefit of farmers as well as all those who are working for the farming community.

The Government of Gujarat identified Anand Agricultural University (AAU) to develop various integrated extension programmes and to set up a network, given its expertise in the IT field. Since it was the first of its kind, an expert committee of scientists, extensionists, administrators, and innovative farmers was formed, which worked in liaison with the experts in the other three agricultural universities of the State and the Agricultural Department of the State. Expertise from other sources was also sought, depending on the need. Some of the salient features of the programme were:

- Gujarati, web-based application, designed to run on network environment, intranet, internet, and GSWAN.
- Id based secured access to the planners, scientists, and other users, based on unique identification.
- Uniformity of user interface for easy understanding and operation.
- Generation of various kinds of qualitative, quantitative, and analytical reports.
- Distributed data-entry and processing capabilities.

- Central control and monitoring system.
- Role-based access to all internal users.
- Easily scalable, expandable, and configurable design.
- Creation of a soil data bank.

✿ 5.4 IMPLEMENTATION

To achieve the objectives of the programme which utilised the various software applications, some basic information was required to be fed into the system. This included:

- Information of individual farmers
- Soil-test values of the individual farmer's field: Values of EC, pH, organic carbon and available phosphorus and potassium.
- Soil characteristics
- Meteorological data
- Cultivation practices
- Data on economics (taluka-wise and crop-wise)
- Recommended fertiliser dose
- Information for crop planning
- Agricultural Production Planning

This information was collected from various government departments, agricultural universities, and NGOs in the state.

The system enables:

- Validation of the data entered for soil analysis, so that data-entry can be checked by the system and the wrongly entered data can be rejected during data entry itself.
- Generation of transaction data for soil, weather, fertilisers, and profitability of a crop, etc. This data can be used for generating reports and making recommendations for crops.

The system can:

- Recommend fertilisers needed for a particular crop based on the nutritional status of the farmer's soil. This is based on low, medium, high soil fertility-ratings.
- Establish the Soil Fertility Index of each village on the basis of the available soil analysis reports for the farmers corresponding to a village. This enables the generation of the Village Soil Health Card. This can be used by

other farmers in the village who have not undertaken soil testing of their fields.

- Recommend the possible alternative crops to a farmer for better crop production, based on his cropping practices and weather conditions in his area. The variables used to decide this are: moisture availability index, available water capacity, length of growing period, surplus water and supplementary irrigation.

- Recommend alternative crops with a generic ranking of the crops in terms of profitability, by looking into the various costs involved for producing that crop.

- Formulate action plans for crop production models, state-wise, district-wise, taluka-wise, and individual farmer-wise.

- Classify and answer FAQ's for the farmers regarding agriculture and animal husbandry.

The main server is maintained at the State capital and the replica server, functioning in contingency capacity, is at the ITC, AAU, Anand. Besides, there is a web server at the agricultural universities at Navsari, Dantiwada, and Junagadh. The programme is a plug-in network to the Gujarat State Wide Area Network (GSWAN). The farmers are also able to access information from their village computers with internet facilities available under the e-gram vishvagram project of the Government of Gujarat.

5.5 Results

Soil Health Card: Soil health and its fertility play a key role in crop production. Soil analysis is an indicator of soil health. However, till the recent past, fertiliser recommendations for different crops were determined by agronomical practices, rather than based on the soil test. Soil test-based recommendations for fertiliser usage not only increases crop production with a judicious investment in fertilisers, but also helps maintain soil productivity. The English version of the printed farmer's Soil Health Card is displayed as Appendix-A.

The general information with regard to the farmer, land, soil analysis, cropwise fertiliser recommendations, and the ready reckoner for calculating the quantity of fertiliser is displayed in the Soil Health Card.

System Generation of Fertiliser Recommendation: The system is fully capable of generating advice regarding the requirement of nitrogen (N), phosphorous (P), and potash (K). The steps mentioned below show how this is arrived at:

- Input of soil sample results from the Soil Health Card

- Comparison against fertiliser range matrix
- Labeling the lab value as either low (L), medium (M), or high (H)
- Comparison against the crop NPK requirements chart
- Advised NPK value for the current crop

Village Soil Health Card: In general it is perceived that the land having different fields in the same village may have less variation with respect to soil fertility. Hence, the fertility index is calculated from the available reports on soil analysis of the fields of the same village. On the basis of the fertility index, the farmers who have not tested the soil are issued recommendations advising them to resort to fertilisation for each crop.

Access to Soil Health Card: The individual soil health card or the village soil health card can be viewed or accessed through the internet. However, it is presumed that the farmers may not have easy access to the internet, hence the Government of Gujarat has offered to supply printed copies of the individual soil health cards to the farmers. Moreover, the printed coloured copies of the village soil health cards will also be supplied to each Gram Panchayat during the Krushi Mahotsav held annually.

Alternative Crop Planning: Crop planning for the rain-fed crops is based on LGP (length of growing period). The LGP is derived from MAI (moisture availability index), which in turn is obtained from AWC (available soil moisture capacity). This exercise takes into consideration soil type, bulk density, available water in the soil, rainfall (average of 80 years) etc. The data on the surplus rain water available for recycling through farm ponds is also obtained. This data has been worked out for all the talukas of Gujarat.

The farmers require guidance on the best possible alternative crops which can be grown on their farms, after considering the soil and meteorological parameters. The Moisture Availability Index is also a factor when considering crop planning.

The availability of water in the soil during the course of crop growth determines its yield largely. Soil water availability depends on the rainfall, the Potential Evaporation Transpiration (PET), the type of soil and crop water usage. Though the availability in terms of the amount, the distribution of rainfall and PET (across locations) undoubtedly affect the duration and the characteristics of the season of growth, the differences in soils, especially with respect to moisture storage and release characteristics strongly influence the agricultural value of rainfall. Thus, a study of the soil water balance is a pre-requisite in planning rain-fed farming for the optimal usage of rainfall.

Calculation of the Moisture Availability Index (MAI): Moisture Availability Index is the ratio of the Actual Evaporation Transpiration (AET) to the Potential

Evaporation Transpiration (PET). Hargreaves (1975) offered the following moisture deficit classification:

Table 5.1   *Moisture Availability Index*

MAI	Moisture
upto 0.33	Very deficient
0.34 to 0.67	Moderately deficient
0.68 to 1.00	Somewhat deficient
1.00 to 1.33	Adequate moisture
>1.34	Excessive moisture

The column definitions used for deriving the above MAI table are:

Available Water Holding Capacity is a constant – Input

Week Number – Input

Weekly Rainfall of Taluka – Input

Weekly PET of Taluka – Input

Difference of Rain and PET (R – PET)

AWPL – Accumulated Water Potential Loss – Sum of negative values of column 4 starting from first negative value

SMS – Soil Moisture Storage

- If AWPL is negative then SMS = AWC* Exp (AWPL/AWC).
- If AWPL is positive then SMS = AWC or SMS =Previous week's SMS + (R – PET) whichever is less.

Delta S = Difference of the current and the previous weekly values of SMS

AET – Actual EvaporationTranspiration

- If Delta S is negative then AET = PET.
- If Delta S is positive then AET = Rain + Delta S

WS – Water Surplus

- If previous week's SMS + current week's (Rain – PET) is greater than AWC then WS = AWC.
- If previous week's SMS + current week's (Rain – PET) is less than AWC then WS = current week's (Rain – PET) – AWC

WD – Water Deficit = PET – AET

MAI – Moisture Availability Index is the ratio of AET to PET i.e., AET/PET.

Using the algorithm detailed above, the Moisture Availability Index has been computed for each Taluka.

Calculation of the Length of the Growing Period (LGP): The crop requires about 0.50 MAI, hence, the length of the growing period can be calculated on the basis of the weekly MAI data for each taluka. To identify the beginning and the end of the growing period, we can make the following assumptions:

1. The Start of the Growing Season (SGS) is considered when AET/PET of that week is > 0.5 and the consecutive three weeks have AET/PET > 0.5 to ensure continuity in water availability to crops after the start of the season.
2. The End of the Growing Season (EGS) is considered during the week when the AET/PET for the week is ≤ 0.5 and the consecutive three weeks have AET/PET less than 0.5.

Finally, the alternative crops that can be cultivated as per the LGP values associated with their respective lands are suggested to the farmers.

Identifying Crops for Different LGP Ranges: The literature suggests certain crops for a given range of LGP. Based on the experience of the currently grown local crops, more crops were added to the list. In addition, some other crops were included, like: (i) the crops which could be grown on residual moisture in Rabi (ii) those which could be grown or which could give a higher yield through the recycling of the surplus rain water (50% of SW, 50 mm per irrigation; generally 1 or 2 irrigation) and (iii) the annual/perennial horticultural and medicinal plants. This exercise has been fulfilled for the entire Gujarat. In the same way, according to the need, crops have been added for different LGP ranges in the state.

This model of the existing crops and cropping systems, and new crops based on LGP and cropping systems has been suggested for each agro-climatic zone. The economics was also worked out and the net profit for each crop/cropping system was also derived.

Suggestion of Alternative Crops: There are two main processes involved in suggesting alternative crops. One is for the rain-fed crops and the other is for the irrigated crops. The rain-fed process is identified as process A (Figure 5.1) and the irrigated process is identified as Process B (Figure 5.2).

The rain-fed cropping module goes through the following processes to create a combination of alternative crops for the farmer's land, based on the LGP (length of growing period) value associated with it.

The irrigated cropping module goes through the process flow stated below. The water requirement of the current crop, the amount of water available with the farmer, and the agro-climatic zone information are the other elements involved.
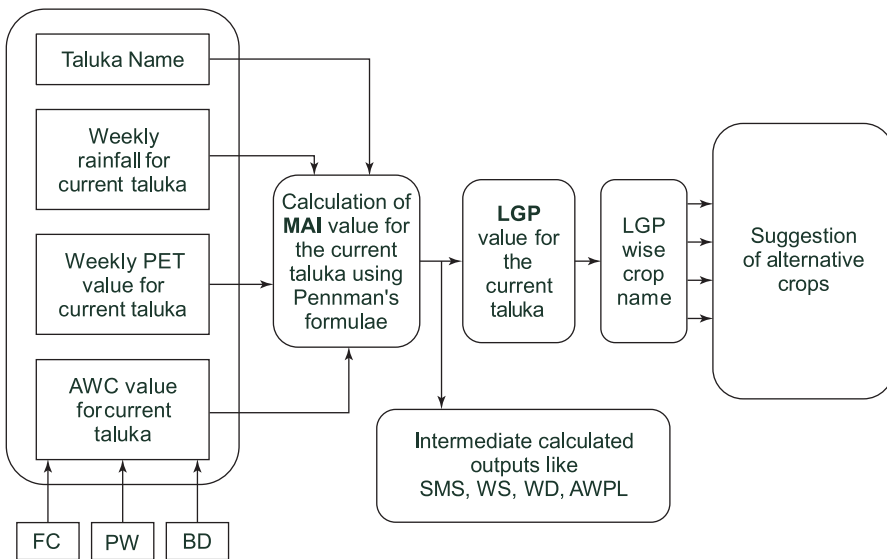
Figure 5.1　*Process Flow Diagram for Rain-fed Crops*
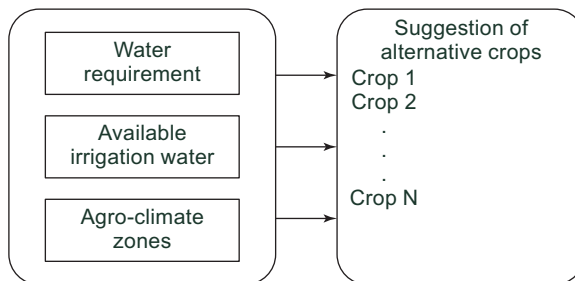
Figure 5.2　*Process Flow Diagram for Irrigated Crops*

The output of these processes for the unirrigated and the irrigated crops, which is the list of alternative crops that can be grown in the farmer's land are generated here. Again, the economic value/economics and the profitability of each suggested crop is given as an input along with the name of the crop. Finally, it generates a list of crops according to their profitability.

Crop Cultivation Practices:　Farmers will be required to understand the scientific cultivation practices of the suggested alternative crops. Therefore, a detailed package of the practices for cultivation has also been given as a hyperlink alongside each crop name. Thus, the existing crops and their economics versus the suggested alternative rain-fed/irrigated crops and their economics along with the package of practices for cultivation of all the crops can be viewed by the farmers.

> **Model Action Plan:**   The function of the Action Plan Module is to capture all kinds of agricultural, demographic, geographic, climatic, and socio-economic data associated with a taluka so that these inputs can further be used to decide the efficacy of the recommendations given to the farmer. This module can also produce different kinds of reports and analysis for the scientists/planners so as to enable better decision making.

FAQ and Solution of Queries: The question—answer bank is classified so as to facilitate easy retrieval of answers by the farmers. The answers of such questions are prepared by the concerned scientists, so that first hand knowledge of research recommendations may be available to the farmers. If a farmer requires more details on technology or has any problems with the existing techniques, he can communicate the issue through the Query Form available on the system.

5.6 The e-Krishi Kiran Application Software

The Soil Health Card Application Software is prepared in six modules as given in Table 5.2.

Table 5.2   *Modules of Soil Health Card Application Software*

Sr. No.	Module	Application Size (MB)	Database Size (MB) [Excluding Log Files]
1	Soil Health Card	114.2	3655
2	Taluka Action Plan	22.32	1072.9
3	Village Action Plan	4.49	200
4	Crop Management	2.9	50
5	Recommendation	63.7	7.25
6	Administration and Security	1.84	30
	Total	209.45	5015.15

5.7 How Innovative is e-Krishi Kiran?

The Government of Gujarat has come up with something unique by launching the e-Krishi Kiran programme which is an online programme enabling technology transfer by focusing on the condition of an individual farm. This programme is expected to bridge the distance between the scientists, the extensionists, the farmers, and the input-output dealers effectively. It is expected to help make the transfer of technology more scientific, precise, easy, and need-based. The e-Krishi Kiran system is a web-based information system, designed to run on a networked environment including the intranet, the internet, and the GSWAN (Gujarat State

Wide Area Network). This is a repository of agricultural information for the benefit of the farmers, the agricultural scientists, and the decision makers.

The e-Krishi Kiran system is a one-of-its-kind information initiative in India, pioneered and initiated by the Government of Gujarat for the benefit of farmers at the grass-root level.

5.8 Impact of e-Krishi Kiran

Soil health analysis provides clues about the health of farms and their strengths and weaknesses in terms of different chemical ingredients, either in excess or in scarcity. It helps to prescribe the required dose of the chemical and the organic fertilisers to bring about maximum productivity, as opposed to the ad hoc methods previously used. Most often, this had led to fertilisers being recommended in excess, rather than as required. Scientific analysis is seen to help farmers make a balanced use of fertilisers, thus bringing about a reduction in costs. The farmer becomes aware of what is lacking in his soil and how he can help make it more productive. The same data helps in deciding an alternative cropping pattern, based on the fertility of the land. The farmer is given a printed card, bearing details of his soil analysis and the recommended dose of fertiliser. The initiative has displayed encouraging results. The farmers who followed the advice, benefitted in terms of cost reduction and could choose better value crops. The farmers who had not been using fertilisers, started using it. Low value crops like jowar and bajra got replaced by cotton as the soil was capable of growing it. Farmers welcomed this, and demanded that this programme be implemented quickly. The fertiliser companies joined hands with the Agriculture Department in these efforts and took up the testing of soil samples in their laboratories. The farmers have benefitted economically, by having access to the agriculture related information and the latest technological innovations. The experts in the field guided them in their own villages or through the gram panchayats, without them having to travel to the district. IT has helped in strengthening the scientist—extension workers—farmers linkages, in addition to traditional extension services.

5.9 Impact on Society

A two-way approach has been pursued by the Government of Gujarat to promote scientific farming. One approach entails the printing of the Soil Health Card and its distribution in the annual Krushi Melas, particularly during the Krushi Mahotsav in summer. The other approach entails the display on the website, http://shc.gujarat.gov.in/. The farmers not only get guidance, but also have full access to the scientific details needed for understanding the various aspects

of scientific farming. On the website information is displayed pertinent to the interlinking of the SHC, Crop Planning, Model Action Plan for extension officials, recommendations on various agricultural technologies, FAQs, e-mail, education, research and extension activities at Anand, Navsari, Junagadh, and Dantiwada Agricultural Universities, various extension programmes, and the agriculture-related data available with the Gujarat Government. Not only has this enabled comprehensive knowledge and guidance to everyone involved in the agricultural development in Gujarat but it has also effected stronger connections through PCs and kiosks. A visit to the website itself will greatly help in harnessing the benefits of this dream project of the Government of Gujarat.

Appendix – A
English version of farmer's soil health card

(7) Crop wise Fertilizer Recommendation on the basis of soil analysis.
(Supply recommended fertilizers as basal dose and in top dressing)
Note: Soil characteristics illustrated in this card is pertaining to this survey number only. Soil characteristics vary for different survey numbers. Use of fertilizers in accordance with soil analysis of individual field is more beneficial.

Season	Crop	General recommendation of fertilizers by Dept. of Agriculture (kg/ha) N P₂O₅ K₂O	FYM (Tones/ha)	Recommendation on the basis of soil analysis (kg/ha) N (kg/ha)	P₂O₅ (kg/ha)	K₂O (kg/ha)
Kharif	Banana			(*FYM-kg/plant, NPK : gm/plant)		
Banana*		180 90 180	15	200	90	180
Kharif	Paddy					
Paddy (Drilled)		80 20 0	6	90	20	0
Medium late (T.P.)		50 25 0	10	55	25	0
Early Maturing (T.P.)		100 25 0	10	110	25	0
Late Maturing (T.P.)		120 30 0	10	130	30	0
Kharif	Tobacco					
Bidi Tobacco (Hybrid)		220 0 0	13	240	0	0
Bidi Tobacco (Improved)		180 0 0	13	200	0	0
Kharif	Castor					
Irri. Castor		75 50 0	10	85	50	0
Kharif	Pearl millet					
Hy. Pearl millet (Rain fed)		80 40 0	13	90	40	0
Kharif	Chilly					
Chilly		100 50 50	10	110	50	50
Rabi	Culcutti Tobacco					
Guj. Culcutti-1		200 0 0	10	240	0	0
Guj. Culcutti-2		150 0 0	10	165	0	0
Rabi	Wheat					
Late sowing		80 40 0	13	90	40	0
Timely sowing		120 60 0	13	130	60	0
Rabi	Chickpea					
Chickpea		20 40 0	10	25	40	0
Rabi	Potato					
Potato		200 100 200	25	220	100	200
Summer	Paddy					
Summer Paddy		100 30 0	10	110	30	0

SOIL HEALTH CARD
DEPARTMENT OF AGRICULTURE
GUJARAT STATE
Year : 2008
SOIL HEALTH CARD NO.: SHC00027842

(1) **Farmer's Name** : Pursotambhai Hirabhai Patel
(2) **Village** : Zarolla **Taluka** : Borsad **District** : Anand
(3) **Account No** : 280
(4) **Land / Soil detail as per account :**

Serial	Survey No.	Area (Ha.)	Soil Type
1	1004-2	00 : 40 : 00	Sandy loam
2			
3			
4			
5			

(5) **Fertility class as per soil analysis of the village :**

Serial	Fertility Class	Nitrogen	Phosphorus	Potash
1	Low	✔		
2	Medium		✔	
3	High			✔

(6) **Details of individual soil analysis : Survey No. : 1004-2**

Sr.	Detail	Result	Interpretation of Result
1	pH (Soil Reaction)	7.20	Normal
2	E.C. (Total Dissolve Salts: dSm/m)	0.49	Normal
3	Organic Carbon (%)	0.26	Low
4	Available Phosphorus (kg/ha)	43.00	Medium
5	Available Potash (kg/ha)	254.00	Medium

pH		E.C. (Electric Conductivity)	
Acidity :	6.5 or less	Normal :	Less than 1.0
Normal :	6.5 - 8.2	Medium:	1.0 to 3.0
Alkaline :	8.2 or high	Harmful :	3.0 or high

Case

6

Mobile Technology Based Reservoir Management System

Sanjay Gupta, IFS

The Irrigation and Command Area Department (I&CAD) of the Government of Andhra Pradesh has built an innovative Decision Support System (DSS) using mobile technology for effectively monitoring and managing the water resources in the state. This has improved the efficiency of decision making on issues relating to water management, on a day-to-day basis, and prepared the state for better disaster management, handling of water crisis and so on. The DSS is supported by inputs from the Remote Sensing (RS) and the Geographic Information System (GIS) based technologies. The system is simple and innovative in design and is being replicated in other states such as Rajasthan.

6.1 History

Irrigation supports about ₹ 4,50,000 million[1] worth of agricultural production in Andhra Pradesh and about 6 million farmers directly. This is excluding those who are indirectly dependent upon irrigated agriculture. All the rivers in the state are seasonal and receive water only during the monsoon months. It is estimated that a significant amount of rainfall occurs over a span of approximately 100 days. This rain water therefore needs to be stored in reservoirs, for use, all the year round. Hence, monitoring of the water supply is essential to keep the economy functioning, especially since the agriculture, power generation, and other industries are dependent on water, and it also satisfies the basic need for drinking water.

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1. At current prices of 2008-09

Table 6.1 *State-wise Comparison of Irrigation Potential—Ultimate, Created and Utilised (in million Hectares)*

State	Ultimate Irrigation Potential	Created Irrigation Potential	Utilised Irrigation Potential
Uttar Pradesh	296.3	323.85	256.8
Madhya Pradesh	162.14	20.39	15.63
Andhra Pradesh	112.6	67.71	60.87
Bihar	108.8	76.37	56.07
Maharashtra	89.92	65.49	49.60

The Irrigation and Command Area Development Department (I&CAD) of the Government of Andhra Pradesh manages a vast network of reservoirs and canals that are comparable to those in some of the larger states in India (see Table 6.1). The Planning Commission estimates suggest that the ultimate irrigation potential of Andhra Pradesh is the third highest in the country, at 112.6 million hectares (ha). The created potential so far, is only about 67.71 million ha while the utilised potential is even less at about 60.87 million ha.

The I&CAD department is responsible for the construction, operation, and management of the irrigation infrastructure, for the entire state, spread across 46 river basins. Surface irrigation projects in Andhra Pradesh include 18 major irrigation projects[2] with the irrigation potentials of about 3.5 million ha, 66 medium-sized irrigation projects with the potential of about 4,00,000 ha and about 75,000 minor irrigation tanks that cover about 17,000 ha. For details of the location and coverage of the major irrigation projects, please refer to Figure 6.1. In addition, these reservoirs supply drinking water to numerous villages, towns and cities including the populous and major ones like Hyderabad, Vishakhapatnam, Vijayawada and so on.

Both the State and the Central Government owned power plants like the National Thermal Power Corporation depend on these reservoirs for their functioning. Approximately 2674 MW of power can be generated by the hydel power stations and about 3860 MW by the thermal power stations, from the water supplied by the reservoirs. Even core sector industries such as the steel industry, require water for production.

Monitoring of the inflows, the outflows, the levels, and the present capacities of the reservoirs is essential for decision making regarding the volume of water

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2. Projects irrigating more than 10,000 ha are classified as major; between 2,000 and 10,000 ha as medium and below 2,000 ha as minor

IRRIGATION BY SURFACE AND GROUNDWATER
in 2000-2001
Mandals

Area irrigated by groundwater
as percent of total irrigated area

80 TO 100%

60 TO 79%

40 TO 59%

Area irrigated by surface water
as percent of total irrigated area

80 TO 100%

60 TO 79%

40 TO 59%

Surface = 59%, Ground = 41%

0   220 km

Data source:
DIRECTORATE OF ECONOMICS AND STATISTICS
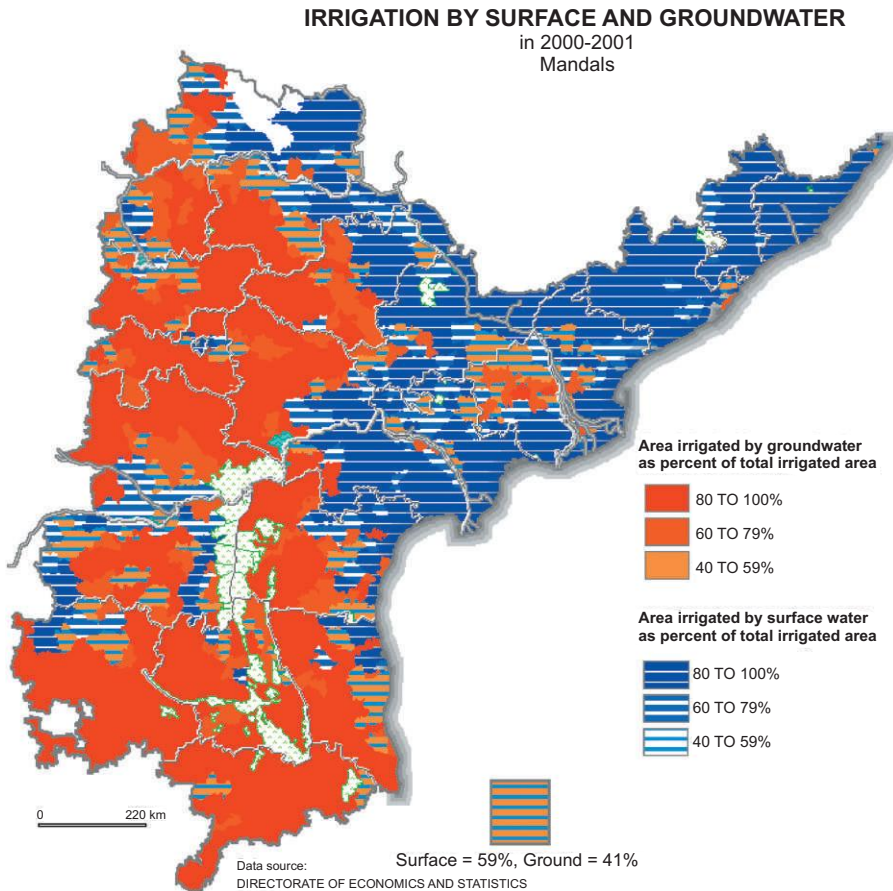
Figure 6.1

to be released for various purposes, round the year. Earlier, a person located at each reservoir site would manually record the levels, the inflows and the outflows in a register, and then transmit the readings over the phone to the control room of the state head office of the I&CAD. The information, received from each reservoir, was recorded by the on-duty staff, in a register, and then a state level report was manually prepared on a daily basis. This report was then either faxed to the various offices or delivered in person. The manual process often resulted in delays and failed deliveries.

To resolve these issues, a sensor based technology was proposed to be used. To start with, it was piloted at a few points in the Nagarjunasagar Project. These electronically operated sensors cost about ₹ 0.5 million each, and were of two types. The first type was capable of auto-transmission. But the user also required satellite bandwidth on a regular basis for consistent and auto transmission of

the information. This was a costly proposition. The other type of sensor would record the information, and then a person would have to draw this information manually, to use it further or to transmit it to others. However, in both the cases, continuous power supply at the installation site was a pre-requisite.

6.2 Problems in the Conventional System

There were several constraints in the manual transmission of reservoir related information. Often a very junior ranked staff was asked to send the information without the approval of the dam site-in-charge engineer. Hence, chances of wrong information being communicated would abound. The compilation of information from different reservoirs and the dissemination of the compiled reports to various offices at the state level was a time consuming process. The historical information was not available to any of the senior officers receiving the compiled state level report. In times of emergencies, for example, during floods, decision-makers had to depend on the availability of the various registers for obtaining historical information. This was again time consuming and affected the response time required during disasters.

No information for the flow of canal water was available within the respective irrigation project. Hence, it was not possible to have a state-wide comprehensive picture on water release in the various project canals. Moreover, these canals criss-crossed the entire state and covered several thousand kilometres. In the absence of any report on outflows, it was not possible to create a real-time picture of the water supply for power generation. Also, data on irrigation water supplies, at various points, within the vast network, was not available on a regular basis, thus leaving the essential issue of water management unattended.

Safety of the sensors was another critical issue, since these sensors had to be installed at places far from the habitations, along the routes of the canals, thus exposing them to the risk of theft. Moreover, these sensors, capable of transmitting data at the desired interval (say every five minutes), involved complex technology and post-installation maintenance generally by a foreign firm or its franchises, which was a costly affair. The use of sensor based technology (SBT) could be justified in the circumstances where data was frequently needed from the otherwise inaccessible sites. SBT proved to be uneconomical for merely monitoring the reservoir levels or canal flows, since under normal conditions, daily information was found to be quite satisfactory. Moreover, the hostile attitude of the rural community which felt that an automated device was for water usage regulation, added to the problems. In some places the locals tampered with the installations, making the system non-functional. These constraints limited the usability and scaling up of the SBT across the state. Its implementation in the Kurnool Cuddapah Canal Modernisation Project (KC

Canal) failed, though the Japanese Bank for International Cooperation was willing to provide the funds.

6.3 APPLICATION CONTEXT

One of the core issues in water management and disaster management is the timely and periodic flow of information to the project managers and the users. Information on water availability in the reservoir including the inflows, rainfall in the catchment and command areas and the depth of the ground water table, play a predominant role in decision making at the project level, on water scheduling. While the information on water release schedules was available to the farmers, the information on the amount of water that would be released, was generally unavailable. Since all the major irrigation projects in Andhra Pradesh were spread across a vast area, with canals spanning hundreds of kilometres, covering millions of hectares and involving a large number of farmer organisations, the collection, consolidation, and dissemination of information to the decision makers and farmers was a mammoth task. Moreover, since the data was of a dynamic nature, its regular update and feedback was required, which would not only enable decision making, but also ensure water use efficiency (WUE) by allowing the canal gate structures at various points to be operated accordingly, to avoid wastage.

6.4 MOBILE TECHNOLOGY BASED WATER MONITORING: OBJECTIVE AND SCOPE OF THE NEW PROJECT

In view of the inherent constraints in the manual monitoring system, the Commissioner, Command Area Development, commissioned an assignment to the Andhra Pradesh Remote Sensing Application Centre (APRSAC) for digitising the entire canal network through remote sensing. This would create a geospatial project map, for attributing data related to the water flow and the actual area irrigated.

The Centre for Good Governance[3] (CGG) was asked to design and develop a dynamic, real-time, web-based, data capturing system using mobile technology. This would help provide information on the reservoir levels and the canal network flows, thereby ensuring timely action for enhanced WUE and natural resource management in a transparent and accountable manner. The assignment included the generation of spatial maps and the distribution of these to engineers, administrators and policy makers. This would in turn minimise the adverse effects of natural disasters like floods and cyclones.

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3. Centre for Good Governance is an agency based in Hyderabad working extensively on innovations in governance.
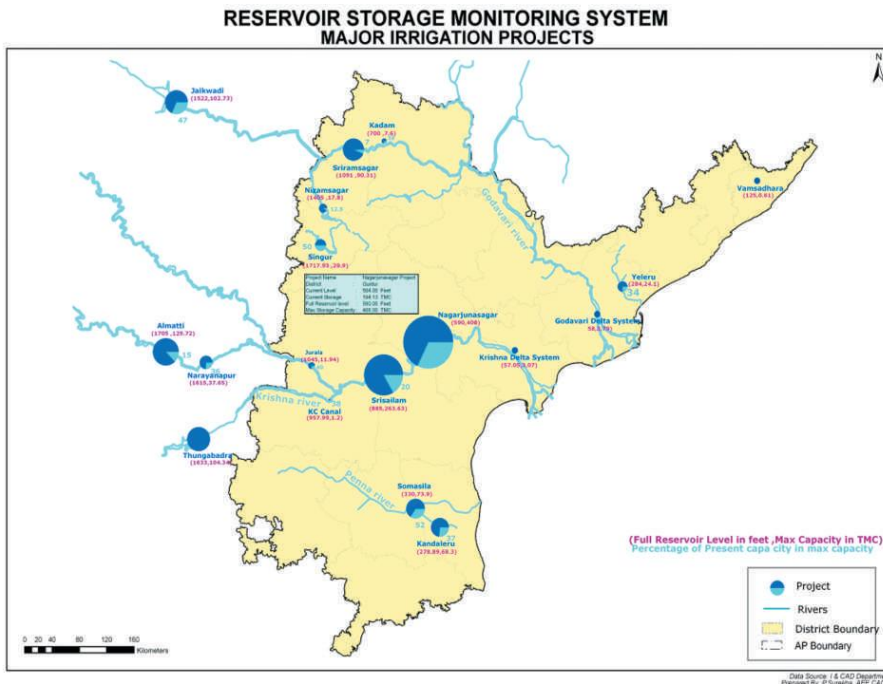
Figure 6.2 *The Reservoir Storage Monitoring System*

Two applications were developed. The first one was the Reservoir Storage Monitoring System (RSMS) and the second one was the Canal Network Flow Monitoring System (CNFMS). The scope of the applications is described below.

Scope

- To digitise the canal network to a 1:25,000 scale for all irrigation projects and to link it with related data on hydraulics and water release.

- To develop a web-based application titled Reservoir Storage Monitoring System (RSMS) to capture reservoir inflows, levels and outflows across 17 major irrigation reservoirs and 60 medium irrigation projects, in the three river basins namely the Krishna, the Godavari and the Penna (Figure 6.2).

- To disseminate information to the predefined authorities and farmer organisations (FO) through auto generated SMSs and FAXes from the server.

- To jointly identify, with the irrigation project authorities, the vantage location points on the project canals that are critical for monitoring canal flows. This activity would cover all the major irrigation projects spread across 67 lakh acres in the state.

- To develop a web-based application titled Canal Network Flow Monitoring System (CNFMS) to capture canal flows across the 14 major irrigation projects in the state.
- To group the points identified, in accordance with the administrative jurisdiction of the various levels of officers and FOs, and disseminate information to them through SMSs.
- To develop not only the data capture interface for mobile phones, but also a website for disseminating the information in the form of graphs, maps and tabular reports and to allow access to historical data.
- To develop and operationalise a method of "on request" data transmission through SMS and FAX to any one from the public.
- To remotely sense the actual area irrigated and the cropping pattern adopted in the respective project areas.

6.5 BRIEF DESCRIPTION OF THE PROJECT

6.5.1 Planning

The planning process was simple. The development team consisted of the Irrigation Department engineers who had an interest and expertise in information technology and were domain experts as well. Consultations on the proposed methodology were held, not only with the seniors in the engineering hierarchy but also with the farmers, to solicit their views. The scope of the information that would be needed for the effective discharge of the day-to-day duties was ascertained. The information to be collected and disseminated through SMS was identified. The scope of the temporal and the spatial information was also ascertained to define the graphical, the tabular and the spatial reports to be made available through the web.

6.5.2 Project Preparation

The Monitoring of reservoir and canal flows are the core governance functions of the irrigation department. Each chief engineer concerned with the irrigation project is expected to draw an operational plan for the project, indicate the water release schedule, and monitor it. At the State level, the Commissioner of the Command Area Development (CAD) is expected to review and monitor the water releases. However, there is no mechanism available with the Commissioner of CAD, to monitor the status and release of water as per the schedule, for different projects. Earlier, the flood-related information was collected by the Flood Control Room in the office of the Engineer in Chief (Irrigation). In 2006, a Geo-MIS cell

was established under the I&CAD department, and staffed with engineers having technical expertise in this area. The cell acquired and stored data on various themes like hydraulic pressure, irrigation, project details, NRDMS, climatological details and so on. It developed applications by networking with the CGG and APSRAC also. Although the SMS-based methodology did not require any formal training or capacity building, training was needed for explaining the method of sending information to the dedicated mobile number. These systems are now established through a technology that is cheaper than the existing manual methods, and involves information dissemination to a large number of users ranging from the office of the Chief Minister, Secretaries and engineers to the FOs. Any disruption in the present methodology would adversely impact these users. Simplicity and easy availability of technology would also ensure its sustainability.

6.5.3 Process Flow in the New System

The overall flow of processes in the new system can be briefly described through the flow diagram below. The base maps of canal networks are created through remote sensing. The reservoir location and canal gauge point location are marked. Information received through SMS, updates the attributes of these locations. The reports are then sent through auto FAX, SMS to the various levels of stakeholders for decision-making and monitoring (Figure 6.3).

Data acquisition-
On reservoir status and water release, through SMS

Data attributable-
To canal network.
Digitised, through remote sensing

Information dissemination-
Auto transmission and on-demand SMS and fax
Web-based tabular, graphical and map-based reports
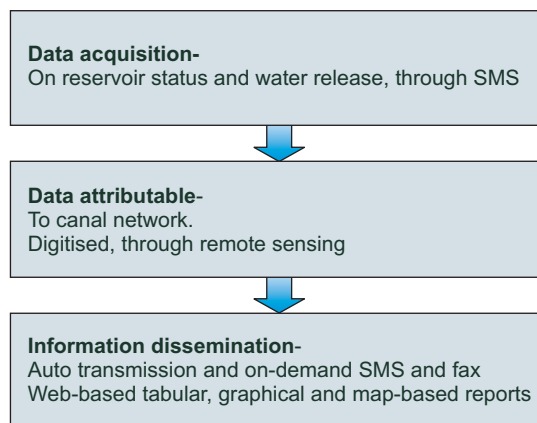
Figure 6.3 *The Process Flow in the System*

6.5.4 Procedure

Since the RSMS and CNFMS are both applications of mobile based technology, the basic process remains the same. This section elaborates the various steps involved in developing the above system.

- Design and development of a web based system
- Data capture

- Data collation, updation, and compilation
- Generation of reports, charts and spatial maps
- Data dissemination and
- Public access to website

6.5.4.1 Design and development of web-based system

The first step in the entire exercise is to plan and design the input formats for the web-based system. Mobile technology is integrated into the software enabling the field engineers to have faster access to the database of the website that has a link to GIS for generating maps. As depicted in Figure 6.4, information flows from the field engineer (in the form of raw data) to the mobile phones of the decision makers (processed information). Different technologies are used en route to achieve the desired purpose.

6.5.4.2 Working principle

The field engineer at the site, sends an SMS, in a predefined format, from the location specific mobile number, to the designated number. This information
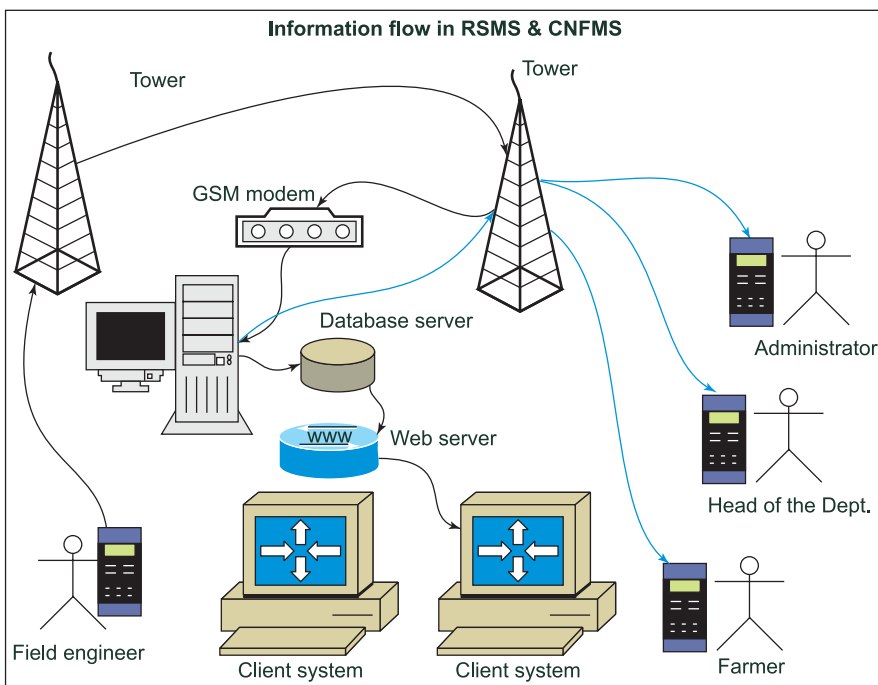
Figure 6.4 *Information Flow in the System*

passes through the towers of cellular phone operators, in store and forward mode. At the receiver's end, the SIM of the designated number is placed in a GSM modem. The GSM modem is connected to a computer running on the Linux operating system. SMS "pull" software application, running on this system, polls the GSM modem at regular intervals and picks up the SMSs received till that time. It then transmits them to the database server, duly deleting them from the SIM card in the GSM modem. The trigger programs written in the database server process the data from the database and make it ready for general use. The web server interacts with the database server and provides the reports relevant to the user who has logged in, depending on the access privileges. SMS "push" application placed in the computer is triggered at scheduled intervals using the "crontab" functionality of the Linux environment. This distributes the information to the predefined authorities in an appropriate format.

Static information regarding the reservoirs and canals, such as the design, discharge at the off take points of distributaries and cross regulators in the main canal, are stored in the database. To begin with, the off takes of fairly large distributaries, covering up to 30 locations in the irrigation project, are identified to initiate the analysis. It is worth mentioning here that it is possible to identify the discharges into the smaller distributaries, with the data obtained from cross regulators. The CNFMS captures the water release data from the designated mobile at regular intervals and stores it in the central database server. An automated triggering mechanism, in-built into the central database server, updates the database on the website http://apcnfms.cgg.gov.in, on receiving the water release data through the SMS enabled input.

The application, which processes the water release data and provides outputs and reports for the different users for the various points on the canal network and cross regulators, is pre-programmed. This CNFMS serves as a water release monitoring tool in the hands of the State level Irrigation Department officers. The field level officers use detailed SMS. This information is now provided even to the office bearers of the Farmer Organisations (FOs) to review the day's water release status and plan appropriately at their level. This has helped resolve conflicts between the FOs to a large extent. Further, the website provides project specific interfaces with other salient information, which varies from project to project. Consolidated outputs and reports are made available to the concerned users in emergency conditions through automated faxes, using a dedicated telephone line, connected to the central unit. The real time discharge is analysed with reference to the pre-designed discharge schedules and localisation. In addition, the tool cross verifies the water release rationale in a transparent manner, which avoids water conflicts among the stakeholders in different reaches (Figure 6.5).
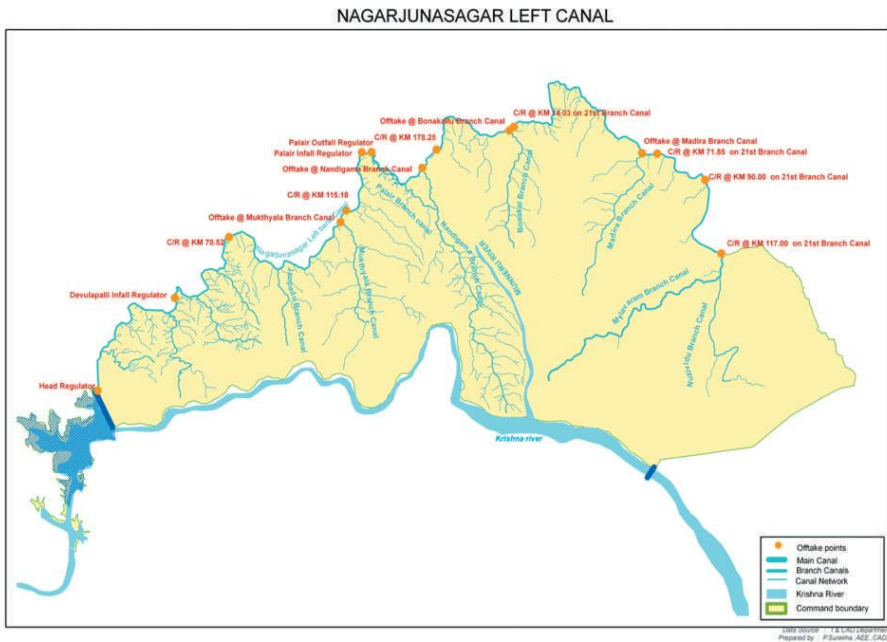
Figure 6.5   *Gauge Point Locations for Canal Network Flow Monitoring System- Nagarjunasagar Left Canal*

The Government of Andhra Pradesh issues instructions from time to time on the utilisation of water by various sectors, under each irrigation project. The allocation in terms of drinking water, irrigation, power generation, and industries is indicated in the orders, which are circulated to the irrigation officials for necessary action. As a next step, based on the actual availability of water, the irrigation officials allocate the water for these sectors and finalise the day to day release schedule with the approval of the government. The allocation as per the order, the discharge design and the actual planned volume of water, constitute the static columns of the format. The actual release data is captured on a real time basis every day and sent through SMS.

6.5.4.3 Data dissemination

The data/information regarding the reservoirs which is received from the concerned project engineers daily, at about 8 am, gets updated in a consolidated manner in the server every day. The system generates a report for all the major reservoirs, which in turn is distributed automatically, to all the stakeholders by the following modes:

(i) Automated data transmission through SMS and Fax
(ii) On demand SMS and FAX
(iii) Reports on the website

Automated data transmission through SMS and Fax—Once the data is updated into the central web-based server, the consolidated information on the major projects is sent automatically through an SMS, at 10.30 am everyday, for the projects in each of the three basins, separately. A consolidated fax gets auto sent to the designated officers daily at 11.30 am.

<Project Short form>space<present storage/Max storage (TMC)>space<Inflow (Cusec)>space<Outflow (Cusec)>. The information will appear as follows:

SRSP 23/163 TMC 2400 cusec 29100cusec

The information relating to the CNFMS is given out in two parts, to two different levels. The consolidated water release information from a project is sent to the administrators and senior level officers like the secretaries, the commissioners and the engineer-in-Chief while the discharge point wise information is sent to the executive engineers and the farmer organisations.
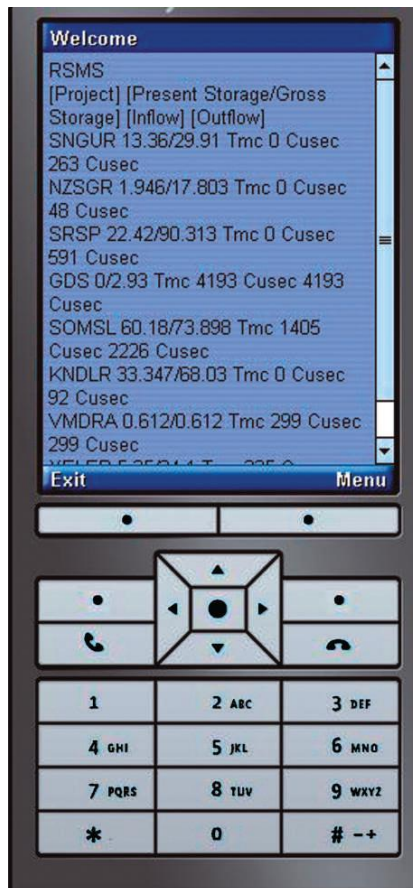
Figure 6.6 *SMS Data Transmission Format*

Automated Fax Format: The RSMS related information, for all the major irrigation projects, is sent to the various government officials in the format shown in Table 6.2:

Table 6.2   *Auto Fax Format*

Sr. No.	Project Name	FRL (Feet)	Present Level (Feet)	Max Storage (TMC)	Present Storage (TMC)	Yesterday's Inflow (Cusecs)	Present Inflow (Cusecs)	Outflow (Cusecs)
	KRISHNA BASIN							
1	Nagarjunasagar Project							
2	Sriramsagar Project							

On-demand Data Transmission: Information is made available to the public at large, on demand, both through SMS and fax. Public users can access project specific information for any of the 17 major projects, through SMS, by sending the message in the format stated below. The user needs to send an SMS specifying the short form of the project to the number: 9963550620. The modem recognises the mobile number that has sent the request. The database at the server sends the latest available information detailing the project name, present level/ full level, present storage(TMC), inflow (cusec) and outflow (cusec). For example, to obtain information pertaining to the reservoir level of the Nagarjunasagar Project, one has to send the following SMS:

   Type NSP and SMS to 9963550620

On-demand Fax: Any one can access information in the format "supra", that is sent to all the government officials. One needs to SMS the number, on which the FAX is required, in the following format, to 9963550620

For Hyderabad: <Fax>space<all>space<Fax Number> For Example: Fax all 23305951

For any other place in Andhra Pradesh: Fax>space<all>space<95STDcode>space <Fax No>. For example to receive Fax at Vijayawada: Fax All 95866224703

For State Outside AP: Fax>space<all>space<STD code>space<Fax No> for example: Fax all 0112440675

Website access to tabular, graphical and map based reports, for the public: Users from among the public can log on to the website http://cadarsms. cgg.gov.in, with user name and password as "guest" for unrestricted viewing access to 1) Tabular: project level reports, basin reports and canal network reports, 2) Graphical: basin level reports, outflow reports and reservoir level reports,

3) Spatial reports. These reports provide the temporal outlook for different administrative hierarchies such as for a canal, a project or a basin. The reports can be for a day, a week, a month or a year. The user can select the project and time period as desired. This is achieved through a dynamic database linked to the website. These reports can be used for different purposes like flood warnings and disaster management, water inflows, releases to various sectors at the dam sites and the planned and actual releases at various locations of the canal network. The various types of reports possible are briefly explained here.

1. Tabular Reports: These reports can be generated by the user for a canal, a project or a basin, for a period, as defined by the user.

   (a) Project level reports: These indicate the project level reservoir status, with daily reservoir level data, for a week (see Table 6.3). They are auto generated, indicating details of the storage level, the capacity, releases into the right and the left canals, the discharges into river, releases to the industries and the power generation units for major irrigation projects. This project report in itself is a tool for monitoring the water releases from a project for various uses.

   (b) Basin reports: Basin reports, as illustrated in Table 6.4, provide a holistic picture of the water level in the reservoirs, in a given river basin. The full reservoir level (FRL) and the maximum storage in TMC, are constant data, while the data such as the present level, inflows of yesterday and today, and outflows, in cusecs, change on a day to day basis. The prompt availability of these basin reports is useful on many occasions such as floods, for power generation and so on.

   (c) Canal network reports: The canal network flow monitoring system is designed to identify the water releases against the design discharge and the planned discharges. The outflows at every identified location are automatically generated into a daily report. This is accessible to the irrigation officials, the farmers' organisations and the general public on demand, through a simplified SMS code. The CNFMS format, for designed discharge, planned and actual discharge of a branch canal is shown in the screenshot below (See Table 6.5). This report also indicates the excess/deficit flows into a particular branch canal.

2. Graphical Reports: The analysed data can be viewed on the website, in the form of charts/graphs, that facilitate quicker and better understanding of facts. Graphical reports are generated automatically now as compared to the previous system, where everything had to be keyed in afresh. Auto report generation facility provides operational ease for dynamic situations. The input format compiled over a period of time also provides better understanding of the time series data depicted through graphs. Yet another

Table 6.3 *Reservoir Level Report for Daily Inflows and Releases*

Date	Level (Feet)	Capacity (TMC)	Inflow (Cusecs)	LMC (Cusecs)	Krishna River (Cusecs)	RMC (Cusecs)	Power (Cusecs)	AMRP (Cusecs)	Industries (Cusecs)	Evaporation Losses (Cusecs)	Total Outflow (Cusecs)
26-Dec-09	550.8	297.04	10469	11617	0	12000	0	1800	0	157	25574
25-Dec-09	551.3	298.33	16287	11456	0	12000	0	1800	0	157	25413
24-Dec-09	551.6	299.1	13373	11532	0	12000	0	1800	0	157	25489
23-Dec-09	552	300.14	7465	11603	0	12000	0	1800	0	137	25540
22-Dec-09	552.6	301.69	10198	11346	0	12000	0	1800	0	137	25283
21-Dec-09	553.1	302.98	4056	11184	0	12000	0	1800	0	137	25121
20-Dec-09	553.8	304.79	19134	11327	0	12000	0	1800	0	157	25284
19-Dec-09	554	305.31	10275	11400	0	12000	0	1800	0	0	25200
18-Dec-09	554.5	306.6	10316	11464	0	12000	0	1800	0	0	25264

Table 6.4 *Basin-wide Report*

Sr. No	Project Name	FRL (Feet)	Present Level (Feet)	Max Storage (TMC)	Present Storage (TMC)	Yesterday Inflow (Cusecs)	Present Inflow (Cusecs)	Present Outflow (Cusecs)
1	ALMATTI	1705	1702.7	129.72	117.3	–	–	6584
2	NARAYANAPUR	1615	1613.33	37.65	35.53	–	6943	6804
3	JURALA	1045	1044.83	11.94	11.72	3330	3780	2530
4	TUNGABHADRA	1633	1624.14	104.34	71.49	–	–	3447
5	KC CANAL	957.99	–	1.2	–	–	–	–
6	SRISAILAM	885	879.9	263.63	235.29	–	1150	4616
7	NAGARJUNA SAGAR	590	550.8	408	297.04	16287	10469	25574
8	PRAKASAM BARRAGE	57.05	57.05	3.07	3.071	–	6043	6043
9	SINGUR	1717.93	1704.43	29.91	13.38	–	–	263
10	NIZAM SAGAR	1405	1383.06	17.8	1.955	–	–	48
11	JAIKWAD	1522	1503.47	102.73	43.1	–	–	212
12	SRI RAM SAGAR	1091	1066.3	90.31	22.417	–	–	548
13	DOWLAISWARAM	45	10.9	2.93	–	–	3354	3354
14	SOMASILA	330	321.69	73.9	60.25	–	2226	2226
15	KANDALERU	278.89	250.54	68.03	33.347	–	–	102
16	YELERU	284	234.45	24.1	5.38	145	225	384
17	VAMSHADHARA	125	125	0.61	0.612	–	50	50
18	Kaddam	700	–	7.6	–	–	–	–
19	Lower Manair Dam	920	–	24.07	–	–	–	–

Table 6.5 *Branch Canal Report of Nagarjunasagar Right Canal*

Sr. No	Name	Location (Km)	Designed Discharge (Cusecs)	Actual Discharge (Cusecs)	Deficit / Excess (Cusecs)
1	Bonkal Branch Canal	14.02	1377.27	953	–424.27
2	Madhira Branch Canal	71.846	1541	52	–1489.00
3	Muktyala Branch Canal	115.405	1770.81	1412	–358.81
4	Mylavaram Branch Canal	117.007	1521	417	–1104.00
5	Nuzvidu Branch Canal	117.007	1233	417	–816.00
6	Nandigama Branch Canal	154.598	980.9	510	–470.90
7	21st Main Branch Canal	178.271	5756	2100	–3656.00

advantage of graphs is that a number of variables can be easily compared and presented at the same time. They also have the inherent capability to project trends. The users of these graphs include a large number of farmers and officials from different disciplines and the media. The following

examples of charts will provide a clear indication on the utility of presenting data in this form, for decision making at various levels. These reports can be generated for different periods and they give an overview of reservoir performance in terms of the capacity and outflow, over a period of time.

(a) Basin level reports: The data received through the reservoir storage monitoring system is converted to bar charts showing full reservoir capacity, full reservoir level, current capacity, current level and the corresponding capacity and level in the previous year, on the same date, for the projects falling within the selected river basin (Figure 6.7).
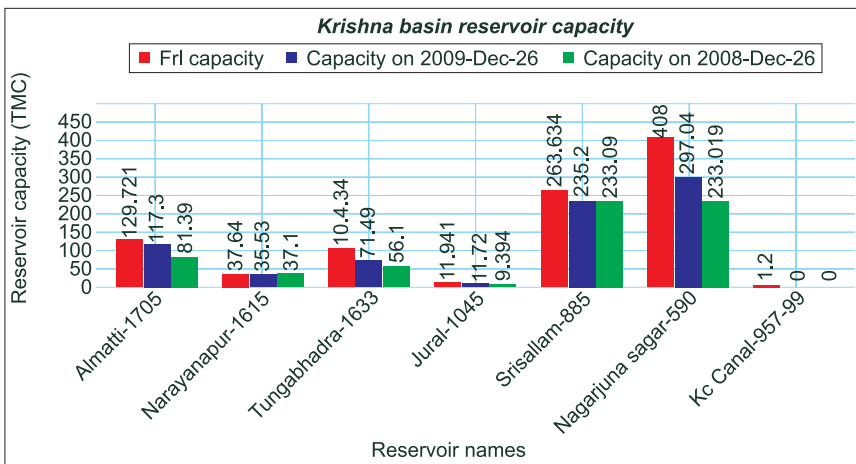
Figure 6.7 *Capacity and Level Graph for Reservoirs in the Krishna Basin*

(b) Outflow report: The following chart shows a comparison between the full reservoir level and the current level, inflow and outflow on a daily basis, generated for all the major and medium irrigation projects (Figure 6.8).

(c) Reservoir level reports: Various types of graphical reports can be viewed on the website for the selected reservoir. These reports could be daily, monthly, annual or a comparison over a few years. The reports can be viewed for reservoir level or reservoir capacity (Figure 6.9).

3. Spatial Reports: The RSMS and the CNFMS are web-enabled dynamic systems, with the databases linked to the digitised canal and river network. They generate maps from the current data using Arc IMS. The maps contain information such as the project location, the current level and storage, the full reservoir level (FRL) and the storage capacity at FRL. This map can be generated for the entire Krishna, Godavari and Penna river basins, covering the states of Andhra Pradesh, Maharashtra and Karnataka.

The CNFMS related maps depict the actual canal network and the daily water flow information along with other hydraulic information (Figure 6.10).
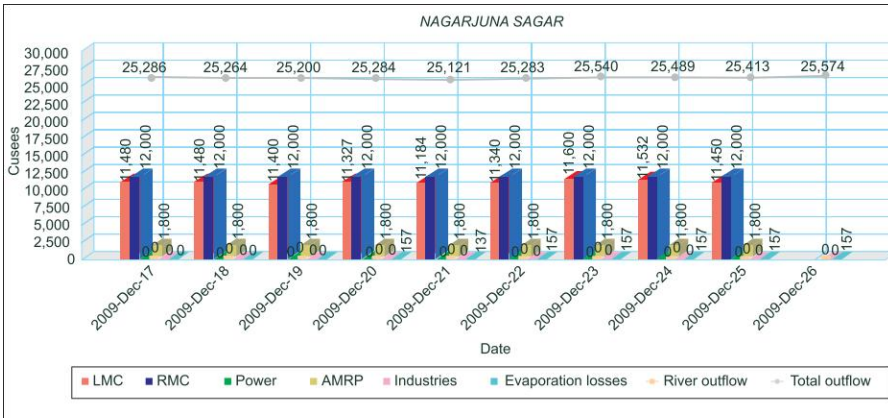
Figure 6.8   *Comparison of Outflows for Different Purposes from Nagarjunasagar Reservoir*
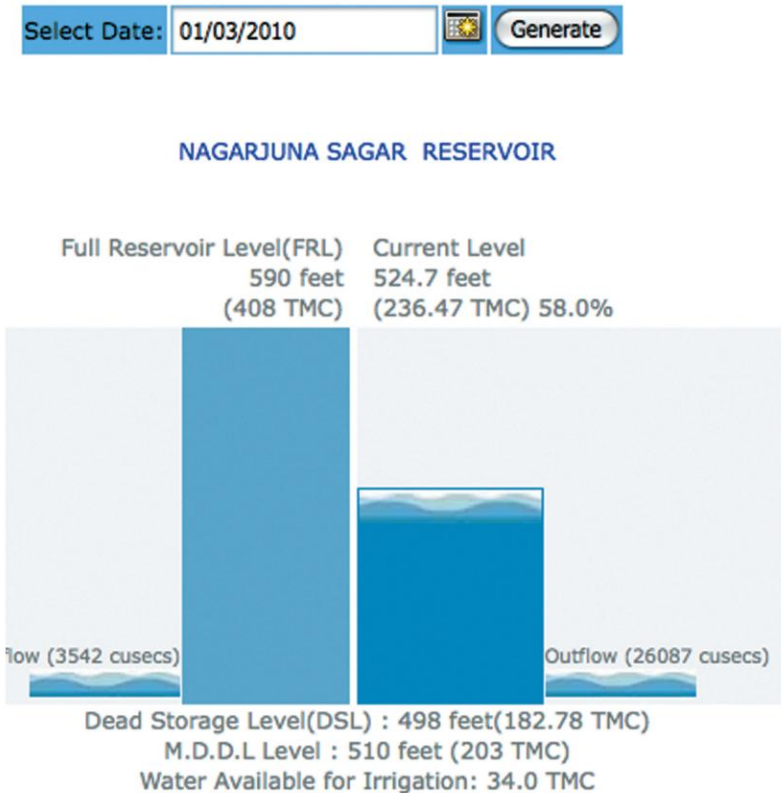
Figure 6.9   *Daily Report of Reservoir—a Screenshot*
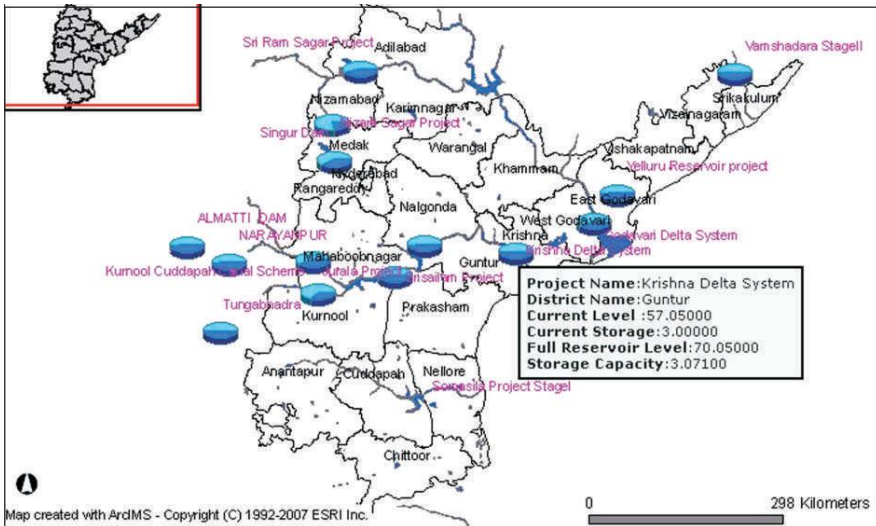
Figure 6.10   *Reservoir Levels and Capacity*

6.6 The Innovative Decision Support System

The temporal data for the various reservoirs and canal systems, provides a decision support system which can be applied to different water management situations. In October 2009, RSMS was applied for monitoring and managing floods in the Krishna basin.

6.6.1 How RSMS was used in Monitoring Floods in the Krishna Basin

Andhra Pradesh witnessed unprecedented floods from the last week of September to the first week of October 2009. 700 TMC was the total quantity of water received in three days of rainfall at the Srisailam reservoir as against the annual normal of 500 TMC. As per the Indian Meteorological Department (IMD) records, the region received about 400 mm rainfall in three days (against the monthly average of 150mm), which was the first of its kind since 1901. The excess water received had to be regulated through the Srisailam, the Nagarjunasagar and the Prakasam barrages and then through the Krishna flood banks, near the delta, into the sea. This unexpected volume of water surpassed the design specifications of the reservoirs and the flood banks. The RSMS system was utilised for flood management in the following manner:

- Real-time Hourly Scenario – The SMS regarding the inflow, outflow, level, and capacity of the affected reservoirs was obtained on an hourly basis round the clock, and was also disseminated hourly to the flood control

room and the connected authorities. Thus a real time scenario could be created for hour to hour decision-making.

- Simulating Inundation Areas – The hourly information was used by the APRSAC for simulation, to assess the possible inundation area due to the reservoir levels and the river flows along the 600 km course of the river. The Honourable Chief Minister appealed to the public to evacuate the areas identified. Thus millions of precious human lives were saved. Six deaths, mainly curious onlookers who had drowned, were reported from the reservoir through which the flood water was passing, though the casualties could have been much more. The low lying areas of the major towns namely Kurnool and Vijayawada, were identified and evacuated.

- Interactions with Farmer Organisations (FO) – The entire flood waters were to be routed through the Krishna flood banks that had a capacity of 1.06 million cusecs. In August 2008, in a similar flood like situation, the Kosi river banks had given way, at 0.16 million cusecs against the rated 1.06 million cusecs capacity, killing thousands of people. In this case, flood waters of more than 1.06 million cusecs were diverted through the Krishna banks for more than 36 hours, for one week. This was primarily achieved through continuous interaction with the farmer organisations in the Krishna Delta region. These FOs mobilised thousands of farmers for patrolling the 200 km long bank, in two shifts, day and night for five days. The I&CAD authorities passed on hourly information to the representatives of the FOs through SMSs. The FOs in turn sent information on the status of the bunds to the central flood control room at the state level and also to the district collector. About 2 million sand bags and other temporary flood control material was kept at various vantage points, which was mobilised immediately at a number of places likely to breach. As a result of this hourly monitoring, the river bank breached only at one place and the crises was handled in the shortest possible time. The entire coordination saved thousands of lives and also prevented huge property loss.

This availability of real-time information has improved the effectiveness and timeliness of the decision-making process. The response time has also improved drastically. Before this system was developed and implemented, delays in information flows were an accepted norm as it involved the process of gathering information over the phone; a single accessible location for the state-wide current information was non-existent; the access and retrieval of the historical information was distant. The mobile based system made the information available on time, resulting in auto storage of information on a widely accessible server and made auto dissemination of information possible. Better decision making has improved water management across the state.

Table 6.6

Description	Reservoir System	Canal Flow System	Total
Location (in numbers)	17	227	
Sensor Based Technology			
Installation cost	8.5	113.5	122.0
Data transmission cost through satellite bandwidth, per annum	2.5		
Upkeep cost @10%, annually	.85	11.35	12.2
Total ₹ million	**11.85**	**124.85**	**134.2**
Mobile based Technology			
Installation cost, using the existing mobile phones of staff	Nil	Nil	Nil
Data transmission cost @ ₹ 10 for about 400 SMSs in a year, for each site, for 17 and 227 sites	680	9080	9760
Total ₹	**680**	**9080**	**9760**

Changing the Expectations of Stakeholders—Earlier the FOs would not receive any day-to-day information on the canal flows or on the disasters. Now, the FO representatives have the feeling of inclusion and also ownership. The information flow has brought about much clarity into the system, helped reduce the apprehensions among the farmers on actual water release, and has also demystified water release and other technical details of water flow and levels. At the policy level, daily information under normal circumstances, and hourly or even more frequent information flow, are now the norm. The decision makers can now make informed decisions instead of struggling to receive and validate information.

6.7 FINANCIAL IMPLICATION

The installation of sensor-based technology requires about ₹ 0.5 million for each location, excluding regular upkeep. Real-time data transmission through satellites needs about ₹ 2.5 million annually. This works out to about ₹ 134.2 million for the usual sensor-based technology while the innovative mobile-based technology costs less than ₹ 10,000. While the cost of analysis and data dissemination is considered to be the same for both the technologies, the total cost of this application is a fraction of the cost of operation and maintenance.

6.8 IMPACT OF THE PROJECT

The project has altered the way water management is monitored in Andhra Pradesh and is now being followed in Rajasthan. The immediate benefits include

enhanced accountability of the field level engineers in providing water to the tail-end areas and substantial reduction in the number of complaints from the users. A feeling of satisfaction and inclusion prevails, as farmers now receive information, which was not available to them earlier. This sense of ownership has enhanced the responsibility towards better water management.

6.9 FUTURE ROADMAP

The applications of this technology and process are innumerable. What was initiated for monitoring the reservoir measuring system was extended to canal flow measurements as well, seeing the tremendous potential and impact. Later on, it was scaled up to a more comprehensive PDA-based system through which simple excel sheets could be transmitted. This upgradation is now being piloted for a comprehensive management information system, in one of the major irrigation projects, that is, the Kurnool Cuddapah Canal Project, with a command area of about 1,00,000 ha. Further, modifications would be possible through the GPS-enabled PDAs. GPS would provide facilities for drawing up the geo-referenced sketches or locations of the field units and would club them with tabular and other text information, for simultaneous transfer to the central data server.

Case

7

Tax Return Preparer Scheme

Amitabh Kumar, IRS

Creating awareness, increasing compliance, providing tax-payer services and promoting community participation are all key elements in rendering the tax collecting process citizen-friendly. One such effort in this direction is the Tax Return Preparer Scheme, launched by the Income Tax Department a few years back.

7.1 HISTORY

The first phase of tax reforms in India aimed at the rationalisation of tax rates and the simplification of tax laws. The underlying principle was – the lower the tax rates, the higher the compliance. The results of these measures were spectacular. Direct tax collections soared from nearly ₹ 11,0000 million in 1990-91 to ₹ 4,79,0000 million in 2010-11.

It was however realised that tax rate was only one of the many factors affecting the rate of compliance. There were others as well, such as the cost of compliance and the quality of service for the taxpayer. The cost of compliance

Studies conducted by Richard M. Bird and Erik M. Zolt, on behalf of the World Bank (2003), suggested that small and marginal taxpayers incurred more cost per unit of their income, for tax compliance, than those in the higher income brackets. This regressive distribution of compliance costs in respect of the taxes collected from the small firms, coupled with the complexities of the tax laws and the administrative procedures resulted in lower compliance levels amongst the small and marginal income earners.

was conventionally defined to mean the cost incurred by the taxpayers, over and above the actual taxes paid and any distortion costs inherent in the nature of the tax, in order to meet the requirements laid down by the tax laws and the administrative processes.

The findings relating to the cost of compliance in India and its effect on tax compliance were even more startling. A study by Saumen Chattopadhyay and Arindam Dasgupta (2002), revealed that in India, the relative compliance cost for the marginal taxpayers was more than ten times higher than that in the developed countries. This study also confirmed that the compliance costs in India were generally regressively distributed, and much higher in respect of the taxes collected from the small firms. Another revelation from this study was that in India, the use of the services of tax advisers resulted in substantial compliance costs for the taxpayers. The study therefore, underlined the need for reducing compliance costs, increasing awareness and monitoring the functioning of the tax advisers.

7.2 Context

The Income Tax Department has been grappling with the issue of bringing new taxpayers into the tax net. It is expected to add millions of new tax payers every year. However, the task has not been very easy due to various reasons. The cumbersome processes, absolute lack of public awareness about tax laws, the high cost of compliance in terms of hiring of legal help, the maintenance of accounts, the paperwork, and the fear of frequent visits to the income tax offices, were the major deterrents to voluntary tax compliance. The department also suffered from major resource, infrastructure and manpower constraints, and was in no position to even open its offices in all the district towns. Many taxpayers had to travel to the nearby cities to file their income tax returns.

At another level, the department had undertaken large scale computerisation of its processes, which enabled it to offer various online services to the taxpayers such as the e-filing of income tax returns, e-payment of taxes, e-filing of TDS returns, tracking of tax challans and so on. Though these processes were convenient, cost effective and could be used from the comfort of one's own environment, the internet as a channel of communication and taxpayer service had limited public acceptance. Many small and marginal taxpayers were unable to utilise these services for want of knowledge or the availability of computers and connectivity. The channel strategy for the taxpayer services adopted by the OECD countries, would explain this phenomenon as stemming from a lack of acceptance of the internet as a channel of communication, by the majority of taxpayers. These taxpayers were still most comfortable with the traditional channels, especially, face to face interaction.

🍃 7.3 GLOBAL EXPERIENCES

The need for providing assistance to the taxpayers in filing the tax returns has been felt across the world. The revenue administrations of various countries have also tried to devise various schemes for the purpose. In the USA, under the Voluntary Income Tax Assistance Programme or VITA, volunteers are trained to offer free help in filing tax returns, to the people with low or moderate incomes, i.e., income below $ 6000. Similarly, under the Tax Counselling for the Elderly or the TCE programme, those above sixty years of age are provided with free tax help. Such volunteers are provided by various non-profit organisations, who partner with the Internal Revenue Service (IRS). In Australia, volunteers trained by the Australian Tax Office, are made available at 1000 community centres, across the country, to help the low income earners file their tax returns free of cost. In Canada, the Canadian Revenue Authority (CRA) has been running a community Volunteer Income Tax Programme, to help people file their income tax and benefit returns, and provide free volunteer training sessions across the country.

A committee set up by the Central Board of Direct Taxes (CBDT), however, suggested a scheme for India which was at variance with the voluntary schemes in force in the other countries. This was because of the enormity of the task involved and the need to meet the objectives of lowering the cost of compliance and promoting the usage of technology on one hand, and providing a source of income to the unemployed or the under-employed youth of the country, on the other. While making its recommendations, the committee kept in view the local constraints and requirements such as: the large number of unemployed persons seeking employment in the country, vast areas in which the Tax Return Preparers (TRPs) had to function, magnitude of the task to be undertaken if this new group of professionals were to locate potential taxpayers for the department, and the limited facilities available with the department itself.

🍃 7.4 TAX RETURN PREPARER SCHEME

7.4.1 Objectives

In the backdrop of these findings, the Tax Return Preparer Scheme(TRPS) was visualised to fulfill the following objectives:

- To reduce the cost of compliance for the small and marginal taxpayers and to increase compliance at their level;

- To provide assistance to them at very low or marginal costs;

- To increase awareness about the tax laws amongst the small and marginal taxpayers;

- To encourage community participation to improve awareness and increase compliance;
- To provide self-employment opportunities to the educated unemployed by assisting the taxpayers in preparing and filing their tax returns.

7.4.2 The Scheme

The Tax Return Preparer Scheme was launched by the Government in the year 2006-07, following the insertion of section 139B into the Income Tax Act,1961, by the Finance Act, 2006. It aimed at training the unemployed and the partially employed graduates from select disciplines, to assist the small individual and HUF taxpayers file their returns of income. The salient features of the scheme were as follows:

Beneficiaries of these Services: The main beneficiaries of the TRP scheme were the small taxpayers who could not prepare income tax returns on their own or use the online services themselves, and were unwilling or unable to utilise the services of the tax advisers due to prohibitive costs.

The People Delivering this Service: A group of young and educated but unemployed youth was trained in the tax laws and procedures, to provide services to the taxpayers at their doorstep, and help them prepare income tax returns, at a very low cost.

Eligibility Criteria: The scheme was made applicable only to the individual and Hindu Undivided Family (HUF) taxpayers including small businessmen, salaried employees, senior citizens, women, non-filers and stop-filers who filed simple and straightforward returns. Taxpayers like the companies and others, whose accounts were required to be audited under the provisions of the Income Tax Act, were kept outside the purview of the scheme.

Countrywide Coverage: To extend the scheme throughout the country, it was decided to train the candidates at 100 different locations. Knowing the complexities of the tax laws in India, the training was restricted to the graduates in select subjects only, such as law, commerce, mathematics, economics, statistics, and management. The maximum age of the candidates was fixed at thirty years, since it was difficult to teach complicated subjects to older candidates who had lost touch with studies.

Community Participation: Being trained from within the community and being neither the employees nor the agents of the I.T. department, the TRPs stood better chances of gaining acceptability in the community. They had an important role to play in creating awareness about the tax laws amongst the community.

Web-based Teaching: Since full fledged classroom training would not only be expensive but also inconvenient to the candidates, a mix of pre-training self-study, classroom training and web based advanced learning was planned for the TRPs. The performance of the TRPs would be monitored online and quality alerts would be issued to them in case they failed to perform as per the expectations.

Business Model: The main objective of the scheme was to encourage the new taxpayers and the stop-filers to join the tax net. No extra fee would be charged by the TRPs and the returns were to be prepared free of cost. Therefore, an incentive of 3% of the tax paid by the new taxpayers, as per the returns prepared by the TRPs, was given to them in the first year. This amount was 2% in the second year and 1% in the third year. The old assessees were required to pay a marginal fee of ₹ 250 for the preparation of returns. This move helped to reduce the compliance costs considerably, while at the same time provided adequate incentive to the young TRPs.

Cost: The cost of training and certification was met by the Government.

Publicity: The cost of publicity for the scheme was met by the Government.

Helpdesk: A resource centre in the nature of the Directorate of Income Tax was set up in the Income Tax Department, to monitor the implementation of the scheme and the working of TRPs in the field. A dedicated website, www.trpscheme.com, was created to provide Learning Management System (LMS) support to the TRPs. Besides this, a Management Information System was created to help the resource centre locate the nearest TRPs in their citiy, for the taxpayers. A toll free number 1800-10-23738 was made available to provide support to the TRPs and the taxpayers.

> Strategy: Since the Income Tax Act was a dynamic act, with provisions getting amended every year and interpreted by various courts across the country, a one-time training in the provisions of the act was not considered enough for the new class of professionals. However, organising periodic trainings for the TRPs across eighty-seven cities and 100 centres was also not possible, especially for an organisation whose core competence did not lie in imparting training. Therefore it was decided to use internet based learning to enable the TRPs to keep updating their knowledge on a regular basis.

7.4.3 Mode of Delivery-Public-Private Partnership Model

Since the training of TRPs involved various steps right from calling for the applications to the end step of conducting the end-of-course examination, it was decided to roll out the scheme on a public-private partnership model. NIIT

Figure 7.1 *Comprehensive Solution for TRPs*

was made a partner organisation to roll out the scheme on a nationwide basis. It was made responsible for the enrollment, the training, conducting the end-of-the-course examinations and the certification of the TRPs. However, since NIIT was not familiar with the tax laws, the responsibility of developing the content for training and advanced learning was given to Taxmann, a leader in tax training.

7.4.4 Training Design

Training to the TRPs was provided using the Learning Management System (LMS). The training was divided into three distinct phases, i.e., self study phase, classroom training, and post certification advanced learning phase. The course content for the training was developed along with a fifteen-day study plan for the students. The course content as well as the practice exercise on the chapter to be studied on the day, was provided on the LMS website. The practice exercise undertaken by the trainee was monitored online by the Resource Centre and the training partner. The trainees who had missed the self-study exercise, were promptly reminded through outbound calls from the help desk. The trainees could clear their doubts during self study, by contacting the "expert", online or through a toll free number.

Classroom training, the phase after the self study phase, was conducted at 100 centres across the country. Prior to classroom training, the trainers were selected and trained. In order to standardise the training at all the hundred centres, a common powerpoint presentation, prepared by the content manager,

was given to the trainers, in the classrooms. Classroom training was also used for the clarification of doubts and to give hands-on training on the return preparation software. At the end of the training, the trainees had to appear for an online "end of the course examination". Those who scored more than 60% in the examination were given an identity card and a certificate, and they became certified TRPs.

The LMS, thereafter, provided advanced learning material to the TRPs. They facilitated the examination of legal issues in greater depth at this stage and conducted mock tests in every subject. The TRPs also got the support of the expert advisers, the helpdesk, and a discussion forum during advanced learning. The Resource Centre kept track of the scores of the TRPs during advanced learning and in the mock tests (Figure 7.1).

7.4.5 Administration of the Scheme

The scheme was monitored by a web- based administrator called the Resource Centre (Figure 7.2). It monitored the enrollment process, the content development by the experts, web-based learning and the discussion forums. The activities of the TRPs were also monitored through the online claims which they filed by quoting their unique identification number. This number was matched with their claims, and the data captured during the computerised processing of the return. A software had also been developed to detect any mismatch in the data and automatically generate quality alerts to the TRPs, pointing out the mistakes committed by them. The Resource Centre maintained the details of training, field performance, quality alerts, claims and disbursements relating to the TRPs and generated an MIS for analysis.
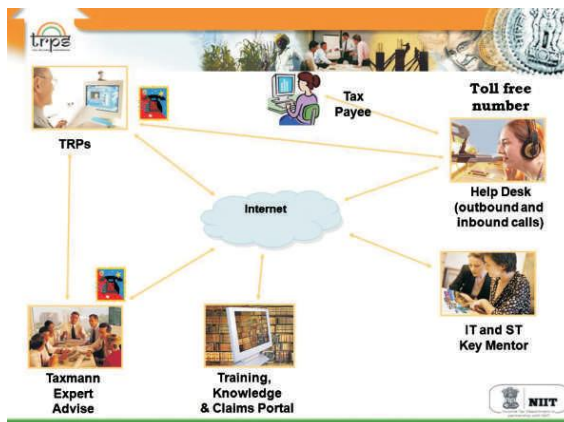
Figure 7.2   *Web-based Resource Centre*

7.4.6 Technology

The TRPS had a series of chronologically placed events that formed the entire execution plan of this scheme. It also had technologically enabled support elements that bound the complete solution together.

7.4.7 Technology Enablement and Support

The department envisaged the extent of intricacies and the interdependencies within the various delivery functions and their impact on the business and clinical processes, the people, or the environment. It recognised that better business value could be achieved from technology investment if it was selected, designed, engineered, and implemented efficiently and effectively. The scheme was rolled out with the support of CLIKS Learning Management System and helpdesk automation, including CRM customisation and the implementation of the right process for the right return on investment within the scheme (Figure 7.3).

7.4.8 Announcement

A three-pronged approach was adopted to address the announcements to the TRPs dispersed across the country:

Web Portal: The website www.trpscheme.com was customised to have official message sections that would display official information from the Resource Centre. The message from the Resource Centre would be displayed when the URL was typed in.

Helpdesk: A telecommunication support within the helpdesk would make calls to all the TRPs and intimate them of the dates of training and other important information.
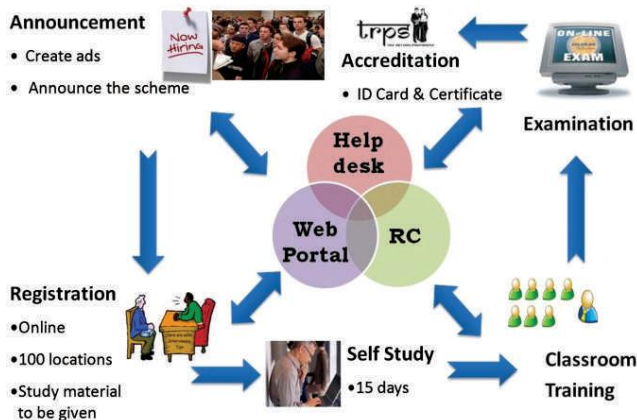
Figure 7.3 *Tax Return Preparer Scheme*

Bulk Message: This feature would use mobile technology and bulk messaging applications to send text messages to all the TRPs, intimating them of the dates of the training.

7.4.9 Registration

The registration process ensured the rejuvenation of the Resource Centre-TRP relationship through the web portal and the helpdesk.

Web Portal: A usability exercise was conducted to change the entire look and feel of the website and enhance user experience. A validation exercise with regard to the current status of the TRPs was carried out and the user ids and passwords were reissued. The TRPs were taken through an information tracking system where their details were verified, and access was provided to the learning centre. The LMS was further customised to help them go through the self study phase. A feedback survey was designed to help the Resource Centre understand the concerns of the TRPs, both at the pre and the post training phases. This feedback was stored in the database and simple analytical reports were generated.

Helpdesk: The outbound support was able to track people who had registered through the helpdesk. It could proactively approach the TRPs to remind them of the registration and help the TRPs manage their account.

7.4.10 Self Study

Web Portal: A fifteen day mandatory period was set aside for self study, as per the TRP scheme notification. During this period, the TRPs had to go through the handbook content provided to them. In order to track their progress, the entire self study was placed on the web portal, through the learning centre. The LMS had been customised to reflect a day wise learning plan. Every learning plan was for fifteen days with a new concept being displayed each day. After going through the concepts, the TRPs had to appear for mock tests to check their understanding. The LMS would track their response and performance. The questions and their responses would again be customised to reflect the weak areas of the TRPs. This was then used to analyse the specific chapters they needed to concentrate on, to understand the concepts.

Helpdesk: Based on the reports from the LMS, the Resource Centre would communicate with the TRPs regarding non compliance with the self study requirements.

Classroom Training: During the classroom training, feedbacks were received, organised and captured online and through the helpdesk. The trainees were encouraged to practice on the LMS and use its facilities, like the discussion forum and the expert's advice to clarify doubts.

Examination: The "end of term" certification examination was an online examination process, powered by the inbuilt assessment engine of the LMS. This engine enabled the creation, the uploading and the hosting of question banks, to be used for conducting online examinations in a doctored environment.

The assessment engine was capable of providing immediate results, and also identifying the training areas where the TRPs were found lacking. The modifications or the strengthening of the programme was decided on the basis of the inputs received from the examination results.

7.4.11 Advance Learning

Web Portal: The website www.trpscheme.com was customised to support the following:

Discussion forum: This was held every fortnight, starred by the department, wherein the TRPs could share their views, voice their opinions, concerns and recommendations.

Ask the instructor: While this feature was available during the self study period as well, it was equally active during the advance learning phase. All the queries posted on the web were tracked through emails and solutions were provided.

Assessment: Regular assessments hosted once fortnightly, would follow the concepts to enable the TRPs to check their understanding of the given topic.

Resource Centre: The Resource Centre application was designed and created to monitor the performance of the TRPs, take care of all the return filing information, provide an overview to the administrator as well as the TRP about the status of claim disbursements, alert generation, account details management, claim information management, various MIS reports and so on.

Help desk: This support would proactively follow-up on the TRPs and also let them use the facility of the expert's advice to resolve issues related to income tax and other areas.

7.4.12 Highlights of the Pilot Run of the TRP Scheme

The scheme was run on pilot basis for one year. Its highlights were:

- The response to the scheme was overwhelming. More than 90,000 applications were received in response to the advertisement. 47,227 candidates were first short-listed for the written enrollment exam on the basis of the marks obtained by them at the graduation level. The examination was conducted by a professional agency and the results were declared through a centre-wise merit list.

Zonewise distribution
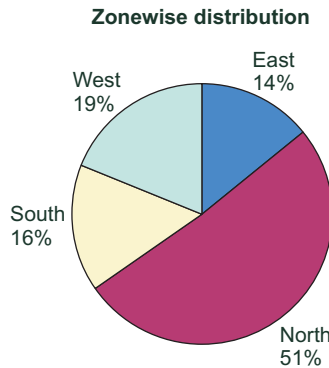
Figure 7.4   *Zone Wise Distribution of Candidates*

Stream wise distribution
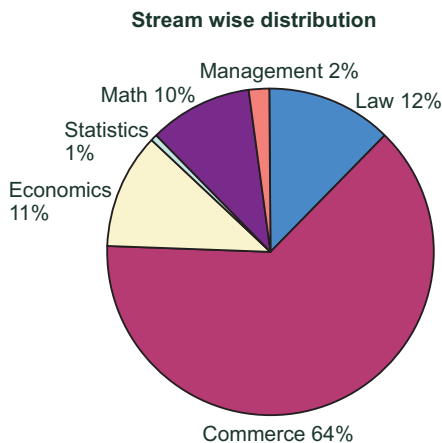
Figure 7.5   *Subject Wise Distribution of Candidates*

- The study material for the training was prepared by Taxmann (the acknowledged leaders in the field of tax related publications), covering the provisions of the Income Tax Act. NIIT provided the study material on the concepts of computer science. The study material was sent to the trainee TRPs in advance, for self study prior to the commencement of the classroom sessions.

- Figures 7.4 and 7.5 give the zone-wise and subject-wise break-up of the applications.

- After a nine day classroom training programme on the income tax laws and computers at 100 centres (a total of 4,517 trainees finally underwent classroom training), a certification test was conducted to assess the accuracy and preparedness of each trainee. Only those trainees who secured 60% or more marks in the "end-of-the-course" online examination, were certified to function as TRPs.

- The focus area of the training programme was not only to train the TRPs in income tax laws, but also to encourage them to prepare and file the returns electronically. The training enabled them to prepare simple and straightforward returns of the individual and the HUF taxpayers.

- To ensure the spread of TRPs across the country, the selection of candidates was made on the basis of merit, for each centre separately.

- Training at all the centres was provided in a standardised manner in terms of the classroom facilities and environment, the content of the class lectures, the study material, the quality of teachers, the helpdesk and so on. In order to maintain uniform standards, the scheme was launched on a public-private-partnership model.

- NIIT in collaboration with Taxmann was responsible for the content development, the instructors' slides and training, the course material, the selection of candidates, classroom training, website training and development, training through Learning Management System (LMS), the management of helpline and so on.

- 3,737 graduates successfully completed the "end-of-course" examination and were certified. The geographical spread of the successful candidates is given in Figure 7.6. It was heartening to see that women formed 27% of the successful candidates.

- A Resource Centre headed by a Director of Income Tax was set up by the Central Board of Direct Taxes to monitor the implementation of the scheme. The Resource Centre monitored the work of the TRPs in the field and was authorised to issue quality alerts to them, as and when needed. The Resource
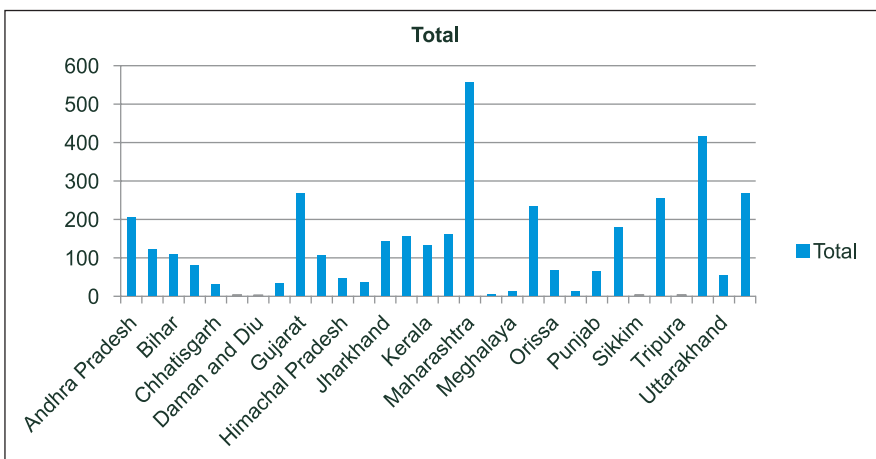
Figure 7.6 *Geographical Spread of TRPs*

Centre was also authorised to withdraw the certification of the TRPs, in the event of misconduct or deficiencies in the returns prepared by them.

- The TRPs were required to undertake periodic online advanced training and examination to further upgrade their skills.

- The Income Tax Department's website, the dedicated website of the Tax Return Preparer Scheme (www. trpscheme.com) and a toll free helpline 1800-10-23738 provided the contact details of the TRPs, to the taxpayers who wanted to utilise their services.

- Advanced learning material, available on the password protected TRP website helped the TRPs to upgrade their skills. The website provided the latest instructions, circulars, notifications and court judgments. An online discussion forum and a helpline were also available for them to clarify their doubts while working in the field.

- The TRPs were trained to operate the return preparation software to prepare error-free returns and to increase their speed.

- The TRPs who were authorised to work in the field were issued a certificate and identity card by the training partner and were permitted to use the TRP logo.

- A major publicity campaign was carried out for the scheme through the audio-visual media, press briefings, newspaper advertisements (both national level and vernacular local newspapers) and so on. The publicity campaign was kicked-off through a press briefing by the Finance Minister, just prior to the issue of the first round of advertisements.

- Inauguration ceremonies were held at the major centres, one of them presided over by the Finance Minister, so that the scheme could get maximum publicity. Upon completion of the training, convocation ceremonies were held at all the centres to distribute the completion certificates to the Tax Return Preparers.

- The trained TRPs started functioning and assisted the small taxpayers to prepare and file their returns from July 2007. As per the reports, over 0.4 million returns have already been filed by the newly qualified TRPs, since the inception of the scheme, showing combined income of more than ₹ 2560 million and a tax mop-up of nearly ₹ 360 million.

🌱 7.5 Learning from the Pilot

Certain issues were identified during the pilot run of the scheme, which needed to be addressed during the next phase of the scheme. These were:

- Though the scheme had visualised advanced learning throughout the year for certified TRPs, the income tax return forms on which the training was imparted, were amended and new return forms for the A.Y. 2007-08 were introduced. This necessitated the re-training of the TRPs on the new forms and the new software. Accordingly, new training software was prepared and the TRPs were trained online by posting the tutorial software on the dedicated website. However, the TRPs could get only seven to eight days for filing of returns before the due date. This severely affected their performance. In future, more coordination would be required within the CBDT, so that software was prepared along with the release of the new return forms.

- As per the report of the committee, the unemployed and the partially employed graduates were to be authorised to function as TRPs. However, the notification issued for the purpose inadvertently barred all the salaried persons (even the underemployed) from functioning as TRPs. This led to a number of qualified TRPs staying away from the scheme.

- TRPs were authorised to file returns only for the small taxpayers. The due date for filing of return for such taxpayers was 31st July. Though returns could technically still be filed for this category of assessees anytime during the remaining part of the financial year, normally, the number of returns in the last three quarters was much lower. This seasonal nature of work veered away some of the trained TRPs to other jobs. It was important to keep the TRPs occupied throughout the year by identifying more functions and creating opportunities for them.

7.6 Amendment to the Scheme

Based on the feedback received, the following modifications to the scheme were made:

- Out of 3,737 certified TRPs, only about 2,000 TRPs were found to be active owing to the seasonal nature of work. It was therefore proposed that TRPs would also be trained and authorised to prepare electronic quarterly TDS returns for the deductors, for whom e-filing had been made compulsory. Since TDS returns were to be e-filed every quarter, it would keep the TRPs occupied throughout the year.

- The existing TRPs would also be trained in filing service tax returns. This would not only reduce the cost of selection of the TRPs for CBEC, but would also establish synergies in the preparation of the income tax and the service tax returns, from the same books of account. Most importantly it would ensure substantive employment for the TRPs which would have been

impossible if separate TRPs were selected for service tax and income tax, considering the small tax base of service tax.

- Before starting web-based training of a new batch of TRPs, the existing TRPs would be re-trained on the new income tax return forms, the e-TDS returns and the service tax returns. The training would again be a mix of self study, classroom learning and web-based advanced learning with expert help through the helpdesk or discussion forum.

7.7 WHY IS IT AN INNOVATION?

As the department strives to improve and strengthen the tax administration and the tax-payer services, it faces several challenges and constraints in its efforts to drive change because of internal barriers, technical silos, outdated methods and the lack of creative problem solving approaches. As we live in an inter-connected age, where the balance of power is shifting from the traditional command-and-control organisations to new centres of gravity which are citizen-centric and based on networks, the relationships and partnerships, governments, business, IT leaders and community must come together to find better ways of generating more transformative, innovative and strategic solutions to the challenges before it.

When faced with the challenge of increasing the number of tax payers, the department first analysed the root cause of non-compliance. The two most striking reasons noticed were lack of awareness and the high cost of compliance amongst the small and marginal tax payers. In its attempt to find a creative solution for this specific challenge, an innovative approach was adopted. It has been known since long that innovation is not achieved through business-as-usual practices. Yet a majority of organisations still struggle to support it. The department realised that some out-of-the-box thinking was required to break out of the traditional mould to address this problem. This scheme was designed to overcome the resource constraints, by utilising the potential of technology and create breakthrough results through serial innovations. There are many elements in the Tax Return Preparer Scheme (TRP Scheme) that make it unique and innovative. It was the first scheme which sought to directly reduce the cost of compliance for the small and marginal taxpayers. This scheme seeks to proactively enhance the awareness of tax laws amongst the taxpayers through the TRPs, who carry the message of tax compliance. On one hand, it relies on community participation for spreading awareness and on the other, it seeks to improve service delivery to ensure increased voluntary compliance to tax laws. Furthermore, it has created an intermediary, using technology tools, to enable a large class of taxpayers to benefit from the use of technology that otherwise they are unable to use. Last but not the least, it has innovatively created a structured and trained work-force outside the department, which is promoting voluntary tax-compliance and tax awareness amongst the

small and marginal taxpayers, while providing self-employment opportunity for the unemployed and the underemployed graduates. The motivation and hard work is of the TRPs themselves, but the department helps them to learn and upgrade their skills. At the same time, the small and marginal tax payers have access to trained help in meeting their tax-related responsibilities within the comfort of their homes, at very nominal costs. It is a win-win-win situation for all the three parties involved—the Department, the tax payers and the young TRPs.

7.8 THE ROAD AHEAD

The TRP scheme could be easily replicated to add a channel of service delivery, if the existing channels failed to reach the desired audience. The scheme has already been replicated by the CBDT to extend the services to TDS returns and by the Central Board of Customs and Central Excise, to Service Tax Returns. Various financial institutions have shown interest in using the services of the TRPs for further penetration of their internet-based services. The Income Tax Department itself would like to further enlarge their role to include other internet-based services.

Case

8

SmartCard Project, Andhra Pradesh

Dr M. Padma

Stimulating the adoption and widespread application of the smart card technology, Andhra Pradesh (AP) has rolled out smart card-based banking services for the implementation of the National Rural Employment Guarantee Scheme (NREGS) and the Social Security Pension (SSP) scheme within the state. These biometric-based SmartCards are linked to the core banking systems using mobile technology/integrated Point of Sales (POS) machines for last mile-connectivity. The entire process of transfer of funds to the banks and delivery of payments under the above schemes is automated. The technology is enabled by a Business Correspondent (BC) of the bank and a Customer Service Provider (CSP) at the village level under a branchless-banking model which is one-of-its-kind in the country. This model has enhanced financial inclusion and brought transparency and accuracy in the entire process of disbursement of funds under the two schemes mentioned above.

8.1 HISTORY

The Department of Rural Development, Government of AP is determined to prove the efficiency and effectiveness of public administration by making itself more accessible to the citizens. At all the levels of governance, there is a commitment to providing government services in a truly transparent manner by identifying divergent innovative interventions. This department implements several development programmes such as the NREGS-AP and the SSP which are the two flagship initiatives, where the key requirements include:

- Proper targeting of beneficiaries
- Proper identification of beneficiaries

- Ensuring prompt and accurate payments to the correct beneficiaries
- Maintaining transparent and trackable records for validation and account-ability

The Government of India passed the National Rural Employment Guarantee Act (NREGA) in September 2005. The NREGS recognises the "right to work" as a fundamental right of all citizens. In the era of globalisation where it is feared that people without basic literacy will slip into deeper poverty, the scheme guarantees at least 100 days of work to the unskilled labour at the statutory minimum wage. The objective of the Act is to enhance the livelihood security of such people. It not only provides wage employment through work, but also develops the infrastructure base. The choice of work addresses the causes of chronic poverty like drought, deforestation, soil erosion etc. The employment it generates, has the potential to transform the extent of poverty. The achievement of a visible economic identity for people at the bottom of the pyramid and an enhancement in the per-capita consumption of financial services in rural areas is also achieved. As on the second week of March 2010, the number of households registered for the NREGS were 1,17,62,009.

Such social protection programmes aim at helping the poor, managing risks, helping them expand opportunities, and enhancing overall efficiency. The Government of Andhra Pradesh implemented the SSP scheme targeted at the most vulnerable sections of the society such as the elderly, the widows, the disabled and the elderly weavers to provide them succor and ensure their economic development. At present, a total of 4.7 million pensions are being disbursed, out of which 3.1 million are old age pensions, 0.18 million are weavers pensions, 0.12 million are widows pensions and 0.5 million are disabled pensions. The monthly pension amount is ₹ 200.

8.2 Problem in the Conventional System

Both the NREGS and the SSPS need a strong IT backbone for implementation. However, like in any social security or wage employment programme run by the governments across the world, these too, are not spared their share of wrong targeting, siphoning of funds by the middlemen, impersonation, and fraud. As only a miniscule part of the funds meant for the poor reach them, it is imperative that systems are evolved to plug the leaks and ensure that funds reach those for whom they are meant.

The very design of these programmes poses specific problems and concerns to the implementing agencies in ensuring that the entitlements and the benefit payments by the Government reach the correct person within the specified time-frame and as per specified entitlements. At present, the schemes NREGS-AP and SSP are plagued by:

- Delayed payments because of the inability of the paying agencies to handle the current levels of payment. In the case of NREGS, the payments are being made through post offices and their infrastructure is unable to cope with the high demand in some places. Therefore, there is a need to establish alternate and viable institutions to build payment channels connecting them to the beneficiaries at the village level.

- The absence of proof that the payments are actually being made to the correct incumbent in the case of either SSP or NREGS. This provides ample opportunity for siphoning of funds and fraud.

- Difficulties in detecting fraud or payments being made to the wrong claimants through the existing records.

- The absence of systems to analyse the actual date of credit by the government agencies and the actual date of receipt by the beneficiaries.

✒ 8.3 Application Context

Considering the total number of beneficiaries, and the related payments required to be disbursed by the Rural Development Department alone, the need for significant improvements in the payment and monitoring services is evident.

Thus, timely disbursement of SSP and the wages to the target group with zero leaks, is the avowed aim of the Government of Andhra Pradesh. To achieve this, the Government has made use of labour leveraging technology through the SmartCards project in partnership with banks and the financial institutions. This is expected to not only enable reliable identification of the beneficiaries of the schemes through finger-print validation, but also promote financial inclusion.

✒ 8.4 Objective and Scope of the Project

The overall objective of the initiative is to provide an operational framework for increasing the outreach of mainstream banking and financial services to the poorest of the poor by using technology-based solutions. By minimising the possibility of fraudulent payments, efficient and timely transfer of government benefits to the poor is ensured, and the ultimate aim, that of achieving total financial inclusion through smartcards, realised.

Hence, it is by establishing a network of business correspondents in each village that branchless banking infrastructure gets created. The banks and the Government work together to open accounts and issue Smartcards to the poor. To begin with, the SSP and NREGS wage payments are delivered through this network. In the next stage, the banks propose to deliver mainstream banking services like savings, deposits, remittances, loans etc. The endeavour is to

establish a banking outpost in each village to include the un-banked poor, thereby facilitating total financial inclusion.

8.5 PROJECT PLANNING

The SmartCards project was planned as a pilot in August 2006 and was followed by two more pilots. Each of these Phases had a different approach. The first pilot was based on "one bank-one mandal" approach. Phase I was based on "bank-led service area approach" and Phase II was based on "one bank-one district" model. Each of these Phases is discussed below.

Pilot (one bank–one mandal)

For the pilot, a steering committee at the state level comprising of officials from the State Government, Reserve Bank of India, and the bankers was established. The pilot initiative started in August 2006. 8 mandals (blocks) were selected for SSP and NREGS payments by issuing smartcards and laying down the EBT platform. Six banks namely, State Bank of India (SBI), State Bank of Hyderabad (SBH), Andhra Bank (AB), Union Bank of India (UBI), APGVB(Andhra Pradesh Grameen Vikas Bank), and Axis Bank participated in the pilot. The payments under the pilot started in May 2007 and are continuing till date. Till March 2010, 0.137 million beneficiaries had enrolled and an amount of ₹ 670.2 million had been disbursed.

Phase I—up scaling (bank led-service area model)

During August 2007, after review it was decided that the pilot would be up-scaled. After discussions with banks, it was decided that a service area approach would be adopted for implementation. As per this approach, there would be 27 banks having branches in six districts. The status of Phase-I as on March 2010 is shown below:

- No. of villages where enrollment started   : 3582
- No. of target beneficiaries under NREGs and SSP   : 3.98 million
- No. of beneficiaries enrolled   : 2.486 million
- No. of beneficiaries issued cards   : 2.23 million
- Amount disbursed to the beneficiaries   : ₹ 3431.6 million

However, the service area approach had its own difficulties. Out of 27 banks, only 20 banks came forward to implement the project and after rigorous persuasion, only 9 banks finalised their service providers and began work. The remaining banks did not respond even after a year. As a result, in each district there were several isolated pockets. The service area being small and widely-dispersed, the operations for the service providers became extremely cumbersome. The

progress was also very slow and a sizeable area was not saturated. Further, each bank branch had few villages under a particular branch. So in each mandal (block), the Development Officer (MPDO/BDO) had to deal with several banks to make payments. Consequently, neither banks, nor the government, nor the people could take full advantage of an efficient payment system. As such, this model failed to enthuse any stakeholder.

Phase II—(one bank-one district model)

In view of lukewarm response to the first phase, internal deliberations on developing alternate replicable models were initiated. Finally, the RBI was approached with recommendations for two new models. The first one was to allow the private financial service providers other than banks, to lay down the infrastructure and operate the payment system. The other recommendation was to allow the whole district to be allotted to one bank regardless of the service area, so that scales of economy could be achieved and expansion could be easier and faster. This model has been described as "One Bank-One District" model.

In response to this request, the RBI set up a high level committee which did not support the private service providers' model but strongly supported the second model. Based on the recommendations of this high level committee, the up-scaling in Phase II commenced using the "One Bank-One District" model. This effort has been underway since August 2008. So far, SBI and UBI have been allotted 3 districts each. SBH and APGVB have been given one district each. Andhra Bank, Syndicate Bank, and Axis Bank have been given 2 districts each. The status of Phase-II districts as on March 2010 is shown below:

- No. of villages where enrollment started   : 6749
- No. of target beneficiaries under NREGs and SSP   : 9.335 million
- No. of beneficiaries enrolled   : 3.696 million
- No. of beneficiaries issued cards   : 3.393 million
- Amount disbursed to the beneficiaries   : ₹ 3555.1 million

As seen from the above details, in the "One bank-One district" model, the coverage is quick in terms of all aspects of the project.

8.6 Project Implementation Details

8.6.1 Technology Used

The banks lay down the entire infrastructure. In order to achieve this, they procure service providers through a process of competitive bidding. The service providers

typically extend two important services: providing technology, i.e., acting as a technology provider, and acting as a banking correspondent on behalf of the bank, by opening and operating banking outposts in every Gram Panchayat and delivering financial services to the people.

In a nutshell, the technology backbone includes a hand-held device called the POS/POT (Point of sale/Point of terminal) at the village level. The POS/POT can get connected to the bank's server and conduct two-way transactions by downloading the account data from these servers and uploading withdrawal particulars. A biometric reader and printer are built into POT which enables the identification of beneficiaries and prints receipts of the transactions. POS is manned by a SHG member called CSP (Customer Service Provider) on behalf of the bank.

These members are trained rigorously. The cash required for disbursement among the beneficiaries is delivered at their doorsteps. The CSP downloads the account balance data from the bank server and makes payments. If the CSP performs the transaction in an offline mode, the CSP mobile registers the transaction on the mobile, updates the customer card with the transaction details, and modifies the customer balance on the card. The CSP has the option to upload all such offline transactions through the GPRS onto the bank server at any time of the day. Some of the technology providers use mobiles for the smartcard operations while others use integrated POS machines, but by and large, the operations are similar (Figure 8.1).

8.6.2 Implementation Process

Enrollment process: The department issues a list of beneficiaries—(SSP and NREGS) to the bank. The concerned bank conducts an enrollment camp in the village. The Gram Panchayats (GP), the Self Help Groups (SHG), the federations at the village level assist in the identification of beneficiaries, the collection of finger prints, photo and other details of the beneficiaries, and then help open an account.

Preparation and issue of smartcard: The data collected during enrollment is encrypted on the card, including the biometric readers and printers (encrypted Java SmartCard with 32 KB memory). The card bearing the photo of the beneficiary is handed over to the beneficiary in the village within three weeks of the enrollment.

The Business Correspondent (BC) of the bank appoints the CSP at the village level. Training to both the CSP and the BC is given by the bank. The requisite
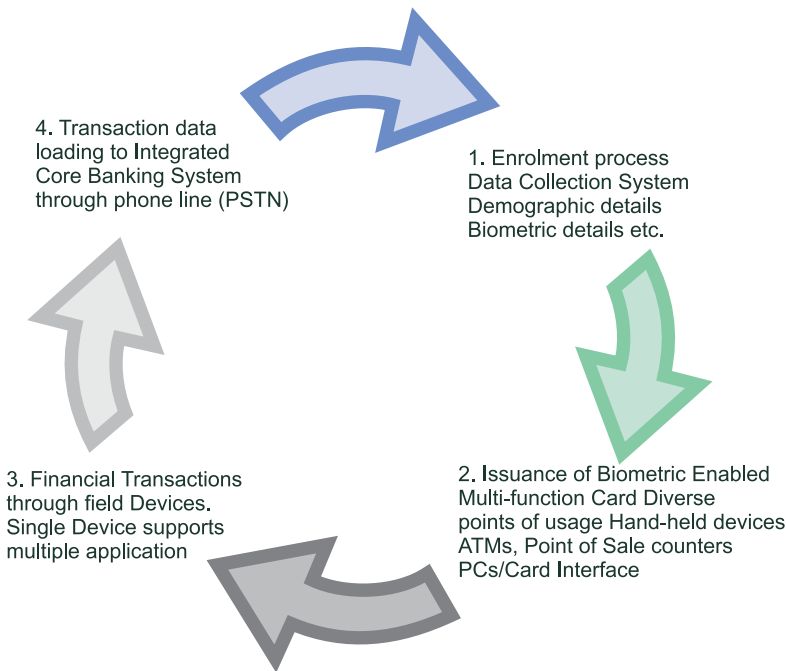
Figure 8.1 *Transaction Flow*

hardware, like the finger print reader, the printer, the mobile phone etc. (POT) are positioned in the village.

Payment: Once the accounts are opened and the card is issued, the government sends across instructions to the banks authorising payment. The lists of beneficiaries and the authorised amounts are provided in the form of pay-orders. Individual accounts of beneficiaries are credited by the bank. Cash is physically transported by the BC on behalf of the bank and delivered in the village to the CSP (Figure 8.2).

Disbursement: The CSP sits at the pre-designated government premises, usually the GP building. The beneficiary approaches the CSP with the smartcard. The card is inserted in the card reader and the identity of the beneficiary is established. Based on the account, the balance is displayed on the screen and the cash is paid. A receipt is generated in duplicate. In case of exigencies, manual payment is also facilitated.

Data Uploading: The CSP/BC upload the data of disbursements daily thus updating the banks' databases. The MIS report on progress of disbursement is submitted to Government by the bank (Figure 8.2).

    The data is available in a public domain and is easily verifiable with the ground position. The banks also send the transaction data every 15 days for reconciliation. The whole project is monitored on a day-to-day basis, to ensure
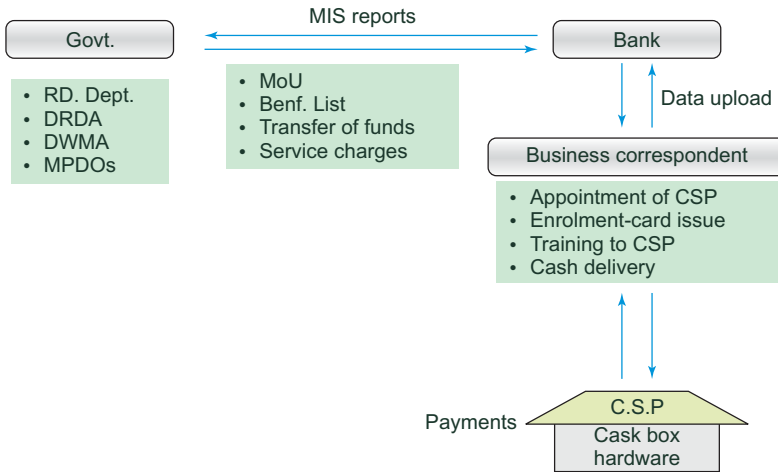
Figure 8.2 *Flowchart Indicating the Entire Process of Cash Delivery and Upload of Data*

that all the processes are strictly adhered to. The data is validated at the points of transactions and logs are maintained (Figure 8.3).

8.7 CAPACITY BUILDING

A positive attitude is built through periodic motivation and orientation from the Ministry and higher officials. For the acceptance and understanding of all stakeholders it is critical to ensure that the scheme's benefits flow to the society as a whole. Hence, communication campaigns are run at the level of the villages, and knowledge sharing workshops are arranged. Constant training processes are arranged and awareness building campaigns are initiated. The personnel at the cutting-edge level are selected with diligence, and given classroom training in field and immersion modules, to enhance their competence and sensitise them to customer-orientation and overall commitment. Highly specialised and dedicated teams of bureaucrats, bankers, and software personnel attend to the changing requirements on a day-to-day basis.

8.8 ORGANISATION AND FINANCIAL SUSTAINABILITY OF THE PROJECT

8.8.1 Organisation Sustainability

The genuine commitment from the political leaders, the private sector, and the civic organisations is garnered well. Frequent stakeholder meetings and workshops have led to knowledge sharing and removal of any apprehensions that may scuttle the project. A proper regulatory framework is put in place to enable secure information exchanges within and between the government and

Customer	CSP	SMS Gateway server
1. Customer displays the Smart card 2. Customer request for Deposit or Withdraw. 3. Customer validate the Card using finger Print scanner	4. CSP validate the customer and card using finger Print scanner and get card validated using finger prints stored in card. 5. CSP touches the Card to NFC mobile phone. 6. Customer details is displayed on NFC mobile. 7. CSP does deposit/withdraw transactions thru NFC mobile. 8. The customer Date is encrypted by NFC Mobile using 3 DES.	9. The NFC mobile SMS the encrypted customer data to SMS gateway to validate customer information and process transactions from the centralized server. 10. SMS gateway receives the encrypted SMS data and forwards it to MLS server.
20. The customer receives the amount and printed transaction.	18. NFC receives the data from SMS gateway and is displayed on the Mobile display. 19. CSP touch the Mobile phone to the Printer and the Printer print the transaction details.	

Figure 8.3   *(Continued)*

the citizens. The evolutionary change in the institutional arrangements is handled prior to implementing the scheme itself. The required infrastructure is placed with the CSP. Their upkeep is covered under a maintenance contract with the service providers and the hardware vendors. The management systems, records, and work processes are put in place for the necessary data to support the implementation of smartcards. The service providers give MIS reports on a real-time basis.

MLS   Transaction
                                  database server
                                  (MIFOS Server)

| 11. MLS validate the encrypted date terminal ID, application ID, and transaction time.
12. MLS decrypt the Data
13. MLS check for the card number and forwards data to respective bank or bank database. | 14. MIFOS database checks the data for the card holder, inserts the transaction details. |
| 16. MLS after receiving the reply from the respective database encrypt the data and send back to SMS gateway server. | 15. Send back the information back to MLS. |

Figure 8.3   *Transaction Flow*

8.8.2 Financial Sustainability

The project is designed as a business model. The processes, technology and the devices are simple. In the pilot phase, the cost of cards and part cost of the hardware was borne by the State Government besides a 2% service charge paid to the banks. In the up-scale mode:

- All capital costs (card, terminals in village), training and remuneration to the BCs are borne by banks which come forward to implement the scheme in a given district.

- The Government pays 2% service charge to the banks on the volume of the total financial transactions; which is reviewed after the first phase expansion.

- The private financial companies are allowed participation only through the banking model.

The RBI recently announced an incentive policy under which banks were entitled to receive ₹ 50 for every smartcard account opened. This policy was effective from 1st July 2008 to 30th July 2009.

The Government of India established the FIF (Financial Inclusion Fund) and the FITF (Financial Inclusion Technology Fund) each with ₹ 5000 million and placed these at the disposal of National Bank for Agriculture and Rural Development (NABARD). Rules for the operation of the funds were also issued.

8.9 How and Why is it an Innovation?

The concept is in consonance with the RBI's proposal to roll out SmartCard-based banking services to the un-banked sections of the society. It is nothing but a branchless banking model enabling establishment of last mile banking in the form of a banking outpost (business correspondent network) in every village to facilitate the efficient delivery of banking and financial services to the poorest of the poor. The entire process is automated and the transfer of data takes place either through wired or wireless connectivity.

The SmartCards project is a mixture of all the three services—Government to Citizen (G2C), Government to Government (G2G), and Government to Business (G2B).

G2C—Payments are delivered within 4 days of transfer of funds to banks.

- People have welcomed the model because it offers them tremendous convenience by bringing banking services to their doorsteps.

- Customers are ensured of complete privacy with regard to their card and account details because of a process of authentication required prior to accessing the details. This has eliminated the need for proxy payments. This has also enabled the old, to access their money without any third person knocking it away.

- A single card for all the government benefits prevents the same benefits from reaching the beneficiary twice. This assists the government in catering

to a large numbers of beneficiaries unlike before, wherein a small group cornered the benefits.

G2G—It has helped in identifying and eliminating bogus beneficiaries in a foolproof manner.

- In spite of extensive use of technology, the user interface of gadgets as well as processes is so simple that literate women in villages are able to operate it with simple training.
- Death vacancies and permanent migration cases have come to light, as banks give information about the pensions not disbursed. This has eliminated the bogus entries.

G2B—The banks use this as an opportunity to extend their services to the village level as part of total financial inclusion.

- Banks are marketing their products.
- The technology service providers are able to experiment with their solutions, fine tune and make them economical and viable for marketing their products.
- The village organisation at the village level is eyeing the project as an alternate source of income for sustaining their community-based activities.

✿•• 8.10 Processes and Methods which Facilitated Innovation

In the two years of the implementation of the AP SmartCard project, new trends have emerged in the direction of simplification of procedures, reduction of costs, and enhancement of efficiencies in terms of time and costs. Hence, there is a constant urge to excel in service delivery to the poor.

Simplification of the enrollment procedure: Significant among the processes of simplification is the enrollment procedure itself. In the beginning, each bank followed its own procedure for enrolment of beneficiaries. A potential account holder had to fill a lengthy form and he also required an introduction, photocopies of several documents like the ration card, the NREGS job card, etc. Consequently, the enrollment was slow. Over a period of time, each bank embraced the formulation devised by the RBI fully, thereby expediting the enrollment process. The simplified norms stated that banks could take the individual's introduction from an existing account holder who had satisfactory transactions with the bank for at least six months. The photograph and address of the prospective account holder needed to be certified by the person who introduced him/her. By adapting this method in the Krishna district, Axis Bank opened accounts of 0.35 million (approx.) people in less than 3 months.

8.11 Point of Sale/Terminal (POS/POT)

Another important development is the customisation/integration of technology for multi-tasking. In the beginning, all banks and the service providers used separate equipment for enrollment and for making payments. Since the entire enrollment procedure does not get completed in one go, very often, the service provider had to run both pieces of equipment in the village at the same time. Now, barring one or two exceptions, all service providers have integrated both functions into one device so that if a POT/POS is positioned in a village; it takes care of enrolment as well as payment.

SmartCards: In general, biometric Java-based cards with 32 KB memory are used. In the beginning, the final price of the card varied between ₹ 100 and ₹ 150 including personalisation, de-duping, hosting of accounts, etc. Of late there is a thought in favour of a shift. The entire application if shifted to the POT, the smartcard can give way to a simple identity card. Since the card cost is the major portion of the total expenditure, such an initiative would bring down the cost of card to less than ₹ 10 leading to a sizeable reduction in the project costs. This is already being implemented by SBI. In another ongoing experiment with "M/s. AP-online", which is poised to implement the project in the Nizamabad district, "AP-online" proposes to dispense with the card altogether and run operations on the POT alone. In the initial years of implementation, the business operations were low thereby resulting in less cash in-flows. Hence, the reduction of the capital costs has been seen as going a long way in giving a fillip to the project and having financial viability, which in turn will go a long way in sustaining the project.

Bank procedures: Even though this project is designed as a branchless model, in the sense that operations can be carried out from a centralised location, during the course of implementation, it was realised that the involvement of branches of the bank at the local level was essential. At the beginning of the project, the branch managers were kept out of the picture and the state headquarters of the bank opened accounts using the CBS and made payments by conveying cash from a designated branch of the bank at the district level. This led to the branch managers being unaware of the accounts opened in their own area. So whenever the cash was not sufficient or the POT did not function or any such problem occurred in the field-state level, the district level machinery had to intervene. It was very difficult to obtain feedback and respond. Therefore, prolonged periods of disruption were experienced at certain locations.

On recognising this problem, systematic efforts were made in the last 6 months to involve the bank managers, by conducting workshops and keeping them informed of the progress. SBI has done pioneering work by fully involving

the branch managers and linking all the accounts opened under the concerned branch of the bank. Such involvement has significantly reduced field level problems and delays.

✏ 8.12 Constraints and Challenges Faced and Overcome

A significantly high proportion of the total payments, purported to be as high as 40%, are made through manual over-rides without using the card. A detailed analysis of the reasons for such phenomena reveals a host of issues like: Non-opening of accounts, non-activation of cards, network congestion which does not allow uploading and downloading of data, batteries of POTs not being charged due to power problems in villages etc. As a result, the biometric identification which is necessary for making the payments, is compromised. There is every need to streamline the backend process and reduce manual payments, as the payments through the smartcards are not only efficient, but also free from possible fraud. So at present, the service providers are giving real-time online reports, thus enabling efficient monitoring of the card payments.

✏ 8.13 Impact of the Project: Both in Measurable Terms and Intangibles

The pilot in the Warangal district was an eye opener especially in case of SSP. At the beginning of April 2007, before the introduction of SmartCards, the undisbursed pensions were ₹ 11.2 million. But in July 2007, after the smartcards were introduced, the undisbursed numbers soared to ₹ 128.4 million. From the financial angle, ₹ 2,240 million was undisbursed in the beginning of April 2007, and ₹ 25,680 million was undisbursed after the smartcards were introduced.

A saving of ₹ 1.138 million per annum has been achieved after the commencement of disbursements through the smartcard which when interpolated for the state, would mean that the government would have a saving of ₹ 189.3 million per annum as the system would eliminate payment to a non-bonafide beneficiary. The number of pensioners not turning up for enrollment despite doing several rounds of enrollment, implied that they were bogus.

The main outcome of the project is the ability to disburse pensions and wages through the cards in a secured and timely manner. The wage seekers are not losing even a day's wage since they can receive the money in their village itself. The pensioners are getting money straight into their hands and are not duped by any middlemen. The other outcomes include, elimination of bogus beneficiaries, prevention of same benefits reaching twice or more times to a beneficiary, business opportunities and awakening of rural economy to technology and e-Governance.

🌿 8.14 Overall Status at a Glance (Pilot, Phase-I and II)

- No. of Districts in which the project is started   : 20
- No. of Gram Panchayats where work started   : 10530
- Target no. of beneficiaries under SSP and NREGS : 13.5 million
- No. of beneficiaries enrolled   : 631.9 million
- No. of cards issued   : 5.738 million
- Amount paid   : ₹ 7,656.9 million

🌿 8.15 Lessons Learnt/Experiences

The entire initiative started as a Total Financial Inclusion model. In order to encourage banks to embark on this in a big way, the Government of Andhra Pradesh agreed to deliver two major programmes namely, NREGS wage payment, and SSP payment, through this network. However, even after 2 years of commencing the project, no bank made worthwhile progress in delivering banking services through this network. It is clear that unless this is seriously attempted by each of the participating banks, the noble objective of making the bottom of the pyramid a part of the formal banking system will remain a dream.

🌿 8.16 Future Roadmap

It is envisaged that though the project was initially started with two schemes, viz., disbursement of Social Security Pensions and payment of wages under NREGS, the other programmes like housing loans, SHG Bank linkages and crop loans etc., could also be taken up through smartcards subsequently. Thanks to the inherent security capabilities, smartcards can also be used to host multiple applications, enabling consolidation of services with one card, which promotes cost savings and efficiency. What is most fascinating about the SmartCard project is the fact that it has brought dignity and value to the lives of the most vulnerable in the society.

Case

9

Aasthi—A GIS Based Property Tax Information System

Anjum Parwez, IAS and Meena Nagaraj, KAS

Aasthi is a real property tax information system linked with a Geographic Information Systems (GIS). The spatial dimension, aids in the analysis of the assessment of real property taxation process. With adequate, accurate and up-to-date records, the local governments can provide better services to tax payers thus encouraging them to pay their taxes on time.

About Host Organisation

The Directorate of Municipal Administration was established in Karnataka in 1984 to oversee the affairs of Urban Local Bodies (ULBs) of the State, except Bangalore City Corporation. The Commissioner is the Chief Controlling Authority. The main function of the Directorate is to have an effective co-ordination with the ULBs, as well as with the Deputy Commissioner. The Directorate has the responsibility to supervise the function of the municipalities, work out suitable human resource policies, exercise disciplinary control over the staff of the municipalities, monitor the tax collection of ULBs, lay down policies for transparency in expenditure and hear appeals against the decisions of municipalities.

Municipal Reforms Cell

Municipal Reforms Cell (MRC), a wing of DMA, was created in 2005 under the Directorate of Municipal Administration, exclusively for the implementation of computerisation and other reforms in all the Urban Local Bodies (ULBs) of Karnataka. The drive of implementation of reforms in the State began in 2004 in select 49 ULBs, under the Asian Development Bank funded "Nirmala Nagar

Project" and later from 2008 onwards, in the remaining 164 ULBs under the World Bank funded "Karnataka Municipal Reforms Project".

The Municipal Reforms Cell co-ordinates with the project partners, namely e-Governments Foundation (application support organisation), Survey Of India (Technical Advice Support Agency in GIS implementation), Karnataka Urban Infrastructure Development Finance Corporation (Funding Agency) and Software Technology Parks Of India, Bangalore (for O & M of Data Centre).

A state level Municipal Data Centre is established within the Municipal Reforms Cell, and a centralised database of all the ULBs are maintained from it. The State Level Municipal Data Centre hosts all the web-based applications. The entire process of rolling out of the municipal applications of ULBs is handled by the IT professionals of Municipal Reforms Cell, duly appointed by the department, directly from the market. The Municipal Reforms Cell hand-holds the ULBs in the implementation of the computerisation reforms, and further maintenance of the same. The task of capacity building and training to Municipal staff also vests with the Cell.

9.1 History

Municipalities play an important role in property tax assessment. Taxation is the main source of income for a municipality and property tax is the foremost among all the taxes. Determining how much tax is to be levied on a property requires true information on the property structure, its location, ownership, condition, size and the use to which it is put.

Under the traditional methods followed by the Urban Local Bodies (ULBs), the tax was calculated manually. Thus, there were chances that a property would be assessed as per the whims and fancies of tax payers rather than the property taxation laws. The method of tax estimation itself was faulty.

The performance of municipalities, in the discharge of their duties was seen to be deteriorating. A number of issues, such as inefficiency in the conduct of business, ineffective participation by the weaker sections of the population in local governance, weak financial conditions, lack of transparency in planning and implementation of the projects and so on, troubled them. Their performance and credibility were getting adversely affected. The need to bring IT into the municipal framework became imperative, especially to store, retrieve and update large amounts of data.

The ULBs in Karnataka were following the "Annual Rental Value" system of property taxation, wherein the assessing officers, appointed by the government, were carrying out a revision of the assessments, once in five years. There were no comprehensive property registers, listing accurate details of all the properties (legal or otherwise) which were being maintained by the municipalities.

Manual registers called "Demand Collection and Balance", having details of only the assessed and the legal properties, served as the *only* property records. Out of these, many properties were wrongly assessed, and there were also those properties on field, which were totally un-assessed by the ULB. To add to the problem, since only the hard copy forms of the property tax details were maintained, the tracking and tracing of the tax defaulters, un-authorized or illegal properties and the under-taxed properties became difficult.

9.1.1 Administrative Deficiencies of the Existing System

Several inherent deficiencies existed in the assessment and administrative systems in place. Some of these were:

- Corruption prone environment resulting in subjective assessments.
- Excessive use of discretionary powers leading to possible collusion between the assessor and the assessee.
- Lack of transparency in the assessment procedures.
- The onus of annual assessment rested on the local body. Notice of demand was to be issued every year and self assessment was not possible.
- Higher social costs due to litigation, and consequent delayed recovery of taxes.
- Absence of a systematic computerised database resulting in a large proportion of the properties being outside the tax net.
- Lack of efficient mechanisms for detection and follow up on defaulters.

9.1.2 Issues Faced by the Department

- Low rate of filing the property tax returns
- High accumulation of arrears
- Negligible penalty for not filing the return.
- Improper assessment of the property tax by ULB Officials which was causing huge revenue loss to the ULB
- Large number of properties were unassesed and not brought under the tax net
- No uniform procedure of taxation
- Tampering of records
- Inaccurate and inconsistent details and data provided by the ULB
- Property records were maintained in manual DCB registers
- Registers had details of only the assessed properties, out of which, many properties were wrongly assessed

9.1.3 Issues from the Perspective of Citizens/Service Users

- Delay in issuing the property tax extract to citizens
- Non service of hand written property tax notices to the property owners by the Bill Collector every year
- Possibilities of tampering the property details entered manually in paper form
- Calculation and clerical errors in taxation by the Bill Collectors and Revenue Officers.

9.1.4 Issues Faced by the Government

- Discrepancies in reported figures from ULBs
- Lack of timely information about property details from ULBs
- Inaccurate projections of property tax demand which was one of the main source of revenue of ULBs
- Monitoring the collection efficiency across 213 ULBs difficult
- Tampering of manual records, misplacement of records
- Manual Data was inaccurate

All this resulted in poor coverage of the properties, low revenues and an inefficient tax management system. The weaknesses and deficiencies in the current system of property taxation did not allow for a full exploitation of the revenue potential of this tax, and it remained one of the most under-exploited tax instruments. The poor revenue collection directly affected the quality of services and infrastructure provided by the urban local bodies. The assessment targets always remained around 50% off the mark.

At this point of time, the Government of India attempted to strengthen municipal governance and improve the performance abilities of the municipalities by enacting the Constitution (74th Amendment) Act (CAA) in 1992.

After the abolition of Octroi in 1978, property tax formed the main source of income for all these Urban Local Bodies. This accounted for about 25% of the total budget of the City Corporation. In 1998-99, the Bangalore Mahanagara Palike (BMP) faced a severe resource crunch. It did not have adequate resources to finance capital projects to upgrade the city's infrastructure. The property tax base of the city was inadequate because a very large number of properties in the city had not been assessed. The discretion exercised by assessment officers, had resulted in a lot of disparities in the assessed values of similar properties, leading to a high level of dissatisfaction among citizens and loss of revenues. This was when the Property Tax Self Assessment Scheme (SAS) was introduced in 2000-01, to make the process of payment of property taxes more transparent and simple.

👉 9.2 FEATURES OF THE SELF ASSESSMENT SCHEME (SAS)

The main features of the SAS were:

- It was based on the mass appraisal system of properties.

- Property tax computation would depend on the location, type of construction, built-up area, use of property and age of the building.

- The zones based on estimated market value of properties, as notified by the Government to the Revenue Department, U/S 45B of the Karnataka Stamp Act, were created throughout the city.

- Owner occupied properties were given a concession of 50%.

- Certain class of non residential properties, whose value was not related to the zone, were classified separately.

- A higher and a lower slab was fixed to avoid a big increase or decrease in the amount of property tax to be paid, consequent to the introduction of SAS.

After seeing the positive experience of the BMP in the use of GIS functionalities, the Urban Development Department, Government of Karnataka, through the Directorate of Municipal Administration (DMA), decided to re-engineer the ULBs' existing manual process of property tax collection. In partnership with the e-Governments Foundation, it developed a computerised GIS-based e-Gov property tax system as part of its Urban Reforms process, to address many of the inadequacies in the current system.

The idea of using the Geographic Information Sytem (GIS) was conceived to enhance the functionality and information that IT yields, in its own unique way and bring a spatial element in it.

> The Aasthi Property Tax Information System (PTIS) application was developed by the Municipal Reforms Cell (MRC), together with e-Governments Foundation. It was an endeavour to make tax assessment simpler, prioritise areas on the basis of tax revenues collected or due, facilitate decision-making and streamline the workflow of property tax assessment.

The project was rolled out across the state in a phased manner. To begin with, a pilot study was first undertaken at ward no.4 of the Byatarayanapura CMC in Bangalore District, to evolve the process of project implementation. Thereafter, 49 ULBs were selected as part of Phase I under the Nirmala Nagara Project (NNP) and subsequently, the same initiative was rolled out to the remaining 164 ULBs under the Karnataka Municipal Reforms project (KMRP).

9.3 Objectives and Scope

- To tap the full potential of property tax as a source of revenue of the ULB.
- To make the system transparent and simple in order to facilitate understanding and proper interpretation by the property owners.
- Eliminate/reduce subjectivity and discretion in assessment, particularly at the field level.
- To introduce self assessment to shift the onus on assessees to pay tax on time.
- To remove the existing inequalities in tax burden on similarly placed or similarly used properties.
- To bring all properties into the tax net.
- To build in buoyancy and elasticity in the tax base to achieve revenue growth.
- To reward the honest tax payers and penalise the defaulters.
- To make the systems of assessment, collection and information citizen friendly.
- Introduce system improvements to increase the efficiency in tax administration focussing on the entire value chain – coverage, billing, collection and enforcement.

Consultation with the target groups/stakeholders: Several rounds of consultations were held with the ULBs, the officials and the elected representatives, for drafting a roadmap to implement the process of e-Governance. The key issues faced in the conventional system and procedures of functioning were discussed. These discussions were participatory in nature. Technical information on the design of the project was shared with the participants and their opinion was sought.

9.3.1 The Core Issues that Came to Light

- Poor Infrastructure
- Lack of IT skills of staff to implement the project
- Lack of funding
- Human Resource issues

The website templates were designed with the help of e-Governments Foundation and given to ULBs for filling up and updating the data.

9.3.2 Requirement Gathering

One of the objectives of the stakeholders' consultative meeting was also to gather information on the requirements prerequisite to project implementation.

Inputs were gathered about:

- Supporting infrastructure requirement
- User charges
- Capacity building
- How technology should be tailored to the environment
- Financial requirements
- Human resource requirement and procurement of various personnel
- Project monitoring and management
- Training

9.4 SALIENT FEATURES OF THE PTIS

The salient features of the project stood as follows:

- Drawing up a city map with road networks and various types of boundaries demarcated
- Carrying out a physical survey of all the properties
- Collection of actual data on all the properties in urban limits with all the property features
- Drawing up property polygons
- Numbering of streets and properties
- Computing automatic property tax demand
- Automatic generation of demand and seizure notices
- Online Property Tax Calculators
- GIS – MIS linkage
- Centralised database with server in Bangalore
- Web based applications

9.5 CAPACITY BUILDING EXERCISE

Extensive capacity building activities were undertaken for various levels of the city administrators along with training of new personnel. These activities focussed on building human capacity in terms of the necessary knowledge and skills to conceptualise, initiate and implement the e-Governance initiatives rolled out in ULBs. All the sections of each ULB were made adaptable to the new computerised system through regular trainings on how to use the online municipal applications.

The Municipal Reforms Cell had an exclusive in-house training wing which was focussed on how to train all the people involved in the implementation process, including the survey assistants. The Survey of India (SoI) was involved in the field survey training.

The municipal data centre had a centralised database running from a high-end server. This was being maintained by a competent authority viz., Software Technology Parks of India. The main feature of the system was, that any new version did not have to be installed in every ULB. It could be uploaded in the main server and within no time, the ULB could access the new version. The versions were upgraded every 2-3 months depending on the new patches developed, which were required for various other services to be linked with GIS property tax. Hence, the ULBs were virtually free from maintaining the server on a day to day basis.

9.6 Sustainability

The Karnataka Municipal Data Society® (KMDS) was setup by the Government of Karnataka. The society was registered with the Registrar of Societies, under the Karnataka Societies Registration Act, 1960. The intention of the Government of Karnataka in setting up KMDS was to manage the e-Governance initiatives taken up by the Municipal Reforms Cell of the Urban Local Bodies. Some important objectives of the KMDS are:

(a) To provide special support for the member institutions, by acting as the central repository for the digitised maps of all the member institutions and the urban related utilities. To also provide or arrange to provide the GIS lab facility with spatial data centre that can keep track of the map requirement with periodic updation for all the member institutions.

(b) To provide or arrange to provide standards for the Urban Local Bodies for their Business Processes Re-engineering.

(c) To carry out aggregation of common data for the government.

(d) To provide or arrange to provide support on connectivity and its related issues.

(e) To advice member institutions on matters related to IT and systems.

The salient features of the architecture were:

1. Centralised architecture to operate 57 cities from one location. Centralising also allows for standardization of formats and processes that automatically drive economies of scale.

2. Hub-n-Spoke model, which allows few resources to be centralised yet spread the benefits to all cities in the spoke e.g., getting high-end GIS

expertise or the relational database tuning expertise to each city is difficult; although experts can be hired at one central location in Bangalore who can take care of all city servers.

3. Network security and preparedness against viruses, worms and hackers can be much better at one central location.

9.6.1 Centralise the Servers at Bangalore

Earlier during phase I, it was planned to have decentralised servers set up in all the Phase I ULBs and all the ULBs to maintain and manage these servers individually. After a series of consultations and assessing the advantages and disadvantages underlying both the models, it was decided to have a centralised server set up in Bangalore for all the Nirmal Nagara ULBs, since Bangalore has IT expertise and immediate solutions to technical problems. It is also easy to maintain all the servers under one roof for security and immediate service reasons. This will also reduce the cost implications, drastically. This decision saw the setting up of the Municipal Reforms Cell, a state data centre for ULBs.

The Municipal data centre having a centralised database running from a high-end server, is maintained by a competent authority viz., Software Technology Parks of India. As such, the ULBs are free from maintaining the server on a day to day basis. The main feature of the system is that any new version need not be installed in every ULB, it is uploaded in the main server and within no time the ULB can access the new version, which is upgraded every 2-3 months depending on the new patches developed which are required for various other services to be linked with GIS property tax.

The focus of the above framework of e-Governance reforms is to strengthen the Urban Local Bodies financially and also technically, so that they are sustainable.

9.6.2 Implementation Process

The first problem to be tackled prior to implementation, was that no ULB maps were available with the wards, with properties marked on them. From the available piece of maps/sketches available with the Survey of India (SoI), the Director of Town Planning and the ULBs, SoI undertook to prepare base maps for all the 49 NN ULBs, that were selected in the first phase.

Enlarged maps on different scales were prepared by the SOI and all the streets were updated on these ward maps. Road networks were updated on different scales by the hired engineers, depending upon the density, and were provided to ULBs to insert/update the property polygons, street-wise/block-wise/ward-wise, with property numbers. These maps were scrutinised by the SOI and approved for further digitisation work.

9.6.3 Activities taken up under the GIS-based Property Tax Information System (PTIS)

- Field survey of all the properties in the ULB.
- Renaming of the entire road network and renumbering of properties in the ULB.
- Preparation of digitised ward maps with individual properties having a unique property ID Number.
- Computerisation of property records.
- Tracking of the tax defaulters.
- Generation of MIS reports at the city, ward and street levels, as decision support tools for the revenue department to analyse the various properties' tax collections.
- Automatic calculation of the property tax based on the Capital Value System (CVS) methods.
- Generation of bank deposit challans and the Khirdi reports.

The first and the foremost important step was the collection of existing data from the records available with the ULBs, and identification of data with SAS declaration. Pre-printed forms 'A', 'B' and 'C' were supplied to the ULBs for entering the necessary data relating to property tax. On a review, it was observed that there was no uniformity in the procedures followed by the ULBs for defining the city/ward boundaries. It was decided to use the existing maps and hand sketches of the ULBs, the town planning maps available with the Director, Town Planning and the satellite/aerial imaginary maps, available with the SOI, and to amalgamate them to develop comprehensive maps before digitising them. It was prudent to digitise the maps; at the (1) ULB level, (2) ward level, (3) block level and also digitise each and every individual property parcel along with road and street networks. This could become the base for GIS based property tax.

Engineers were hired and given comprehensive training at Bangalore by the SOI and the e-Governments Foundation.

Training sessions for the bill collectors, the revenue inspectors, the revenue officers and the commissioners/chief officers were also held in Bangalore. As the work progressed, several complications arose and the target of two months had to be stretched. To assist the Bill Collector and the hired engineers, SOI deputed its surveyors to supervise the work of street and property numbering and naming.

The hired engineers were appointed at the ULB level for carrying out a field survey of the properties, collecting the property details in the prescribed form and drawing the polygon sketches of the property with measurements.

They also named and numbered the individual streets and provided a unique property identification number (PID) to individual properties. The numbering of properties and streets was done as per the guidelines issued by the Directorate of Municipal Administration (DMA).

Retired KAS/KMAS officers were recruited on contract basis to supervise the work. After due theoretical and practical training at Bangalore, they were assigned the selected project towns. 18 employees were exclusively deputed by the SOI to guide and streamline digitisation, of the Nirmala Nagar wing.

The tender document for appointing a CAD agency for the digitisation of all properties, was created and sent to the ULBs for floating tenders. This digitisation would only give a schematic representation of properties in the ULB with the property ID, but not the exact location and dimensions.

Even though, initially it was envisaged that each hired engineer would complete 40 properties per day, experiences indicated that it was a difficult target to achieve, considering the detailed work that was required to be done in this respect. As such there was a request to provide one labourer for each hired engineer.

Property details like plinth area, building structure, built-up area, ownership details, occupant details and tax details were captured during individual property survey in Form-Cs. This data was used to create an MIS database of properties.

A copy of Form C was served on citizens, calling for objections, if any. The objections received, would be heard by the Commissioner/Chief Officer and corrections incorporated in the database. If required, field verifications would again be carried out by the ULBs to check the authenticity of data.

It was also necessary to impart training to the CAD agency to maintain uniformity in the implementation of the whole process of digitisation of property details. The SOI took necessary steps for imparting such training. It agreed to look after the digitisation work up to the street level, and scan the ward level maps in which property parcels were incorporated subsequently by the hired engineers. It would also approve the naming and numbering scheme, within the ward limits. The SOI would look into the quality control aspect of the work to be handled by the CAD Agency.

Data pertaining to nearly 3 million properties under 49 ULBs was to be computerised. Standard tender documents were finalised by the Government Urban Development Department and the consent of the Karnataka Urban Infrastructure Development Project was obtained.

Accordingly, 49 ULBs called for tenders. Once the tender was finalised in majority of the ULBs, it was decided to include the scanning and printing of property sketches also. In addition, a data-entry software would be prepared for easy data-entry and printout. Therefore, it was necessary that a data-entry tender

be called afresh, incorporating the earlier aspects and also giving due regard to the provisions of the KTPP Act.

9.6.4 Challenges in Implementation

An implementation of this magnitude and scope without any precedence in India was bound to have several challenges throughout the project.

9.6.4.1 Process challenges

(a) The municipal bodies (especially the Corporations) had their own rules and operating procedures. These had to be standardised through a series of government orders issued by the DMA.

(b) A multi-year, multi-disciplinary implementation of this nature was very difficult to monitor for progress. To overcome this, a project monitoring mechanism was devised whereby each municipal body reported its weekly progress on a pre-defined set of parameters.

9.6.4.2 People challenges

(a) Any e-Governance initiative would throw up capacity challenges. This was overcome by a series of training sessions and by recruiting a whole lot of engineers and accountants at the local government level.

(b) Many e-Governance initiatives in India have failed because they have been individual centric. This was a risk that was relevant in case of this implementation as well. To mitigate this, the DMA office setup an independent society (Karnataka Municipal Data Society) which was setup with a self-sustaining revenue model by which the municipal bodies were expected to pay an annual subscription fee to the KMDS for accessing the applications.

9.6.4.3 Technology challenges

Providing high-speed internet connectivity to the municipal bodies to access the systems over the internet was a big challenge. This was resolved by the DMA office contracting out the ISP provisioning for all the 213 bodies to BSNL as a turnkey contract.

9.6.4.4 Other challenges

(a) Estimation of taxes and their collection.

(b) Incorrect maps and incorrect data entries.

(c) Overcoming inertia and resistance to change.

(d) Lack of awareness among the public at large.

(e) Training to be provided from the cutting edge level.

9.7 Why is it an Innovation?

This was the first time a state-wide model of reforms was being implemented, whereas traditionally, the municipal e-Governance reform initiatives had all been at the local level. This had made them difficult to replicate. The vision here was to create a standardised set of systems and processes across the state to provide the benefit of knowledge sharing across the individual bodies and also create a common platform on which a comparative evaluation between municipalities could be undertaken.

Under this framework, some of the most innovative decisions taken on the e-Governance front were:

1. Creation of a centralised system with a common process and data model, across the state.

2. Leveraging the internet to develop an application that could be accessed by the individual municipal bodies over the internet.

3. Hosting of applications centrally by an independent entity (Karnataka Municipal Data Society) which provided applications to the individual municipal bodies, for an annual subscription fee under the SAS model. This was also first, in the context of the Indian Government.

The core of the project was implementation of e-Governance initiatives with citizen participation in city administration. This was the first time in India that reforms had been institutionalised with administrative, professional and technical back-ups.

(i) Administrative Backup

- A reform focussed office called the Municipal Reforms Cell (MRC) has been created by the Karnataka Government under a government order. The duty of the officers appointed for MRC is to implement and oversee the progress of reforms in the state.

- The cadre and recruitment rules have been amended and the senior/junior programmers' posts have been created, prescribing minimum qualification of B.E (CS/IT)/MCA for senior Programmers and B.Sc (IT)/BCA for junior programmers.

- For the first time, IT Engineers posts in the ULBs were filled up through competitive exams.

(ii) Professional Backup

- Survey of India has been appointed as the technical assistance and support agency, by the Directorate of Municipal Administration, for the implemen-

tation of the GIS programme. Software Technology Parks of India has been appointed for setting up of Karnataka Municipal data centre at Bangalore and for carrying out the O&M of the same.

(iii) Technical Backup

- Web-based applications have been developed by the Government free of cost with the support of an NGO called e-Governments Foundation. All the data of the ULBs are stored in the central servers, maintained by the Department at Bangalore. Thus, a ULB IT engineer or other municipal staff with a userid and password can access the ULB e-Governance applications in any computer system with an internet connection based on their roles.

9.7.1 Process and Methods which Facilitated the Innovation

In Karnataka state, the initiative of e-Governance reforms started in 2004 with the use of ICT systems to process and collect data, transmit information to the citizens, computerise the manual procedures etc. The web-based technologies and widespread societal use of internet provided the Government an increased potential to communicate with the citizens and organisations of all kind. This injection of technology into the bureaucratic administration set-up, led to the introduction of several reforms where innovation occurred as a by-product of technological development.

The top-down implementation methodology is adopted in implementation of all the reforms in the state. Though the requirement gathering has been through brain storming sessions, meetings with elected representatives and the senior officers, the process and methodology of implementation has been from the Directorate Municipal Administration to all ULBs . The responsibilities at each stage has been clearly defined in the Job Chart and the same is regularly monitored at MRC.

9.8 New Workforce Structure

An effective computerisation strategy involves the positioning of proper human resource at the various action points. Some of the resources need to be of a permanent nature and inherent to the system, while some experts need to be brought in for short periods. The following human resource intervention was made for computerisation:

At the district level:

- A nodal officer with requisite qualification, has been appointed at the district level for monitoring the implementation of computerisation. These

nodal officers handhold the ULBs in the implementation and maintenance of the e-Governance reforms.

At the ULB level:

- IT engineers were appointed in every ULB to implement the computerisation modules and future maintenance.
- Accountants appointed in every ULB to implement accounting reforms
- Nodal engineers appointed for GIS work at each ULB

9.9 Benefits

The impact and benefits arising out of the new system were tremendous. It resulted in a foolproof system of implementation of the property tax reforms with the following outcomes:

- Identification of the un-assessed properties and bringing them under the tax net. This resulted in identifying 40-50% of the hitherto unassessed properties.
- Fixed assets worth crores of rupees, which were otherwise unnoticed, were physically identified, numbered and brought into the records.
- e-Governance brought about higher transparency, general awareness about ULB administration and increased accountability.
- A sound database of all the properties was created.
- Digitised ward/block maps were prepared, up to the property level, with unique property identification numbers, which could be accessed by other departments like the Urban Development Authorities for city planning, infrastructure planning and City Survey Department for the certification of property titles and so on. This could also be useful to other departments such as the Electricity Department, Transport, Census Department, and the like.
- The centralised database would provide required information to the state level agency (DMA) to develop state level plans.
- 24/7 public grievance cell manned by an NGO, was set up. People could lodge a complaint on any of the issues pertaining to the GIS property tax system, alongwith other grievances. Any discrepancy in data would be corrected after field verification. The new system thus addressed many of the inadequacies of the erstwhile property tax system.
- Web-based application enabled faster delivery of the property tax extract, which was generated automatically. Additional features like demand and penalty calculation were being implemented as enhancements to the existing application.

- The automated tax calculator had a user friendly interface, was easy to understand and use, and saved time and cost. Service fee was no longer charged.

- Auto generation and over-the-counter issuing of the Khatha extract saved time and much of the red-tapism that existed in the earlier system was done away with.

9.9.1 Reports can be Customised to Reflect the Following Data

- *Coverage:*   Number of properties in the assessment register, number of new assessments during the year, number of properties assessed as % to the number of properties in the city. The target has reached 100% coverage over a five year period.

- *Tax Mapping:*   Properties covered by the GIS mapping and field survey, targeted, achieved during the year and cumulative in the reform period. Number of properties and covered area, ward-wise and use–category-wise.

- *Demand:*   Current demand, arrear demand, % increase in current demand year-wise.

- *Collection:*   Current and arrear collection separately, and % to demand-year-wise. The target to reach a minimum of 85 % collection efficiency.

- *Tax Revenue:*   The revenue from tax as a percentage of total revenues of the municipality, and trend over the years.

- *Enforcement:*   Number of cases of evasion/suppression detected, amount of suppressed revenue/penalty recovered, number of cases pending in the court, additions in the year disposed off, revenue locked up in pending cases, revenue collected from the case disposed off.

- *Grievances:*   Number of grievances received from the public, number disposed off/pending, average response time for settlement of the grievance.

9.10 EXPERIENCES

- Transparency policy is very well accepted both by the citizens and the elected representatives.

- The most important lesson learnt is that any true effort made towards serving the citizens, will always be supported and encouraged by the masses. This could be seen in the collection of property tax after improving the Control Room facilities.

- Need for an expertise in handling the citizens, the elected representatives and the officers was realised.

- Review meetings conducted to know the progress of the work and discuss the future plans for efficient functioning of ULBs.

9.10.1 Recruitment Issues

To introduce ICT reforms, it was necessary to strengthen the ULBs with the capacity of IT resources. In the Nirmal Nagar Project, IT engineers were recruited to work for the ULBs, District Urban Development Cell (DUDC) and DMA office. Their main activity was the implementation of the projects involving computerisation activities like the ULB website, PGR system, GIS based PTIS, birth and death registration and certification system and double-entry accrual based accounting system. The IT engineers were directly recruited by the Directorate of Municipal administration.

The entire process of selection for all the ULBs across the state, implementing the project under Nirmal Nagar was held in Bangalore. The outcome of this selection process was that most of the candidates who appeared for the written examination and who were selected, were from localities closer to Bangalore. These IT engineers were the interns posted to the various ULBs and DUDCs of the state to which they had no adequate familiarity of the regional or local conditions. This resulted in high attrition rate which acted as roadblock to the progress of project implementation. As a result, the State Government delegated the powers to the Dy. Commissioner of the district as on 10-04-2006 to recruit IT engineers for the ULBs and DUDC of the district. Recruitment was carried out at the district level. By following the above procedure of recruitment, a lot of applications from local qualified candidates were received. The persons recruited, helped in plugging the attrition rate to a large extent. Also, due to the familiarity of the local conditions the performances in the deliverables have shown improvement.

9.10.2 Statistical Evidence

The above innovative process has resulted in a foolproof system of reforms implementation with the following outcomes:

Table 9.1 *Identified Unassessed Properties*

No. of ULBs	No. of Properties as per MAR 19	No of Unassessed Properties Identified	% Increase in No. of Properties brought under Tax Net
213 ULBs	26,26,108	11,09,601	42.25%

Property Tax Demand

Pre and Post Aasthi Implementation

(Amount in millions)

Name of the ULB	Before Demand	After Demand	Amount of Increase in Demand	% Increase
Gokak	7.94	10.77	2.83	35.68
Nippani	6.43	7.96	1.53	23.87
Channapattana	5.50	7.0	1.500	27.27
Hassan	63.76	90.91	27.15	40.31
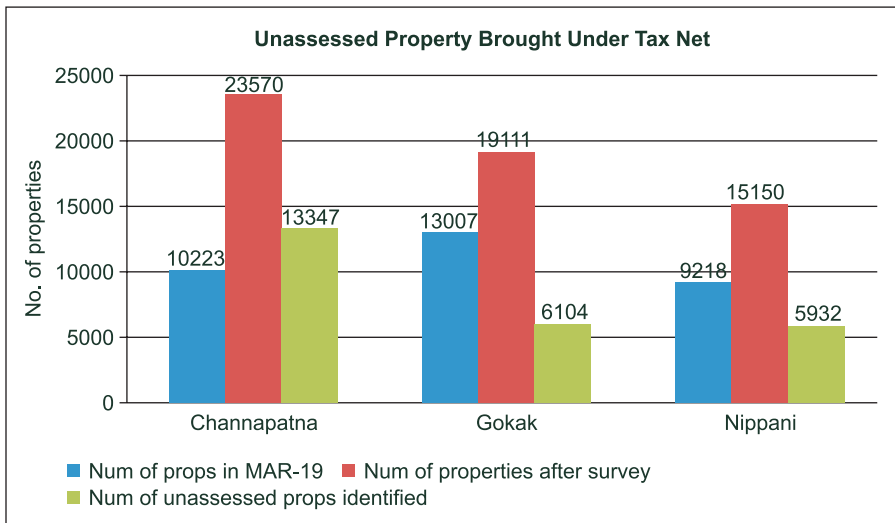
Figure 9.1   *Unassessed Property brought under Tax Net*

9.11 CONCLUSION

e-Governance has resulted in higher transparency, general awareness about ULB administration and increased accountability. Overall, the service delivery, performance and credibility level of Urban Local Bodies has improved.

9.12 FUTURE PLANS

Future plans include further enhancements to the GIS-based PTIS application. It includes the following aspects:
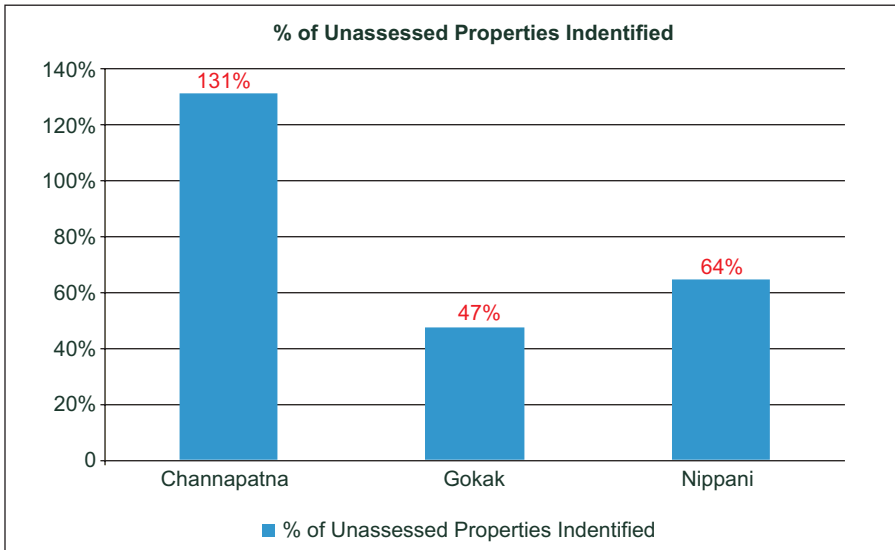
Figure 9.2   *% of Unassessed Properties Indentified*

- Supporting property mutation
- Handling bank and field payments with the ability to integrate with credit card and multiple payment kiosks
- Biometrics for authentication
- Integration with building plan approval and other e-Governance modules like FBAS

Case

10

e-SANCHAR (e-Speech Application through Network for Communication, Help and Response)

Tanmay Kumar, IAS

e-SANCHAR was developed to provide quick and efficient dissemination of information through database driven automated voice calls. With the help of this technology, deprived citizens are able to access a variety of services. It also brings the e-Government's interest and mission to the people and adheres to the principle of SMART governance.

10.1 History

The Social Justice and Empowerment department of the Government of Rajasthan dispatches pensions to widows, the aged and the physically challenged under the social welfare programmes and various other schemes and categories. The pension is sent either through postal money orders or directly credited to the bank accounts, on a monthly basis. Most of these pensioners who belong to the rural areas do not have any definite means of finding out whether the pension has been sanctioned or whether the despatch/credit has taken place. They remain clueless about it and keep waiting for the money orders to reach them.

In the absence of an institutional mechanism to intimate pensioners about their pensions soon after its sanction/release, they get to know about the status of their pension after considerable delay. They also sometimes need to personally pay a visit to the office or depend on some contact person to find out the status of their applications. Hence this socially underprivileged section is dependent on non institutional support such as the intermediaries, for obtaining information about their pension application and other entitlements under the various welfare schemes, when in fact, it should flow to them as a matter of right (Figure 10.1).
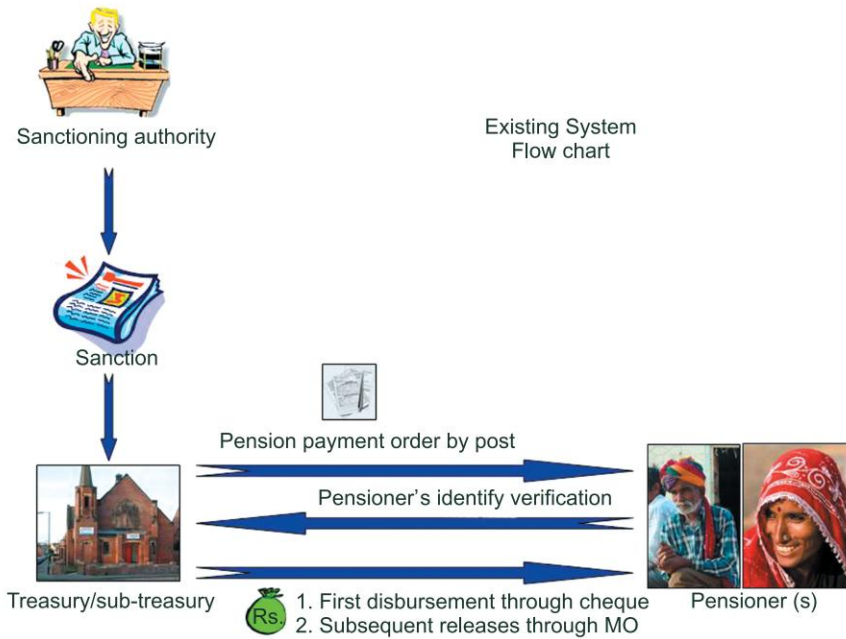
Figure 10.1 *Flowchart Depicting the Existing System of Despatch and Receipt*

10.2 Problem in the Existing System

Under the existing system, a *Pension Payment Order (PPO)* is issued to a pensioner. Due to inherent problems in the postal system in the country, this PPO takes considerable time to reach the concerned beneficiary. Simultaneously, bulk money orders are printed and issued, for transfer of pension payments. However, as mentioned earlier, no institutionalised system exists for the pensioners, to find out/confirm the status of their applications. The intermediaries therefore take advantage of the ignorance, illiteracy, physical disability and immobility of the disadvantaged group, and charge for transactions carried out through them.

10.3 e-Sanchar for Pension Services

e-Sanchar is a voice to text application, which has been used by the Government of Rajasthan to evolve an institutional mechanism, to proactively inform the pensioners about the status of their pensions. The project was conceived and executed by the then Secretary, Information Technology and Communication, Government of Rajasthan. A pilot study was conducted in the Shahpura Sub Treasury in 2009. The results were well-received and are being extended across the state for the pension scheme and for other Government to Citizen (G2C)

services. The project integrates mobile telephony with information technology to generate voice calls, to provide timely information to rural citizens such as the aged, the handicapped and the widow pensioners, regarding the sanction and monthly release of their pension. The application can be used in cases where direct communication with the beneficiary/target group is felt necessary.

The pilot project of e-Sanchar (*e-Speech Application through Network for Communication, Help and Response*), which integrates IT with mobile telephony, was conceived by Mr. Tanmay Kumar, the then Secretary, Department of Information Technology and Communication (DoIT&C), Government of Rajasthan keeping the aforesaid ground realities in mind, with a view to meeting the above mentioned objectives. The e-Sanchar application converts text to speech in Hindi, provides automatic dialling and communicates the government's advice and information in the form of fixed as well as variable voice messages, to the targeted beneficiaries. The e-Sanchar application has wider penetration in the rural areas, where the medium of instruction is Hindi and the local dialect. This addresses the constraint of illiteracy.

The e-Sanchar system provides information to the applicant or to the contact person authorised by the applicant, regarding the status of sanction of his/her pension, soon after the Pension Payment Order (PPO) has been issued and again after the pension amount has been released by the sub treasury, to be credited into the bank account/post-office account of the applicant.

The voice call, apart from providing a path for the flow of information, presents the humane face of the administration. It helps in building up tremendous trust, faith and goodwill in the government besides bringing in efficiency and effectiveness in administration through greater transparency, accountability, responsiveness and accessibility.

Moreover, the mobile platform has a much larger and widespread reach in rural areas as compared to the internet and other media.

The statistics given below clearly explain the advantages of linking IT applications with mobile telephony. As on 1st November 2009:

- The total no. of phones in the rural areas covered by the project were: 519 million

  Mobile: 482 million

  Landlines: 37 million

- Total no. of PCs in the rural areas covered by the project were: 36 million

- Internet accounts opened in the rural areas covered by the project were: 16 million

  Broadband: 7 million

- Active Internet users in the rural areas covered by the project were: 60 million

✆ 10.4 Planning of the Pilot at Shahpura Sub-treasury

Under the state's "100 Days Action Plan", the Department of Information Technology and Communication (DoIT&C), in association with the Directorate of Treasuries and Accounts (DTA), successfully executed the pilot project of e-Sanchar in the Shahpura Sub-Treasury.

Approximately, 3800 pensioners were registered and pensions through money order were given. Under the existing system, the NIC had developed a software to help expedite only the process of printing money orders by all the treasuries. The software was examined by the DoIT&C and necessary suggestions were made to the Director, T & A to revise the NIC module with respect to:

- master and monthly release data entry module;
- module for generating text files for uploading;
- module for generating bank advice

> With the help of the District Collector, Jaipur, information on PPOs, available with the Shahpura Sub-Treasury, was sent to the SDO (Shahpura) to capture the relevant details. In 33% of the cases, that is approximately 1300 out of the total PPOs, contact numbers could be provided by the Block Development Officers (BDO), the Tehsildars and the Gram-sevaks.

10.4.1 Proof of Concept (PoC)

The following two dates were selected by the DoIT&C, on which pensioners' data was to be uploaded for PoC:

Table 10.1   *PoC Dates*

1.	31st March, 2009	New PPOs (first pension yet to be disbursed)
2.	2nd April, 2009	Monthly release of PPOs (regular monthly pension)

10.4.2 Voice Calls Generated

- On 31st March, 2009, data relating to 28 pensioners was uploaded at 19:21 hrs. and the calls were made.
- On 2nd April, 2009, data relating to 120 pensioners was uploaded for monthly releases at 13:30 hrs. and calls were made.

- On 9th April, 2009, 547 pensioners' data was uploaded for monthly releases followed by calls.

- On 20th April, 2009, additional 654 pensioners' data was uploaded for monthly releases and followed by calls.

- On 22nd April, 2009, the number of pensioners whose data was uploaded and to whom calls were made, stood at 42.

- On 19th May, 2009, this number was 24.

- On 4th June, 2009, 205 pensioners' data was uploaded for monthly releases and the calls were made.

- On 13th June, 2009, this number stood at 993.

10.4.3 e-SANCHAR Call Status of Shahpura Sub Treasury

Table 10.2 *e-SANCHAR Call Status of Shahpura Sub-treasury*

Date	Month	New PPOs		Old PPOs		Total	
		Total Calls	Matured	Total Calls	Matured	Total Calls	Matured
3/31/09	Feb,09	28	20	–	–	28	20
2/4/09	Mar,09	–	–	120	63	120	63
9/4/09	Mar,09	–	–	547	422	547	422
20/04/09	Mar,09	–	–	654	385	654	385
22/04/09	Mar,09	42	28	–	–	42	28
6/14/09	Apr,09	–	–	993	316	993	316
7/15/09	May,09	–	–	1878	402	1878	402
8/17/09	Jun,09	–	–	2044	1457	2044	1457
9/9/09	Jul,09	–	–	1838	1324	1838	1324
15/10/09	Aug,09	–	–	1850	1325	1850	1325
11/11/09	Sep,09	–	–	2431	1779	2431	1779
12/16/09	Oct,09	–	–	2649	1911	2649	1911
1/12/10	Nov,09	–	–	2910	2118	2910	2118
Total		70	48	17914	11502	17984	11550

Total pensioners = 3200 numbers

Bank accounts opened = 3000 numbers

The above mentioned data was entered into the software after necessary examination. The system had started generating voice calls as below:

- New PPOs which had been received by the sub-treasury and had contact numbers (mobile numbers/landline numbers) were fed into the revised pensioners' software.

> • Before preparing the soft copy of the text for processing, a thorough manual check was done jointly by the DoIT&C, the Sub-Treasury Officer and the DTA official. A text file was planned to be uploaded since it would require less space for storage and could therefore be uploaded through the internet within no time. The text file was to be used by the automated dialer system to generate voice calls to the registered pensioners' ids, in respect of whom, information regarding own or reference mobile/landline numbers existed.

The use of telephone and mobile technology along with IT, were the key ingredients of e-Sanchar. The project was based on a client-server technology consisting of a very light weight, web-based, Graphical User Interface (GUI). This was from where the treasury operator would update the database of recipients, with the relevant pension details and mobile/telephone numbers of people to whom the calls were to be made. The front-end allowed the operator to schedule the calling immediately or to the next day. The process of making calls could be stopped/ resumed as per requirement, for instance, to allow the next database to be uploaded. The server components were used to store data on to an RDBMS and serve the web pages for the front-end. A *Hindi TTS engine* converted the names and the words from the Roman text into Hindi while an auto dialogue system picked up recipients from the database and dialled their mobile/telephone numbers and played customised messages to the recipient (Figure 10.2).
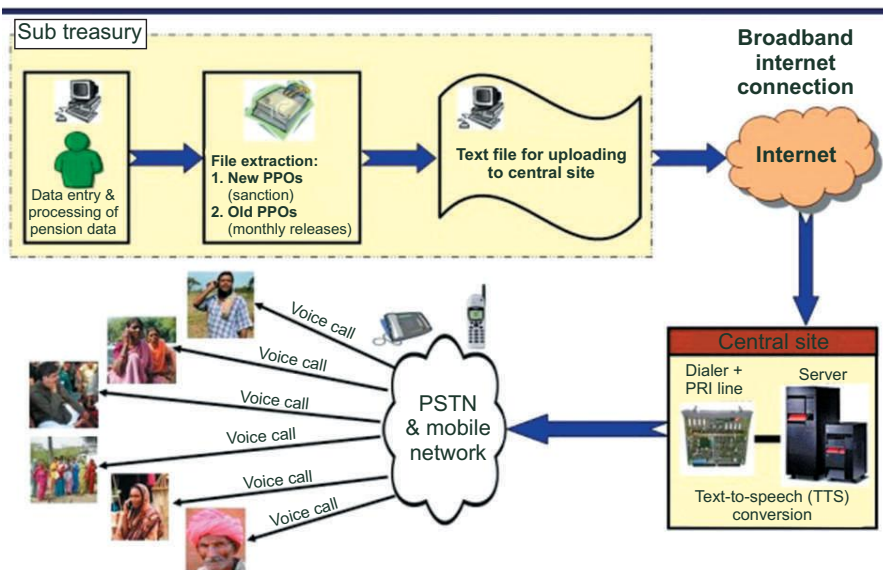
Figure 10.2   *Working of the e-Sanchar System*

10.5 How and Why is it an Innovation?

e-Sanchar was conceived to allow quick and efficient dissemination of information to citizens through database driven, automated voice calls. In the first ever application of this concept, the pensioners got to know on a real-time basis, the status of despatch of their pension amounts and by when they could expect the money to reach them. This was aimed at addressing deprived citizens and informing them that the government cared for them and adhered to the principles of SMART governance. The project was simple in nature as it was an automatic information dissemination (AID) system. *E-Sanchar has since been integrated as one of the modes of communication under the Chief Minister's Relief Fund monitoring system.*

10.6 Future Plans around the e-Sanchar Application

The project has wide ranging applications. It facilitates proactive governance. RajCOMP[1] considered scaling-up of the innovative application and having it replicated in all the developmental programmes and initiatives for the citizens in the rural areas of the state. With this objective in mind, it signed a Memorandum of Understanding (MOU) with OneWorld Foundation-India, on 17th February, 2010. A project for scaling up of the project in approximately 70 sub-treasuries and treasury offices at 7 divisional headquarters, has been submitted. Some of the other related developments in this field are:

- The application has been integrated with the web-based application under preparation relating to the CM's relief fund and is in the process of being integrated with Arogya online and the schemes of the Rural Development and Panchayati Raj Departments in the Bhilwara district.

- A proposal for combining this component with the pension scheme and scholarship scheme of the Social Justice Department is under progress.

- For the next financial year, a proposal of ₹ 4.9 million, for the replication of the project in Rajasthan has been approved in the budget.

- Department of IT, GoI has appreciated the innovative product and enquired whether it could be made available to other State Governments as well.

- DoIT & C through RajCOMP is also in the process of making a commercial sale of the product.

Apart from being fully automatic and providing direct and personal communication with individual beneficiaries, the project also helps in creating awareness about other government schemes.

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[1] Raj Comp Info services Limited is a fully owned Government of Rajasthan company looking after the implementation of e-SANCHAR in Rajasthan

- The e-Sanchar application can be linked to individual ration card holders, residing in the catchment area of a ration shop, to inform them about the allotment of wheat, kerosene and other essential items, on a real time basis, just after the allotment order for the particular shop has been issued, by the district supply officer.

- The beneficiaries under various scholarship schemes can be informed about the release of scholarships, by linking the sanctions to the mobile/landline numbers.

- e-Sanchar can be used as a very effective tool for spreading social messages which are quite common in several government run schemes/programmes.

- e-Sanchar can be used in a wide variety of other individual beneficiary/group beneficiary programmes and to remove any intermediaries between the government and the targeted beneficiaries.

Trademark and Copyright: The DoIT & C, through RajCOMP, is at an advanced stage of obtaining a trademark and copyright for the e-Sanchar logo.

City Health Line

Dr. Rajan Pradhan

Nagpur Municipal Corporation (NMC) has taken a series of initiatives under its programme, City Health Line (CHL) to provide critical health-related services in the district, such as making available reliable and updated information on health facilities across the district through web-sites, call centres, and SMSs providing round the clock ambulance facilities on an "easy to dial" number amongst others. CHL has centralised all health-related information and provides it through a one-stop authenticated source. It has also improved upon the enabling processes. Therefore, the simplicity of the concept and the enabling processes, along with their success in fulfilling the critical health-related needs of the end-users, is what makes CHL the most valued asset in the NMC's closet.

Chandrashekhar lived on the outskirts of Nagpur city. He woke up at 1 am. His father, who had been ailing for sometime now, was feeling breathless. Chandrashekhar decided to take his father to a hospital, but neither was he aware of the nearest medical facility nor did he know whom to contact for an ambulance at that time of the night.

He sat with the telephone directory and started dialling numbers to call for an ambulance. To his utter dismay, the initial eight to nine times, he was informed that the numbers did not exist. On his tenth attempt his call went through, but the reply he got was "no driver is available during the night." His father was becoming increasingly uneasy and Chandrashekhar was getting desperate. He then started dialling various hospitals. One hospital responded and agreed to send an ambulance but as luck would have it, the hospital was 10 kms away from his residence.

It took an hour before the ambulance found its way to Chandrashekhar's house. By the time they reached the hospital it was 3:30 am and two precious

hours had already been lost. Unfortunately, it was too late. The entire exercise seemed to have gone waste.

11.1 HISTORY

It has been observed that the residents of big cities often find it very difficult to get health-related information and services when they need it the most. The "one stop shop" concept where health services, health information, and health-related registrations are all available under one roof is sadly missing today. Valuable information about doctors and hospitals in the locality such as addresses, telephone numbers, information about blood banks, voluntary blood donors among others are not available when most needed and precious time is spent in finding them in a directory. Also, there is no single system in place for the registration of health-related subjects such as, registration of eye donors, voluntary blood donors, and hospitals. This poses problems especially in times of an emergency when one needs an ambulance or a hearse van.

Ambulance Services: In the past, the ambulance service in Nagpur city was provided in isolation by the Nagpur Municipal Corporation or NGOs or private hospitals or private owners. All these ambulances were available on a 7 digit landline number or a 10 digit mobile number, which was very difficult to recollect during emergencies. The exact location of the ambulance could not be traced and there were possibilities that the ambulance was stationed far away from the citizen's residence. If the call to a particular ambulance provider went through once, the number could get busy or unavailable the next moment. There were chances that the Municipal Corporation would be running short of ambulances to serve the whole city. Again, there was no uniformity in the rates the ambulance service providers charged. The private service providers would charge arbitrarily and depending on the situation, time, and place the payout could be between ₹ 400 and ₹ 1000. Sometimes relatives of the patient would spend more time negotiating the rates with the service providers. To make matters worse, some of the ambulances would not even be equipped with life-saving equipment. All this would lead to time being wasted and the chances of casualties doubling. Hence, there was the need to collate and organise all the information about the various types of ambulance providers (NGOs, private players, corporation and the government).

Hearse Van: When a death occurs, the relatives are already grieving. If at such a time, the phone numbers of those offering free services of hearse vans are not available, it only adds to the misery. Also, there is the problem of sub-optimal utilisation of the hearse vans of the NGOs, which provide this service free of cost to the society.

Providing speedy health services remains the primary concern of the NMC. This includes meeting user requirements such as getting ambulances across swiftly when needed, dispatching free hearse vans, collating all health-related information in one call, on a user-friendly website, or through an SMS for mobile users. Similarly there is also the need to provide easy and quick registration for blood and eye donations.

11.2 City Health Line—An Integrated Effort

City Health Line (CHL) was conceived to fill the gaps in the delivery of essential medical services mentioned above.

Its objectives are:

- Effective dissemination of all medical and health-related information to the people via telephones, mobiles (SMS), F.M. radio, television, and websites.
- To ensure effective use and improved access to medical services for all.
- To improve disease surveillance and control through active involvement of all the pathology labs and hospitals.

CHL offers its services through three channels:

1. The website (www.cityhealthine.org)
2. SMS services through 54242
3. 24x7 call centre reachable at (0712 – 102)

11.3 Laying the Foundation for CHL

The need of the hour was to consolidate, organise, and provide an umbrella of health-related services to the citizens through one entity instead of several. Several meetings between the NGOs providing ambulance and hearse van services, social organisations supporting eye donations and blood donations, representatives of the Indian Medical Association and other medical bodies, along with government and the local body officials, were frequently held. The consensus they reached was that there should be one single official and an authenticated call centre which would have comprehensive health-related data, available to the citizens of the city. Accordingly, City Health Line (CHL) was set up, with its centre at the Nagpur Municipal Corporation's Indira Gandhi Rugnalaya.

11.3.1 Planning for Ambulance Services

Being able to provide ambulances to people promptly and at affordable prices was one of CHL's critical objectives. To fulfill this objective, the NMC undertook the following steps:

- Fixed a uniform charge of ₹ 250 per call with the consensus of all the ambulance service providers.
- Selected 4 ambulances owned by the Municipal Corporation and 26 ambulances of the "willing" private providers for the project.
- Fitted the Global Positioning System (GPS) in all the 30 ambulances so that they could be tracked through the website. This resulted in swift despatch and an ambulance being available to a patient within 15 minutes. The initial expenditure of ₹ 0.3 million was paid by the NMC while the monthly recurring expenditure on connectivity was paid by the ambulance owner. A MOU to this effect was also signed between the parties.
- Operationalised the "Number 102" service with 4 lines which was made available by the Bharat Sanchar Nigam Limited (BSNL).

Figure 11.1 *An Ambulance belonging to the CHL Service*

- Set up a 24×7 call centre, manned by 4 trained operators at the Municipal Corporation's hospital.

- Provided group mobile phones to ambulance drivers so that round the clock contact could be maintained by call centre operators. While the sets were purchased by the ambulance owners, the connections were provided free of cost by the service providers as this was towards a social cause.

- Created a database of approximately 3000 hospitals, doctors, and blood banks with approximately 7000 voluntary blood donors on the list. This database is continuously updated.

11.3.2 The Enabling Processes

It is interesting to see how this whole framework functions. As soon as a request for an ambulance is received from a particular area within Nagpur city, the operator activates the system. The ambulance nearest to the location of the call is notified by clicking the ambulance icon on the screen from where the operator gets the driver's contact number. The operator with the group mobile then contacts the driver and directs him to the spot. An ambulance can thus reach the location within 15 minutes of the call. The operator, all the while, is in touch with the caller and the ambulance driver.

In the mean time, the operator makes enquiries about the type of patient and the kind of medical service required. If a particular hospital has been decided upon, then, the call is completed as soon as the ambulance reaches the caller's residence. In the event of uncertainty as to where to take the patient, the operator locates the nearest hospital that can best cater to the patient and guides the ambulance driver to that location. While all this is happening, the operator contacts the hospital where the patient is to be taken, and informs the authorities about the imminent arrival and prepares them to meet the patient. As soon as the patient arrives, the operator completes the call after ensuring that the patient has been taken to the examination table. A trained allopathic doctor is available 24x7 in the event of any first aid consultation being necessary during the admission process.

In case of blood loss due to an accident or any other reason, if the patient's blood group is known, the operator can also provide the numbers and addresses of voluntary blood donors for that particular blood group from the database. The operator also informs the hospital authorities regarding the requirement for blood. If that particular blood group is difficult to locate within the hospital, the operator contacts the nearest blood bank by referring to the database and informs the hospital and the patient's relatives about the availability of blood.

CHL provides information round the clock on:

- 24x7 medical shops;

- Registered eye and blood donors;
- Hospitals, clinics and specialist doctors, area-wise, for use in case of emergencies or for regular referral;
- Epidemic outbreaks such as for example, Swine Flu.

It also provides facilities for centralised registration, through its website, call centre and SMSs, for services such as blood and eye donations, hospitals and nursing homes, telephonic booking of funeral spots in the mortuary etc. Registration forms for birth, death, blood or eye donation, nursing homes etc. are now available online. It provides 24x7 consultations on first aid to the citizens through its call centre.

11.4 BRIEF DESCRIPTION OF CRITICAL SERVICES

The NMC tries to make available, on a timely basis, critical health services to its citizens, which include the following:

11.4.1 Dial '102' Call Centre

In emergencies, one can always turn to CHL's call centre for assistance. Whether it is for an ambulance, a hearse, for blood, or information on blood or eye donors, the up-to-date database enables the call centre to promptly render services of a critical nature. As soon as a call is received from a particular area in Nagpur city, demanding for ambulance, the operator on the website immediately tracks for

Figure 11.2   *The CHL Call Centre in Action*

In the call centre, a database of approximately 3000 doctors of Nagpur city is created. In between the time of the call and the ambulance reaching the spot, the operator enquires with the relatives regarding the type of the patient and kind of the medical service required. If the relatives have already decided to shift the patient to a particular hospital which is known to him, the call is completed as soon as the ambulance reaches the caller's residence. But if the caller is confused as to where to take the patient, the operator searches for the nearest hospital according to the need of the patient and guides the ambulance driver to the hospital address. During shifting of the patient, the operator contacts the hospital where the patient is to be taken and informs the authority about the type of the patient they are going to receive and requests the authority to be ready for accepting the patient. As soon as the patient reaches the hospital, the operator ensures that the patient is taken to an examination table, and completes the call.

A trained allopathic doctor is available in the call centre on a 24 × 7 basis, in case, first aid consultation is required during shifting of the patient.

the available ambulance in the area from where the call is made. The operator, on clicking the ambulance icon on the screen, gets the phone number of the driver and the operator with the group mobile, contacts the driver and directs him to take the ambulance to the spot. In this way, the ambulance availability is ensured to the citizen within 15 minutes of the call. The operator all the while is in touch with the user and the ambulance driver.

The database of approximately 7000 blood donors is also made available at the call centre and if the relatives of patient informs the operator regarding blood loss due to accident or due to any other reason and if the relatives know the blood group of the patient then the operator provides the relatives, the number and addresses of voluntary blood donors of that particular blood group. The operator also informs the hospital authorities regarding the requirement of blood for the patient which is to be brought to the hospital. If blood of that particular group is not available in the hospital, the operator contacts the nearest blood bank (the detailed information of blood banks is available in the database of the call centre), and ensures the availability of blood bag of that particular group and informs the hospital authorities and the patient's relatives regarding the availability of blood.

11.4.1.1 Information yielded by dialling '102'

The call centre helps with the information such as:

1. *Doctors and Hospitals (Area and Specialty-wise):* The CHL call centre maintains a database of 3000 doctors and clinics located in Nagpur city alone.

Figure 11.3 *A Hearse Van Affiliated to CHL*

2. *Vaccination Details:* Vaccination schedules for children are provided by the CHL operators to the citizens. The information regarding necessary vaccination to be done is also provided by means of City Health Line to the travellers going abroad.

3. *Blood Donors:* A list of voluntary blood donors is readily available at the CHL call centre. The Honourable Health Minister of Maharashtra has shown keen interest in taking up this project at the state level as well.

4. *24x7 Medicine Shops:* A list of medical shops, providing services round the clock is also available with the CHL call centre and can be obtained as and when needed, by calling the call centre or simply sending a SMS to 54242.

5. *Free Hearse Van:* City Health Line has a list of hearse van services which are providing services to the citizens of Nagpur free of cost.

Anyone requiring a hearse van may call CHL on '102'. The operator immediately contacts the hearse van service provider, checks its availability and informs the caller about the time of arrival.

Telephonic booking of a funeral pyre/cremation site is also possible. In fact the NMC has distributed 10 mobile handsets across the cremation sites. If a particular site is full, the caller is requested to come at a later time.

11.4.2 Counselling Services Provided through the DIAL '102' Call Centre

Counselling services are provided by the call centre, under the "Public Private Partnership (PPP) Model". Every day, more than one expert, either from the government or leading private practitioners and consultants is available, as per a predetermined time schedule. Each of these practitioners can be consulted over the phone by dialing 102 any day of the week, between 4:00 and 5:00 pm. The issues available for counselling pertain to **'WELCOME'**:

W.	Women's Disorders	- Mon.	4.00 to 5.00 p.m.
E.	ENT, Eye and Environment	- Tue.	4.00 to 5.00 p.m.
L.	Long-term (chronic) Diseases	- Wed.	4.00 to 5.00 p.m.
C.	Child Disorders	- Thu.	4.00 to 5.00 p.m.
O.	Old Age Diseases	- Fri.	4.00 to 5.00 p.m.
M.	Mental Health and Marriage Counselling	- Sat.	4.00 to 5.00 p.m.
E.	Epidemic Issues	- Sun.	4.00 to 5.00 p.m.

Additionally, tele-counselling on TB and HIV AIDS is also possible every day, between 9 a.m. and 4 p.m. Counselling on first aid is undertaken round the clock by resident doctors at the call centre itself. Thus, the CHL does away with the long queues and hefty counselling fees at the private hospitals. So it is a win-win situation for the citizens of Nagpur city all the way.

11.4.3 Integration of the Website 'www.cityhealthline.org' with the Call Centre

The 24x7 call centre concept aims at converging mobile telephony, the basic telephone services, the SMS service, and the internet. It acts as a "one stop shop" for disseminating information on medical and health issues and the deployment of peripheral aids such as ambulances, hearse vans, mobile medical clinics, laboratories etc. A specially-developed website complements and supports its functioning.

The website provides facilities such as:

(a) Online registration and a central registry along with detailed information about blood and eye donations. Alternatively, this could be done offline through telephones, faxes, or by personally visiting the corporation's dispensaries and zonal offices (n = 52). Once the donor is registered, a congratulatory email or SMS is generated automatically and sent.

(b) Registration of the hospital and the nursing home through registration forms available online. Once the registration request is filled online, the information is forwarded to the concerned officer for inspection. All other formalities duly completed, the issuance of the certificate is ensured within 15 days.

(c) Forms for registering births, deaths, blood and eye donations can be downloaded from the website for offline submission.

(d) Easy and swift delegation of work through 10 zones thereby saving time and money.

Figure 11.4   *Pages on the CHL Website*

(e) Making information available about the notifiable communicable diseases online. Under the Health Information System, online notification for the registered hospitals/pathology laboratories is available. The notification form can be downloaded or the reporting form can be filled in online. This initiative has been highly appreciated by professional associations.

11.4.4 Integration of SMS (to 54242) into the System

The required information can be accessed through SMS just by following some simple steps:

11.4.4.1 For information on voluntary blood donors

Figure 11.5   *3 Si mple Steps to Receive Information through the SMS System*

11.4.4.2 For information on blood group-specific donors

To avail of information pertaining to the blood groups mentioned below, just type the abbreviations on the left and send an SMS to 54242.

- NMC bpos : For B+ve blood donors
- NMC bneg : For B-ve blood donors
- NMC abpos : For AB+ve blood donors
- NMC abneg : For AB-ve blood donors
- NMC Opos : For O+ve blood donors
- NMC Oneg : For O-ve blood donors
- NMC apos   : For A+ve blood donors
- NMC aneg   : For A-ve blood donors

11.4.4.3 For information on 24x7 medicine shops in Nagpur city

To avail of information pertaining to 24x7 medical shops, just type the abbreviation "NMC medsh" and send an SMS to 54242.

11.4.4.4 For information on specialist doctors in Nagpur city

To avail of information pertaining to specialist doctors, just type the abbreviations on the left side and send the SMS to 54242.

- NMC<space>pae: For Paediatrician
- NMC<space>card: For Cardiologist
- NMC<space>orth: For Orthopaedist
- NMC<space>gye: For Gynaecologist

Figure 11.6   *3 Simple Ways to Avail Information on 24x7 Medical Shops in the City*

Figure 11.7 *3 Simple Ways to Avail Information about Specialist Doctors in the City*

11.4.4.5 Persons willing to donate their eyes or be voluntary blood donors can register themselves thus

- *SMS the following details to 54242 for blood donor registration*

  NMC<space>bd<name of donor><space><BloodGrp><space><cell no>

  For more information, call '102' or log on to **www.cityhealthline.org**

- *SMS the following details to 54242 for eye donor registration*

  NMC<space>ed<name of donor><space><cell no>

  For more information, call '102' or log on to **www.cityhealthline.org**

For quick information on blood donors, vaccination, 24 hour medicine shops, doctors and hospitals, 'SMS to 54242' facility is available to all the citizens of Nagpur city.

11.5 How and Why is it an Innovation?

One of the basic responsibilities of the Municipal Corporation is to provide primary healthcare facilities to the citizens, especially the slum dwellers. After several discussions and meetings with citizens, doctors, medical associations, government officials, and public representatives, the common consensus arrived at was, that there should be a system that gives complete health-related information and service to the citizens either through a phone call or on the click of a mouse.

The concept of CHL is a breakthrough in the healthcare system of the country. It has brought about a marked positive change as far as the delivery of medical

services is concerned. Right from getting advice from a specialist to shifting a patient to a hospital to getting health-related information on mobile phones, to calling for an ambulance in an emergency and being assured of getting one in not more than 15 minutes, all these worries seem to have been taken care of. It is merely enough to remember and dial '102' and leave the rest to CHL.

The participation of NGOs and private ambulance providers has been remarkable and is a big step towards the success of the PPP Model.

Different tools such as GPS, SMS, the website, and call centre are integrated to facilitate the efficient delivery of services. The project also concentrates on the social aspects related to health such as eye donation, booking of funeral sites at crematoriums, providing hearse van services and so on.

11.6 Constraints and Challenges

Cooperation from private ambulance providers and doctors is required constantly, since the project is based on the "PPP Model". Uninterrupted services by mobile and the internet service providers are the mainstay of the project and so is the uninterrupted service of the number '102.'

11.7 Impact

CHL today serves approximately 3 million people within the city of Nagpur alone and about 2 million outside the city limits. The immense success that the program has earned in such a short span of time can be gauged from the following statistics:

For the Year 2009-10:

- 92,242 eye donors registered
- 7,200 blood donors registered
- 2,471 availed the ambulance facility
- 633 callers availed the hearse van facility
- 454 Keratoplasties were conducted
- 1,407 citizens got their health problems solved through the "WELCOME" programme
- Information regarding specialist doctors was provided to 16,668 citizens.

The massive social mobilisation of the cause of blood and eye donations has resulted in around 5000 people residing outside the city limits pledging their support for this noble initiative, in addition to the 90,000 eye donations. A separate database for such supporters is being created and handed over to the respective district health authorities.

Figure 11.8   *Public Transport Advertising CHL's Services*

🌱 11.8 CONCLUSION

CHL has revolutionised the delivery of healthcare services. The project has been widely appreciated by the State Government, other municipal corporations, the media, and the public. It is being efficiently run since the last 2 years with an increasing number of calls, website hits, and SMSs recorded per day. Due to the 'PPP' nature of the project, the cost to the Corporation per year is not major compared to the tremendous benefits being imparted. The prompt delivery of services when most needed, helps build up the confidence of the people in the government.

Case

12

Aarogyam–Freedom from Illness

Ritu Maheshwari, IAS & Mayur Maheshwari, IAS

The health of the population of any country is a strong indicator of its future development. In India, however, despite a burgeoning population, its health has always remained a matter of concern. Successive governments have tried to address these issues through various schemes. The National Rural Health Mission (NHRM) is one such scheme that has tried to correct the health problems faced by women and children.

12.1 HISTORY

In India, the annual mortality rates for children and women are around 2.4 million and 1,36,000 respectively. These numbers represent about one fifth of the global total. Only if a dramatic reduction in these is achieved, can India hope to reach the Millennium Development Goals (MDG) on 'maternal and child mortality'. India's National Rural Health Mission (NRHM) was launched in April 2005, with a strong commitment to reduce the maternal and infant mortality and provide universal access to public health services. The second phase of India's Reproductive and Child Health Program (RCH-II) is an integral and important component of this mission. RCH–II commenced from 1st April, 2005. The main objective of the program is to bring about a change in mainly three critical health indicators i.e., reducing total fertility rate, Infant Mortality Rate (IMR) and Maternal Mortality Rate (MMR), with a view to realising the outcomes envisioned in the Millennium Development Goals, the National Population Policy (2000), the Tenth Plan Document, the National Health Policy (2002) and the Vision '2020' India.

Tremendous improvements have been witnessed since the launch of NRHM programme. This is clear from the fact that as per the National Family Health

Survey-3 (NFHS-3), the estimates were 57 infant deaths per 1000 live births, as compared to the National Family Health Survey-2 (NFHS-2) estimates of 68 deaths per 1000 live births. Hence, the IMR in India has been declining slowly but steadily. Nevertheless, more than 1 in 18 children die within the first year of life and more than 1 in 13 die before reaching age five. As far as maternal health care is concerned, 76% of women who had a live birth in the five years preceding the survey, received ante-natal care (ANC), while only 44% received ante-natal care during the first trimester of pregnancy. Just over half of the mothers had three or more antenatal care visits.

If we look at the immunisation statistics, only 44% of children, aged 12-23 months, were fully vaccinated and 5% had not received any vaccination at all. The coverage of individual vaccines had increased considerably, and was much higher than would appear from the information on full coverage alone. BCG, the first dose of DPT and all three doses of polio vaccine had each been received by at least 76% of children.

Another reason for the above situation was the presence of wealth/region/gender based inequalities in healthcare delivery. As per NFHS-3 statistics, the disparity between the urban and the rural women, with respect to ante-natal care was especially pronounced, with 75% of the urban women receiving ANC, as compared to only 44% of rural women. Three-fourths of the urban women and only 38% of the rural women received assistance at the time of delivery, from a skilled care provider.

Similarly, as per NFHS-3 statistics, the vaccination coverage also showed a marked variation among different states. While states like Maharashtra, Punjab and Andhra Pradesh showed substantial decreases in vaccination coverage, there was major improvement in Bihar, Sikkim, Haryana and Uttaranchal.

The above statistics clearly indicate that despite all efforts, a lot more needs to be done to ensure good health for all. The Ministry of Health and Family Welfare in coordination with the Ministry for Women and Child Development, has been trying to improve results through the NRHM. The importance of technology as a means to improve the situation has been recognised and understood.

This paper seeks to discuss a unique technological innovation aimed at improving the situation and ensuring health to citizens at their doorsteps. This project called 'Aarogyam' seeks to strengthen the health delivery mechanisms for all, with special focus on maternal and child health. It also tries to neutralise the region/class/gender/wealth based disparities in healthcare.

12.2 Aarogyam: The Way Forward

'Complete freedom from illness', was a concept that aimed at health for all in the family, especially the mother and the child. Health, strictly speaking, did not

only mean the absence of disease, but complete physical, mental and social well being of a person. Aarogyam, aimed at this complete 'WELL BEING' and 'ZERO TOLERANCE' for disease. With this objective, it envisaged individual health mapping so as to strengthen preventive medicare within the society. Aarogyam visualised health as a two way demand based approach, contrary to the traditional view of regarding it as a one way, supply based approach. Aarogyam believed that 'Knowledge is Power'. It sought to provide specific information on all aspects of child immunisation, ante-natal care, care to pregnant mothers, safe delivery and so on, by just a phone call. Thereby it tried to ensure health for the family. Knowledge of one's family health profile could empower one to avail the required health facilities. However, this was not all. The project informed the family about various health parameters and also entertained complaints. The involvement and accountability of service delivery providers was ensured at all times, by keeping the medical staff informed about the lapses in their service delivery. The project also envisaged a unique family ID to each family, as its health ID.

12.3 Geographical Coverage

The program was launched on 10th October, 2008, and is running in three districts (Baghpat, J.P. Nagar, Gautam Buddha Nagar) and catering to a 4 million population. The main target groups is pregnant women, infants and children due for immunization. Project funds have been sanctioned under NRHM for all the remaining districts of the Moradabad Division (Moradabad, Rampur, Bijnore, JP Nagar), and this programme has been initiated.

12.4 Objectives

The earlier health model was curative in nature, with the functionaries from the top to the bottom emphasising curative medicines. The problem was compounded by the fact that the lower levels were not only short staffed but the staff also lacked motivation, training and supervision. This resulted in gaps in the delivery mechanisms. This model made 'curative health' its central theme. The aim of the new health model called 'Aarogyam' was to generate a demand for health services and convert the health model to a preventive one rather than a curative one. This model also aimed at bridging the digital divide between the haves and the have-nots through dissemination of information. Aarogyam was therefore a potent vehicle for people living in the lower socio-economic brackets, to access healthcare at their doorsteps through the feedback mechanisms inbuilt in the system.

The purpose of Aarogyam was to develop a technology based healthcare delivery programme to ensure:

- 100% immunisation for children in the 0-5 years age group.
- Complete ANC/PNC including early registration of pregnancy, three ANC visits, Tetanus Toxoid (TT) for mother, institutional delivery, promotion of Janani Suraksha Yojana(JSY) and so on.
- Development of a replicable model of technology based pregnancy tracking and child immunisation system.
- Generation of awareness in the community about health services and inducing a change in their health behaviour by reinforcing the messages.

12.5 Methodology

12.5.1 Phase 1: Baseline Study

Through the co-ordinated efforts of the Health—Integrated Child Development Services (ICDS) Department, a comprehensive baseline survey of the district was conducted, and family details with all the health indicators were collected. These included the name and address, the age of family members, the immunisation details of all the children with reference to their expected dates as well as actual dates of immunisation, the details of pregnant mothers with respect to Ante-Natal Coverage (ANC) and Post-Natal Coverage (PNC) status, the location and phone numbers of each family. Finally a unique family ID was assigned to each family.

12.5.2 Phase 2: Implementation Phase

1. The above information formed the master database, which was then fed into a computer using a customised software and linked to an Integrated Voice Response System (IVRS). The technique made use of analogue/digital cards to read all the uploaded data and disseminate it to the beneficiaries.

2. The next step was the establishment of multiple phone lines and initiation of a health helpline for the citizens, to get an update on health services and to register their complaints.

3. Establishment of required institutional mechanisms at the district (central server) and block levels, ensuring updates at the central level and linkage with the master database, was the next step.

4. A rigorous capacity building exercise was undertaken. Training of service providers and data entry operators on the software, with clear delineation of their roles, responsibilities and accountability, was carried out.

5. Information, Education and Communication(IEC)/Behaviour Change Communication (BCC) (films, songs, nukkad natak, pamphlets, hoardings) were used to create general awareness about the project.

6. Group and individual counselling, home visits in specific cases were also done.

12.5.3 Phase 3: Monitoring and Evaluation

- A web-based monitoring portal was developed which reflected the total disposal of grievances, officer-wise pending complaints, status of call alerts and SMS sent on a daily basis and so on. This portal was regularly accessed by the key officials including the Chief Medical Officer (CMO) and District Magistrate (DM).
- Regular monthly meetings were held with the key stakeholders to assess the progress.

12.6 STAKEHOLDER CONSULTATION: ROLE OF STAKEHOLDERS

1. **ICDS:** The AWWs (Angan Wadi Workers) played a crucial role not only during the collection of baseline data, by ensuring coverage of each and every household, but also in the identification of gaps in the system and service delivery at village level.

2. **ASHA:** Each village has a trained female community health activist called ASHA or Accredited Social Health Activist. ASHAs assisted the team during the baseline survey and also motivated the communities throughout the approach. The presence of ASHAs helped the department to reach out to the beneficiaries.

3. **Village Pradhan:** Being the face of the community at the village level, the Pradhans were also actively involved in the entire process. The system informed them about the health service status of the particular village and directed pending calls to them, thereby increasing their responsibility towards communities in terms of the primary health care services.

4. **Basic Education:** The network of school teachers and shiksha mitras was utilised to spread awareness about the project at the village level, through school health programmes, nukkad nataks and so on.

12.7 INSTITUTIONAL REQUIREMENTS

The digital model required a few institutional mechanisms to be set up at the district and block levels. At the district level, a central server connected to an IVRS, operating on multiple phone lines was set up and the district database was uploaded therein. At the block level and Central Health Centre (CHC)/Primary Health Centre (PHC) level, another computer (with internet connectivity) would ensure maintenance and regular updates.

12.8 WORKING OF AAROGYAM

Aarogyam, as discussed earlier, entails a four pronged approach.
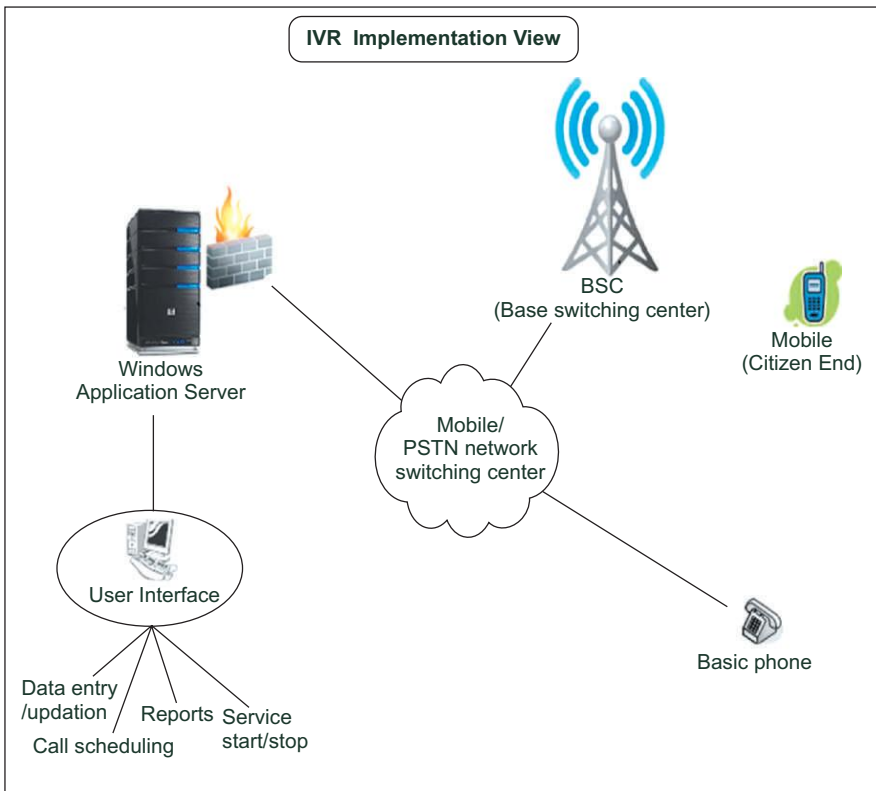
Figure 12.1   *Digital Model*

12.8.1 The Proactive Approach

This model can be visualised in two perspectives:

1. Aarogyam is a citizen-centric health model, which provids automatic call alerts/SMS to each family, thereby generating a demand for health services. The out dial option in the IVRS system, can generate family specific calls and SMSs, relating to the following:

   • Child immunisation details for children from 0-2 years with respect to the date of birth (DOB) of the child, vaccine immunisation due dates, mechanisms for getting the child vaccinated free of cost. This call would remind the family about the child's vaccination schedule so that the family could plan accordingly.

   • Ante-Natal Care/Post-Natal Care details with respect to the pregnant/lactating mothers such as the due dates for Tetanus injections, tablet intakes and so on.
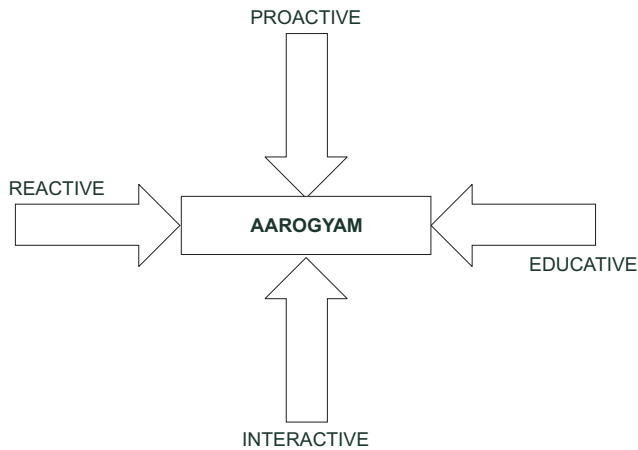
Figure 12.2   *4 Pronged Approach*

- Institutional delivery with reference to the expected date of delivery (EDD), providing information on *Janani Suraksha Yojana (JSY)* and its benefits.
- Generating specific calls regarding Pulse Polio campaigns, emphasising the need to bring the child to the booth for immunisation.

2. Another aspect was the strengthening of real time delivery. This was done by generating reminder calls to the Auxiliary Nurse Midwives (ANMs) for all uncovered families per village. The reminder calls would also go to the family concerned.

    The above approach ensures specific information to all and therefore helps the administrator monitor and target the most vulnerable groups. It ensures accountability of the ultimate executing authority i.e., the ANMs and ASHAs, simultaneously covering the Reproductive and Child Health (RCH) and ICDS activities.

12.8.2 The Interactive Approach

This approach broadly covers two aspects:

(a) It allows citizens to interact with the system. Through the 'in-dial option' on a helpline number, one can gather specific health information with respect to:

- Child immunisation details i.e. expected vaccination dates for each child in the family.
- ANC care details.

(b) It also provides specific 'call-in services' such as 'doctor on call' at specific times and days.

12.8.3 The Reactive Approach

The reactive approach is based on the information fed-in through a recording mechanism. The complaints of all health related activities are generated through the voice recording mechanism. A complaint register, kept at the central server, records all the complaints lodged and the complainant is given a token number against his/her complaint. A nodal officer ensures that the complaints were sent to the concerned Medical Officer/ANM through the Auto-Dial up/SMS mode. This system would be linked to the district website, so as to enable the DM/CMO to monitor and check the status of the pending complaints.

12.8.4 The Educative Approach

This approach, aims at providing educative support to various health campaigns like Directly Observed Treatment Short-course (DOTS), Pulse Polio campaigns, gender-equality, anti-epidemic campaigns, Pre-Natal Diagnostic Techniques (PNDT) tests, JSY, burden of disease in a particular region and so on, by making use of phone lines. It can also be integrated with campaigns for other departmental activities such as education, ICDS, total sanitation and the like. Special campaign calls are routed through Panchayati Raj Institutes (PRIs) to enhance community mobilisation.

All the above approaches have clearly demonstrated the incremental output capacity of Aarogyam. By providing linkages to health-ICDS-education, it has ultimately led to the betterment of socio-economic status for one and all.

12.9 SUSTAINABILITY STRATEGY

The sustainability of Aarogyam is citizen driven. It can broadly be viewed from three aspects.

(a) Technological Sustainability

Aarogyam has inbuilt measures of sustainability. Once the database is uploaded, auto diallers and SMSs need not to be worked upon. They can be automatically sent to the beneficiaries. However, the database has to be regularly updated after immunisation/polio rounds. The inbuilt sustainability is supported by the IVRS based technology, features such as ease of use, ease of access and use of Hindi characters for wider acceptability.

(b) Systemic Sustainability

A project can be successful only if it is system based rather than individual based. This is ensured by:

- Institutionalisation of the project by the State Government in various districts and divisions as is evident from the fact that it is successfully running in three districts (Baghpat, J.P.Nagar and G.B. Nagar.), catering to around 4 million population.

- Development of a cadre of trained and skilled staff for data interpretation, data entry, analysis and documentation. Under the supervision of NRHM, data entry operators are engaged and trained for feeding, updating and uploading the databases, both at the central server as well as the PHC level.

- A district level review committee has been set up to monitor the progress with supportive supervision.

(c) Behavioural Sustainability:

- Improved health behaviour in the community which has been possible through mass awareness generation using folk media, TV ads, posters/ banners and so on.

- Demand driven involvement of the Panchayati Raj Institutions and the local populace.
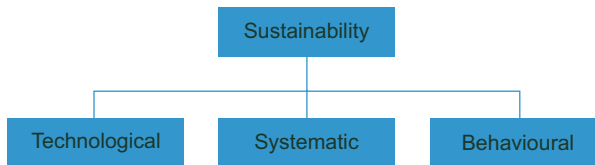
Figure 12.3 *Sustainability Energy*

12.10 Why is it an Innovation?

Aarogyam is a unique mobile-governance health initiative. Its innovativeness is in its being:

- The first outbound IVR application in government healthcare delivery mechanisms.

- A pioneer in terms of the establishment of a scientific and comprehensive pregnancy tracking system.

- A powerful community broadcasting medium for various educative campaigns, not only in health like Pulse Polio and JSY, but also in public welfare schemes of other departments like Total Sanitation Campaign, education, flood/epidemic alerts and so on.

12.11 Advantages

The model envisaged above, has a few inbuilt advantages in terms of the technology used as well as on account of the wide database collected.

1. Ease of access: The services are easily accessible to anyone who knows how to receive a call.

2. Wide range of people covered: A wide range of people who have landlines or mobile phones can be reached to.

3. Applicable to illiterate people: There is no need to be literate to avail the facilities. Only listening ability is sufficient.

4. Zero cost to people: Since is was an 'out dial voice call', no cost is incurred for receiving a call, anywhere in India.

5. Fast: Awareness can be created in no time. Hence, there is less of a time lag as compared to visiting a remote village.

6. Reliable service: The service under this scheme is more reliable as compared to personal counselling. Every message is scrutinised before making a call. Hence, it ensures much lesser chance of deviation from the objective.

7. Less human endeavour: Human interference is minimal, hence greater efficiency can be ensured.

8. Protection from natural calamity: As long as mobile and Public Switched Telephone Network (PSTN) networks are in operation, the system can work in cases of natural calamities as well.

9. Promotion of equality in healthcare delivery: As discussed above, the scheme provides free information to one and all. It targets the poorest of the poor, and tries to neutralise the gender/class/region based inequalities.

12.11.1 Vital Statistics

Number of users and services:

- **Number of users registered in the system:**   Around 0.1 million users are registered in the Aarogyam system in the two districts of Baghpat and JP Nagar.

- **Number of service providers registered in the system:**   More than 1000 service providers like doctors, ANMs, Pradhans and so on are registered.

- **Number of calls made/received in the last one year:**   More than 40,000 calls were exchanged between the users and the Aarogyam system over the last one year.

- **Number of SMSs sent in the last one year:**   More than 35,000 SMSs were sent to the users by the Aarogyam system over the last one year.

12.12 CONCLUSION

Aarogyam is a broad and holistic concept, which ensures one to one contact between the government and the citizens. It is a move towards achieving integrated and composite health delivery mechanisms, which is also the theme underlying NRHM. It enables the government to reach out to the people. Technology acts as the catalyst to facilitate this government and citizen convergence.

Case

13

Disaster Management Information System

Vinod M. Bothale, Director, and Anand N. Khobragade, Resources Scientist

The MRSAC has indigenously developed a decision support system for disaster management using the GIS and RS technologies. The Disaster Management Information System (DMIS) integrates the spatial and the non-spatial data to facilitate dynamic analysis and prompt response to disaster situations. This enables the state to face any disaster in a more effective way and builds confidence across the different segments of the society. The DMIS extends itself to every phase of disaster management right from getting prepared to face the disaster, to relief rehabilitation for the entire state of Maharashtra.

13.1 History

"Disaster Management" means a continuous and integrated process of planning, organising, coordinating, and implementing measures which are necessary for the prevention of disaster and the mitigation or reduction of its risk. It also includes capacity building and preparedness to respond to disaster situations depending on the severity or magnitude, evacuation, rescue and relief, rehabilitation and reconstruction. Disaster Management comprises all forms of activities, structural and nonstructural, to avoid (i.e., prevent) or to limit (i.e., mitigate and prepare) the adverse effects of disasters in the pre and post-disaster stage.

Under the directives of the Government of India-United Nations Development Program (GoI-UNDP), the Government of Maharashtra (GoM) set up a Disaster Management Unit (DMU). This unit prepares the action plan to support and strengthen the efforts of the district administration for overall disaster vigilance in the State. Each district also has its own District Disaster Management Action

Plan (DDMAP) to address the district's response to disaster situations such as earthquakes, floods, cyclones, epidemics, off-site industrial disasters, road accidents, fires and so on. Some of these disasters such as floods and earthquakes affect a widespread area causing extensive damage to life, property and the environment. The management of these disasters requires far-reaching resources and manpower for their containment, through remedial action.

The underlying objectives of the DDMAP are: to protect life, environment, and property while mitigating the disaster to the maximum extent possible; to provide relief to those affected, and to restore normalcy at the earliest. Essentially, the communities draw their support from the social institutions and the administrative structure. The policy aims at capacity building and the prompt utilisation of resources in a disaster situation through partnership between the GoM, the NGOs, the private initiatives and the community. In pursuance of this policy, the DDMAP addresses itself to strengthening the pre-disaster and post-disaster responses of the various stakeholders including the "victims" of the disaster. As part of the DDMAP, the development of the Disaster Management Information System (DMIS) was entrusted to the Maharashtra Remote Sensing Applications Centre (MRSAC) by the GoM, at the initiative of the Relief and Rehabilitation Department.

The Maharashtra Remote Sensing Applications Centre (MRSAC) was established in 1988 at Nagpur, as an autonomous organisation, under the administrative control of the Department of Planning, GoM. MRSAC is recognised as a pioneer institution offering services in Remote Sensing (RS) and Geographic Information System (GIS) technologies, across the country. The Central Government has been making sincere efforts to preserve and manage natural resources across the states by providing innovative and effective solutions. MRSAC recognises the importance of such initiatives and contributions at the state level.

❦•• 13.2 PROJECT BACKGROUND

Originally, the District Collector managed all pre-disaster and post-disaster activities with the help of several taluka level officers. He laid down the standard operating procedures (SOP) for taluka/block level officers who assisted in managing the pre and the post-disaster activities.

Pre-disaster planning considered the following activities:

1. Preparation of a detailed map of the disaster prone area of the taluka covering all the available amenities. Collection of detailed information about the disaster history of the taluka, its geo-physical condition, commercial details, rainfall, irrigation, industries and so on.

2. Arrangement of boats as safety stands for disaster management.

3. Assignment of duties to the officers in the regional offices, tahsil office, geographical section and the disaster management cell.

4. Collection of detailed information on food grain godowns and ration shops in the taluka.

5. Obtaining detailed information on communication media available in the villages.

6. Collection of addresses and phone numbers of the NGOs.

7. Organising trainings for taluka level officers, for efficient operations, during a disaster.

8. Nomination of a competent authority as control room in-charge, at various talukas.

9. Performing a "need vulnerability analysis" of disaster prone areas on the basis of the weather, rainfall and disaster history of the areas.

10. Preparing an action plan of preventive measures, remedies, and things required for better rescue operations.

11. Updating of the previous village disaster management plan and the taluka disaster management plan.

12. Locating safe buildings and safer places during village visits and training local people with the help of DM officers, NGOs and rescue teams.

An integrated taluka level disaster management plan, includes the following activities which are to be carried out post-disaster:

- Activation of disaster management teams for isolating people from the affected area.

- Preparation of an activity plan on an emergency basis and starting work on the same.

- Evaluation of the losses and making corrections in the above plan.

- Preparation of charts and abstracts for the said plan and explaining it to the staff.

Under the conventional system, multiple agencies located at distant geographical locations, prepared and maintained the disaster records. Usually, the District Collector managed the pre-disaster and post-disaster activities with the help of several taluka level officers. In the event of a disaster, coordination with all these agencies was a cumbersome process. Database generation and updation of records was ineffective, resulting in incomplete and outdated databases. A complete picture of all the infrastructure facilities in the targeted areas was not available.

- Explaining orders to the members in all the groups and guiding them. Also explaining the aims and aids of the government in the event of a disaster.

- Making arrangements for the distribution of government aid, transportation of items up to the village and the taluka levels. Ensuring smooth distribution of items. Taking due care that needy people are not deprived of aid.

- Making necessary arrangements for drinking water and other related provisions at the shelter camps.

- Making a primary survey and estimate of the loss incurred, i.e., Damage Assessment.

- Starting rescue operations for the calamity affected people, with the help of the disaster management team, trained police and trained swimmers.

- Making arrangements for sufficient number of vehicles to carry out relief work and shifting of people to temporary shelter camps.

- Making arrangements for resettlement of the affected people after the disaster.

The spatial maps prepared by conventional methods were not on a uniform scale nor were they geo-referenced, which restricted their efficient use. Overlay of several thematic maps was not possible. Hence, the disaster plan did not allow integration of the spatial and the non-spatial data. Dynamic analysis, such as buffer analysis, proximity analysis, analysis of the amenities available and their distribution could not be done because of hard copy maps. Although, a disaster management plan was being prepared manually, the disaster management authorities found it difficult to use the information at the time of disaster.

Considering the limitations in the conventional system, it was decided to develop a GIS-based Disaster Management Information System (DMIS). To make it user friendly, a GUI based, menu driven application software was developed in an ArcGIS environment. DMIS was designed and customised keeping in mind the type of information required by the response agencies at the district emergency control centres and also the skill level of the operating officials at the district level. The application is password protected to prevent unauthorised access.

13.3 OBJECTIVE

The objective of DMIS is to provide a quick and effective response in emergency situations. In the absence of a defined plan, the response to disasters would be arbitrary, leading to overemphasis on some actions and neglect of the others, which could be critical. DMIS aims at the localisation of a disaster and the minimisation of its impact on life, environment and property. It provides for a centralised support system that assists in managing all the activities in disaster management.

Although preparedness on part of the administrative authorities is a pre-requisite, substantial involvement of the NGOs and the private initiatives too, are required. Community participation is one of the most effective tools for the management of disasters. Training of the community and key social functionaries thus becomes an essential element for the successful execution of a disaster management system. DMIS pursues the objectives of capacity building and community participation.

In the event of a disaster, a uniformity in approach and a clear perception of the various issues at hand, helps to avoid undue complications. At the same time, the system needs coordination of different agencies right from the field level to the Central Government. DMIS helps to ascertain the status of the existing resources and facilities available with the various agencies involved in the management of disaster in the district. It helps in disaster risk and vulnerability analysis up to the district level. This enables the district to face a disaster in a more effective way and builds confidence across the different segments of the society.

DMIS helps to concisely develop a framework for proper documentation of future disasters in vulnerable districts. The updation of critical information essential to a plan, critical analysis, appraisal of responses, and recommending appropriate strategies are its main tasks. It helps to minimise the impact of disasters in terms of human, physical and material losses by means of "Damage Assessment Analysis". The DMIS has vital information relating to the pre-disaster and the post-disaster stages, at its fingertips. It has helped to build a decision support system for better district administration. The MRSAC aims to evolve DMIS as an effective managerial tool within the overall policy framework of the GoM.

13.4 Brief Description of Project Planning

As per the requirement of the Emergency Operations Centre (EOC) of the Relief and Rehabilitation Department (GoM-Mantralaya, Mumbai), the MRSAC was assigned the responsibility of devising a DMIS application to meet user needs. To start with, a resource database on various themes, obtained through the Remote Sensing technology, was compiled for all the districts of Maharashtra. Attribute data on demography, census and the core government sectors, was integrated in DMIS. A multi-dimensional spatial and non-spatial database was created in a GIS environment. "Outline for Vulnerability Assessment," was used as the basic instrument to gather district/taluka/village-level information on the above mentioned themes. District Planning Officers (DPOs) were instructed by the

GoM to send district information, in the format of the data requirement sheet furnished to them (see Appendix-1).

High-resolution satellite data was used for the generation of a base map as well as a Digital Elevation Model (DEM). The vulnerable villages were identified on the basis of slopes derived from DEM and the weighted matrix concept. All the shelter sites, buffers and evacuation routes were highlighted. A customised software was developed using prototyped models of the Software Development Life Cycle (SDLC). The system comprised of a centralised database, user-friendly Graphical User Interface (GUI) and better analytical tools for Mitigation Strategies, Risk Estimation and Vulnerability Mapping. The software was extensively tested before packaging and deployment. Each district user was authenticated for accessing the data in DMIS.

The DMIS was well documented and a user manual was designed to provide the operating guidelines to the users. A checklist was prepared before actual installation in the districts of Maharashtra. The process of installation was initiated only after the successful development of DMIS. The entire DMIS installation was completed in a mission mode, for 15 districts, in only 40 days. Training of Disaster Project Officers as well as the officials recommended by the user department, was arranged once the installations were over. It was also installed at the Relief and Rehabilitation Cell, Mantralaya, Mumbai. The system could incorporate new requirements with ease and was hence sustainable and maintenance free.

13.5 Technology Used/System Design

The indigenously developed DMIS software used a single database, a user-friendly front-end and analytical tool to support decision making. The administrators would not have to depend on a file-based system any more, to take quick action in hazardous situations. The database design and structuring that was carried out in the project, took care of standard spatial database generation and provided unique keys for linking it with non-spatial data. The software could incorporate new requirements without much effort and thus was capable of providing GIS support to the administrators, executives, and functional officials. DMIS facilitated the users by providing on-screen distance measurement facility that would assist the government officials in planning the evacuation route in flood-prone villages.

User departments were responsible for providing historical data for the natural and other disasters. A centralised system was created for each district to prioritise the hazards so as to develop mitigation strategies, carry out risk estimation and vulnerability mapping. DMIS emphasised on GIS based decisions for providing speedy and efficient services such as suitable shelter identification, suitable evacuation route, buffer analysis and vulnerability risk analysis. DMIS
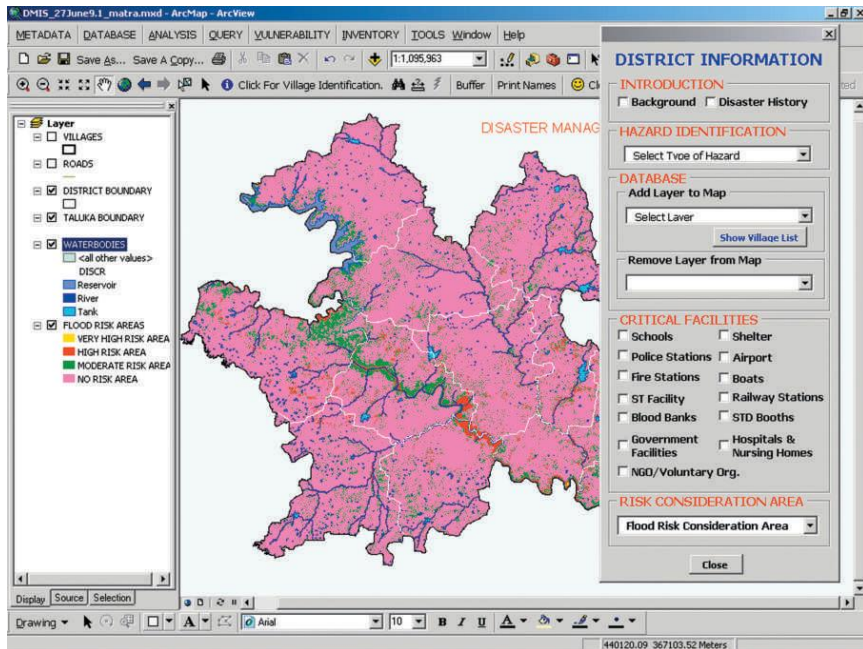
Figure 13.1   *District Map Showing Vulnerability Index*

could be used for post-disaster damage assessment because all the amenities and respective detailed information was already incorporated in the system. The number of boats in a village, the number of trained swimmers, the population likely to be affected and so on, were important parameters available in the system for pre-disaster analysis.

CARTOSAT I, stereo pair satellite data for the disaster prone districts, was analysed for generating a base map as well as DEM. Slopes (or contours) generated from DEM were used for locating shelter camps in the event of disasters. The logic for deciding on the elevated/safest shelter locations was based on themes like slope, land use and geology. These three themes were amalgamated so as to arrive at weighted ranks that would indicate the vulnerability index. For example, Slope (0-1%) + Landuse (river, reservoir, double cropped) + Geology (water body mask, deep alluvial plain) = Rank 1. This index would decide the sensitivity of the flood prone area i.e., very high-risk area, high-risk area, moderate-risk area, low-risk area, and no-risk area. It would elaborate on the vulnerability index of disaster prone areas in the district at risk (Figure 13.1). Once the user selected the "Flood Risk Consideration Area" option in DMIS, a district map showing high-risk, moderate-risk, low-risk, and no-risk areas in different colours on a map would be displayed.

🍃•• 13.6 DISASTER MAPPING AND ANALYSIS

Flood mapping and analysis is an important section of DMIS. It illustrates all the necessary steps for risk assessment of the flood prone areas. The analysis could be carried out at the district level and also at the village level. The spatial database on natural resources, built by MRSAC at 1:50,000 scales, is the backbone of such analysis on a large scale. The MRSAC has been planning the creation of a natural resources database for the Maharashtra State on a scale of 1:10,000, under Central Government directives.

The Relief and Rehabilitation department collects data from authenticated sources and passes it on to the MRSAC. The history of flood prone districts is then incorporated into the system by integrating it with a thematic layer of settlements. Flood affected villages can be easily highlighted in DMIS and are indicated with a red star symbol on a district map. DMIS helps to obtain the "affected villages" list for a quick response in the event of a disaster.

In pre-disaster planning, the information on vulnerable villages plays a vital role for deciding the mitigation strategies. DMIS is equipped with features for predicting the villages at risk, by bringing to light the flood prone villages within a 1 km buffer, along the major rivers in a district. DMIS supports a user-defined criterion on buffer selection. The village list can be filtered out by applying
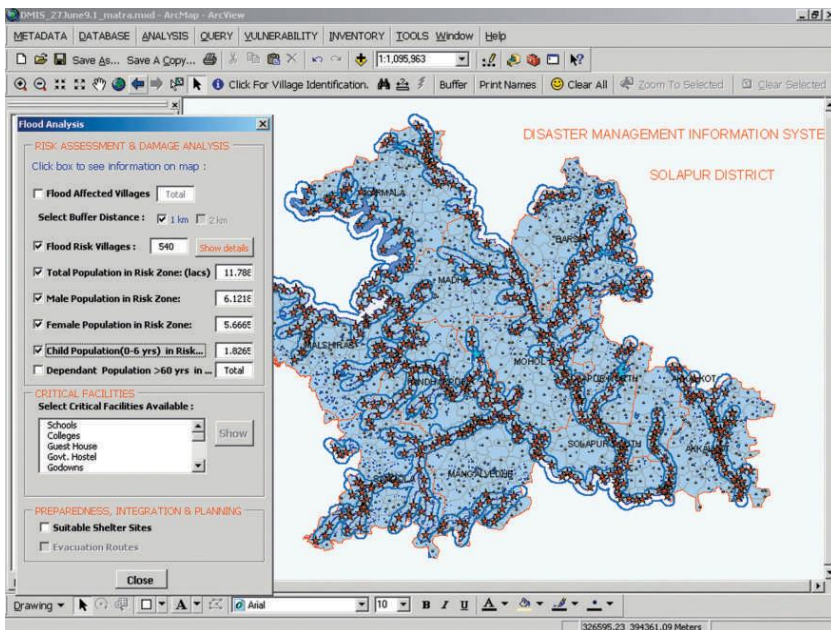
Source: Maharashtra Remote Sensing Applications Centre, Nagpur

Figure 13.2   *Vulnerable Villages within 1 km Buffer along Major Rivers*

parameters such as low lying area within the buffer marked. Low lying villages are evaluated on the basis of scientific inputs from the research, based on weighted matrix concepts, viz., slope constraint below 3%. With due consideration to the metrological parameters like rainfall or weather conditions, the accuracy of the adapted process can be improved and the flood prone villages can be highlighted easily on the district map (Figure 13.2).

DMIS is more effective for damage assessment in a post-disaster scenario. Demographic information is integrated with a thematic database and aggregated at a district level. Non-spatial data on property and population is incorporated into the system to analyse the damages. Demographic details of the disaster prone villages indicates the population at risk. This gives valuable feedback to the district administration in the event of a disaster. While framing the mitigation strategies for any disaster, the entire database needs to be compiled at the district level. DMIS fulfills this requirement easily.

The DMIS facilitates macro-level planning through the information on the demography, the critical facilities or amenities at the village level and so on. The system highlights issues of flood analysis at the village level based on the availability of critical facilities within a 5 km buffer, as well as, all shelter locations within that buffer area. It also draws up evacuation routes to reach the shelter locations (refer to Figure 13.3). Some of the critical facilities that are incorporated
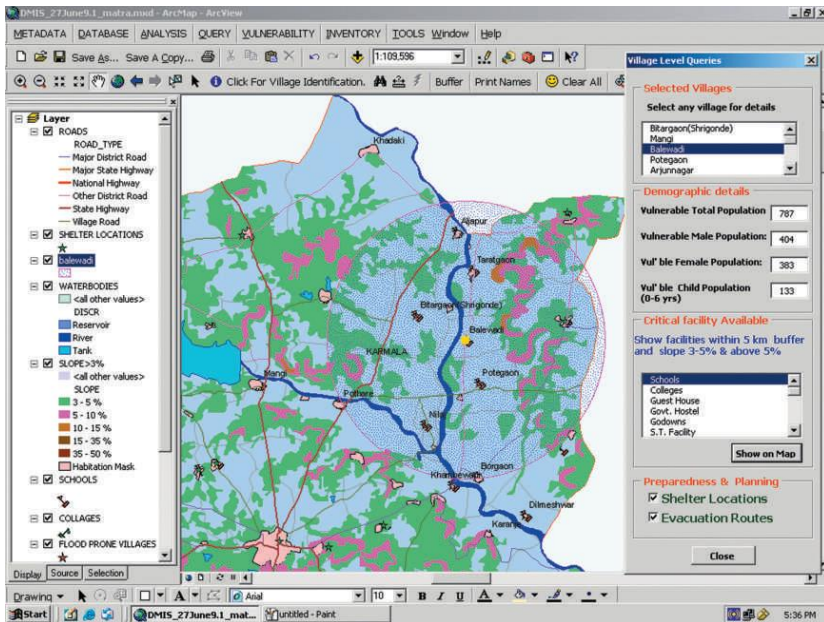
Source: Maharashtra Remote Sensing Applications Centre, Nagpur

Figure 13.3   *Shelter Locations, Evacuation Routes and Critical Facilities within 5 km*

in the DMIS include schools, shelters, police stations, airports, fire stations, boats, ST facilities, railway stations, blood banks, STD booths, government facilities, hospitals and nursing homes, doctors, medical shops and NGOs.

3D-visualisation of the disaster prone area is done using the Digital Elevation Model (DEM). Information on the altitude, which is a major consideration for deciding upon the safety of a location can be easily calculated using DEM. DEM is built by processing CARTOSAT satellite images using Image Processing Software. This model can be used for extracting 20m contours, that help in deciding the locations at different elevations. Hence, locating shelter places at higher elevations is not a very complicated task. Finding the shortest distance by road from any disaster-affected village to the nearest shelter camp is however a difficult process. DMIS makes it possible by calculating effectively the optimal evacuation route in case of a disaster rescue operation (Figure 13.3). The system considers the latest information on the number of boats, number of swimmers, population likely to be affected, PHC, rural hospitals, industries and so on, of all the villages in Maharashtra.

13.7 How and Why is it an Innovation?

DMIS is based on Remote Sensing and GIS technologies. Project implementation coverage includes the entire state of Maharashtra. The beneficiaries of the project are the district administration and other stakeholders. DMIS provides information on revenue saving in terms of manpower and time. With the wide spectrum of information now available on fingertips, the administrators need not depend on the old file-based system to take quick action in hazardous situations. Disaster planning maps of the district, taluka, and village indicating all amenities, can easily be printed and handed over to the functional officials for ground operations.

The database on almost all the geographical themes is ready with the MRSAC. Therefore, analysis under the various geo-physical conditions becomes easy. Such results can be made available immediately to the administrators by just printing the disaster plans. Not only are the maps prepared digitally, but once created, they can be viewed on different scales by more people at a time. Maintenance of such type of spatial database is easy as well as cost and time effective. Owing to customisation based on Arc-GIS, the software development and maintenance becomes cost efficient.

DMIS can draw a buffer of the desired range (in Km), from major rivers and water bodies in the selected district. The system can highlight all the shelter sites at higher elevations within the buffer area in the district, using slope and contour information and evacuation routes to reach the destination shelter locations. The DEM can be used effectively for 3D-visualisation of the disaster prone area.

The system can locate shelter places of the higher elevations easily using slope and contour information acquired from DEM. On screen distance measurement facility in the DMIS can assist the government officials in planning the evacuation route from the flood prone villages. One can obtain demographic details of the entire district or any village at a click of the mouse, which is an imperative input for framing the district disaster management plan.

DMIS displays the risk consideration areas identified by the vulnerability index of the disaster prone areas. Flood analysis at the village level shows spatial distribution of the disaster-affected villages along with the total number and names of the villages. Latest positions post disaster, can be visualised through satellite images of the area under study. Ground realities known from the images helps in gauging the total affected area in a short time. The DMIS state model can be easily applied to other states in the country. It provides bilingual support to cater to the needs of local citizens of the state viz., "Marathi" language for the state of Maharashtra.

The Relief and Rehabilitation Department controls DMIS implementation. This department coordinates with the District Administration for smooth functioning of the DMIS. The respective District Collectors look into the data updation and maintenance part of the system. It is being considered whether the updations of thematic layers can be done by the MRSAC, on behalf of the District Administration, subject to the availability of professionally trained personnel. Need based training sessions can be arranged in the premises of MRSAC as and when required by the users.

DMIS installation and operation has been successfully completed for 15 districts viz., Nashik, Thane, Wardha, Gondia, Chandrapur, Gadchiroli, Bhandara, Kolhapur, Solapur, Sangli, Osmanabad, Satara, Latur, Pune and Nanded. Besides, the installation and training has been completed at the Emergency Operations Centre Cell of the Relief and Rehabilitation Department, Government of Maharashtra, Mantralaya, Mumbai. For the remaining districts in Maharashtra, installation is in progress. The geographical scope is the entire state of Maharashtra.

13.8 Capacity Building

As part of its capacity building exercise, MRSAC has conducted training for the district administration officials. Officials from each concerned line department have been given first hand training on DMIS/NRIS followed by practical sessions. Disaster Project Officers (DPO) who belong to the highly disaster prone districts, are trained as a part of project requirements. In brief, the MRSAC has conducted regular training programmes to carry out the ground level implementation of disaster management plans.

13.9 Constraints and Challenges

The biggest constraint faced by MRSAC during the implementation of DMIS was the lack of awareness among the users, namely the officials at the operational level, the public and the customers who were likely to use the system on the Geographical Information System (GIS). Hence, creation of awareness was a challenge.

Another major stumbling block in the execution of DMIS was data collection. As the users were widely scattered along varied geographical locations, proper and timely coordination was a must. The MRSAC would send the data requirement sheets along with a letter to the Director, Disaster Management Cell of the Relief and Rehabilitation Department. The Director in return would communicate the requirements to the concerned district administration and co-ordinate the process till the desired data was acquired. But, the issue of delayed response was inevitable. Then the MRSAC started to send one copy of the same letter to the district administration directly as a remedial action.

System maintenance was another challenge in the successful implementation of the DMIS. Sometimes, officials with low technical skills were deputed for maintenance of the system. The same staff was often over burdened with additional job responsibilities, which would limit their interest in DMIS. As a result, some of the districts were unable to maintain the system properly. The MRSAC suggested the appointment of a dedicated GIS skilled staff, on a contract basis, at each district, to overcome the problem.

The DMIS is well equipped to avoid unauthorised access to district data. Each district has access to its own data only, since the client machine is loaded with district specific data which is password protected. Only the authorised official, nominated by the District Collectorate, can open the system after validating his username and password. The Directorate of Information Technology (DIT), Government of Maharashtra, was given the responsibility of providing GIS software to each District Collectorate. Accordingly, DIT distributed ArcView 3.2a software in Phase-I, to all the District Collectorates. In Phase-II, DIT was directed to upgrade and renew the licenses to the ArcGIS 9.1 version. The delay was because of lack of dedicated co-ordinators from the State Government. The Phase-II of the project is still not complete. There are some issues related to software compatibility, which is a challenge in DMIS operationalisation.

13.10 Impact of the Project

The major success indicators of DMIS are record/database maintenance and decision support. Before the implementation of the project, records were

maintained by different agencies in isolation, The GIS centralised all the records and maps at one location. The availability of information, on time, helped the district administrators to manage disaster situations better. Decision support in the early system was dependant on human intervention and therefore subject to human errors. However, DMIS being system dependent, has reduced error possibilities drastically and improved the accuracy of output.

The assessment of impact may be done by taking parameters such as the changes before and after the implementation of the system, the time taken for preparation of the disaster plan, accuracy of the output and reduction in the number of errors, the extents of delays in service delivery, the number of users served, the convenience or effort required, the cost of implementation and so on.

Mitigation and preparedness planning is better, since villages at high risk can be identified easily with the DMIS and damage assessment can be worked out accurately. The latest post-disaster scenario can be viewed due to the availability of satellite images of the study area. The ground realities known from the images helps in calculating the total affected area, within a few days. A Disaster Management Plan needs to be backed by continuous preparedness. Only a sustained effort at preparedness can make a Disaster Management Plan effective.

In the former system, limited users could participate in analysing the situations using maps. With DMIS, multiple agencies can be involved in making crucial decisions, in the event of a disaster because of the availability of scale independent digital maps. Overlay analysis is also possible. DMIS is able to cover more number of users as compared to the conventional system. Human efforts have been optimised with the implementation of this system.

13.11 Experiences with DMIS

The process of collecting data from the districts needs to be made more robust. Continuous interaction with the district collectors and the officers has enabled the MRSAC to understand user requirements and refine the software accordingly. The district disaster management representatives are being trained for optimal use of the system. The DMIS user manual guidelines are well documented and provided as a resource to the districts.

Nasik, Kolhapur, and Chandrapur districts in Maharashtra experienced severe floods recently. The installation of DMIS had already been completed in these districts. The District Collector could use the wide spectrum of information from DMIS for decision making. The Disaster Management Unit (DMU) established in each District Collectorate, used the database and software for preparation of the District Disaster Management Plan (DDMP). DMIS could be used as a flood

warning system, since it is very easy to predict the villages in low lying areas along the major rivers or water bodies.

13.12 Conclusion and Future Roadmap

Despite genuine human efforts, the rise in the number of socio-economic victims of disaster draws one's attention towards the need for organising and efficiently managing the disasters. It is important that organisations involved in Disaster Management, institutionalise the mechanisms to assimilate information for better preparedness to disaster situations. This will assist in every phase of Disaster Management starting from preparedness, to relief rehabilitation. Moreover, it will improve the delivery mechanism, and mitigation measures could be better focused. Furthermore, in recent years there has been tremendous advancement in scientific earth observation techniques, thereby making it imperative to get abreast of new technologies and their application potential in disaster management.

Currently, the system is designed in the context of flood inundation related disasters. DMIS is scalable to incorporate other disasters such as earthquakes, fires, cyclones, material spill hazards, droughts, landslides and so on. One can now access information on all types of disasters of any district in the state. Thus, DMIS can act as a decision support system in any disaster. MRSAC is making efforts to deploy DMIS on a multi-user web environment with a natural resources database created on 1:10,000 scale to back the system.

DMIS is scalable to be applied to other states in the country by replicating the same prototyping methodology. DMIS is scalable for support in any of the Indian languages (e.g., Marathi for Maharashtra). Presently, DMIS has been implemented across 15 Collectorates in the State of Maharashtra. The same model can be extended to other departments dealing with Disaster Management Operations, by means of spatial and non-spatial databases. The software can incorporate new requirements with ease. However, considering the reliability factor, the new system must run parallel to the earlier system.

The Relief and Rehabilitation Department, Government of Maharashtra has sponsored the development of the DMIS. As per the vision of the project, the DMIS web version can be designed and developed to facilitate users across the state. If the web version of DMIS is designed and implemented in future, it could be linked to the official website of the Government of Maharashtra as well as the Emergency Operations Centre, Mantralaya, Mumbai. The District Administration could extend the use of the DMIS to the taluka level through its control rooms. It could work on the state level intranet with the available bandwidth via VSAT. All the 35 district headquarters and one node at Mantralaya (Mumbai) could access the system for decision-making. DMIS could be used as a flood warning

system, since it is easy to predict the villages in low lying areas along major rivers or water bodies. DMIS has proved to be a milestone in facing disaster situations in Maharashtra State.

Appendix – 1
Data Requirement Sheet

Sr. No.	Data Required	Remark
1	Village/Town/City	
2	STD: Address and Phone.	
3	Railway Station: No.	
4	Police Station: No.	
5	Air Port/Air Strip : No.	
6	Port/Jetty: No.	
7	Post Office	
8	Community Cultural centre	
9	Library : No	
10	Child welfare centre No.	
11	Bank : Name and Address	
12	Mahila Mandal : No.	
13	Whether Gram Panchayat office has independent building	
14	Veterinary hospital	
15	No. of Doctors in Vet. Hos.	
16	No. of Poultry Centres	
17	PHC : No. of Doctor/Nurse/Bed/Stretcher/Ambulance/Address and Ph.	
18	Sub-PHC : No. of Doctor/Nurse/Bed/Stretcher/Ambulance/Address and Phone.	
19	Cottage Hospital :No. of Doctor/Nurse/Bed/Stretcher/Ambulance/Address and Phone.	
20	Rural Hospital :No. of Doctor/Nurse/Bed/Stretcher/Ambulance/Address and Phone.	
21	Blood bank: Capacity/Address and Phone.	
22	Mobile Primary Health unit	
23	Fire Station : No. and Staff and Fire Equipments available	
24	No. of Health workers	
25	Private hospital : No. of Doctor/Nurse/Bed/Stretcher/Ambulance/Address and Phone.	
26	No. of Medical shop, Address and phone.	
27	Primary School: No. of Student/Teacher/No. of room/Address	
28	Secondary School: No. of Student/Teacher/No. of room/Address	

Contd.

Sr. No.	Data Required	Remark
29	High School: No. of Student/Teacher/No. of room/Address	
30	College; No. of Student/Teacher/No. of room/Address	
31	Worship Place: Temple, Mosque, Church etc.	
32	No. of Godowns	
33	No. of Ashram	
34	No. of Dharamshala	
35	No. of registered fishing agencies	
36	No. of mechanical fishing boats	
37	No. of non-mechanical fishing boats	
38	No. of fishermen	
39	No. of Children (0-14 yrs)	
40	Aged Population (60 and above)	
41	MSEB: Substation Address and phone.	
42	STD facility: No. of Depot and bus	
43	No. of swimmers	
44	Collectorate/Nagar Parishad Control Room: Ph	
45	NGO/Voluntary Organisation: Address and Phone.	
46	Factory/Industry: Type, Address	
47	Name, location and Capacity of Minor/Medium/Major Project/Dam	

Note: In case of Taluka and District level information mention Address and Ph. for all amenities

Sr. No.	Past Disaster Data (Flood/Earthquake/Cyclone/Accident/Epidemic/Hailstorm etc)	Remarks
1	Location	
2	Type of disaster	
3	Year	
4	Population Affected	
5	Population Rehabilitated	
6	Cattle Loss	
7	Loss in ₹	
8	Crop Damage: Area and ₹	

Source: Maharashtra Remote Sensing Applications Centre, Nagpur

Case

14

NI-On—Using Technology for Learner Support in Open Schooling

Dinesh Singh Bist, IPS

The National Institute Online (NI-On) project was a giant leap in Open and Distance learning (ODL) set up in India. Today, the NIOS has over 1.5 million learners making it the largest open schooling institute in the world. It has proved to be a milestone in providing educational access and infrastructural resources to the hitherto untouched sections of the society through innovative use of ICT. The following text attempts to outline the story of NI-On and the re-engineering processes within the institution that revolutionised the concept of Open and Distance Learning at the school level. The institution has successfully contributed to the national goal of making education universal.

14.1 History

The National Institute of Open Schooling, formerly known as the National Open School, is an autonomous organisation which was set up in November 1989, under the auspices of the Ministry of Human Resource Development (MHRD), Government of India. Its three-fold mission was to assist the Government of India in achieving its goal of making education universal, promoting greater equality and justice in society, and helping in the evolution of a learned society by providing relevant, continuing, and developmental education up to the pre-degree level. This was to be done through a distance learning set up through its prioritised group. It was seen as an alternative arrangement to the formal schooling system. In short, its one line charter was to reach the "unreached," comprising of the school drop-outs, the rural youth, the urban poor, the scheduled castes and

scheduled tribes, the minorities and other sections of the society, which had been left out of the mainstream formal schooling system.

14.2 Functioning of NIOS

The NIOS is one of the three National Examination Boards, the other two being the CBSE and the ICSE Boards. It conducts its public examinations at the secondary and higher secondary levels and for the vocational courses developed by it, twice a year. It develops its own curriculum for academic and vocational courses and tries to: maintain standards with its quality inputs, allow easy entry to and flexibility in the selection of courses, pace and place of study, with multiple attempts for qualifying examinations at the learners' own pace. A critical review of its functioning before the launching of the NI-On project initiative, showed the following drawbacks:

- Inadequate access: Although the NIOS was supposed to operate, both for its academic and vocational courses, through a pan India network of Accredited Institutions (AIs)/Study Centres, a closer scrutiny showed that the geographical coverage of the study centres (AIs) was highly skewed. Majority of the AIs of the NIOS were located in and around Northern India only, including Delhi. Their reach in the remote parts of the country like the North Eastern States and other hilly areas like Jammu & Kashmir, Uttarakhand and so on, was dismal. Similarly, the presence of AIs in areas dominated by the SCs, the STs and the minorities, the far-flung rural areas, some urban areas having the urban poor, and school dropouts was inadequate. Therefore, the very objective of providing access to education, to the "unreached" sections of the society, was defeated.

- Poor quality of access: Most of the educational institutions (formal schools, NGOs, and other organisations), which were accredited to the NIOS as its study centres, for conducting its academic and vocational programmes, were found to be lacking in terms of physical infrastructure and teaching resources. Therefore, they were not able to provide timely, adequate, and comprehensive support services to the students enrolled through them. The entire process, beginning with the distribution of the prospectus, collection of admission applications, their tabulation, and their despatch to the regional centres for data entry and so on, was done manually. The resultant errors and delays caused great inconvenience to the students. A large number of learners frequently approached the regional directors at the regional centres and NIOS Headquarters for redressal of their problems. The situation became more pitiable when these students, most of whom belonged to the financially disadvantaged and marginalised sections of the

society, had to travel long distances to reach Delhi. Thus, the NIOS proved to be a poor service provider to them.

- One time admission policy: The existing policy of the NIOS admitted students only between July and August. The limited admission period of 45 to 60 days pressurised both the learners as well as the study centres to complete the admission process within the stipulated time. It prevented a large number of potential learners from enrolling for the educational courses offered by NIOS. In addition, it encouraged unscrupulous study centres of NIOS to indulge in malpractices such as blocking and restricting the seats to students in general and charging extra money for offering admissions at the end of the admission period. Errors in admission data and malpractices during examinations became a common occurrence. Admission data formed the basic data on which the entire NIOS system was dependent. This data was subsequently used by the Evaluation Department, the Student Support Services Department, the Material Distribution Unit, and by the Academic Department. The errors which occurred inadvertently or deliberately were thus further compounded at the various stages in the service delivery mechanism of the NIOS, creating multi-dimensional problems for the organisation as well as the learners. All this affected the efficacy of the NIOS as an Open Distance Learning system in terms of quality of education imparted to the learners and attendant support services.

- Lack of administrative control of NIOS over its study centres: In order to function efficiently as an educational service provider, the NIOS was dependent on its collaborating institutions such as formal schools, NGOs, and other institutions. The basic philosophy was to provide education at a low cost, through such collaboration. However, there was no well defined administrative framework to regulate the functioning of these study centres. In a majority of the cases, these study centres either did not hold Personal Contact Programmes (PCPs) for learners or held them in far lesser numbers than were required. Tutor Marked Assignments (TMAs) which were the only tools for mid-term assessment of the students were not used effectively. In many cases, the study centres were over burdened with the administrative work of admissions and examinations and were unable to concentrate on the delivery of academic content and support services.

- Manual processing of data by regional centres and NIOS Headquarters through its departments: With a student base of 1.5 million learners, the NIOS generated huge amounts of complex, heterogeneous data, which was cumulative in nature, since an enrollment was valid over a period of 5 years. All this data related to learners was processed manually at the

regional centres or by the concerned departments at the NIOS Headquarters. Thus there was scope for errors at various levels. Not only did this create an inconvenience for the learners but also its rectification was a major issue for them. Moreover, frequent break downs in some of the major activities of NIOS greatly reduced its credibility as a good service provider in the domain of Open and Distance Learning (ODL). This problem was further complicated by the issue of equivalence of the certificates issued by NIOS with other examination boards. A large numbers of learners enrolled under the NIOS were those who had either dropped out or opted out of other examination boards, to appear for public examinations at the Secondary and Higher Secondary levels of NIOS. They had been allotted the facility of "Transfer of Credit" (TOC) in a few subjects, by their previous boards. All this magnified the complexity of the data related to learners in NIOS, which was to be maintained for over 5 years. The conduct of public examinations, twice a year, and in between an academic year, further reduced the time frame available to collect, collate, and rectify the errors in the entire process starting from admissions till certification being given to the learners.

❧ 14.3 OBJECTIVE AND SCOPE OF THE PROJECT

This project was initiated with the general objective of promoting better governance through e-Governance and to ensure transparency in the operations of NIOS in its key areas of functioning such as admissions, accreditations, examinations, and other activities. By this, it was envisaged that the reach of the NIOS would be enhanced and the government's goal of making secondary education a universal concept, would be met. Also, the digital divide between the learners under the NIOS and the formal system would be bridged, by providing them the opportunity to use ICT for the purpose of admissions and avail the benefits associated with it. The overall goal was to facilitate the structural and functional transformation of NIOS as an ODL institution by giving it greater flexibility, openness, superior quality and reliable services, to serve its marginalised, target group of learners.

Amongst the specific objectives related to e-Governance were the goals of restructuring the operations of NIOS through the innovative use of ICT and the simplification of procedures that would result in cost effectiveness and time saving both for NIOS and its learners. It would help NIOS to provide better quality of student support services as well as improve the reliability and accuracy of its database.

14.4 Stakeholder Consultation

The idea of National Institute Online (NI-On) was a pioneering one and there were no existing "best practices" to model it on. It was an experiment that was being undertaken for the first time in the country in the education sector. Hence, considerable in-house exercise was carried out prior to its launch. The initial idea was debated by NIOS within its constituent departments i.e., student support services, vocational education, academics, examination as well as administration. Subsequently, special meetings were convened with all the regional directors heading the (then) 13 regional centres/sub centres of NIOS across the country. An in-house study on capacity data of NIOS was conducted to find out the gap between the actual intake and the potential of the institution.

The detailed proposal was then placed before the Finance Committee and the Executive Board of the NIOS. The idea was greatly appreciated and it was felt that the NIOS would now be able to reach its unreached target group better, as well as remove many of its student services-related problems.

The NIOS kept the Ministry of Human Resource Development, which was the controlling ministry, informed of the progress of the Ni-On project through consultative meetings.

> The partners of NIOS namely the Accredited Institutions were also involved in the implementation of the NI-On project. Meetings of the study centre coordinators and academic facilitators were convened in different regions of the country and their views were obtained. Views of the learners were taken through the regional centres, study centres, as well as the grievance cell.

14.5 NI-On—An Innovation (The How and Why of Process Re-Engineering)

From the perspective of policy implementation and the effect of the outcomes, the Ni-On project was certainly path breaking and revolutionary. It was a giant leap for Open and Distance Learning (ODL) systems for being the first programme of its kind to be launched by any ODL institution in India. The project achieved remarkable success even at an international level.

From the national point of view, NI-On was a solution to the problems that the Government of India was facing, in providing access to education and infrastructural resources to the masses, irrespective of caste, religion, community and location of learners, wanting to seek education.

From an institutional policy level, the re-engineering of the admission process, through online admission, introduced an ODL system that was most flexible and

open. NI-On was an innovative use of technology for furthering a social cause at large. It proved to be an excellent model of e-Governance.

Some of processes that were re-engineered were as follows:

- *Opening and expanding the existing admission streams thereby reducing the digital divide and making education equitable and accessible:* Realising that the erstwhile one time admission policy of NIOS was restricting admission and delimiting the role of NIOS, a new admission policy was drawn up. Two blocks of admission dates were decided. They were from March to September for Stream I (offline admissions) and from October to February for Stream II (online admissions). These coincided with the existing bi-annual examination policy of NIOS. Also, admission was opened round the year only for students who could not clear the public examination at the secondary level, from any recognised examination board and wanted to appear under the "On Demand Examination System" of the NIOS. This was categorized as Stream III. Another category called Stream IV was introduced for those learners who had either appeared for, or already passed the senior secondary level or above, from any recognised board/university and wanted to take part-admission in one or more subjects, up to a maximum of four subjects, for updating their qualifications. Admissions to this stream were also allowed round the year. Streams III and IV were specifically offered only through the online mode and examinations could be taken through the "On Demand Examination System" of NIOS. This was possible only because admission data was readily available to NIOS through NI-On. For instance, a number of students who wanted to become pilots but did not have mathematics and physics at the senior secondary levels could take advantage of the Stream IV of NIOS.

- *Admission process through NI-On:* NI-On customised the admission procedures through the generation of interactive online forms. This facilitated various categories of learners to participate by simplifying the process of admissions, examinations, and distribution of study material. The NI-On project ensured that potential learners all over India had equitable educational access as compared to the limited access offered through its study centres (3000 in total). Since the application forms for admission were available online, learners could access them anytime from their homes or go to the nearest cyber-cafés and download them. Hence, the need to go to an Accredited Institution (AI) to buy a prospectus was done away with. The reach of the NIOS was thus extended to the learners even in places where there were no AIs, and to those special groups such as women and girls who were unable to go to secondary schools due to social, religious, cultural restrictions or due to the long distance of schools from their homes. The

learner was now free from touts and other anti-social elements who resorted to malpractices at the time of admissions. In order to make the online admission process user friendly, NIOS customised its admission procedures. The admission form could be filled up by the user by following simple instructions.

- *Institutionalising the online payment gateway:*   An online payment system, through the *ICICI Bank Payment Gateway*, using a credit card (Master/ VISA), was introduced for online admissions from the 2007-08 session. However, this was not an easy task and it took many months of negotiations before banks were willing to enter into an agreement with an educational institution. A number of meetings were held between the NIOS officials and the ICICI bank officials. NIOS also took advice from its panel of legal experts/advocates. Finally, NIOS was able to draw up an agreement that was in keeping with the needs of an educational institution instead of accepting the bank's standard agreement, basically meant for the merchant category. Once the agreement was drawn up, the technical procedure of integration of the payment gateway "Payseal", with the NIOS online application was successfully completed. Thereafter, online payment through credit card began with effect from 08 September, 2007. In 2008 and 2009, the payment gateway was extended to the payment of fees for obtaining duplicate documents and for other services as well. Today, this first ever agreement for online payments by an educational institution at the school level, has become a model for other educational institutions which want to begin online payment gateways.

- *Efficiency through innovation in online study material distribution and information system:*   One of the key activities in an ODL system is the distribution of study material to the students. Under the erstwhile practice, one had to wait for the admission period to be over, after which the manual admission forms would be fed into a computer, errors checked prior to data finalisation, and data transferred to the Material Distribution (MD) unit. The MD unit would compare the new admission data with the stock of books lying with the study centres from the previous year's admission and then compute the study material to be sent to the study centres. Thus, there was a considerable time lag before the materials reached the students. NI-On was able to reduce this time lag since computerised data in the form of online forms filled directly by the students themselves was readily available. Moreover, there were lesser chances of the data having errors. The online/web-based system of capturing and processing the AI-wise study material requirement through NI-On, made it possible to compute the requirements faster as well as monitor and track the status of the study

material despatched from the NIOS HQ to the AI. Therefore, the steps and the follow-up measures to find out the status of the study materials despatched, were reduced. Information relating to the despatch instructions with complete details of the requirement of study materials, transporters, date of despatch and the expected date of delivery, with links for tracking the movement of the consignment, were available on the website.

- *Creation of Learner Support Centre (LSC) for feedback/grievance redressal mechanism:* The experience of NIOS showed that the redressal of learners' grievances was a weak area due to which the students were being inconvenienced and lured by touts and agents. The NI-On project helped the NIOS to improve the quality of its students support services. A call centre which operated through a toll free number was designed. It had both an IVRS as well as executives trained to handle queries. This call centre was fed by the massive data bank of the NIOS and offered services both online and over the telephone. NI-On also helped to create a feedback system and establish a direct contact with the learner since each of them was required to submit his/her email ID and all individual responses were given through this email ID. Thus, NI-On helped to make NIOS more citizen-centric.

- *Reaching out to distance learners through extensive use of the website:* The use of technology brought about significant changes in the working of NIOS. The idea of e-Governance was extended by NIOS to its partners. Study centres were encouraged to correspond through emails and send data in soft copies. Workshops were held across the country to explain the concept and working of NI-On. The regional centres of NIOS were given a direct link to its HQs. The website was used to put up notices both for internal and external use. The end result was that the learners even in remote areas were able to access information easily. The number of hits on the NIOS website following the posting of the examination results and the extensive use of the website by the students, is an example of the breakthrough that NIOS achieved in e-Governance.

- *Addressing inequality:* The strength of technology lies in the fact that it is able to overcome barriers. In a country as diverse as India, the aspect of inclusion is paramount and this was seen in the openness and transparency of operations post NI-On. Now, even students from the North Eastern states, J&K as well as the hilly districts of India, where NIOS does not have a physical presence, are able to take admission through NI-On.

- *Reducing wasteful paper printing and contributing to conservation of environment/natural resources:* In any ODL system, printing of books is one of the largest expenses. From the environmental point of view, NI-On helped NIOS to conserve paper and save on printing costs, through better

actualisation of the number of books to be printed. Also, printing of admission forms and thousands of copies of the prospectus were no longer necessary since admission forms and all the information was available online.

- *Linking processes to outcomes—efficiency enhancement:*   The most significant aspect of NI-On was that it resulted in enhancing the efficiency of the NIOS by cutting down on transaction procedures, reducing turnkey time and costs and at the same time making procedures more transparent and accountable. One of the major expectations from NI-On was that the time taken to process the transactions should be reduced so that other activities could be undertaken in the saved time. This was an evident achievement since the admission data could now be finalised in less than one month from the last date of admissions (20 days) as against the earlier situation when it would take about 90 days for the data to be finalised. Similarly the reduction in the number of steps undoubtedly increased the efficiency and also had a spin-off effect upon other transactions of NIOS. Regarding the accuracy of output, it was seen that generally two types of errors occurred. One type was the errors on the part of the learners and the other was systematic errors which arose from handling of the data. In the past, it was observed that almost 80% of the student grievances were related to the inaccuracies in filling up of the admission forms. Many learners either misspelt their father's/mother's names or checked on a wrong selection and then, had to run from AIs to regional centres to get the corrections done. Many a times, the forms would be filled by persons other than the students and therefore the mistakes were inevitable. Now with the forms being available online, the students could check and recheck the data themselves. Moreover the form has been designed such that the "pull down menu" ensures that the mistakes of typing are reduced. Further the "view" facility allows a learner to see the form before finally submitting it. Thus error free data is available immediately upon the close of the admission session.

Table 14.1 shows the savings in terms of man-hours and man-days after the implementation of NI-On as compared to the traditional offline mode

Table 14.1   *Summary of Efficiency Enhancement due to NI-On Project*

	Offline		Online	
	No. of Transactions Involved	Time-frame Involved	No. of Transactions Involved	Time-frame Involved
Admissions	15	180-210 days	5	30-45 days
Payment	6	90-100 days	1	7-10 days
Examination Stream 3 and 4	10	60-70 days	5	20-25 days

of admissions, payments and examinations followed by the NIOS (i.e., through AIs/study centres). This was possible because the time-frame involved in completing all these transactions was drastically reduced from 6 – 7 months to 1 month. Moreover, the process of re-engineering done under the NI-On project provided accurate and quality data to NIOS, which was used by its Learner Support Centre to provide 24x7 assistance to its learners, directly, without them having to spend time, effort and money in running from AIs to regional centres and NIOS headquarters in Delhi, as was the case under the offline system.

- *Accountability, transparency of process, responsibilities:* NI-On has not only helped bridge the digital divide being faced by the NIOS learners but has also brought about greater transparency in its operations. The operations have been simplified by breaking down each activity into a series of smaller activities and fixing a time-frame within which they are to be completed. Responsibilities have been assigned for all activities within the online cell, the departments, as well as the outside support agencies and partner institutions. The NIOS did a commendable job by implementing the provisions under the Right to Information Act 2005, immediately upon the enactment of the Act. It built a computerised record maintenance system for the purpose of the Act. With the implementation of NI-On, passing on information to the learners became much simpler.

14.6 Building Team for the NI-On Project

The idea of NI-On was conceived in 2006-07 when the author was given charge of the Student Support Services (SSS) Department of NIOS. In an organisation as small as the NIOS, as it was then, in terms of the staff and with no staff dedicated to any one project, it was indeed a challenge to set up an effective and efficient system that would contribute to the national goals of making education universal. The NI-On effort therefore became a team effort. There was one team leader, who was the then Secretary cum Director, Student Support Services. He was assisted by a core team comprising of the deputy director (academics/ personnel) and the systems analyst and programmer. While the former took care of the development of academic content, staff components, HRD and legal issues, the latter handled the technical issues including the planning and procurement of hardware and software. The other members of the team took care of important aspects like infrastructure, publicity, printing, finances and so on.

The implementation of the NI-On was done through the Student Support Services department at the Headquarter level and through regional centres. The staff deployed at these locations was required to run the project as part of their duties and were accountable for implementing the directions given.

14.7 Capacity Building and Organisational Sustainability

Since this was a new concept, it was necessary to train the existing staff at the Headquarters and Regional centre levels. The staff was first briefed on the philosophy and the operational aspects of the project. Hands-on training in the use of technology was undertaken to familiarise the staff with the new method of working. The regional directors (RD) heading the regional centres were the first to undergo training to handle this new responsibility. Orientation programmes were conducted by the Students Support Services department. Detailed meetings were held prior to the launch of NI-On so that every RD was clear about his roles and responsibilities. This training was then taken up with both the regular and contractual staff.

Since the NIOS regional centres were poorly staffed, it was necessary to hire some technical staff to support this project. Most of the staff appointed were young MCAs from local universities, on a contract basis. The exercise of hiring the staff was done expeditiously so that the project could be made operational at the earliest.

14.8 Audit Trials

NI-On was launched in July 2007. During the initial phase, only 30,000 admissions took place. Nevertheless, these admissions provided a valuable learning for the NIOS. The running of the NI-On project in this phase allowed the NIOS to see the efficacy of the system and to further fine-tune the online processing of admissions and payment facilities. Both these processes were then re-engineered and the project was found to be viable on an all-India basis. In this phase, NI-On outcomes were audited in terms of what had been initially planned and what was actually achieved. The audit showed that the perception that internet facilities were inadequate for the NIOS target group of learners, was not correct, since a large number of learners from deprived backgrounds and far flung areas, used this mode of admission, successfully. It was no surprise that in Phase II, i.e., the year 2008–09, admission through NI-On leapt to more than 0.16 million approximately.

14.9 Challenges in Implementing NI-On

Several constraints were faced in the implementation of NI-On. While some were related to physical infrastructure, others were mainly attitudinal. A series of in-house discussions and consultations helped to overcome these constraints. Some significant ones were as follows:

- *Lack of electricity:*   In 2007, the NIOS moved out from its rented premises in New Delhi to its own permanent campus in NOIDA. The area around the office building was still under construction and electricity lines had not yet been laid. The NIOS had to be run on generators that were switched on and off at fixed times. This meant that running a 24X7 Learner Support Centre (LSC) would be a costly affair. Delinking the LSC electricity supply from the main generator and buying a smaller generator with a lesser capacity on which the LSC alone could be operated, seemed to be a solution to this problem. Another problem was that there were no internet lines in the area. However, since the building was new, internet lines would have to be installed even for routine operations, which meant that many of the fixed and recurring costs relating to ICTs would have to be incurred irrespective of the NI-On Project. With NI-On, it became easier to plan the internet requirements on a larger scale.

- *Shortage of staff:*   The NIOS had always faced the problem of shortage of manpower. When the NI-On project was launched, the total staff strength of NIOS was 163 regular staff and around 170 contractual staff for its Headquarters, 10 regional offices and 3 sub regional offices put together. With the student enrollment and the consequent work load increasing every year and the staff strength remaining static, it was obvious that introducing new ideas through additional projects like NI-On would face resistance and resentment. Detailed, in-house discussions were held to motivate the staff, advocate the benefits for all, and to create enthusiasm within them through personal example. Approvals were sought from the Finance Committee and Executive Board for engaging additional technical staff so that the project could be given a firm foundation.

- *Resistance from parties with vested interests:*   In any system that has been in existence for over 20 years, the staff, partners and even the management tend to sink into a comfort zone. Anything new might be looked upon with suspicion. Moreover there may also be people with vested interests who do not want any changes to take place. Under Ni-On, online admission forms were available 24X7 and free of cost to the students. The study centres felt that the power to register the learners had been taken away from them. They could no longer dictate the terms of admission nor could they restrict entry to an elite group only, as they were doing earlier. It required advocacy and determination to convince the partners that this was the only way forward which would eventually benefit all.

- *Overcoming the digital divide by the NIOS Learner:*   Many of the learners who enrolled under NIOS, were actually drop outs from the formal schooling system. With the use of technology, it was hoped that the NIOS learners

would become global learners. Unfortunately, many of them continued to be dependant upon touts and coaching centres to fill up their forms and were misguided. It was only after repeatedly stressing that direct interaction between NIOS and the learner was necessary, that middlemen were removed from the system.

- *Pioneering Effort*:   NI-On was the first of its kind in India, hence there were no models or "best practices" that could be looked upon for support or guidance. The re-engineering of processes had to be innovative and cus-tomised to suit the requirements of NIOS, keeping in mind that it was an educational institution. This is why the legal agreement with the bank for the payment gateway had to be completely remodelled to suit the educa-tional character of NIOS.

14.10 Social Impact of the Project

The single biggest impact of the NI-On project was that it had suddenly opened the doors for the learners to participate in secondary education programmes by making the entire effort much simpler and easily accessible. At a time when the entire country was facing issues of shortage of seats in schools, lack of access to education and reservations in educational institutions, NI-On offered an opportunity where at the click of a button, school level admission could be sought from home. For those learners who, having failed in the national/ state level examinations would feel their lives were ruined and even contemplate suicide, the impact of NI-On with respect to effort, time and cost has been phenomenal.

In 2007-08, the annual enrollment of NIOS ranged from 0.3 million learners. It was envisioned that once the on-line admission/examination system took off at an all-India level, the NIOS enrollments would rise to about 0.7 million students annually, without requiring a proportionate increase in manpower for dealing with such large numbers. It was also felt that the numbers could be enhanced by another 0.3 million learners per annum, if the State Open Schools (SOS) also followed the model of NIOS. This meant that NIOS and SOS together would be able to cater to admissions of 1 million learners per annum and 5 million out of school children, thereby achieving the 11th Five Year Plan targets.

The Ni-On project ensured that all potential learners of NIOS had equitable access to education on an all-India basis as compared to the limited access that was available earlier through its study centres (3000 in total). With application forms for admission being available online, learners could access it anytime from anywhere. The need to go to an Accredited Institution (AI) was done away with, and NIOS was able to reach out to learners even in places where there were no AIs, as well as those special groups such as women and girls who were unable to

go to secondary schools due to the social, religious, cultural restrictions or due to the travel distance involved. It is noteworthy that in year one, out of 30,000 learners, as many as 4000 were from minority groups and 2000 were Muslims. The apprehension that people in the rural areas and in those occupied by the marginalised groups would reject ICTs due to the lack of Internet facilities, proved to be a myth. That this technology based process was welcomed by learners made the project sustainable.

From the national perspective, NI-On was visualised as an able answer to the problems that the Government of India was facing regarding providing access to educational and infrastructural resources to the masses. The strengths of the ODL system were further magnified by this project since it surpassed all boundaries of caste, religion, community and place of learners wanting to seek education.

14.11 Impact on Effort, Time and Cost

NI-On allowed admissions to be offered through the NIOS website. Anyone with internet access either at home or through a cyber-café could download the admission forms. This was in contrast to the earlier practice where admission forms were available only at Accredited Institutions (AIs) and the learner had to find the time and make the effort of going to the AI to buy an admission form. Moreover, there were fixed timings when the forms would be sold, depending upon the availability of the concerned teacher/clerk. The AIs were not too keen to do this since they had to maintain a separate prospectus account, for this sale. The NI-On admission made the system, learner/citizen centric, as it gave power and responsibility to the learner and saved considerable time and effort.

Even in terms of cost, the online admissions proved to be beneficial to the learner. While an offline learner (admitted through the study centre) had to buy the prospectus with the admission form paying ₹ 50, the online learner had to pay only ₹ 30 as online form charges, to download and fill up the admission form. The prospectus was available free of cost in Hindi and English languages, on the website. Nevertheless, if the online learner wanted a copy of the printed prospectus, he/she could purchase another document called the online admission brochure (without the admission form) at a cost of ₹ 10 only. The student could also avail an online facility to pay the examination fees.

14.12 Conclusion

The NI-On project revolutionised the concept of open distance learning in India. The NIOS helped improve governance through innovative design of educational processes. Its pan India network today provides easy access to education to those who have dropped out of the mainstream of education. It plays a critical role in

the government's role of bridging the digital divide. NIOS has shown how the innovative use of ICTs can simplify procedures, thereby resulting in cost and time saving for itself and its learners. Its achievements in the field of education are indeed a giant leap towards realising the national goals of Universalisation of Secondary Education (USE) in India.

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