GLOBAL VIEWPOINTS

Examining Internet and Technology around the World

LAURA M. STECKMAN, EDITOR

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Series Foreword

We are living in an ever-evolving world, one that is rapidly changing both in terms of society and in terms of our natural environment. Hot-button topics and concerns emerge daily; the news is constantly flooded with stories of climate change, religious clashes, education crises, pandemic diseases, data security breaches, and other countless issues. Deep within those stories, though, are stories of resilience, triumph, and success. The Global Viewpoints series seeks to explore some of the world's most important and alarming issues and, in the process, investigate solutions and actionable strategies that countries are taking in order to better our world.

Volumes in the series examine critical issues, including education, war and conflict, crime and justice, business and economics, environment and energy, gender and sexuality, and internet and technology, just to name a few. Each volume is divided into 10 chapters that focus on subtopics within the larger issue. Each chapter begins with a background overview, helping readers to better understand why the topic is important to our society and world today. Each overview is followed by eight country profiles that explore the issue at a global level. For instance, the volume on education might have a chapter exploring literacy, honing in on literacy rates and advocacy in eight nations. The volume on war and conflict might dedicate a chapter to women in the military, examining women's military roles in eight countries. The volume on crime and justice might include a chapter on policing, focusing on police infrastructure in eight countries. Readers will have the opportunity to use this organization to draw cross-cultural comparisons: to compare how Brazil is grappling with renewable energy amid a booming economy versus India, for instance, or how internet access and control differs from Cuba to the United States.

Readers may read through each chapter in the volumes as they would a narrative book or may pick and choose specific entries to review. Each entry concludes with a list of further reading sources to accommodate additional research needs. Entries are written with high school and undergraduate students in mind but are appropriate and accessible to general audiences.

The goal of the series it not to make stark comparisons between nations, but instead to present readers with examples of countries that are afflicted by various issues and to examine how these nations are working to face these challenges.

Preface

Examining Internet and Technology around the World explores how different technologies and the related challenges from widespread international use of these technologies differ—sometimes slightly and other times distinctly— across the globe. Just as the encyclopedia *Online around the World* (2017) showed that the use of social media varies greatly around the world in terms of who uses what and for what purpose, this work seeks to demonstrate that similar variation occurs worldwide when new technologies are developing—even when applying them to similar social or economic issues. In fact, it is often these similar challenges occurring in different cultural contexts that lead to the most innovative development or application of emerging technologies. These solutions are shaping our world today in some very interesting, promising, and occasionally even scary ways.

This encyclopedia uses a compare-and-contrast method for each of the ten featured technologies. The countries selected feature nations representing most of the world regions. Many are at different stages of technology development and implementation; some are finding success, and others are even failing, facing extreme domestic or international pressure to take an action that they will not or cannot. Readers should recognize that technology development is always in motion, always changing and evolving; in some cases, breakthroughs happen daily that alter the technological landscape. Equipped with that knowledge, readers are encouraged to follow up on any questions they may have through additional research and to think critically about how to tailor technology research and development (R&D) to specific parts of the world for maximum impact with the least amount of negative disruption. While this book is descriptive rather than prescriptive, similarities and differences in each country's approach to a technology show that every nation has unique needs when it comes to technology or the issues that stem from that technology usage, as seen in the cyberbullying and cybercrime sections.

This volume represents the research and expertise of many exceptional scholars; they work in academic institutions and in jobs where they have perfected the research skills to examine topics such as emerging technologies from unique vantage points. Some are even practitioners in the field who perform empirical research and develop strategies to address the problems that stem from technology use. One of the lessons learned, however, is that the number of scholars who examine emerging technologies developments in terms of specific countries is actually extremely small. Most technology researchers look at either specific trends, such as trends in the development of artificial intelligence (AI), or extremely specific

subtopics, such as the legal aspects of autonomous robots, who often get even more specific into laws surrounding drones or autonomous vehicles rather than the robotics field more broadly. They often look at regions like Europe, which has the European Parliament that regulates many technologies for its members, rather than looking deeper into e-learning in Poland versus all members of the European Union, which also have their differences.

While both of these approaches are vital, they introduce a major research gap; they can often overlook some of the value and beauty in understanding that countries use and need technologies that meet their specific needs, which often differ greatly from what is developed abroad. This aspect of technology is critical and often overlooked. In addition, researchers who look outside of North America or Europe—with some exceptions—are also rarer than anticipated, and the assumption does not hold that someone from a specific country who researches a technology does so from their country's perspective. For this reason, I offer my sincerest thanks to the contributors who added the depth and breadth of their expertise to this book. It is due to their hard work, along with the talented staff at ABC-CLIO, that this book has been possible.

Introduction

Every day there are new breakthroughs in the world of technology. Across the globe, these developments may look the same or be entirely different, even when achieved in pursuit of the same type of technology. The reason these developments are uneven and not always parallel is because technology is conceived of by people, and people from different backgrounds and life experiences may use entirely distinct approaches to technology development. These differences arise because people from other parts of the world think differently, have unique values and worldviews, speak different languages, or envision new ways that technology might solve critical problems specific to daily, local, or national needs or lives. These human differences that contribute to different technological inventions add an exciting, extra variable to understanding emerging technologies.

Many of these technologies contribute to the invention of new or improved hardware and software with the potential to change human lives—and they may be more effective when tailored to local, sociocultural contexts. In some cases, technologies may be disruptive; when applied, they can significantly alter how society operates. In the past, some parts of the world had a monopoly on technology development; because of this monopoly, researchers paid little attention to the innovation and entrepreneurship radiating from other parts of the world. In the realm of social media, for example, most of the major international platforms come from the United States, where the idea of allowing people to connect online and communicate in the same virtual space originated.

While platforms from these countries continue to boast the largest numbers of users, today there are indigenous domestic platforms in countries worldwide that are growing because they better meet populations' specific social, cultural, and linguistic needs. While they may never match the large platforms in global popularity, these local platforms allow people to write in their own languages in their actual fonts. Sometimes they even have special user interfaces or content specifically designated to the user base. Therefore, no longer are technological developments and inventions confined to one part of the world. Across the globe, people, companies, academics, and corporations contribute to designing and implementing new ideas that address global, regional, and even unique local problems.

The rate of technology development is awesome and astounding. At no time in the past has technology development moved as quickly, nor has it offered iteration upon iteration of society-changing opportunities. Development is accelerated in many parts of the world because the start-up culture has gained more acceptance.

It is now more usual to find workplaces in new or young companies that prioritize creativity and open communications and that have reduced the bureaucracy that can be found in hierarchical organizational structures. For start-up company culture, this is a groundbreaking shift, as an employee no longer needs to work through five or more layers of management to pitch an innovative idea to the chief executive officer.

The removal of traditional hierarchies often allows companies to accelerate from idea to product in a relatively short amount of time. With fewer constraints from ideation to creation, new technologies fly out the door and reach the market faster than ever before in history. It also means that there is a new social implication: people will continuously be using and experimenting with new technology, so in some ways, every person will always be a newbie, or noob, because with the continual release of new products, people will experience a new learning curve with each product launch. People will be kept in a state of flux in terms of what to learn and how quickly it must be learned as technology, often exciting, becomes more embedded in our daily lives.

Almost every person on the planet has experience with new technologies. Many of the successful technologies have introduced a greater degree of mobility and flexibility, allowing for ubiquitous use and consumption, meaning the technology is available anytime and anyplace. An everyday example for many parts of the world includes streaming services, such as YouTube or Netflix. Prior to online video streaming, most people had to go to a store to rent or buy videos. They also had the option of subscribing to network television cable or satellite television services that varied in price based on the amount of content and selection of premium channels. As online videos became popular worldwide, YouTube became one of the largest video and social networking platforms in many countries; people switched to it because it allowed them to consume content from multiple types of devices, even mobile devices, which allow on-the-move content consumption. YouTube, Netflix, and similar streaming services are available everywhere today.

In Africa, Mobile Pesa, or m-Pesa, a system that allows people to transfer money via mobile phone in Kenya has spread to other nations. It provides people with accessible, rapid, and secure financial capabilities that had previously not existed. The adoption of m-Pesa has cut down on robberies and other crime, and it has eliminated the need for travel from rural areas to cities to go to banks and allows for people in cities to send remittances to family who are located remotely or internationally. Social and economic transformations will continue to occur due to technology.

Some emerging technologies will become extremely significant, while others will fail. While no one can predict successes and failures with any degree of accuracy, there are several emerging technologies that experts believe show promise for being transformative. This volume covers several of these emerging technologies, many of which have the potential disrupt society. Whether they will have a positive or negative impact is an unknown, as technologies have the power to do either or, in some cases, both, depending on how people adopt and adapt them.

Emerging Technologies and the Internet

Technology is a term that covers a broad range of meaning. While people often think of technology as items that use electronics or a computer, the word itself has a broader meaning. The *Merriam-Webster* dictionary lists three meanings: a capability derived from the practical application of knowledge, a manner or process used to accomplish something through technical processes or knowledge, and specialized aspects from a specific field (Merriam-Webster 2019). From these definitions, technology is not necessarily electronic or computer based. A pencil or pen, for example, is a type of technology.

More complex devices, such as smartphones, employ a number of technical processes and capabilities that make them advanced types of technology relying on electronics and computing—at least by today's standards. For their time, both of these technologies—the writing utensil and the computer-enabled mobile telephone—changed the world by making it easier for a person to accomplish a task. Technology development continues to advance in speed and complexity and promises to change and improve how people work and behave. It has shifted its focus from supplementing human labor and increasing productivity on assembly lines using automation to a stage where the machines are programmed to emulate human cognition and decision-making, endeavors that were once reserved solely for people. As they release, emerging technologies have the potential to alter lives in meaningful, and even sometimes detrimental, ways.

The definition of emerging technologies does not have universal agreement. It depends on who is providing an answer as well as the length of time under consideration, as an emerging technology could have a near-term impact or take a decade for full implementation. Generally, and for purposes of this volume, emerging technologies are those that are currently under development or expected to develop over the next five to ten years and that have the potential to alter the current way that businesses and society function (Business Dictionary 2019). Even using this definition, experts use different criteria to predict which technologies fall into this category.

Among those, popular predictions suggest that the Internet of Things (IoT), artificial intelligence, 5G internet connections, serverless computing, and blockchain rank highly. Other technologies that typically fall into the emerging category include robotics, biometrics, 3-D printing, virtual and augmented reality (VR/AR), and drones (DeNisco Rayome 2019). Development for each of these technologies or capabilities is underway, with investment varying based on a number of factors.

This volume takes a closer look at how selected emerging technologies and internet-related capabilities, as well as the social issues they have created, are developing in different countries around the world. The first five chapters focus on internet-related capabilities and their associated issues. The remaining five chapters examine the development of specific, emerging technologies that are relatively newer and upon which many experts have pinned high hopes for the advancement of society.

Chapters 1–5 cover internet-related capabilities and the social problems that have stemmed from internet usage. The internet is no longer a new technology. Its origins trace back to the 1950s, when the U.S. government commissioned research that laid the foundation for what would become the internet. After three decades of advances in computer science, in 1993 the European Organization for Nuclear Research, known as CERN, produced the software required for the World Wide Web (WWW) to run over the internet (Steckman and Andrews 2017). Today, the internet will imminently celebrate its thirtieth birthday.

One and a half generations of people, Generation Z (sometimes referred to as centennials) and part of Generation Y (or millennials), started their lives on the planet never knowing a time when the internet did not exist. Older generations may have also grown up entirely with the precursors to the internet, meaning that although the technology changed with the WWW, many people also have lifelong experiences with preinternet and internet-related technologies. For these reasons, this book avoids problematic terms such as *digital native* because they ignore the internet's history. In other countries, the internet arrived at different times, with access dependent upon the availability of connectivity, cost of devices, cost for service, and many other factors that prevent generational divisions from translating evenly to the entire world—including across the entire United States.

Chapter 1, "Access and Control," details success stories as well as areas of the world that have used the internet to restrict information sharing under a variety of circumstances. *Access* refers to one's ability to go online. *Control* refers to the degree of restrictions or limitations that governments, or in some cases corporations, place on access to the internet or the information shared through it. During the internet's lifespan, both prior to its widespread implementation and post-1993 when the WWW launched, the technology has been used to improve people's access to information. For some users, the immediate access to needed information from anywhere in the world at the click of a few buttons is one of technology's greatest achievements. For others who have learned to use the available information to their benefit and the detriment of others, such as for criminal or pseudo-criminal activities, free and open internet access has created public controversy about regulating online safety. While many countries have championed universal internet access for information sharing, others have decided to place strict controls over content and usage. The access and control spectrum is wider than being "free" or "not free," as some countries' responses to the challenges the internet can present fall somewhere between the spectrum's two poles.

Cyberbullying, covered in chapter 2, is an issue that has arisen from internet usage. In some parts of the world, it is a criminal activity, and in others, it comes close but does not trigger a law enforcement response. The research shows that cyberbullying may be a growing problem in some areas of the world, but while it exists in others, studies reveal that there's no current way to validate the extent to which it is a problem, nor whether it is on the rise. Much of the concern surrounding cyberbullying, while valid and demonstrating a clear need to protect children online, may occasionally be hyped by the media to so that cyberbullying appears

a larger problem than it currently is. However, the extent of the problem is one of many research questions that scholars have yet to answer.

Cybercrime, the topic of chapter 3, is on the rise in some parts of the world, although in those areas, criminals can use the boundaryless internet to select victims in other countries. The internet has provided criminals with new ways to commit crimes while complicating the process of arresting those criminals through jurisdictional and other legal issues. At the same time, cybercrime is evolving through new technologies that either create new vulnerabilities or help people develop new techniques to commit crimes. The internet and the more connected world that it has created offer new opportunities for those wishing to harm others. Dealing with crime in virtual spaces has no 100 percent solution.

E-learning is covered in chapter 4. E-learning, now *m-learning* in some areas, offers educational and training opportunities for more people across the world than ever before. Evolving from correspondence and distance learning, new technologies allow people to complete coursework at their own pace and on their own schedules. It reaches more people than ever, allowing a student in the remotest village to study advanced topics from renowned international institutions without having to raise the funding to move to that country to attend traditional brick-and-mortar classes. Instead, students can work with a professor or course materials virtually from the comfort of their own homes around their work and life commitments. Although e-learning is not one-size-fits-all from the student or institutional perspective, it is a game changer for students worldwide. It also provides a boost to some institutional bottom lines, as delivering online content is cheaper than traditional instruction. One of the caveats to comparing e-learning worldwide is that not all countries publish their statistics, so it is not always possible to assess the usage and effects of courses offered in different locations, even when examining the same course from the same provider. That challenge is increased when countries use domestic developers for tailored content and delivery.

Chapter 5's topic, online privacy, is an area of growing controversy worldwide. The fact that data collection and usage is virtually unregulated in most parts of the world has never been a secret, but the majority of people either do not understand that companies have the right to do almost whatever they want with people's data, including selling it to sometimes-less-than-reputable third parties for undisclosed purposes. There are also cultures where privacy has varying definitions and where these understandings do not translate well to the for-profit nature of online data collection and usage. In some cases, the sense of anonymity, whether real or fictional, may be enough for users to avoid worrying about the risk of data breaches. Some people may even believe that they have nothing to hide, but research is showing that it is the aggregation of data on a person that can do the most damage, with no relevance to whether that individual has done something "wrong" or has something to hide (Torpey 2019).

The controversy has grown since Facebook, one of the world's largest international social media companies, has been at the center of numerous data privacy and security breaches since 2018. The reality is that Facebook—and almost every

company that operates online—allows people to collect data inappropriately and use it for purposes to which the user base did not consent, such as what occurred when the research firm Cambridge Analytica gained access to millions of people's data around the world and used it to profile them psychologically in order to manipulate their votes in the United States, India, and other places. As a result, data privacy and protection has become a more important issue.

Chapters 6–10 cover emerging technologies that involve hardware or the development of physical components. The exception is AI, which is generally built through the development of algorithms that operate digitally, although they can be incorporated into AI-enabled technologies, such as smart homes or robots, to operate within the context of hardware or another physical component. Just as the internet-related technologies and issues covered in the first half of the book differ worldwide, the technologies featured in the second half also vary depending on country of development, legal or regulatory frameworks, and national or local development needs.

These technologies are emerging because they are either relatively new or are now supported through advances in computing power that did not exist previously. They are also technologies that experts expect to have a significant impact on society directly or through other sectors, such as agriculture, education, transportation, medicine, and renewable energy power, and even for entertainment purposes. Sections in this part cover alternative energy technologies, AI, autonomous robots, genetically modified organisms (GMOs), and virtual and augmented reality.

Chapter 6, covering alternative energy technologies, discusses how countries use their natural and renewable resources to produce energy. While each country's ability to do so depends in part on its geography and the extent to which it is able to invest, most countries are seeking to maximize their energy production while moving away from reliance on traditional fossil fuels. Some nations plan to continue to rely on traditional fuel sources as well. Even in these cases, there are at least some government-level initiatives to experiment with alternative energy sources, and often nongovernmental organizations (NGOs) will also contribute to this exploration. Depending on the country, there are also opportunities to experiment with unique or unusual sources, ranging from algae to human waste to industrial waste. These potential energy sources depend on the country and often complement some of the well-known sources, such as wind, solar, and hydroelectric energy.

Artificial intelligence refers to a bundle of technologies and is the topic of chapter 7. None of these are technically new; one of the first philosophical ponderings over AI occurred in the seventeenth century. AI, as it is known today, has been under development for decades. Development initially stalled in the 1960s and later in the 1980s once the technology had reached the limits of available computing power; only recently have the computers caught up to the technologies and enabled them for experimentation and employment. Experts believe that these technologies, whether by themselves or used in conjunction with other AI-enabled capabilities, will change the world. Many researchers believe that they will have

Dance clubs across the world are experimenting with a new kind of energy. They have created special dance floors that work on the principle of *piezoelectricity*, which captures energy generated when an object is stressed. When dancers use the floor, it creates an energy current that feeds into batteries that keep the floor powered. Some floors react even more directly with the dancer's moves so that they can see how much electricity their dancing style creates. One major dance off could one day power an entire building (Daftardar 2015). First brought to market by a Dutch company, the technology is currently operational in the United States, Japan, and Australia. Other industries, such as the fitness world, are considering how to use the technology.

positive impacts on agriculture, health and medicine, education, finance, and other sectors.

High-level perspectives on AI vary. Russian President Vladimir Putin (1952–) has stated publicly that "control of artificial intelligence will be crucial to global power" (Meyer 2017). Chinese officials have stated that China plans to be the world leader in AI by 2030. On the other side, tech entrepreneur Elon Musk (1971–) believes that AI represents a greater threat than nuclear weapons—although he still funds research in it. Sebastian Thrun (1967–), another tech entrepreneur, has stated on multiple occasions that AI will empower people by taking over the repetitive work and allowing them to be freer and more creative.

While the future as shaped through AI is unknown, there are efforts the world over to solve complex problems facing society through the application of AI. In the meantime, one of the most interesting aspects of AI is how countries develop and apply it differently to suit their own social, cultural, and linguistic contexts. This viewpoint is only available for researchers who consider local contexts and needs when studying emerging technologies such as AI.

Chapter 8, "Autonomous Robots," encompasses various types of robots programmed to operate, and sometimes even make decisions, without human interference. Robots that fall into this category include autonomous industrial robots, autonomous vehicles, and certain types of drones. They can be AI-enabled or not, depending on their purpose and design. Many developers around the world are looking to apply robots to improve human lives. High levels of innovation are coming from developing areas of the world not known for creating advanced technologies; cutting-edge development is coming out of the top universities and corporations seeking to advance the field of robotics. There are also controversies surrounding robots, revolving primarily around robots that could make decisions to harm humans, not unlike the Hollywood depiction of robots in the movie *Terminator: Rise of the Machines* (2003). Another, perhaps more realistic, controversy is how to contend with the idea that autonomous robots will put people out of jobs and affect overall unemployment rates. The field of autonomous robotics is moving swiftly and has led to many legal, policy, and ethics questions.

Genetically modified organisms are covered in chapter 9, which discusses biotechnologies that involve the genetic engineering or manipulation of a living organism. Modifications are usually made to enhance a desired quality, eliminate an undesired one, or sometimes add in new features based on the genetics of another organism. GMOs are best known for the role they play in foodstuffs. Some scientists view them as the solution to managing the world's food supply and ensuring that people receive the nutrition they need to thrive. Public response across the world is not so clear-cut; for different reasons, certain segments of the population have taken anti-GMO stances, especially toward GM food and other agricultural applications.

One of the major controversies, for example, is the belief that GM foods negatively impact human health; although science does not substantiate this claim today, the idea that GMOs are harmful is pervasive in many societies. GMOs are not limited to food; in fact, they can create needed medicines, such as insulin, or even lead to further controversies, such as the ethics of genetically engineering humans or other animals. At the most basic level, GMOs are a technology that continues to evolve with new methods, processes, and testing. They are considered emerging because as the science and research advance, there are more opportunities to meet populations' needs and develop new solutions for long-standing societal issues, such as starvation or malnutrition due to drought or blight. However, GMOs are surrounded by a number of laws, with countries acting both for and against development, import, and export of GM seeds, foods, and other materials and responses differing widely depending on national circumstances.

Finally, chapter 10 covers virtual reality and augmented reality, which are interrelated technologies that stem from a larger pool of immersive reality technologies. The first invention using VR happened in the mid-1960s, and the first attempt at AR is slightly older, having been achieved in the late 1950s. Like AI, VR/AR did not receive significant attention until computing power increased enough for these technologies to become realizable.

Since that time, development has steadily occurred. Barriers to VR/AR use still exist, especially as they relate to the cost of some of the hardware required to use the technologies, although the Pokémon Go craze of 2016 introduced AR to a large number of people across the world. In the last few years, several countries have taken the initiative to develop VR/AR further, especially for entertainment and are now exploring applications to other sectors. Some countries are more advanced than others with these technologies. Some have different visions for what the technologies should be able to do and hope to see them revolutionize not only their economies but also various aspects of education and training.

There are other technologies that this book could have covered. Cryptocurrencies are growing in popularity and increasing in controversy worldwide. Blockchain, a technology that records transaction data and change in ownership, originated with cryptocurrency but has expanded to other sectors. Many governments across the world are starting to rely on blockchain technologies in different ways, such as for the reduction of fraud and corruption, making it one of the most fascinating

global technologies that has been adapted for numerous purposes. Technologies such as these are not covered in this volume. Expertise related to them, as well as how countries apply them, is on the rise, making them potential candidates for a future or similar work. However, these technologies are not yet "mainstream" emerging technologies. The data available on them is, as of yet, too scarce to provide detailed, country-specific summaries, and the ability to summarize them further depends on whether researchers spend more time examining country-specific developments and progress rather than general or worldwide technology trends.

For all of the technologies that are featured in this volume, it is an exciting time in development and implementation. As with many technologies currently being explored, researchers are making daily advancements. In some instances, in a very short time, these technologies have gone from being philosophical and theoretical to initial realization. Some have practical, real-world applications and greater potential over time. Within every country, through a combination of government, industrial, and educational institutional support, these technologies are at different stages of development.

In some parts of the world, they are nascent, just starting to grow in terms of development and demand. For example, many digital technologies are gaining momentum in Africa because internet connectivity has become more stable and bandwidths have become faster. 5G promises to make these connections even more promising for technology development. For other areas, some technologies have already resulted in demonstrable impact. In India, a government initiative piloted an AI-powered crop tool in July 2019 to determine estimated crop yields and identify optimal times for harvesting. Pilots such as these demonstrate AI's ability to reduce farming costs while maximizing productivity and profitability.

On Country Selection

Technology development occurs all over the world and is at varying stages of development. In Paraguay, for example, the technology scene is nascent but starting to grow, with the exception of hydroelectric energy. Despite having few domestic efforts focused on technology development outside of the 1860s when President Francisco Solano López (1827–1870) pushed technology as a way to transform Paraguayan society and ultimately brought in one of the first telegraph lines to South America, the country is only now, slowly, moving toward technology development.

While Paraguay did not intentionally isolate itself from technological developments—it does use the internet and has other digital capabilities—for a time, it followed global technology trends rather than sought to cultivate them domestically. The country has only recently started moving toward a start-up culture and sees promise in agricultural technologies. Today, the Fundación Paraguaya (Paraguay Foundation) has developed Poverty Stoplight, a tool that it uses to identify and reduce poverty. The tool has been exported to more than a dozen countries where it helps governments and nongovernmental organizations fight poverty. In

contrast, Israel is sometimes referred to as the "Start-Up Nation" because its culture and policies support new tech ventures. China is investing heavily in advanced technologies as it shifts from a country known for cheap manufacturing into a nation that produces high-end technological capabilities. Every country is at its own stage of technology development, with each having different goals and unique niches that the technologies need to fill.

In this volume, the countries have been selected to demonstrate the way that countries are at these different stages while working to develop similar types of technologies. The United States is featured in nearly every section because developments in the country have often been achieved first and a wealth of information is available about the history of that development and subsequent accomplishments. The other countries represented in each section provide a sampling of snapshots from across the world. To the greatest extent possible, countries from each world region appear in every section. Together, they offer readers not only the opportunity to compare and contrast where the country's technology development for each specific capability, or set of capabilities, is at the time of writing but also information on some of the barriers to technology development. A prime example is the entry on the development of autonomous robotics in the Democratic Republic of the Congo. The burgeoning industry there is exciting because it is not a location typically known for robotics and other technologies.

However, there are some gaps in the information that can be presented. While the technologists move forward, the information available to the outside world is limited. It is scarce in quantity as well as quality, as it is only available and accessible in languages that current technology (e.g., Google Translate) can translate when the publication's native language is unknown to the reader—and even then, computerized translations may not be intelligible. For many African languages, while they do have presences on the internet, the translation capabilities remain almost nonexistent to this day, making them inaccessible to all but native language speakers. The entry on AI in Nigeria specifically addresses this point; while Nigeria is a hotbed for fast-paced technological development on the continent, the inability versus ability to translate the country's more than 500 spoken languages restricts the information available to researchers as well as the Nigerian people. For similar reasons, some countries with high technology innovation may not be as well represented, as information about these achievements is not readily accessible.

Along those same lines, countries that could feature more prominently may not appear as often as they could. In the United Kingdom, for example, there are significant amounts of work occurring in many of the fields represented in this book. The United Kingdom itself, however, only appears in two entries: AI and autonomous robots. By no means does the omission of the United Kingdom in other sections indicate that there is no work being done in the country; on the contrary, the United Kingdom—as well as Australia, Brazil, China, or a number of others—could feature in every section. An entire book could be written on AI development in the United Kingdom alone. In cases like these, countries are featured a small number of times to allow other nations to appear, enriching the

perspectives that the volume offers. The remaining space is dedicated to countries that have lesser-known technology industries or that are performing exceptional, less publicized work in particular industries.

A Note on Sourcing

Writing about technology has some unique challenges. The rapid speed of technology development and the emergence of new or adapted technologies to different areas is breathtaking. It is indeed an exciting time to live and see how new technologies and ideas are reshaping the world, but it is also challenging to keep up with the trends and general momentum of change. For an insider, one who spends significant time within the world of tech development, the situation is the same, as Chen and Guizani (2006, 1) note, "for any IT engineer who stays out of the technological advancement for even a very short period of time, he/she will quickly find himself/herself an outsider to the technological transitions, with difficulty in understanding hundreds and thousands of new terminologies that are invented every year for newly emerging technologies." For someone who is not hands deep in technology development, keeping up with rapid pace of development is quite challenging.

Researchers also experience this challenge when approaching new technologies; it takes time to read, analyze, and synthesize all of the information on a topic. The pace moves even more slowly for people who conduct studies, because there is time involved between designing and conducting the study, and then even more time to write up the results for a submission to a journal. Some journals can take a year or more to publish a new piece, although many journals now have an online component that can often take months rather than years, slightly reducing the time between the conduct of the research and the sharing of results to a broader audience. This timeline also assumes that there is a journal focused, whether entirely or in part through a special edition, on the technology under study. The pace from research or analysis to publication is often too slow to allow readers to stay up to date on new technological developments. In order to produce this volume, journal articles have been used when possible; some technologies and technology-related issues, while undergoing change as technologies evolve, have years of research behind them. Cyberbullying, e-learning, and genetically modified organisms, for example, have decades of research behind them. For those topics, journals and books often feature in entry references.

For other topics and entries, the sourcing relies on news sources and online reports; in areas where news is sparse, sources have been found in reputable social media accounts to provide a more comprehensive overview of technology development. For example, there is incredible innovation in emerging technology across Africa. In many cases, however, that information would not otherwise be available without using online news and social media sources. Adding to the challenge is that technology research is often not examined from a country or national perspective, so in some cases, the entries may be one of the first times a technology

has come under examination from that perspective. Taking all of these factors into account, this volume strives to provide representation for a large sample of relevant technology developments across the globe.

Further Reading

Business Dictionary. 2019. "Emerging Technologies." Accessed September 29, 2019. http://www.businessdictionary.com/definition/emerging-technologies.html.

Chen, Hsiao-Hwa, and Mohsen Guizani. 2006. *Next Generation Wireless Systems and Networks*. West Sussex, UK: Wiley.

DeNisco Rayome, Alison. 2019. "Top 10 Emerging Technologies of 2019." Tech Republic. Accessed September 29, 2019. https://www.techrepublic.com/article/top-10-emerging-technologies-of-2019/.

Merriam-Webster. 2019. "Technology." Accessed September 29, 2019. https://www.merriam-webster.com/dictionary/technology.

Meyer, David. 2017. "Vladimir Putin Says Whoever Leads in Artificial Intelligence Will Rule the World." *Fortune*. Accessed September 29, 2019. https://fortune.com/2017/09/04/ai-artificial-intelligence-putin-rule-world.

Steckman, Laura M., and Marilyn J. Andrews, eds. 2017. *Online around the World: A Geographic Encyclopedia of the Internet, Social Media, and Mobile Apps*. Santa Barbara, CA: ABC-CLIO.

Torpey, Kyle. 2019. "If You Don't Care about Online Privacy, You Should Read This." *Forbes*. Accessed May 25, 2020. https://www.forbes.com/sites/ktorpey/2019/02/28/if-you-dont-care-about-online-privacy-you-should-read-this/#224709543886.

Chapter 1: Access and Control

OVERVIEW

Around the world, governments have different approaches to how they view the internet. Although the internet's original design intended to promote the open exchange of information and sharing of ideas, those democratic ideals appeal to some nations and conflict with other countries' political, economic, and social ideologies. Where the internet is not open, governments levy restrictions on the content that their populations can access and exert various levels of control over sites, content, and other media that clash with their laws and worldview. In some instances, countries like China are developing their own internet systems to exert tight controls over the information accessible to their populations.

Internet access is the ability to connect to the internet. Access can occur using any device capable of access, including computers, mobile phones, tablets, and even the emerging smart appliances with the ability to connect as part of the Internet of Things (IoT). With connectivity, an individual or organization has the ability to interact with internet services, such as social media platforms, online banking, online courses, and many other services.

Internet control refers to the ability of an entity, usually a government, to place limitations or restrictions on the content that reaches the population. Internet control has a technical and a human component, the two often working together to assert or reduce control. The technical component can include the hardware and software used to run and access the internet. Two of the main protocols required to run the internet are the transmission control protocol (TCP) and internet protocol (IP), which together are commonly known as the TCP/IP suite. TCP is a communications method that works as an intermediary layer between a device or application and the IP. It ensures that information is split into packets, or smaller parts, and then reassembled in the correct order when they transition to the IP.

IP is a protocol that addresses and routes each packet to its intended destination. When sending an email, which has several address line options, a subject line, and a body, for example, the TCP makes sure that these pieces reach the IP in the correct order. The IP then routes to the correct location so that the receiver finds them in the inbox. When an IP address is blocked, the information cannot arrive at that location.

Other technical means for controlling the internet include domain name system (DNS) poisoning, which ultimately sends people to the wrong location when they are trying to access blocked sites; DNS hijacking, which points URLs to the wrong

location; keyword filtering that allows a system to block sites containing predesignated words by forcing a TCP connection reset; limiting the type or amount of communications through monitoring internet service providers (ISPs), such as what China uses in its Great Firewall of China; and using custom applications to block URLs. These methods are always being tested and updated as technologies improve and people become more educated about how to circumvent them. As of 2018, the Canadian company Netsweeper provided several international governments with censorship technologies (Braga, Ayed, Seglins, Sher, and Gagno 2018). Other companies, such as Apple and Amazon, regularly delete or censor products and apps offered in various countries to comply with local laws (Glaser 2017). By doing so, they remain entitled to do business in that state, but they also receive criticism that they further technical censorship.

To supplement technical censorship capabilities, people can be an additional resource for ensuring that banned content does not slip through the other censorship mechanisms. Generally, this is a paid or volunteer job where people either sift through information or use directed keywords to search for illegal content. People are better at understanding context than machines; artificial intelligence is not yet at the state where it can recognize subversive memes or the other creative ways that individuals attempt to circumvent censors.

For example, in the early 2010s, people in China found a new way to talk about the 1989 Tiananmen Square massacre on the internet. Because discussion of the event is illegal and highly censored, people started using the image of a yellow rubber duck to represent the tanks that rolled through the square. The human and technical censors did not understand the meaning of the ducks initially, so they circulated until a person concluded that they should be banned. Subsequently, words like *yellow duck* were added to the list of banned keywords, which then informed the technical censorship mechanisms to block when people mentioned the ducks.

Another way to circumvent censors is to fictionalize an account or story. This method has been used in printed materials but may transfer to the internet in certain circumstances. For example, people in many parts of the world enjoy writing and sharing fiction online and use numerous different sites and blogs to increase readership. Using these fictionalized stories to share ideas or provoke thought may displease some governments or seek to undermine censorship efforts. However, countries like Malaysia and Indonesia block many sites used to share fictional stories, such as FanFiction.net. The reason given to the public is that some blocked sites supposedly spread erotic content, which is illegal, though blockage affects the entire site rather than only applying to the offensive content. With some fiction-sharing sites entirely blocked, governments ensure that citizens comply with the law and eliminate the potential that users can circumvent censors, including reducing exchanging ideas they may consider undesirable, albeit not explicitly illegal.

Every year Freedom House publishes its Freedom on the Net report, which rates all of the world's countries in terms of how open their access is. The report

uses multiple indicators to make the determination that a country has free, partially free, or not free access. In 2017, the report also noted an overall decline in free access to the internet around the world. During this period, the report listed Estonia, Iceland, Canada, Germany, and Australia as the top five freest nations. Armenia, Colombia, and Brazil ranked as partly free, although they came within a few points of the free category. Of the not-free nations, China rated the lowest, while Syria, Ethiopia, Iran, and Cuba did not score significantly higher (Freedom House 2018).

This report is a good guide for tracking yearly changes in the overall control that different countries place on the internet and the associated technologies, such as apps, virtual private networks (VPNs), and voice over internet protocol (VoIP) connectivity. The reports also include information about specific cases that triggered government reactions, which usually involve arrests or changes in the law dealing with internet freedoms and restrictions.

One response governments occasionally use is to shut down the internet when they view it as causing social unrest or when they want to prevent people from violating laws. In some instances, the internet is shut down to prevent the population's response to political activities. In mid-2018, Algeria and Iraq opted to shut down the internet during school exams. Algerian officials had noted in 2016 that the competitive national exam questions leaked online and students used that information to cheat. In the subsequent year, the government asked internet providers to curb social media access. When that did not work as well as anticipated, in 2018, the government decided to shut down the internet entirely for short periods of time, informing the population in advance.

Other countries, like India, Syria, Mauritania, and Ethiopia, have also experimented with shutdowns during exam time (Al Jazeera 2018). India shut down the internet more than twenty-five times in 2017 for varying reasons. Cameroon holds the record for the longest shutdown, which lasted almost three months because of rising unrest in the country's Anglophone section, an action that cost the country millions of dollars (Ritzen 2018). Other countries that have implemented full or partial internet blockages include Vietnam, Egypt, Brazil, Sri Lanka, Pakistan, Turkey, the Democratic Republic of the Congo, Mali, Morocco, Senegal, South Sudan, and Togo. Governments that use the shutdown technique impose high levels of control over the internet and access to it.

Even more extreme than shutting down the internet, North Korea has prohibited internet access almost entirely for its citizens. As an alternative, it has a national intranet called Kwangmyong, meaning *brightness*. An intranet is like the internet, only instead of being able to access information from anywhere, Kwangmyong is a closed network that does not touch the internet. The advantage for the government is that foreigners cannot gain access, the system is closed to cyberattacks unless they come from domestic sources, and all activity can be easily monitored. The system reportedly has only 168 sites and continually takes screenshots to monitor all activity (Talmadge 2017). North Korea's intranet solution demonstrates the strictest control over the system in the entire world.

The opposite of strict internet control is free, or unrestricted, internet control. Theoretically, a country with free internet access and loose control has unimpeded access to content, websites, and other technologies powered by the internet. All countries with "free" access are not equally free, however. One of the critical issues that defines free internet access is the idea of net neutrality. *Net neutrality* is the idea that ISPs allow access to all internet services and content, regardless of source, without favoring one over another for any reason. Many countries in Europe, like Estonia, endorse net neutrality and believe that internet access is a fundamental human right. India has also passed a law guaranteeing net neutrality. Other nations considered to have free internet access, like the United States, have repealed net neutrality rules that once prohibited ISPs from regulating internet access. With the removal of the law, ISPs can restrict sites that require higher bandwidth, such as television streaming sites like Netflix and Hulu. The result is that in countries without net neutrality, there are restrictions imposed on internet access, but rather than being subject to government control, these are instead regulated by corporations and their profit margins.

Geo-restrictions are another type of access control that apply to countries regardless of freedom of access considerations. Geo-restrictions are limitations placed on access in certain locations. They can be placed by governments and also by internet services based on the agreements they have signed with content providers. For example, when users are trying to access streaming through Amazon, many of the programs are not available outside the United States. Amazon uses an IP tracking system to determine where the IP address originates. When that IP address does not correspond to an area where that programming is allowed, a message appears stating the content is not viewable in that country. The majority of geo-blocking is performed at government request or due to legal restrictions. Other reasons include price differences between regions as wells as blackouts in certain areas where the content has not yet been released or in offices so that employees cannot view streaming content at work.

People themselves also seek to control their own internet access. There are multiple techniques for avoiding censors and accessing blocked content. Often, these rely on technologies designed to obscure or obtain another IP address. Proxy services, onion browsers like Tor, and VPNs all provide the means to change or obscure IP addresses. These methods are not always secure, however, so they cannot necessarily protect someone from having their activity monitored. There are also apps designed to encrypt communication, such as the RedPhone app that provides end-to-end encryption for phone conversations, assuming the call is to another RedPhone app user. Signal is a similar app that allows for the secure transmission of text messages and attachments. Because of the ability to send encrypted content, some countries ban apps like these to prevent communications that prove difficult to monitor. Most people want to keep their communications private, or as private as possible. They will use or invent technologies and techniques that circumvent surveillance and monitoring when possible.

The following section provides an overview of countries that have free, partially free, and not free internet access. The governments wield varying levels of control, imposing some or many restrictions on content depending on national laws and total internet penetration. With each country, it is important to note its unique political, social, and cultural circumstances and the way that these play a role in determinations about internet access and control. Each country balances the perceived needs of the population with national security interests differently to accommodate for and address these needs. These nations also differ in what freedom of access means and whether a population can truly handle unlimited access to potentially conflicting information. In most cases, restrictions on internet access and control are always being reassessed, whether incrementally or microscopically, because the internet is always changing. New technologies and people's growing awareness of techniques to circumvent restrictions lead to constant adaptation and innovation. The following cases provide a snapshot of where selected countries are in the process of negotiating internet access and control intentionally or in response to rapid technological change.

Further Reading

Al Jazeera. 2018. "Algeria and Iraq Shut Down Internet to Prevent Exam Cheating." Accessed May 25, 2020. https://www.aljazeera.com/news/2018/06/algeria-iraq-shut-internet-prevent-exam-cheating-180621074343644.html.

Braga, Matthew, Nahlah Ayed, Dave Seglins, Julian Sher, and Michelle Gagno. 2018. "To Censor the Internet, 10 Countries Use Canadian Filtering Technology, Researchers Say." CBC News. Accessed July 21, 2018. https://www.cbc.ca/news/technology/citizen-lab-netsweeper-internetfiltering-tech-censorship-1.4631243.

Freedom House. 2018. "Freedom on the Net 2017: Manipulating Social Media to Undermine Democracy." Accessed May 25, 2020. https://freedomhouse.org/sites/default/files/2020-02/FOTN_2017_Final_compressed.pdf.

Glaser, April. 2017. "Apple and Amazon Are Helping China Censor the Internet." Slate. Accessed July 21, 2018. http://www.slate.com/blogs/future_tense/2017/08/02/apple_and_amazon_are_helping_china_censor _the_internet.html.

Ritzen, Yarno. 2018. "Cameroon Internet Shutdowns Cost Anglophones Millions." Al Jazeera. Accessed May 25, 2020. https://www.aljazeera.com/news/2018/01/cameroon-internet-shutdowns-cost-anglophones-millions-180123202824701.html.

Talmadge, Eric. 2017. "North Korea Is Going Online—Sort Of." Global News. Accessed July 22, 2018. https://globalnews.ca/news/3852274/north-korea-internet-smart-phones/.

CANADA

Canada applies minimal control to the internet and allows free access for its citizens. User rights are not unlimited, however; they must comply with national and local laws, which prohibit certain types of offensive or illegal content. As digital technologies continue to evolve, Canada wants to address them early with frameworks and regulations that allow for some flexibility while upholding online freedom of

speech and expression. Some of these efforts are not without controversy; recent pushes to overturn the country's net neutrality laws as well as technology exports that are used to censor the internet abroad challenge Canadian values.

Canada's internet has been ranked "free" on lists that calculate the degree of internet freedom permitted in a country. Freedom House's Freedom on the Net (2018) ranks Canada highly, at the fifteenth position, noting that there are few obstacles to access in the country and very limited restrictions on content. This ranking surpasses that of its neighbor, the United States. Canada would likely place higher on the list if it reached more citizens; internet penetration reaches about 90 percent of the population, with different demographics having varied internet usage preferences. The internet is integrated into many lifestyles, often daily.

Canada declared the internet a basic telecommunications service in 2016. In order to make this declaration a reality, the country also started to pursue universal internet access, which would translate into the entire population having access to the internet. One of the major barriers to universal access is Canada's geography. Remote rural areas, especially in the northern territories where populations are small and spread out, have limited telecommunications infrastructure. Thus, equipping these communities with internet access points and cables is difficult and expensive. Where the internet does exist, it is often slow in comparison with Canadian cities. The government is working to overcome these barriers, trying to ensure that even remote, rural populations have internet access and that Canada accomplishes the goal of universal access.

Whether fast or slow, Canada's internet is almost entirely uncensored. The government rarely blocks internet content, but it does block content that violates the law. Project Cleanfeed Canada, which began in 2007, involves a coalition of domestic internet service providers that block child pornography hosted outside the country. In 2017, it developed a new tool, Project Arachnid, to identify illegal content and request its removal. In its first six weeks, Arachnid identified over 5 million unique websites hosting illegal material (Kenny 2017). Other laws exist that allow for content blocking. A 2016 law requires ISPs to block gambling sites, although it has not been implemented. The law has been the subject of several court cases, and though the provincial level has offered several rulings, such as initially determining the law unconstitutional and, later in 2019, starting to update gambling laws to allow Canadian-hosted gambling sites holding government-approved permits. There has not yet been a federal-level determination, however, and no prosecutions have resulted in guilty pleas or sanctions.

Other reasons exist for content removal. Certain types of speech, such as those classified as hate speech, libel, or those advocating terrorist acts, are punishable under Canada's criminal code. These speech forms are not protected under Canada's freedom of speech right because they either do harm or advocate harm against others. Canada upholds copyright laws, which can lead to content removal. Taking a different approach to website liability than the European Union, in 2004, Canada decided that websites were not liable for content posted by users. However,

they have the obligation to pass copyright violation notices onto users. In Quebec province, commercial websites must be in the French language. When they are not, they must be translated or incur a fine. Websites that cannot afford translation often self-censor to avoid penalties.

Changes may be coming for the internet in Canada; new government regulations may curtail some aspects of freedom of expression online through its new Digital Charter. The document aspires to hold online media platforms accountable for the spread of illegal speech acts rather than to monitor citizens' speech more widely. The Digital Charter, announced in 2019, has ten principles, including universal access; safety and security; control and consent; transparency, portability, and interoperability; open and modern digital government; fair competition; data for value and societal strengthening; strong democracy; freedom from hate and extremism; and enforcement and accountability (Government of Canada 2019a).

The plan appears to have been dually inspired by the inability of media platforms to remove fake news and disinformation, false information that is intentionally spread, and the massacre in Christchurch, New Zealand, where a bigoted zealot murdered fifty-one people at two mosques while livestreaming over Facebook. Justin Trudeau (1971–), the Canadian prime minister, signed the Christchurch Call to Action in 2019, a document allying governments and technology companies to stop the spread of online rhetoric calling for violence and terrorism (Prime Minister of Canada 2019). Details on how the new charter will function are slim. Many online activists believe they will ultimately lead to increased censorship.

Another area of concern for the Canadian internet involves net neutrality, the idea that ISPs do not discriminate between internet sites or communications. Canadians, as well as the Canadian government, have generally supported net neutrality. However, pushes from industry, such as Bell Media and other big media companies, have campaigned to remove net neutrality protections. They claim that the removal of net neutrality would allow companies to identify and remove piracy sites more easily, although the removal of net neutrality is really about allowing companies to control what content is viewed and to slow bandwidth access to streaming sites, including legitimate, paid services.

The U.S. turnover of its net neutrality law emboldened these companies to ask Canada to follow suit. Legislators took a different approach to the United States' actions: they signed a resolution to recommend incorporating net neutrality in the law (House of Commons 2018). For the present, Canadians enjoy internet access that cannot be censored or restricted by ISPs. However, the debate and conversation have not yet been decided, meaning that the possibility of overturning net neutrality exists. The existence or defeat of net neutrality will shape Canada's future internet usage, playing an important role in internet access and control, or lack thereof, for its citizens.

Ironically, Canadian companies have contributed to diminishing internet freedom around the world. Netsweeper, a company based in Waterloo, Ontario, created an internet-filtering technology to help filter out objectionable content from the Web. At least ten countries use the technology to censor content, ranging from

news to LGBTQ resources to other sensitive topics. These countries include the United Arab Emirates , Bahrain, Yemen, Kuwait, Qatar, Sudan, Somalia, India, and Pakistan (Braga et al. 2018). Other sources estimate that the tool blocks content, particularly content deemed "alternative lifestyle," in more than thirty countries.

In early 2019, Netsweeper announced that it had removed the alternative lifestyles category from its system after backlash from Canadians and other people worldwide. Netsweeper's original inclusion of the filter category contradicts multiyear efforts by the Canadian government to defend human rights—including those involving the digital space—around the globe. Since 2016, the Canadian government has spent more than C$1.75 million to protect human rights and human rights defenders, including bloggers and cyber activists working on human rights causes (Government of Canada 2019b). The ethical question of whether a Canadian-based company must comply with Canadian values when exporting abroad, assuming it has complied with the law, has not been asked. Few other countries have posed this question to themselves, despite the answer having repercussions for internet access and control.

Canada has many freedoms when using the internet. There are few obstacles to access, with the government exerting minimal control and expressing few reasons to impede access. When it does, the government intervenes solely to uphold the country's laws and obligations to protect its citizens. Freedom of speech and freedom of expression are unlikely to face any serious threats in the near future. There are domestic discussions and debates that will start shaping the future of Canada's digital technologies, such as those surrounding net neutrality and the new Digital Charter, as well as actions abroad that may impact future decision making.

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Further Reading

Braga, Matthew, Nahlah Ayed, Dave Seglins, Julian Sher, and Michelle Gagnon. 2018. "To Censor the Internet, 10 Countries Use Canadian Filtering Technology, Researchers Say," CBC News. Accessed September 2, 2019. https://www.cbc.ca/news/technology/citizen-lab-netsweeper-internet-filtering-tech-censorship1.4631243.

Freedom House. 2018. "Canada." Accessed September 2, 2019. https://freedomhouse.org/report/freedom-net/2018/canada.

Government of Canada. 2019a. "Canada's Digital Charter in Action: A Plan by Canadians, for Canadians." Accessed September 2, 2019. https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00109.html.

Government of Canada. 2019b. "Voices at Risk: Canada's Guidelines on Supporting Human Rights Defenders." Accessed May 25, 2019. https://www.international.gc.ca/world-monde/assets/pdfs/issues_development-enjeux_developpement/human_rights-droits_homme/rights_defenders-guide-defenseurs_droits_en.pdf?_ga=2.63267501.308881419.1590434707-35041923.1590434707.

House of Commons. 2018. "The Protection of Net Neutrality in Canada: Report of the Standing Committee on Access to Information, Privacy and Ethics." Accessed May 25, 2020. https://www.ourcommons.ca/Content/Committee/421/ETHI/Reports/RP9840575/ethirp14/ethirp14-e.pdf.

Kenny, Kelly. 2017. "OPP Tackling Child Pornography throughout Province, Including Muskoka." MuskokaRegion.com. Accessed September 2, 2019. https://www.muskokaregion.com/news-story/7374354-opp-tackling-child-pornography-throughoutprovince-including-muskoka/.

Prime Minister of Canada. 2019. "Canada Joins Christchurch Call to Action to Eliminate Terrorist and Violent Extremist Content Online." Accessed May 25, 2020. https://pm.gc.ca/en/news/news-releases/2019/05/15/canada-joins-christchurch-call-action-eliminate-terrorist-and-violent.

CUBA

Cuba has the most restrictive internet access in the Northern Hemisphere. Its government controls the media and severely limits the rights of expression and the press; it intends to protect the state monopoly over information, similar to countries such as North Korea and, to a lesser extent, China. Control over information allows the state to perpetuate its ideology uncontested, because people are blocked from the perspectives and beliefs prevalent in other parts of the world. In addition to these restrictions, the lack of internet access also plays a role in the limitations surrounding access to information; cost is an additional factor inhibiting access. Recent events suggest that the Cuban government is loosening some of its control over internet access. Between the efforts of the national telecom provider and the population's quest to obtain access, Cuba's internet is undergoing changes at the highest levels and is poised to connect the island more closely with the rest of the online world.

Cuba's restrictive internet regulations demonstrate the country's need to control communications. Current regulations allow the government to monitor all traffic and access points. They allow for government-approved office connections but prohibit home internet connections to prevent citizens from employing techniques to obscure their identities. Apart from supposed anonymity and the use of pseudonyms online, Cubans have few methods to go online without being identified. Tools such as virtual private networks can assist in online anonymity, but they require downloading and installation, a feat that the current system prohibits. However, there are indications that this situation is changing. Etesca, the national telecom corporation, claims to have installed around 15,000 DSL lines in homes in 2017, with plans to complete 50,000 installations by the end of 2018 (Cubacasas 2018). The company also announced plans to permit internet on Cuban cell phones; by the end of 2019, it claimed to have connected more than 3 million mobile phones to internet data packages. Access via mobile phone will increase the number of people who have internet access.

The situation surrounding internet access and control has improved in recent years. Since 2015, more Cubans have gained the ability to access the internet. Through 2014, approximately 5 percent of the population could access the internet. The restrictions still applied; often, access remained limited to approved offices. In 2015, the government installed Wi-Fi hotspots in cities, primarily in

parks and some hotels. Initially, the government installed 200 hotspots; by mid-2018, over 650 hotspots exist, covering parks and other public areas (Cubacasas 2018). Government statistics attest that 40 percent of Cubans had internet access as of mid-2018 (Urrechaga 2018).

This progress may be attributed to Decree 209/1996, Access from the Republic of Cuba to Information Technology Networks with a Global Reach, which guarantees full access to the internet starting mainly with institutions and spreading to the population at large. It also aligns with the United Nations' International Telecommunications Union (ITU) and its Connect 2020 Agenda that focuses on increasing internet access and reducing associated costs. Cuba, as a member of the United Nations and the ITU, would need to update its internet-access policies to achieve the agenda's goals. Pressure to open internet access also likely occurred when U.S. President Barack Obama (1961–) restored diplomatic relations with Cuba at the end of 2014, which portended to lessen economic sanctions and promote tourism.

A study in late 2017 revealed that Cuba's internet had less censorship than anticipated. Xynou, Filastò, and Basso (2017) probed the internet from multiple access points in Havana. They determined that only forty-one websites were inaccessible, with only the unsecured versions of the websites being blocked. These blocked sites primarily contained information that criticized the government. The research confirmed the blocking of Skype, but not Facebook or WhatsApp. Google was also not accessible, although the researchers confirmed that it was the company that blocked its own search engines rather than the government. Another interesting finding was that China had some involvement in developing the country's internet technology (IT) infrastructure. While these results might be different in other parts of the country, or may only demonstrate the state of Cuba's internet as a snapshot for a specific point in time, they suggest that Cubans are able to access the majority of the internet. However, the government maintains its vigilance online; it still monitors Cuba's internet traffic, and penalties for violations are not clear.

In response to Cuba's heavy-handed control, the country's citizens have started several grassroots initiatives to circumvent internet restrictions. One effort is the Paquete Semanal, or Weekly Packet, that originated in the 1980s to avoid the government-controlled, heavily politicized, state-owned news media. The Paquete was a compilation of banned movies that circulated periodically. It started with the entrance of Betamax videos and continued through VHS tapes and DVDs. When computer technologies arrived in the country, the Paquete changed its distribution to a USB drive that is copied, sold, and circulated almost weekly. It distributes approximately one terabyte of censored digital files across the country (San Martín and Cabrera 2017). The contents of this drive allow the people access to otherwise-inaccessible ideas and programs. A potential competitor, La Mochila, or the Backpack, started in 2014 as a more official replacement, but it has never attained the same popularity. Ultimately, the Paquete keeps the population informed of external events and exposes them to new ways of thinking.

An elaborate response to strict government control is the invention of the Street Network, or SNET. SNET started in 2011 when local people cobbled together

smaller local-area networks (LANs) to form a larger network that connects the computers without being connected to the internet; today it encompasses an estimated 150,000 residents. SNET upholds many standards that the government applies to internet access with the exception of the access itself. It bans pornography and foul language, and it prohibits illegal searching and posting, while allowing gamers access to globally popular online games. While SNET users have enjoyed this low-cost network access, the system is not without its flaws. An incident at the end of 2017 caused the networked communities to establish some definite borders. One of the community networks accused another of stealing its data and blocked users from that node from accessing their content. The nodes quickly divided into two factions, blocking their respective services from the other side (Carralero Burgos 2017). The conflict has the potential to fracture the SNET and the connected online communities. If that occurs, the people's access to information will be further restricted.

Another form of resistance occurs through local entrepreneurs who have established business practices that extend internet access to more people. One practice is to resell accounts granted with the state's telecom provider. Reselling these accounts grants the purchaser, or multiple buyers, the ability to access Wi-Fi hotspots at lower costs and without an approval process. This method is less effective for those who need more than a few minutes online, as Cuba sells internet access by time. However, it is more cost-effective; the average price of one hour of internet access is US$1. Compared to Cuba's average monthly income, which is around US$30, internet access is cost-prohibitive without less expensive options (Reuters 2018). There are other people willing to share access credentials, which increases internet availability, although this option does not circumvent the time limits placed on access credentials. Another practice involves installing special Wi-Fi extenders to increase the hotspot's range.

One of the effects of strict internet access regulations is that Cubans became isolated from the knowledge stored on the internet. While not all websites have an educational value, many contain or are repositories for the increasing amount of scientific knowledge, from studies to technological advancements. The Cuban government has recognized the need to connect their students and professionals not only with that knowledge but also with other professionals to increase collaboration and knowledge exchange. To address the knowledge gap, the government has established a health portal and special network for medical professionals called Club Coopera, or Club Cooperate. It has established a similar portal for its schools, Cuba Educa, or Cuba Educates. The portal provides special sections for school subjects to offer additional academic support to students, teachers, and parents. These programs promote information sharing and knowledge transfer, which keep with the original vision of the internet as a platform for the free exchange of information across boundaries.

While Cuba has had a reputation as one of the most restricted environments for communications with the outside world and maintains its status as the most restricted country in the Northern Hemisphere, the government's activities related

A group of Cuban men share access to a Wi-Fi connection on an Aguilera street in Guantanamo. Cubans have devised multiple ways to access the internet through sharing credentials at sanctioned Wi-Fi hotspots and developing creative means to establish or extend unsanctioned Wi-Fi areas. The increasing access to the internet suggests that more Cubans are able to get online despite what appear to be lessening, albeit still existing, policies to control access within the country. (Matyas Rehak/Dreamstime.com)

to telecommunications indicate that the country is in the midst of a major change. Internet access is more widely available and continues to become more accessible through 2020. Although prohibitively expensive and often slow, access that was once impossible is now available in many public spaces. The national telecom provider's announcement that internet will be available on mobile phones suggests that the government will continue to increase access. It has not stated whether it will monitor these communications. The government's historical involvement in the control of information suggests that meeting popular demand for internet accessibility and availability may not promote greater internet privacy.

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Further Reading

Carralero Burgos, Ernesto. 2017. "La Comunidad Inalámbrica SNet Se Divide En Medio de Una Fuerte Crisis." Diario de Cuba. Accessed July 15, 2018. http://www.diariodecuba.com/cuba/1512776932_35829.html.

Cubacasas. 2018. "WiFi Zones in Cuba." Accessed July 15, 2018. http://www.cubacasas.net/internet/.

Reuters. 2018. "Communist-Run Cuba Starts Rolling Out Internet on Mobile Phones." *Japan Times*. Accessed July 17, 2018. https://www.japantimes.co.jp/news/2018/07/17/business/tech/communist-run-cuba-startsrolling-internet-mobile-phones/#.W05-QdJKjIU.

San Martín, Augusto César, and Rudy Cabrera. 2017. "Los Verdaderos Padres Del Paquete Semanal." Martí Noticias. Accessed July 15, 2018. https://www.martinoticias.com/a/cuba-los-verdaderos-padres-del-paquetesemanal/157121.html.

Urrechaga, Raimundo. 2018. "Feature: How Cuba Is Boosting Access to the Internet." Xinhua. Accessed July 15, 2018. http://www.xinhuanet.com/english/2018-03/26/c_137066142.htm.

Xynou, Maria, Arturo Filastò, and Simone Basso. 2017. "Measuring Internet Censorship in Cuba's ParkNets." Open Observatory of Network Interference. Accessed July 17, 2018. https://ooni.torproject.org/documents/cuba-internet-censorship-2017.pdf.

ESTONIA

Estonia, a small nation in the Baltic region, prizes its position as either the top or second to the top on annual lists that rank internet freedoms. In some ways, the open, free internet is a symbol of freedom and democracy, essentially much more than a communications tool or an information-sharing portal. The country generally has no obstacles to access and few limits on content, and it rarely, if ever, violates user rights; it also has strong data privacy rights and protections because every citizen owns their data. Estonia is a model of how the open internet can promote freedom of expression, and the country has used the technology to deepen democracy through e-governance, where most citizens use the internet to conduct all government business.

Estonia guarantees the rights to freedom of speech and freedom of expression, rights which extend to the internet. As of 2018, Estonia's internet penetration had reached 88 percent, with a 145 percent mobile-telephone penetration (Freedom House 2018). The difficulty in reaching higher percentages revolves around rural communities that have not been adequately integrated onto the World Wide Web. To correct this imbalance, the government's goal for 2020 is to have all people less than two kilometers from an internet access point regardless of where they are located. Estonia's push to keep the internet free and open occurred in part because Estonia considers freedom of expression online to be a fundamental human right. It attributes this stance, in part, to a special report from Frank La Rue (1952), UN Special Rapporteur, in 2011 that constituted the first United Nations document to address freedom of communications on the internet (Ministry of Foreign Affairs 2017). A decade prior, in 2000, Estonia's parliament issued the Telecommunications Act and included internet access as a universal service.

Content is almost completely unrestricted in the country. Site blocking generally only occurs for sites that violate the Gambling Act. Internet gambling sites, whether hosted locally or internationally, must acquire a permit to operate in Estonia. Because many online sites are accessible online regardless of permit, the government blocks sites that are in noncompliance with the law. The government

openly shares a list of these sites with the public, and the list contains approximately 1,300 websites. Beyond these gambling sites, there are no other efforts to block websites. Content itself is rarely removed, and content that is removed is usually taken down due to violating the law. Generally, websites can assume liability for the content of third-party actors if they host it. Therefore, in order to reduce liability and lawsuits, most websites have a code of conduct. Posts that violate that code are taken down as part of the site's enforcement procedure. It also lessens the liability the site takes on for hosting comments. The codes of conduct have sparked conversation about what it means to act politely and follow social norms online, especially as so many of the country's citizens are able to interact virtually.

A new law adopted by the European Parliament may add restrictions to content in Estonia. The law will affect all members of the European Union, including Estonia, which abstained in the vote. Article 17 is a copyright directive that adds special filters on websites to check whether the uploaded content complies with copyright law. When the law passed in March 2019, it gave governments two years to implement the new directive. At present, how the filters will determine whether content infringes on copyright is unknown. Many internet users believe that this law will limit the amount of content that they access. In Estonia, since sites can be held liable for third-party content, they will have more reason to remove content. They may apply arbitrary rules and, depending on the standards applied through the law, may restrict freedom of expression online, which is against the Estonian view of internet access as a human right. There's also the possibility that examining content to identify that which must be removed or censored will take larger amounts of dedicated resources. As such, smaller websites may find it more challenging to compete with larger, international platforms without penalty.

It is not immediately clear why Estonia abstained from voicing an opinion on this directive. From the final voting results listed on several websites, only one of Estonia's six members of the European Parliament (MEPs) voted for Article 17, with four voting against and one abstaining (#SaveYourInternet 2019). Generally, a vote of one for, four against, and one abstention would appear that the majority voted against the bill, yet Estonia's vote counted as an abstention for Article 17. The Ministry of Justice did publicly acknowledge the abstention several weeks after the vote. However, since the European Parliament passed the directive, Estonia is required to enforce the new measure once the details and requirements are clear. Generally, Estonia has always supported copyright law.

In 2018, in a precursor to the copyright bill, which took over two years to develop and negotiate within the European Parliament, European Commission Vice President Andrus Ansip (1956–), an Estonian from the Reform/ALDE party, proposed wording to a copyright law intended to ensure fair remuneration to content creators and lessen the power of the proposed upload filters. The bill remains extremely controversial. Online activists and technology companies protest it, because it allows websites to filter content more ambiguously, leading to arbitrary censorship. Ansip, after seeing the bill pass at the European Parliament, resigned his European Commission seat in June 2019 to accept a position on the European Parliament.

Another factor that supports Estonia's free internet is privacy. Estonia's Digital Agenda 2020 is developing a framework for Estonian internet users to know what personal data is collected and accessed and will give them significantly more control over what data the public sector can access. When someone accesses personal data, that access is logged. Violations of privacy, such as access to data by an unauthorized person, is a criminal offense. Estonia has had few of these incidents, but they do include a woman working with the police department who accessed her boyfriend's data. She was convicted of a felony for that privacy breach (Orton-Jones 2019). There are also hints of a prosecution of a political candidate who accessed potential voters' information. Interestingly, because personal information is so protected, it is difficult to obtain details about these cases other than references to them. As part of increasing the levels of online privacy that individuals have, online anonymity is unrestricted. Anyone can use the internet anywhere, and people can do so without prior registration or fear that significant amounts of personal data are being collected on their devices, online habits, or online acquaintances.

Estonia's internet access is so ubiquitous that the country has the most advanced e-governance system of anywhere in the world. Ninety-nine percent of government services are accessible online, including voting. One challenge of having everything online is that the information becomes valuable to hackers. While Estonia is world renowned for its cybersecurity capabilities, it still wants to address vulnerabilities quickly. A government announcement in 2017 about a cybersecurity flaw in the country's national identification cards surprised Estonians. Developers quickly fixed the flaw, and voters were able to use their cards online to vote in the 2017 municipal elections.

Along with e-governance, there is also an e-residency program. Anyone can establish Estonian residency online from anywhere in the world as long as they meet basic requirements and pay a fee. This program grants an Estonia ID card and provides the same protections that a European Union citizen would receive. As of 2019, Estonia had enrolled approximately 55,000 e-residents, with people from 154 countries applying for the program. The goal is to enroll 10 million e-residents by 2025, which accomplishes a goal set in 2014 to increase Estonia's population (European Commission 2019). E-residency allows people to start businesses in the country, which in turn has the potential to boost its economy. Estonia has birthed several well-known technology companies; Skype, later purchased by Microsoft, is one of the best-known companies originating there.

Estonia is a model for the free and open internet, ranking highly on every list that calculates internet freedoms worldwide. Laws in the country allow for almost entirely unrestricted communications and information sharing. The internet has become such an important part of domestic life that the government now operates almost entirely online. Although internet usage is a human right in the country, it may not always be as unlimited as in the past; legislation, such as the new copyright directive, will have an impact on internet expression. The extent of that impact is not yet known. Overall, until such time as there are changes to Estonia's

internet openness, the country's internet usage most closely resembles how the internet's inventors viewed it, allowing the open sharing of information.

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Further Reading

European Commission. 2019. "Digital Economy and Society Index (DESI) 2019 Country Report: Estonia." Accessed September 1, 2019. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=59894.

Freedom House. 2018. "Estonia: Internet Freedom Score." Accessed September 1, 2019. https://freedomhouse.org/report/freedomnet/2018/estonia.

Ministry of Foreign Affairs. 2017. "Internet Freedom." Accessed September 1, 2019. https://vm.ee/en/internet-freedom.

Orton-Jones, Charles. 2019. "Estonia: The Inside Story of Building a Digital Nation." Chartered Management Institute. Accessed September 1, 2019. https://www.managers.org.uk/insights/news/2019/june/estonia-the-inside-story-of-building-a-digitalnation.

#SaveYourInternet. 2019. "Estonia." Accessed September 1, 2019. https://saveyourinternet.eu/ee/.

ETHIOPIA

Located on the Horn of Africa, Ethiopia is one of the world's least connected countries, with an internet penetration rate at around 15 percent and some estimates even lower. Since the internet arrived in the country, it has been closely regulated. As the sole owner of the only telecommunications company in the country, the government, supported through the country's legal framework, has enforced policies that permit active censorship and restrict online content. Since 2018, with the election of the country's new prime minister, sentiment in the country appears to have changed. The government has expressed greater openness to internet freedoms and has backed this idea with several actions that support media freedom online and offline. While Ethiopia's future with the internet may be shifting away from its past restrictions, there remains the fear that the country will return to old patterns, especially as it has reinstated internet blackouts during periods of discontent and unrest.

Most ranking systems on internet freedom classify Ethiopia as "not free" or otherwise rank it low for restrictions on freedom of speech online and offline. Freedom House's Freedom on the Net (2018) gives it eighty-three out of one hundred points, which places it in the entirely unfree category. More specifically, the report classifies the country as having almost completely blocked or restricted access and significant limitations on content and reports that it commits a high percentage of violations against user rights (Freedom House 2018). According to the Reporters without Borders rankings, Ethiopia placed 110 in 2019 for freedom of information and the internet. While this ranking is relatively low, it is actually significantly higher than its 2018 score, which ranked Ethiopia as 150 of 180 countries. The change shows that the rating system has captured significant improvements towards greater internet freedom, while also pointing out that the country has even more room for additional improvements.

The Ethiopian government has a history of shuttering the internet in times of social and political turbulence. It can do so due to the 2011 Freedom of Mass Media and Information Act, as well as the 2016 Computer Crime Proclamation, which together provide legal standing for the government to control the internet with a heavy hand. Since 2015, the government has blocked the internet at least twice a year, generally in response to political unrest and national emergencies or to curb cheating on examinations (Dahir 2019). In some cases, its decision to block the internet is not explained. From 2017 to 2018, most areas outside of Addis Ababa, the capital, had no access due to a government-sanctioned shutdown. Since 2017, the internet goes down for a week every June during major exam time. Although the outage is not usually explained, citizens have come to believe that the blockage curbs cheating on major national exams. There is precedent for using the internet to cheat. In 2016, Ethiopia reportedly canceled national exams and banned social media when it noticed university exams posted online; while social media was inaccessible, local populations also indicated that the blockage extended well beyond it to other media (BBC 2017). Along these lines, the government prohibits all voice over internet protocol technologies.

The Ethiopian government controls and manages the only internet service provider in the country. For this reason, it has complete control over the internet and the majority of content that people can access. Censorship and content filtering have been common since internet connections became available in the country. There are laws in place to prosecute individuals who use defamatory or violent language. Website owners can be held liable for illegal content on their site, leading to self-censorship and the removal of potentially offensive content. Blocking or, in some cases, filtering content is common.

At the national level, EthioTelecom, the state-controlled monopoly over phones and the internet, blocks websites using two different methods. The first is to block an IP address directly. This process allows the company to preselect sites, determine their numerical IP number, and enter it into a filtering system. The second way is to use deep-packet inspection, or DPI, which runs keyword searches on content. When it identifies censored words, it then blocks the site or sometimes only the page containing the objectionable term. Content filtering is not a transparent process; the government never issued rules or guidelines to explain how sites or keywords lead to content blocking. In some instances, the company or an official can reach out to a content producer and request that certain content be removed, or the individual can be sanctioned.

Ethiopian political elites have relied on troll armies to push their agendas, promoting party politics and denying criticism related to the country. In late 2017 and early 2018, a trove of documents leaked that showed how top government officials and party members had paid commentators to post content online, like employing a troll army to push their viewpoints and make it appear that their ideas were very popular countrywide. In the local language, Amharic, these trolls are called *cocas*, something akin to a "contemptible cadre" (Endalk 2018). Other reports suggest the government has used trolls previously; in 2014, an Ethiopian newspaper reported

A screenshot of the Ethiopian government portal. The Ethiopian government retains complete control over internet access in the country through the management of the country's only internet service provider (ISP). Through this control, the government frequently mandates internet shutdowns, which have been performed for various reasons including alleged cheating on testing and inhibit reactions to social and political developments, such as attempted coups to overthrow the government. (Jarretera/Dreamstime.com)

that the government had trained 235 bloggers to open social media accounts and use them to support government interests (ECADF 2014).

Shedding some of its previous restrictive policies against the media, in 2018 newly elected prime minister Abiy Ahmed (1976–) released the journalists and bloggers detained under previous regimes. He also reinstated some previously blocked news websites and permitted diaspora-owned media channels to operate freely in the country. The unblocking of more than 200 websites occurred in conjunction with Abiy's pronouncement that freedom of speech is a fundamental right. Unfortunately, this speech occurred the same day as an attempted coup, which led the government to shut down the internet and interrupt text messaging and telephone services. The blackout included the social media sites WhatsApp, Telegram, and, at least for part of the outage, Facebook. While the speech reflected progress toward a freer and more open internet, the coup caused the government to fall back on its pattern of restricting communications during times of real and potential social unrest.

Reports that internet access and control are improving is positive for Ethiopia's economy, especially for its e-commerce and technology development efforts. However, many barriers to access remain. These barriers include a limited number of

connection points scattered throughout the country, making access uneven; slow bandwidth rates; frequent disconnections due to growing demand on an outdated network; frequent power outages; discrepancies between urban and rural telecommunications and services; and the costs associated with internet service plans as well as the devices needed to connect.

Despite these barriers and the fear that the country will slip back into old patterns of censorship and tightly controlled internet access, the newly empowered regime has made progress on media freedom. In Prime Minister Abiy's first year in office, the country went from being the lead jailor of journalists on the entire continent to jailing none at all (Human Rights Watch 2019). Under his guidance, the government has indicated that it will enact an anti–hate speech law to combat the rising volume of hate speech online that provokes ethnic discord. Abiy has also expressed interest in revising the laws, such as the 2011 Freedom of Mass Media and Information Act, that actually restrict expression. In addition, the government hosted the Forum on Internet Freedom in Africa, or FIFAfrica, in late 2019, bringing together hundreds of people from around the world to discuss internet rights. Ethiopia has also made overtures to the African Union to promote regional dialogue and partnerships to address outstanding concerns related to the internet and other emerging technologies. The newfound interest in international collaboration and information sharing suggests that Ethiopia wants to harness the potential of the internet and wants to understand how to do it in a context that preserves internet freedoms.

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Further Reading

BBC. 2017. "Ethiopia Blocks Internet to 'Stop Cheats.'" Accessed September 3, 2019. https://www.bbc.com/news/technology40118378.

Dahir, Abdi Latif. 2019. "Ethiopia's Tech Startups Are Ready to Run the World, but the Internet Keeps Getting Blocked." Quartz Africa. Accessed September 3, 2019. https://qz.com/africa/1646789/ethiopia-tech-startups-hurt-by-social-media-blockinternet-shutdown/.

ECADF. 2014. "Ethiopia Trains Bloggers to Attack Its Opposition." Accessed September 3, 2019. https://ecadforum.com/2014/06/07/ethiopia-trains-bloggers-to-attack-its-opposition/.

Endalk. 2018. "Leaked Documents Show That Ethiopia's Ruling Elites Are Hiring Social Media Trolls (And Watching Porn)." Global Voices. Accessed May 25, 2020. https://globalvoices.org/2018/01/20/leaked-documents-show-that-ethiopias-ruling-elites-are-hiring-social-media-trolls-and-watching-porn/.

Freedom House. 2018. "Ethiopia." Accessed September 2, 2019. https://freedomhouse.org/report/freedom-net/2018/ethiopia.

Human Rights Watch. 2019. "Ethiopia: Abiy's First Year as Prime Minister, Review of Freedom of Expression." Accessed May 25, 2020. https://www.hrw.org/news/2019/04/03/ethiopia-abiys-first-year-prime-minister-review-freedom-expression.

Reporters Without Borders. 2019. "Ethiopia." Accessed September 2, 2019. https://rsf.org/en/ethiopia.

IRAN

Internet access in Iran is characterized by strong censorship, limited access, surveillance, and widespread state-sanctioned propaganda. The regime in Tehran views internet freedom as a critical threat to its national security (Henry, Pettyjohn, and York 2014). Using an index of variables such as obstacles to access, limits on content, and violations of user rights, the nongovernmental organization Freedom House rates Iran's internet access as "not free" (Freedom House 2018). On a scale of zero to one hundred, where zero is "free" and one hundred is "not free," Freedom House scores Iran at an eighty-five, making it the least free nation in the world in terms of internet access (Freedom House 2018).

Due to the nature of the Iranian regime, which is highly authoritarian and closed to outside influences, it can be difficult to get accurate and reliable information on internet availability and usage in the country. Despite the regime's desire to control all information being shared within the country, official sources reveal that much of the population is active in cyberspace. As of 2019, the Iranian population was estimated at over 80 million (World Bank 2019), and the country had the second-largest economy in the Middle East (CIA 2019). While estimates vary, of this population, over half are estimated to be active internet users (Mehr News 2018; Internet World Statistics 2018). According to TechRasa, a technological entrepreneur website run by Iranians living outside Iran, the Statistical Center of Iran reported that over 59 percent of households in the country had internet access in 2016 (Jafari 2016). The encrypted messaging tool Telegram is one of the most widely used social media applications in the country, followed by Instagram, WhatsApp, and Facebook (Freedom House 2018). Popular websites among the Iranian population also include Google, YouTube, and Yahoo (SimilarWeb 2019).

Iran's information and communication technologies (ICT) infrastructure is controlled via a state-owned enterprise, the Iranian Telecommunications Network. Another state-owned enterprise, the Telecommunications Infrastructure Company, "is the exclusive provider of internet bandwidth" and internet traffic flowing in and out of Iran (Small Media 2015). Iran's Information Technology Organization, housed under the Ministry of Information and Communications Technology, is responsible for policies affecting internet usage in the country (Freedom House 2018). In accordance with Tehran's interpretation of Islamic law, Iran's legislative framework blocks internet activity it deems a threat to national security or moral values (Immigration and Refugee Board of Canada 2015). Internet service providers are required to include filters that stop non-Islamic content from being viewed, and all websites must be registered with the Ministry of Culture and Islamic Guidance (Freedom House 2018).

Censorship and Surveillance

The Iranian regime has created some of the most active and controlling government institutions in the world for censoring internet content and surveilling its citizens.

Iranian censorship of internet activity takes a multitude of forms, including blocking websites, filtering information from websites, removing search results, throttling bandwidth, hacking websites, and actively punishing internet offenders. Iran also touts a record of extralegal intimidation and state-sanctioned violence against political activists who use the internet to promote their agenda (Freedom House 2018).

The first state-sanctioned website blockage in Iran began in 2003 (Michaelsen 2018). From that period forward, the regime began to centralize its censorship and surveillance apparatus (Michaelsen 2018). Internet filtering began in 2005 (Freedom House 2018), but massive government protests in 2009 sparked a decisive shift in the regime's control over the communications infrastructure (Michaelsen 2018). After the 2009 elections, in which the internet played a prominent role in an opposition movement, Iranian leaders revised the legal code to include issuing strict guidance to news websites and social media channels, as well as how to cover political events in the country (Freedom House 2018). This sanctioning included the state's blockage of Tor, a free and open-source software that enables anonymous communication (Tor Blog 2011).

In the wake of the Arab Spring, Iran's supreme leader created the Supreme Council of Cyberspace, which was designed to oversee three censorship organizations: the Committee for Determining Offensive Content, the Iranian Cyber Police (FATA), and the Revolutionary Guard Cyber Defense Command. The first two organizations police Iranian citizens. The Committee for Determining Offensive Content maintains and updates lists of offensive websites, while the FATA enforces the rules set forth by the committee. The Revolutionary Guard Cyber Defense Command takes a proactive approach to defending the country against cyberattacks and malware (Aryan et al. 2013).

The FATA conducts surveillance by monitoring Iranians' online activities and prosecuting dissidents (Aryan et al. 2013). ISP bandwidth throttling regulates traffic and minimizes congestion by slowing the speed of the network. In Iran, officials throttle internet traffic during times of national upheaval or mass protests (Freedom House 2018). In 2018, Iranian clerics banned the popular messaging application Telegram in an effort to promote messaging applications created by Iranians. To circumvent the harsh restrictions on popular applications and websites, a large percentage of Iranians use virtual private networks, antifiltering tools, and anonymity networks such as Tor. Accordingly, as of May 2019, Telegram was still the most widely used internet tool Iranians used to share news, information, debate, and conduct business (Esfandiari 2019).

Domestic Propaganda and Control

To control the flow of political information about the current regime, the Islamic Republic of Iran Broadcasting (IRIB) has co-opted the internet to disseminate its propaganda and promote the most conservative factions in the government. While the IRIB is technically independent of the Iranian government, the organization

A woman stands in front of a graffiti-painted wall that indicates the presence of an uncensored Wi-Fi hotspot in Iran. The Iranian government maintains a high degree of control over the internet, which includes filtering non-Islamic content, blocking objectionable or controversial sites, and throttling or cutting off bandwidth. Iran has a long history of imposing restrictions and sanctions related to internet access, and exerts great effort to control the information that reaches its people. (Jerome Cid/Dreamstime.com)

has a monopoly on all news services in the country and is under direct supervision of the supreme leader. In 2016, the regime introduced the National Information Network (NIN), which many in the country have dubbed the "Halal Internet" (Freedom House 2018). The NIN was part of a ten-year communications infrastructure upgrade, and to promote usership, the regime offered subscription packages to Iranian citizens at half the cost of the regular internet (Michaelsen 2018). The regime's stated intent was to create a national network that could be safe from foreign sources and immune to massive breaches. Yet, the network gives the regime more control over its citizens and strictly controls what people can access.

Counterefforts

Iran has been subject to strict international sanctions for decades. Many of these sanctions have blocked the country's ability to procure the latest high technology products and made it difficult for technology companies to accept payments for services. Despite these restrictions, the Iranian regime is a major proponent of offensive cyberattacks (Denning 2017). Furthermore, with the help of encryption devices, VPNs, and anonymity networks such as Tor, the Iranian people themselves

are highly successful at circumventing the state's restrictive policies. In an effort to undermine the Iranian regime's austere internet censorship regulations, the global community has also rallied to penetrate the society and offer internet freedom for all its citizens. One such measure is the U.S. Internet Freedom Program, run through the U.S. State Department's Bureau of Diplomacy, Human Rights, and Labor. The program offers secure communication channels and digital security training for Iran's citizens. Despite these efforts, however, Iranian citizens remain heavily sanctioned, censored, and surveilled by the state.

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Further Reading

Aryan, S., et al. 2013. "Internet Censorship in Iran: A First Look." Third USENIX Workshop on Free and Open Communications on the Internet. Accessed May 25, 2020. https://www.usenix.org/system/files/conference/foci13/foci13-aryan.pdf.

Central Intelligence Agency (CIA). 2019. "The World Factbook: Country Comparison, Gross Domestic Product." Accessed June 28, 2019. https://www.cia.gov/library/publications/the-world-factbook/rankorder/2001rank.html.

Denning, Dorothy. 2017. "Iran's Cyber Warfare Program Is Now a Major Threat to the United States." *Newsweek*. Accessed June 28, 2019. https://www.newsweek.com/irans-cyber-warfare-program-now-major-threat-united-states-745427.

Esfandiari, Golnaz. 2019. "Iran's Social-Media Struggles Laid Bare by Telegram and Cleric's Viral Moment." Radio Free Europe/Radio Liberty. Accessed June 28, 2019. https://www.rferl.org/a/iran-social-media-struggles-telegram-cleric-s-viralmoment/29879014.html.

Freedom House. 2018. "Freedom on the Net 2018: Iran." Accessed May 25, 2020. https://freedomhouse.org/country/iran/freedom-net/2018.

Henry, Ryan, Stacie L. Pettyjohn, and Erin York. 2014. *Portfolio Assessment of the Department of State Internet Freedom Program.* Santa Monica, CA: RAND Corporation.

Immigration and Refugee Board of Canada. 2015. "Iran: Government Surveillance Capacity and Control, Including Media Censorship and Surveillance of Individual Internet Activity." Accessed June 27, 2019. https://www.refworld.org/docid/550fdcc34.html.

Internet World Statistics. 2018. "Islamic Republic of Iran." Accessed June 28, 2019. https://www.internetworldstats.com/middle.htm.

Jafari, Hamed. 2016. "Iran Internet Access Reaches over 55% of Homes." TechRasa. Accessed June 28, 2019. http://techrasa.com/2016/11/02/iran-internet-access-reaches-55-homes.

Michaelsen, Marcus. 2018. "Authoritarian Practices in the Digital Age, Transforming Threats to Power: The International Politics of Authoritarian Internet Control in Iran." *International Journal of Communication* 12: 3856–3876.

Mission for Establishment of Human Rights in Iran. 2018. "Islamic Penal Code of Iran." Accessed June 28, 2019. http://mehr.org/Islamic_Penal_Code_of_Iran.pdf.

Powers, Shawn M., and Michael Jablonski. 2015. *The Real Cyber War*. Champaign: University of Illinois Press, 63–69.

SimilarWeb. 2019. "Top Sites Ranking for all Categories: Islamic Republic of Iran." Accessed June 28, 2019. https://www.similarweb.com/top-websites/iran--islamic-republic-of.

Small Media. 2015. "Iranian Internet Infrastructure and Policy Report." Accessed June 27, 2019. https://smallmedia.org.uk/media/articles/files/IIIP_Jul15.pdf#page=9.

Sreberny, Annabell, and Gholam Khiabany. 2010. *Blogistan: The Internet and Politics in Iran.* London: I. B. Tauris.

Tor Blog. 2011. "New Blocking Activity from Iran." Accessed June 27, 2019. https://blog.torproject.org/new-blocking-activity-iran.

World Bank. 2019. "Population, Total. Iran—2017. Dataset." Accessed March 17, 2020. http://datatopics.worldbank.org/world-development-indicators/themes/people.html.

Xynou, Maria, et al. 2017. "Internet Censorship in Iran: Network Measurement Findings from 2014–2017." Open Observatory of Network Interference. Accessed May 25, 2020. https://ooni.org/post/iran-internet-censorship/.

MALAYSIA

Malaysia has always controlled access to information over its information and communications technology services. In fact, the Freedom on the Net report has ranked it consistently at partly free since 2011, with 2017 being slightly freer due to increased access speeds (Freedom House 2017). In 2018, however, the government made a number of decisions that tightened access, including the introduction of a strict anti–fake news law and increased censorship of websites that criticized the government. It has also promoted self-censorship, citizens and other entities monitoring the content they post or access online in order to avoid potential conflicts with the law.

Malaysia's stance toward media access and control has existed since the country gained its independence from Britain (first, Malaya gained independence in 1957, and the other regions united to form Malaysia in 1963). Its laws over media control sometimes appear to contradict individual rights. Despite being guaranteed freedom of speech and expression in its constitution and the right to noncensored internet access in the Bill of Guarantees No. 71, the government monitors internet content and restricts access to some sites. The government controls content through multiple laws, including the Official Secrets Act, the Sedition Act, and the Communication and Multimedia Act, which allow it to block false or offensive content. However, in 2014, the Malaysian Communications and Multimedia Commission claimed it only blocked pornographic material online, which has always been prohibited by law, although researchers uncovered more than 6,000 blocked web pages and removed pieces of content containing information it did not condone (Wok and Mohamed 2017).These laws have also been used to block news websites that are critical of the government, despite criticism not being included in the legal reasons for restricting content. When information content is in question, government control supersedes the rights of freedom of speech and an open internet.

Blocking legacy and online media usually occurs with the justification that it helps maintain social harmony. In some instances, such as the blocking of all pornography and gambling sites, these decisions align with other laws and societal norms; they are not technically about censorship but about good values, and many people believe that they remove activities with undesirable attributes from society,

such as those that stereotypically surround gambling culture like drunkenness, higher crime rates, and indebtedness from society. In other cases, blocking access is not as straightforward.

For example, in mid-2017, the government blocked the Steam game store. It objected to the game Fight of the Gods by PQube, a game where players choose to fight as gods and fight against other gods from various world religions. When PQube added Jesus Christ as a new fighter, the government requested that Steam geo-block all Malaysian users, meaning that all Malaysian IP addresses would be unable to access the content. When the block did not go into effect immediately, the government blocked Steam and all websites with access to the Steam store (Stewart 2017). This block, later lifted once the game Fight of the Gods was blocked in Malaysia, represented a case where the government found the game potentially offensive to multiple religions and worried that it could destabilize religious tolerance and harmony within the country.

Malaysia's official statistics report that as of 2017, 80.1 percent of all people over the age of fifteen used the internet, demonstrating a continued increase from previous years (Mahidin 2018). Due to the government's control over the internet and content, many of the individuals and businesses that use the internet practice a form of self-censorship. They are cautious about the information that they share online and actively remove or edit content that might have legal ramifications. Media outlets often participate in self-censorship because they are held to the same legal implications if content violates the law or a government official perceives that the content is inflammatory.

In 2017, the government scolded media outlets nationwide for playing the international hit song "Despacito" by Luis Fonsi and featuring Justin Bieber, one of the top-streamed songs globally. In Malaysia, the response was severe. Religious leaders declared the song offensive and inappropriate. State-owned broadcast networks pulled the song for having vulgar lyrics. Leaders heavily encouraged privately owned stations to pull the song and apply strong self-censorship when determining what material to play. Individuals, too, received encouragement to self-censor and refrain from accessing improper material online that might violate state or religious laws as well as societal norms. The government often warns people of the importance of practicing self-censorship regularly on social media and other online forums.

In April 2018, Malaysia took another step toward tightening internet control. The government introduced an anti–fake news law under the guise of protecting society. Malaysia is a heterogeneous society, meaning that it includes people from different ethnic and religious backgrounds. There are inherent tensions that can turn violent when events ignite them, often along ethnic, racial, or religious lines, although incidents have been infrequent in the recent past. To write the initial draft law, the government invited representatives from across the government, the police, and selected representatives from nongovernmental organizations. The finalized law went into effect in April 2018 with sentences that could include large fines of 500,000 ringgit (c. US$13,0000) and six years in jail. Outlets refusing to

remove fake news would also be heavily fined. Neighboring nations Singapore and the Philippines expressed interest in following the law's implementation, using it as a possible model for enacting similar laws; in Europe, Germany had already passed an anti–fake news law.

Police immediately applied the fake news law when Salah Salem Saleh Sulaiman (c. 1972–), a Danish citizen, posted a YouTube video criticizing slow police response after a shooting. He spent a month in prison when he could not pay the fine ordered by a judge. In his video, Sulaiman claimed that the police took almost an hour to respond to the shooting, during which time the victim died. The police claimed they were on the scene within eight minutes. The police decided that Sulaiman's claims represented fake news, a decision that the legal system upheld. Interestingly, it is not clear if evidence on either side was offered to substantiate the different response times. Instead, it seemed as though the police accusation of fake news was enough for the law to apply and lead to a conviction, leading to societal concerns about the definition of fake news and the penalties of being accused under it. One thing the arrest did accomplish was to demonstrate to Malaysians and the world the seriousness of the law and the associated penalties for violating it.

Less than two months after the law became official, evidence surfaced that one of the primary motivations for instituting the law related to growing evidence in a government scandal. In June 2015, the *Wall Street Journal* reported on now former prime minister Najib Razak's (1953–) alleged embezzlement or misuse of billions of dollars from Malaysia's coffers. The scandal, named 1Malaysia Development Berhad (1MDB) after the fund involved, led Razak to push legislation quickly through the government right before the elections in early 2018. With the law, Razak and others could quash supposed fake news that could harm his campaign or shed more light on the international investigations into 1MDB. Razak's government also used the new law to investigate his challenger right before the vote (Griffiths 2018). In May 2018, Razak and his party lost the elections. This moment made Malaysian political history, as Mahathir Mohamed (1925–) regained control. He pledged to focus on Malaysia's financial situation, restitution for 1MDB, corruption, and abolishing the anti–fake news law (Star Online 2018). After his coalition officially won the election, Mahathir reduced his campaign promise to overturn the anti–fake news law and announced that, instead, the law would be reviewed and redefined as needed, stating that there must be limits to freedom of speech and freedom of the press.

Malaysia's government exerts control over the content available online and blocks access to offensive sites and information. Its efforts to exert control have increased from 2017, where researchers had noted eased controls, to 2018, with the implementation of the anti–fake news law. It continues to encourage self-censorship to allow individuals and business the first right to restrict content, despite the constitution and subsequent laws guaranteeing freedom of speech, expression, and the right to a noncensored internet. With the newly installed prime minister and coalition, the future of government access and control is under

review. Laws, such as the anti–fake news law, are unlikely to be revoked, but they may be revised using more precise definitions to determine what threshold information must meet to be considered fake and to develop appropriate sentences to punish offenders. Other restrictions, such as those currently levied on songs, movies, and other media that do not align with Malaysia's social and cultural standards, will continue to face blocking and outright removal in line with the country's historical precedents.

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Further Reading

Freedom House. 2017. "Malaysia Country Report." Accessed May 27, 2020. https://freedomhouse.org/country/malaysia/freedom-net/2017.

Griffiths, James. 2018. "Malaysia Election: Opposition Leader Mahathir Facing Fake News Charge." CNN. Accessed July 21, 2018. https://www.cnn.com/2018/05/03/asia/malaysia-election-mahathir-fake-news-intl/index.html.

Mahidin, Mohd Uzir. 2018. "ICT Use and Access by Individuals and Households Survey Report, Malaysia, 2017." Department of Statistics Malaysia Official Portal. Accessed July 20, 2018. https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=395&bul_id=bHBzbWxkWExRDlmaU81Q3R2ckRkZz09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09.

Star Online. 2018. "Dr M Vows to Abolish Certain Laws." Accessed July 21, 2018. https://www.thestar.com.my/news/nation/2018/04/04/dr-m-vows-to-abolish-certain-laws-wewill-follow-the-requirements-of-the-time/.

Stewart, Sam. 2017. "Malaysia Blocks Entire Steam Store Because of God Fighting Game." IGN. Accessed July 21, 2018. http://ca.ign.com/articles/2017/09/09/malaysia-blocks-entire-steam-store-because-of-godfighting-game.

Wok, Saodah, and Shafizan Mohamed. 2017. "Internet and Social Media in Malaysia: Development, Challenges and Potentials." IntechOpen. Accessed July 20, 2018. http://dx.doi.org/10.5772/intechopen.68848.

NORTH KOREA

For many years, North Korea has held the distinction as the least free country in the world, according to the World Press Freedom Index (Reporters Without Borders 2019). Its totalitarian government completely controls communication in the country by limiting access to telecommunications for most citizens, augmenting devices to facilitate state surveillance, and practicing strict censorship. A miniscule percentage of citizens have access to the internet. A higher, but still relatively small, percentage of North Koreans has access to the national intranet, which functions like an internet that is totally encapsulated within the border of the country. Most information that is available to the populace, both analog and digital, is carefully prepared propaganda. This tremendous censorship and control over access to information has kept North Korea at the bottom of the World Press Freedom Index for years. However, it should be noted that Turkmenistan overtook last place in 2019, pushing North Korea to the second-to-last position on the list, which contains 180 countries.

North Korea's intranet, known as Kwangmyong or *bright*, is what connects most devices in the country. Nearly all smartphones and computers are connected to this state-run web. The network is tightly guarded, which means that not much information exists about it outside the country. As of 2014, only 1,024 IP addresses existed inside the country, which has a population of about 52 million people (Andrews 2017). This network was provided by one Chinese telecommunications company and created an infrastructure that was about as big as one that a medium-sized company would use. Recently, a Russian company has provided an alternative route to this network (Trend Micro 2017). Owning a computer to access the intranet requires special permission from the government and costs about three months' worth of a typical salary. However, with the construction of the Sci-Tech Complex in 2015, the intranet has become more accessible, at least to those in Pyongyang. This facility is home to 3,000 computers and North Korea's largest e-library (Associated Press 2017).

Naenara is the Firefox-adapted browser that people use to surf the less than 170 websites available on the intranet (Associated Press 2017). Interestingly, when Kim Jong-un's (c. 1983–) name appears on a web page, it does so in a slightly larger font than the surrounding text. The only approved operating system to be found on any computers within the country is known as Red Star, which was developed by the government from open source Linux coding. Originally it was designed to mimic Windows XP, but updated versions appear more like Mac (Associated Press 2017). Several surveillance features are built into the system, most of which users are completely unaware.

For example, any attempt to tamper with the system results in an automatic reboot of the computer. Files that are downloaded from a USB drive are watermarked so that they can be traced in case the information is deemed subversive and presents a threat to the authoritarian control of the government. When outside information from places like China and South Korea makes its way into the country, it is often in the form of a USB drive. Red Star also takes regular screenshots of what is being viewed, which are stored on the computer in such a way that regular users cannot delete or even access them. However, they are there for government officials in case unauthorized activity is suspected. Penalties for watching South Korean media, listening to foreign news, or communicating with the outside can range from five years in a "reeducation" prison camp to the death penalty (Jerreat 2017). These types of activities are considered attempts to overthrow the state government.

Recently, the most common way a typical North Korean citizen experiences Kwangmyong is not with a computer but with a smartphone. Whereas even a decade ago, few people possessed a mobile phone, now there are more than 2 million mobile phones in the country (Andrews 2017) and likely many more, considering the efforts by Kim Jong-un to boost technology. High-quality phones range from US$200 to US$400, while more basic phones and used phones can cost much less (Associated Press 2017). Citizens must purchase an authorized cell phone that has been modified to only accept and make calls within the country. According to Alek

Sigley (1990–), an Australian graduate student who studied North Korean literature at Kim Ill Sung University in Pyongyang, the only person he met who did not own a smartphone was his seventy-three-year-old professor, who preferred her older-model cell phone (Sigley 2019). He also noted that while on the metro, all the passengers seemed to have their eyes glued to their smartphones, using them to browse the news, play games, or watch movies.

Sigley's observations, including that the country's intranet has become more developed, are evidence that Kim Jong-un's efforts to make science and technology a national priority have been successful. Despite the transition to a more modern economy that Sigley noted, the country remains extremely protective over its ability to control communication. About three months after Sigley published his article in the *Guardian*, which contains very basic details about his life in Pyongyang, he was arrested for "committing antiDPRK (Democratic People's Republic of Korea) incitement through internet" (Britton 2019). He was detained for a week before being released due to "humanitarian leniency," according to the North Korean government.

A local man uses his mobile phone to make a call in a Pyongyang park. North Korea, despite being considered one of the most restrictive nations for all communications systems, has seen a rise in smartphone usage and ownership, with approximately 2 million people owning one. Increasingly, these phones are accessing Kwangmyong, the North Korean intranet, which is as close to the global internet as most North Koreans ever reach; only foreigners and approved elite may access the internet from within the country. (Znm/Dreamstime.com)

The internet is accessible from North Korea, but only foreigners visiting the country and a few select elite are able to use it. The exact number of North Korean citizens who possess this access is not known, but Recorded Future, a cyberthreat intelligence firm that investigated North Korean internet activity from 2017 to 2018, reports that estimates range from "'only a very small number' to 'the inner circle of North Korean leadership' to 'just a few dozen families'" (Moriuchi 2018). Along with their team of researchers, Insikt Group, Recorded Future has noted three interesting trends in North Korean internet use during this time period:

North Korea and China both use censorship to control the information that the population can access. In both countries, censorship applies to all media, not just the internet. For foreign companies wishing to access the Chinese market, the world's most populated country and a potentially lucrative return on investment, they must make special considerations to ensure approval from the censors. Paramount Pictures rewrote parts of the Brad Pitt movie *World War Z* in 2013. In the original book, the disease outbreak occurred in China. Because the movie studio knew that it wouldn't pass the censors and did not want to give up millions of dollars in revenue, it changed the script to make South Korea the location of the outbreak and altered some of the film's dialogue (Shaw and Waxman 2014). By moving the location, Paramount secured censorship approval to release the film in China on the second review, after an initial rejection.

widespread abandonment of Western social media for Chinese equivalents, heightened attempts to hide their traffic by using tools such as VPNs, and cryptocurrency mining.

In July 2017, Recorded Future noted that the most commonly used social media by North Koreans accessing the internet was Facebook (Moriuchi 2018). Daily usage of Facebook was double that of any other service, including Chinese alternatives. Instagram and Google were two other popular Western services. However, between December 2017 and March 2018, a drastic change occurred; Facebook became nearly absent from their consumption, and Chinese alternatives, such as Baidu, Tencent, and Alibaba, became far more widely used. This trend continued beyond March to the point that Alibaba, a Chinese service, was used twice as much as any other Western or Chinese service (Insikt 2018). Activity on Alibaba was mainly video and game streaming, along with searching and shopping. Potential reasons for this change in pattern could be related to the increasing international attention North Korean media consumption had been getting; stricter enforcement of bans on sites, such as Facebook, Twitter, and YouTube instituted in 2016; or government concerns over security (Moriuchi 2018).

In addition to this changing pattern of media consumption, in April 2018, Recorded Future noticed a 1,200 percent increase in the use of obfuscation technologies to hide North Korean internet traffic (Insikt 2018). Virtual private networks, virtual private servers (VPSs), and the onion router Tor were some of the technologies being used. Use of these tools accounted for 13 percent of all traffic out of North Korea. However, just six months later in September, they noticed a moderate decline, where it accounted for only 5 percent of traffic (Insikt 2018). Recorded Future was unable to identify a reason for this spike and then decline; however, they note that it could be a response to perceived external threat that declined over time due to the costs involved with these services, notably money, time, and access.

Recorded Future first noticed Bitcoin mining from North Korean computers in May 2017 and have since noted a sharp increase in cryptocurrency mining, including expansion to Montero (Moriuchi 2018). This could be related to the fact that Montero cryptocurrency is truly anonymous, which can help North Korea circumvent certain economic sanctions placed on the country. Another benefit of Montero is that it was designed for lower-capacity machines, using port 3333. However, Recorded Future reports observing North Korean Montero mining occurring over port 7777, which suggests the use of a high-end machine (Moriuchi 2018).

Further analysis by the cyberintelligence firm suggest that over a fifteen-year period from 2002 to 2017, more than $430,000 worth of computer equipment was imported from the United States. In the wake of North Korea's first nuclear weapons testing, widespread international sanctions were imposed in 2006, making such economic exchange illegal (Moriuchi and Wolens 2018). However, blame may not lay on U.S. companies, and not much can be done to prevent this importation, as North Korea is savvy in using intermediaries and false identities to procure such technology.

North Korea remains a tightly-controlled country; most of its population does not have access to the internet and experiences high degrees of censorship with the information they do have. Despite what appears to be an increase in access to technology such as smartphones and the national intranet, state reactions to those who violate rules concerning access and communication suggest that not much has really changed. Freedom of information exists only for the elite few, and the general populace remains largely ignorant of anything outside of North Korea.

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Further Reading

Andrews, Marilyn J. 2017. "North Korea." In *Online around the World: A Geographic Encyclopedia of the Internet, Social Media, and Mobile Apps*, edited by Laura M. Steckman and Marilyn J. Andrews, 214–219. Santa Barbara, CA: ABC-CLIO.

Associated Press. 2017. "North Korea's Internet Is as Weird as You Think It Is." Fox News. Accessed July 16, 2019. https://www.foxnews.com/tech/north-koreas-internet-is-as-weird-as-you-think-it-is.

Britton, Bianca. 2019. "Student Arrested in North Korea Tweets He Is 'Obviously' Not a Spy." CNN. Accessed September 1, 2019. https://www.cnn.com/2019/07/09/asia/alek-sigley-north-korea-tweets-intl/index.html.

Insikt Group. 2018. "Shifting Patterns in Internet Use Reveal Adaptable and Innovative North Korean Ruling Elite." Recorded Future. Accessed July 16, 2019. https://www.recordedfuture.com/north-korea-internet-usage/.

Jerreat, Jessica. 2017. "North Korean Censorship." *Huffington Post*. Accessed July 16, 2019. https://www.huffpost.com/entry/north-koreancensorship_b_58fe78afe4b086ce58981445.

King, Robert R. 2019. "North Koreans Want External Information, but Kim Jong-Un Seeks to Limit Access." Center for Strategic International Studies. Accessed July 16, 2019. https://www.csis.org/analysis/north-koreans-want-external-information-kimjong-un-seeks-limit-access.

Moriuchi, Priscilla. 2018. "North Korea's Ruling Elite Adapt Internet Behavior to Foreign Scrutiny." Recorded Future. Accessed July 16, 2019. https://www.recordedfuture.com/north-korea-internet-behavior/.

Moriuchi, Priscilla, and Wolens, Fred. 2018. "North Korea Relies on American Technology for Internet Operations." Recorded Future. Accessed July 16, 2019. https://www.recordedfuture.com/north-korea-internet-operations/.

Reporters Without Borders. 2019. "World Press Freedom Index." Accessed July 16, 2019. https://rsf.org/en/ranking/2019.

Sigley, Alex. 2019. "I'm the Only Australian Living in North Korea. Let Me Tell You about It." *Guardian*. Accessed July 16, 2019. https://www.theguardian.com/commentisfree/2019/mar/31/im-the-only-australian-living-in-north-korea-let-metell-you-about-it.

Trend Micro Forward-Looking Threat Research Team. 2017. "A Closer Look at North Korea's Internet." Trend Micro Security Intelligence Blog. Accessed July 16, 2019. https://blog.trendmicro.com/trendlabs-security-intelligence/a-closer-look-at-north-koreasinternet/.

Warf, Barney. 2014. "The Hermit Kingdom in Cyberspace: Unveiling the North Korean Internet." *Information, Communication, and Society* 18 (1): 1 09–120. https://doi.org/10.1080/1369118X.2014.940363.

UGANDA

Internet access in Uganda has increased rapidly over the past decade, and besides limited occurrences, content remains unfiltered and largely uncensored by the government. Policies supporting information and communications technologies are a priority of the Ugandan government, and ICT use is supported by donors and international organizations that contribute development aid to Uganda. Although Uganda has had significant technological developments and advancements in internet access, recent tax policies of the Ugandan government have served to restrict access and internet users have declined significantly over the past year. Uganda also has experienced instances of government-led internet shutdowns, particularly around political events like elections. While there have been notable advancements in access to a predominantly open internet, policies of the Ugandan government hinder internet access for many, including the poorest Ugandans.

Measurements of internet access in Uganda differ. While the Ugandan government reported that 22 percent of the population had access in 2016 and 44 percent had access in 2017 (Freedom House 2018), a World Bank analysis notes that household-level surveys found lower levels of internet access, at 14 percent in 2016 (Mahler, Montes, and Newhouse 2019). Although internet access is still limited in rural areas, telecommunications infrastructure in Uganda has developed substantially over the past five years to increase internet availability and speed.

In partnership with Ugandan internet service providers, foreign technology companies like Facebook and Google have laid fiber optic cables in the capital, Kampala, and northwestern areas around Gulu (Freedom House 2018). Despite recent investments in infrastructure, internet access remains limited in rural areas. The National Broadband Policy of Uganda notes that broadband internet

connectivity is limited to 45 percent of the country and that fiber optic coverage is largely duplicated, reducing coverage from almost 7,500 miles to 1,300 miles in practice (Ministry of Information, Communications Technology and National Guidance 2018, 14). Uganda also has significantly slower internet speeds compared to the global average (Freedom House 2018).

While internet access increased rapidly prior to 2018, the Ugandan government has created recent obstacles to access and policies that increase government control. One government internet policy places a tax on the use of social media and communications applications. In July 2018, the Government of Uganda introduced a daily tax on social media use, termed the Over the Top tax, or OTT tax. This policy charges individuals the equivalent of about US$0.05 per day to access fifty-eight social media and communications applications like Facebook, Twitter, WhatsApp, and LinkedIn (Freedom House 2018). Access to the applications is blocked by individual ISPs until the tax is paid by users using mobile money. President Yoweri Museveni (1944–) explained the tax by stating that its purpose is to put an end to "gossip" and raise needed government revenue (Freedom House 2018). President Museveni's statements suggest that one intention of the OTT tax could be to strengthen government control by limiting freedom of expression.

Some research suggests that the OTT tax significantly harms internet access and affordability. Introduction of the OTT tax may have contributed to a large decline in internet users. An analysis for the ICT Policy Centre for Eastern and Southern Africa (CIPESA) reports that since implementation of the OTT tax, internet users in Uganda have been reduced by 5 million, according to data from the Uganda Communications Commission, Uganda's telecommunications regulator. In June 2018, a month before the OTT tax, Uganda had 18.5 million internet users, representing 47.4 percent of the population. Three months later, in September 2018, there were 13.5 million internet users, or 35 percent of the population (Nanfuka 2019). This represents a substantial decline in access with a reduction in users greater than 12 percent.

This type of tax could put social media and communications application use out of reach for Uganda's poorest internet users, while also making access expensive for many others. The highest increase in the cost of internet use after the tax is for Uganda's poorest, for whom the tax represents a 10 percent increase in the price of access. This means that 1 gigabyte of data now costs 40 percent of average monthly income (Nanfuka 2019). In response to the OTT tax, many users began to use virtual private networks, or encrypted private networks, to bypass tax requirements by ISPs. A 2019 study of the OTT tax found that 38 percent of the sampled 1,000 social media users relied on VPNs to access social media instead of paying the OTT tax. This finding is supported by the decline in revenue generated by the tax (Pollicy 2019, 3). The Ugandan government directed ISPs to block or tax access to VPNs to prevent social media usage without paying the OTT tax, although without much success.

In addition to barriers of access through government taxes, Uganda has experienced internet shutdowns, particularly around election periods. Internet shutdowns

are increasingly common in sub-Saharan Africa and are used by governments as a tool of control and censorship. Shutdowns often occur during periods of violent conflict, political protest, and elections, and they are mostly associated with authoritarian or hybrid-authoritarian governments. An internet shutdown can be defined as an "intentional blockage of access to the internet or sections of the internet such as social media platforms" that are mainly ordered by governments to limit access to information or control communications (CIPESA 2019, 2). While shutdowns are often justified on the basis of public safety or national security, they prevent communication and access to information for citizens.

Over the past five years, twenty-two African countries have experienced internet shutdowns, including five shutdowns in January 2019 alone (CIPESA 2019, 2–4). Internet shutdowns can be total shutdowns of internet services or partial restrictions due to filtering of specific sites or access to social media applications. For example, there was a total shutdown of internet access after elections in the Democratic Republic of the Congo in December 2018. Chad, however, has continued to experience a partial shutdown between 2018 and 2019 with the blocking of social media applications. Similarly, during elections in Uganda in 2016, the government blocked social media and mobile money access.

Internet shutdowns primarily occur at the national level in Africa, but shutdowns have been used differentially at the subnational level to restrict access for particular populations. In 2018, the government of Cameroon shut down internet access for English-speaking regions of Cameroon to stifle opposition protest and repress select regions while enabling access for French-speaking populations. In addition to restrictions on media coverage and press freedom, communication, and access to information, which are activities often critical during political events like elections, internet shutdowns are estimated to have significant economic impacts. Loss of internet affects internet-based business services, access to digital information for economic activities, and everyday personal services like banking and mobile money transfers. Internet shutdowns also limit access to emergency and health services. Shutdowns may be more likely in places where internet infrastructure like ISPs are state-owned, as partial and total shutdowns require ISPs to follow requests made by governments. However, internet shutdowns also occur in countries like Uganda where ISPs are not state-owned (Freyburg and Garbe 2018).

Uganda has a hybrid-authoritarian regime, where President Yoweri Museveni has been in power since 1986. Uganda's February 2016 internet shutdown occurred during the presidential and parliamentary elections period. A similar shutdown occurred during the 2011 elections in Uganda. In 2016, the government restricted access to social media applications and mobile money for four days during elections. Social media was also shut down on the day of President Museveni's inauguration to a fifth presidential term. The government of Uganda described the election-period social media blackout as necessary for security reasons in order to avoid threats to the electoral process like violence and the dissemination of "lies" or false information and electoral results (Duggan 2016). In response to social media

restrictions, internet users turned to VPNs to bypass the restrictions enacted by ISPs. This response to the partial internet shutdown was similar to the use of VPNs after the introduction of the OTT tax.

In addition to limiting communications and access to information for citizens, disabling access to social media applications can impact the operations of political parties during elections. Losing access to WhatsApp and mobile money applications can prevent political parties from paying and communicating with party agents or individuals who represent parties at individual polling stations to ensure party oversight for voting and polling station activities. Loss of social media communications also impacts the ability of parties to monitor and transmit information about voting and election results. Disruptions in internet access can negatively affect election quality, particularly when they inhibit the operations of opposition parties in nondemocratic settings like Uganda. While the Ugandan government was able to control social media access during the 2016 elections and continues to exert control through the OTT social-media tax, civil society organizations have filed suits related to election-period shutdowns which may subject the practice to future judicial review by the Ugandan high court.

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Further Reading

CIPESA. 2019. "Despots and Disruptions: Five Dimensions of Internet Shutdowns in Africa." Accessed July 15, 2019. https://cipesa.org/?wpfb_dl=283.

Duggan, Briana. 2016. "Uganda Shuts Down Social Media; Candidates Arrested on Election Day." CNN. Accessed June 6, 2019. https://edition.cnn.com/2016/02/18/world/uganda-election-social-mediashutdown/index.html.

Freedom House. 2018. "Freedom on the Net 2018: Uganda." Accessed June 6, 2019. https://freedomhouse.org/report/freedom-net/2018/uganda.

Freyburg, Tina, and Lisa Garbe. 2018. "Blocking the Bottleneck: Internet Shutdowns and Ownership at Election Times in Sub-Saharan Africa." *International Journal of Communication* 12: 3896–3916.

Mahler, Daniel Gerszon, Jose Montes, and David Newhouse. 2019. "Internet Access in Sub-Saharan Africa." World Bank Group. Accessed July 15, 2019. http://documents.worldbank.org/curated/en/518261552658319590/pdf/135332-POV-PracticeNote-13.pdf.

Ministry of Information, Communications Technology and National Guidance. 2018. "The National Broadband Policy." Accessed July 15, 2019. https://www.ucc.co.ug/wp-content/uploads/2017/09/National-Broadband-Policy-2018_Final.pdf.

Nanfuka, Juliet. 2019. "Social Media Tax Cuts Ugandan Internet Users by Five Million, Penetration down from 47% to 35%." CIPESA. Accessed June 6, 2019. https://cipesa.org/2019/01/%EF%BB%BFsocial-mediatax-cuts-ugandan-internet-users-by-five-million-penetration-down-from-47-to-35/.

Pollicy. 2019. "Offline and Out of Pocket: The Impact of the Social Media Tax in Uganda on Access, Usage, Income and Productivity." Accessed July 15, 2019. http://pollicy.org/wpcontent/uploads/2019/01/Offline-and-Out-of-Pocket.pdf.

Chapter 2: Cyberbullying

OVERVIEW

Cyberbullying involves using a digital device to send messages that intimidate or threaten another person online. It can take place over email, social media, text messaging, or social networking sites in a private or public channel. Cyberbullying usually involves repeated messaging intended to harm the recipient psychologically, socially, or even by threatening physical harm, any or all of which can affect a person's mental and emotional well-being. It is a tactic that has evolved with the growth of the internet, and in general, it is usually associated with children and young adults despite also occurring with adults. In fact, some countries use a different term when adults are victimized.

The term *cyberassault* is used in some parts of the world, such as Latin America, when an aggressor spreads malicious rumors, shares personal details, or posts intimate pictures online with the intent to shame or harm. Because cyberbullying is generally considered a new behavior, it is considered a crime only in areas where lawmakers have passed bills that criminalize it. Countries that have had greater access to the internet for longer periods of time are most likely to have laws governing cyberbullying, although some parts of the world with growing access to the internet have also established laws to punish offenders. For other countries, cyberbullying is one aspect of internet exchanges that will need consideration as policy develops.

Cyberbullying can be categorized in several ways. *Harassment* is one form. It aligns with the generally understood definition of receiving offensive or hurtful messages repeatedly over time. These actions can also be referred to as *cyberstalking*. *Flaming* is another form that involves the cyberbully arguing or fighting with the intended victim online. *Exclusion* is the act of singling someone out online and purposefully isolating the person from online group discussions or activities. Instead, the remaining group makes rude comments or amplifies harmful gossip about that person. Often, these people are informed of these activities after the fact. *Outing* is when a cyberbully shares very personal information about a person to a larger audience with the intention of hurting them with that information.

Masquerading is a technique cyberbullies use when they create false identities to commit cyberbullying acts. The bully can assume a new identity or pretend to be another person whom the victim knows to obscure their own identity. Another type of cyberbullying involves *revenge pornography*, where a person

posts intimate photographs of another online without their consent. These photographs can be humiliating and damage future job prospects. In some places where the photographs violate strict antipornography laws, both the person photographed and the person who posts can face heavy fines and jail time. As technologies for online communications advance, new categories of cyberbullying could emerge.

Victims of cyberbullying often suffer from psychological effects that can be mild to severe. Even mild effects can have a lasting impact on a person's life. Research on cyberbullying effects on people around the world show that its victims usually experience adverse psychological effects, such as affective disorders, anxiety, depression, and thoughts of suicide; they can also experience related physical effects, such as insomnia, aches, skin reactions, and loss of appetite (Nixon 2014). To treat these effects, some people turn to therapy or psychiatry, while others choose to self-medicate through alcohol, drugs, or self-harm. The effects cyberbullying has on individuals depend on multiple factors, including self-esteem, the strength of the person's support network, and cultural values. The long-term effects of cyberbullying are still unknown because it has only been acknowledged for the last decade.

Many countries have cyberbullying laws to protect people against the negative intentions of others online. In the United States, there is no federal law that applies to cyberbullying, although certain types of messages could fall under antidiscrimination laws. Almost every state, in contrast, has laws that address cyberbullying to some degree. In 2018, the Navajo Nation passed a law that gives tribal courts jurisdiction over tribe members who commit cyberbullying. New Zealand passed its Harmful Digital Communications Bill in 2015 to criminalize deliberate harmful behavior online. The law has grown to encompass more than just criminalization; as of 2018, its broader purpose included deterring and preventing unwanted online behavior.

The Philippines and Singapore each have passed laws with cyberbullying protections. The Philippine law focuses on the role of schools in preventing online harassment, while the Singapore law applies to its citizens more broadly. Israel passed its anticyberbullying law in 2015; in 2016, it established a nationwide program with police task forces looking to combat and prevent cyberbullying. The law and initiative only cover combatting online abuse against teenagers. The countries with the most advanced law, or sets of laws, addressing cyberbullying are places where the internet is widely available. Without internet access, cyberbullying is not possible, and in areas where the internet is emerging, it is a new issue for policymakers to pursue.

Other nations have proposed bills to create or strengthen existing antibullying laws. Argentina is considering strengthening existing law to cover cyberassaults from actions related, but not limited to, cyberbullying. Canada's Nova Scotia province redrafted its anticyberbullying law in 2015 after the provincial superior court ruled that it violated existing foundational law. The redrafted bill took effect in mid-2018. Critics say that while it adds protections against revenge pornography,

the new bill in many ways strips people of protections, such as allowing perpetrators to claim that they did not have harmful intentions. The new law also puts more responsibility on the claimant to push the case forward rather than the CyberScan unit, a provincial body that worked as an arbitrator and recommended when cases should advance to the courts (Global News 2018). Drafting and redrafting bills is an important part of the legal process. It demonstrates the importance of reviewing and updating laws to accommodate technological advancements while maintaining the rights guaranteed to citizens.

Governments are not the only entities with policies against cyberbullies. Social media platforms have developed their own policies to address cyberbullying behavior. These policies are necessary to protect the safety of their users, in part because researchers have found that sites such as Facebook, Twitter, and Snapchat have become places where cyberbullies operate. It can also be a problem for online gaming platforms or any place where large numbers of people socialize online. To address the problem, Facebook developed its Bullying Prevention Hub for teens, adults, and educators. Facebook users also have the ability to block unwanted content and to report content that violates the site's policies.

Twitter has received significant criticism for its inaction against hate speech and bullying. After polling its users in late 2016 about features they wanted, Twitter received an overwhelming request for tools to prevent bullying. In early 2017, Twitter implemented several new features and has started using machine learning to identify harmful posts earlier (Bernazzani 2017). Most social media sites encourage anyone who feels bullied to refrain from responding, to document the abusive messages, and to reach out to a trusted adult for support. In cases where a user is threatened physically, they recommend contacting law enforcement. Users can also report the offensive message to the platform, which will then consider removing the content or banning the offending user account.

One of the challenges surrounding cyberbullying is a general lack of awareness. One in four adults polled claimed to have never heard of the concept in a 2018 multicountry survey (SABC News Online 2018). Acknowledgement of cyberbullying varies worldwide. For some regions, the concept may be so new that it has not even entered the language. For example, in the Middle East and North Africa, there is no word to describe bullying and associated behaviors in Arabic (Foody et al. 2017). The lack of a vocabulary to discuss an issue is a decent indicator that a society has not previously addressed it. Lack of awareness can occur in areas that have little-to-no internet access, as they have not experienced cyberbullying.

On the other side, there are people who believe that cyberbullying does not need additional legislation because it is already covered in existing laws on harassment and libel. They also view physical bullying as an act that assault laws already cover. While it is not clear how South Africans feel about cyberbullying, the country currently does not have a law aimed to curb it. Instead, depending on how the cyberbullying occurs, the perpetrator could face charges like harassment, extortion, assault, or criminal defamation.

Researchers have noted a new type of cyberbullying: self-cyberbullying. When people cause themselves digital harm, such as posting something negative about themselves, they bully themselves online. In 2017, Florida Atlantic University researchers conducted a survey of 5,500 young adults between the ages of twelve and seventeen. They determined that one in twenty people bullied themselves online, sometimes multiple times (Warner 2017). Although not much is known about the phenomenon, it has had real-world consequences. Hannah Smith (c. 1999–2013), a fourteen-year-old student in the United Kingdom, sent harmful messages to herself leading up to her suicide. Her friends and family believed that she was the victim of cyberbullying, but later evidence showed she bullied herself online (Davies 2014). This subset of cyberbullying is not addressed by national policies directly because it is very new. However, many countries outlaw suicide and related attempts, so these laws could apply in extreme cases. As the law develops, it is important to note that self-cyberbullying is likely a call for help.

Recognizing, preventing, and raising awareness about the dangers of cyberbullying is not simple. In many countries, there are organizations that work toward prevention and mitigation. They work with schools and communities and online to disseminate information widely and quickly. For example, Ireland has numerous organizations that give workshops and design programs to prevent cyberbullying. Sticks and Stones, one of the country's longest-running award-winning programs, works with schools and parents to train them how to prevent bullying. One of their programs likens cybersecurity and cyberhygiene to having a tattoo—a permanent record of a person's online activities that follows them around for life (Sticks and Stones 2018). This approach may deter possible bullies by teaching them empathy and discussing alternative means to reduce stress and aggression.

Training is a critical part of combatting cyberbullying and cyberattacks. There are many assumptions made about cyberbullies that, when untrue, increase the difficulty of addressing the issue. Sabella, Patchhin, and Hinduja (2013) revealed several myths or incorrect assumptions that complicate resolving issues with cyberbullying. These assumptions include the following: everyone agrees on the definition of a cyberbully; cyberbullying is pervasive across the internet; it leads to suicide as the only outcome; it occurs more frequently than offline bullying; it is nothing more than a normal experience before entering adulthood; those who commit the acts are bad people; and turning off devices solves the entire problem (Sabella, Patchhin, and Hinduja 2013). To clarify the assumptions, training reaches and educates parents, educators, teenagers, and adults about the realities of cyberbullying. Busting the myths is critical for ensuring people have the same understanding so that they can work together.

The following section looks at how countries from different world regions confront the issue of cyberbullying. Some of these countries have developed more detailed responses and programs because their societies have had more exposure to the problem. Others have only recently turned their attention to the fact that cyberbullying affects their citizens, whereas another group has only dealt with a small number of cases and may not be fully attuned to the situation.

Further Reading

Bernazzani, Sophia. 2017. "How Twitter Is Fighting Harassment & Cyberbullying." HubSpot. Accessed July 8, 2018. https://blog.hubspot.com/marketing/twitter-harassment-cyberbullying.

Davies, Caroline. 2014. "Hannah Smith Wrote 'Vile' Posts to Herself before Suicide, Say Police." *Guardian*. Accessed May 27, 2020. https://www.theguardian.com/uk-news/2014/may/06/hannah-smith-suicide-teenager-cyber-bullying-inquests.

Foody, Mairéad, M. Samara, A. El Asam, H. Morsi, and A. Khattab. 2017. "A Review of Cyberbullying Legislation in Qatar: Considerations for Policy Makers and Educators." *International Journal of Law and Psychiatry* 50 (November): 45–51.

Global News. 2018. "Redrafted Nova Scotia Anti-Cyberbullying Law Comes into Force." Accessed July 8, 2018. https://globalnews.ca/news/4314469/redrafted-nova-scotia-anti-cyberbullying-law/.

Nixon, Charisse L. 2014. "Current Perspectives: The Impact of Cyberbullying on Adolescent Health." *Adolescent Health, Medicine and Therapeutics* 5: 143–158. Accessed July 8, 2018. http://www.ncbi.nlm.nih.gov/pubmed/25177157.

SABC News Online. 2018. "Global Views on Cyberbullying." Accessed July 7, 2018. http://www.sabcnews.com/sabcnews/global-views-on-cyberbullying/.

Sabella, R. A., J. W. Patchhin, and S. Hinduja. 2013. "Cyberbullying Myths and Realities." *Computers in Human Behavior* 29 (6): 2703–2711.

Sticks and Stones. 2018. "About Us." Accessed July 8, 2018. http://www.sticksandstones.ie/aboutus/.

Warner, Claire. 2017. "What Is Self-Cyberbullying?: A Dangerous New Trend Involves Teens Sending Bullying Messages to Themselves." Bustle. Accessed July 7, 2018. https://www.bustle.com/p/what-is-self-cyberbullying-adangerous-new-trend-involves-teens-sending-bullying-messages-to-themselves-3072212.

AUSTRALIA

Prevalence

Adults in Australia seem to think that cyberbullying is a growing epidemic because of how the media portrays some of its tragic consequences, such as death by suicide in which cyberbullying was a trigger (Campbell 2017). In reviewing a number of major Australian studies with prevalence data, Katz et al. (2014) found that 6–40 percent of young people aged between eight and seventeen years had been cyberbullied. However, in the latest research published in Australia, only 2 percent of students experienced bullying that solely included cybervictimization (Thomas et al. 2017). Studies in Australia have found that cyberbullying is more prevalent during early adolescence, ten to fifteen years of age (Katz et al. 2014), and when students are transitioning from primary to high school (Cross et al. 2009).

It is difficult to ascertain whether cyberbullying is increasing in Australia because of difficulties in measuring the phenomenon. Many research studies use different definitions of cyberbullying, different time frames, different kinds of measures, and different cutoffs for frequency; they also collect data differently

(Huang and Cornell 2015). However, while there has been no reduction in cyberbullying, it is not increasing. In 2004, it was found that 14 percent of secondary school students were cyberbullied (Campbell 2005), while four years later in 2008, 10 percent reported they were cybervictimized (Cross et al. 2009). In 2012, Cross and colleagues found that 7 percent of students reported being cybervictimized, and in 2014, estimates indicated that about 20 percent of students were cyberbullied (Katz et al. 2014). In 2017, the estimate was 6.6 percent (Thomas et al. 2017). All these studies however, had the aforementioned differences in measurement.

In Australia as elsewhere, cyberbullying is not just conducted by young people. Studies show that university students have been cyberbullied (Wozencroft, Campbell, Orel, Kimpton, and Leong 2015), as have technical education students and manufacturing workers (Privitera and Campbell 2009).

Definitions

However, as with all measures of cyberbullying, everything depends on how the concept is defined. A definitional debate has been ongoing as to whether bullying using technology constitutes a different phenomenon from face-to-face bullying or is a separate form of bullying, making it the fourth form after physical, verbal, and exclusion bullying. In Australia, this debate was led by Dooley, Pyzalski, and Cross's 2009 paper that argued that although cyberbullying might present differently from face-to-face bullying (often now called *traditional bullying*), it is a similar behavior because it includes an imbalance of power. The imbalance-of-power concept as applied to cyberbullying, however, is disputed by many North American researchers, such as Justin Patchhin, Michele Ybarra, and Robert Tokunaga. However, some researchers conclude that without an imbalance of power, cyberbullying should be renamed *cyberaggression* or *cyberfighting*. This difference is still a contentious point between U.S. scholars and others.

Consequences

The negative consequences of cyberbullying seem to be the same worldwide. Young people who are victimized report feeling sad and lonely and exhibit reduced school attendance and suicidal ideation (Thomas et al. 2017). These students also report more social difficulties and higher levels of anxiety and depression than those students who have been traditionally bullied (Campbell, Spears, Slee, Butler, and Kift 2012). However, interestingly, many cybervictimized students fear being traditionally bullied more than cyberbullied (Corby et al. 2016). Students who engage in cyberbullying also report higher scores on anxiety, depression, and stress than students not engaged in cyberbullying (Campbell, Slee, Spears, Butler, and Kift 2013), and these emotional consequences are still found a year later (Hemphill, Kotevski, and Heerde 2015).

Legal Responses in Australia

Australia does not have a specific law against cyberbullying in either the criminal or civil statutes. This means that cyberbullying behaviors are not legally defined and cannot be prosecuted (Langos 2013). However, there are laws for criminal offences that could apply, such as the vilification law, law of torts, defamation and privacy, criminal, and discrimination law (Butler, Kift, and Campbell 2009). Civil laws involving prosecution of young people for cyberbullying would be drawn out and costly and would be unlikely to gain much compensation for the person cyberbullied (Butler 2018).

There are calls for the law to be changed. In 2013, a law symposium was held in Melbourne with recommendations that an appropriate legal framework addressing all forms of bullying be introduced. Both state and federal parliamentary enquiries followed in 2014 and 2018, both of which resulted in no changes to the law (Legal and Constitutional Affairs Senate References Committee 2018). An anticyberbullying task force was commissioned in Queensland in 2018, which again recommended no changes to the law for cyberbullying.

However, other measures have been taken to address the problem. A new statute was created in Australia called the Enhancing Online Safety for Children Act 2015, which created the office and website of the Australian eSafety Commissioner. The commissioner's mandate is to promote the online safety of children and to create an effective service for handling cyberbullying complaints. The office is able to serve notices to social media companies to remove cyberbullying material targeting an Australian child and has legislated authority to investigate serious incidents of cyberbullying.

Policies

The Australian government was one of the first countries to provide leadership in reducing bullying in 2003 by providing schools with an integrated national framework called the National Safe Schools Framework, or NSSF (Cross et al. 2011). This policy was revised in 2018 and named the Australian Student Wellbeing Framework (Australian Government Department of Education and Training 2018). The Wellbeing Framework, like the earlier NSSF, has been endorsed by ministers of education from each state through the Federal Education Council.

Under this framework, all Australian schools must have an antibullying policy. However, these policies have not been very effective in reducing cyberbullying. Butler, Kift, Campbell, Slee, and Spears (2011) examined a small sample of Australian schools' cyberbullying policies according to the expectations of the law and found them wanting in terms of definitions, reporting procedures, and handling of complaints. Even as late as 2016, a review of the effectiveness of antibullying school policies found that less than half the students surveyed knew about the policy (Rigby and Johnson 2016).

Other Initiatives

Other measures to reduce cyberbullying are the informational websites Bullying. No way! (https://bullyingnoway.gov.au/) and a National Day of Action against Bullying and Violence (https://bullyingnoway.gov.au/nationalday). Preservice teachers' curricula include cyberbullying definitions and methods for handling situations (Spears, Campbell, Tangen, Slee, and Cross 2015). Nongovernment agencies such as the Kids Helpline, which is run by Your Town, provide free, confidential telephone and online counseling services for people aged between five and twenty-five years. The Australian Universities AntiBullying Research Alliance conducts research into cyberbullying and links with the American Bullying Research Network (BRNET) and Canada's Promoting Relationships and Eliminating Violence Network (PREVNET). The Cyber Friendly Schools project, Beyond Bullying, and the Safe and Well Project have all been initiatives of this alliance.

Marilyn Campbell

Further Reading

Australian Government Department of Education and Training. 2018. "The Student Wellbeing Hub." Accessed September 22, 2019. https://studentwellbeinghub.edu.au/.

Butler, D. 2018. "Cyberbullying and the Law: Parameters for Effective Interventions?" In *Reducing Cyberbullying in Schools: International Evidence-Based Best Practices*, edited by M. Campbell and S. Bauman, 49–60. London: Academic Press.

Butler, D., S. Kift, and M. Campbell. 2009. "Cyber Bullying in Schools and the Law: Is There an Effective Means of Addressing the Power Imbalance?" *eLaw Journal* 16 (1): 84–114.

Butler, D., S. Kift, M. Campbell, P. Slee, and B. Spears. 2011. "School Policy Responses to Cyberbullying: An Australian Legal Perspective." *International Journal of Law and Education* 16 (2): 7–28.

Campbell, M. A. 2005. "Cyber Bullying: An Old Problem in a New Guise?" *Australian Journal of Guidance and Counselling* 15 (1): 68–76. https://doi.org/10.1375/ajgc.15.1.68.

Campbell, M. A. 2017. "The Australian Perspective: Efforts to Counter Cyberbullying." In *Bullying and Cyberbullying: Prevalence, Psychological Impacts and Intervention Strategies*, edited by C. McGuckin and L. Corcoran, 201–218. Hauppauge, NY: Nova Science Publishers.

Campbell, M. A., P. T. Slee, B. Spears, D. Butler, and S. Kift. 2013. "Do Cyberbullies Suffer Too?: Cyberbullies' Perceptions of the Harm They Cause to Others and to Their Own Mental Health." *School Psychology International* 34 (6): 613–629. https://doi.org/10.1177/0143034313479698.

Campbell, M. A., B. Spears, P. Slee, D. Butler, and S. Kift. 2012. "Victims' Perceptions of Traditional and Cyberbullying, and the Psychosocial Correlates of Their Victimisation." *Emotional and Behavioural Difficulties* 17 (3–4): 389–401. https://doi.org/10.1080/13632752.2012.704316.

Corby, E.-K., M. A. Campbell, B. A Spears, D. Butler, S. Kift, and P. Slee. 2016. "Students' Perceptions of Their Own Victimisation: A Youth Voice Perspective." *Journal of School Violence* 15 (3): 322–342. https://doi.org/10.1080/15388220.2014.996719.

Cross, D., M. Epstein, L. Hearn, P. Slee, T. Shaw, and H. Monks. 2011. "National Safe Schools Framework: Policy and Practice to Reduce Bullying in Australian Schools."

International Journal of Behavioral Development 35 (5): 398–404. https://doi.org/10.1177/0165025411407456.

Cross, D., T. Shaw, J. J. Dooley, M. Epstein, L. Hearn, and H. Monks. 2012. "Cyberbullying in Australia: Is School Context Related to Cyberbullying Behaviour?" In *Cyberbullying in the Global Playground: Research from International Perspectives*, edited by Q. Li, D. Cross, and P. K. Smith, 75–98. Chichester, UK: Wiley-Blackwell.

Cross, D., T. Shaw, L. Hearn, M. Epstein, H. Monks, L. Lester, and L. Thomas. 2009. *Australian Covert Bullying Prevalence Study (ACBPS). Western Australia: Report Prepared for the Department of Education, Employment and Workplace Relations (DEEWR)*. Perth, Australia: Child Health Promotion Research Centre, Edith Cowan University.

Dooley, J. J., J. Pyżalski, and D. Cross. 2009. "Cyberbullying versus Face-to-Face Bullying: A Theoretical and Conceptual Review." *Zeitschrift für Psychologie/Journal of Psychology* 217 (4): 182–188. https://doi.org/10.1027/0044-3409.217.4.182.

Hemphill, S. A., A. Kotevski, and J. A. Heerde. 2015. "Longitudinal Associations between Cyber-Bullying Perpetration and Victimization and Problem Behavior and Mental Health Problems in Young Australians." *International Journal of Public Health* 60 (2): 227–237. https://doi.org/10.1007/s00038-014-0644-9.

Huang F. L., and D. G. Cornell. 2015. "The Impact of Definition and Question Order on the Prevalence of Bullying Victimization Using Student Self-Reports." *Psychological Assessment* 27 (4): 1484–1493. https://doi.org/10.1037/pas0000149.

Katz, I., M. Keeley, B. Spears, C. Taddeo, T. Swirski, and S. Bates. 2014. *Research on Youth Exposure to, and Management of, Cyberbullying Incidents in Australia: Syntheses Report* (1925218074). Sydney: Social Policy Research Centre, UNSW Australia.

Langos, C. 2013. "Which Laws Can Apply to Cyberbullying?" *Bulletin (Law Society of South Australia)* 35: 38–39.

Legal and Constitutional Affairs References Committee. 2018. *Adequacy of Existing Offences in the Commonwealth Criminal Code and of State and Territory Criminal Laws to Capture Cyberbullying*. Accessed September 2, 2019. https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Legal_and_Constitutional_Affairs/Cyberbullying/Report.

Privitera, C., and M. A. Campbell. 2009. "Cyberbullying: The New Face of Workplace Bullying?" *CyberPsychology and Behavior* 12 (4): 395–400.

Reeckman, B., and L. Cannard. 2009. "Cyberbullying: A TAFE Perspective." *Youth Studies Australia* 28 (2): 41–49.

Rigby, K., and K. Johnson. 2016. "The Prevalence and Effectiveness of Anti-Bullying Strategies Employed in Australian Schools." Accessed March 17, 2020. https://core.ac.uk/download/pdf/51343534.pdf.

Spears, B. A., M. A. Campbell, D. Tangen, P. T. Slee, and D. Cross. 2015. "Australian Pre-Service Teachers' Knowledge and Understanding of Cyberbullying: Implications for School Climate." *Les dossiers des sciences de l'éducation* 33: 109–130. https://doi.org/10.4000/dse.835.

Thomas, H. J., J. P. Connor, D. M. Lawrence, J. M. Hafekost, S. R. Zubrick, and J. G. Scott. 2017. "Prevalence and Correlates of Bullying Victimisation and Perpetration in a Nationally Representative Sample of Australian Youth." *Australian and New Zealand Journal of Psychiatry* 51 (9): 909–920. https://doi.org/10.1177/0004867417707819.

Wozencroft, K., M. A. Campbell, A. Orel, M. Kimpton, and E. Leong. 2015. "University Students' Intentions to Report Cyberbullying." *Australian Journal of Educational and Developmental Psychology* 15: 1–12.

COSTA RICA

In Costa Rica, rising internet access has exposed the people to new challenges in the wake of regulating how people come together and exchange information online. The social and cultural changes brought on by the World Wide Web have affected many sectors of the population, and children and young adults are at high risk for cyberbullying, or cyberassault. To this end, the government has attempted to regulate online conduct, particularly to protect the rights of the youngest generations. Despite the government's multiple attempts to institute laws and legal remedies against cyberbullying, the situation has become direr; by mid-2018, Costa Rica ranked second for the highest number of bullying cases in Latin America.

Internet use is prevalent among children and young adults. Statistics report that 90 percent of all students use email, with the number rising to 99 percent for adults between the ages of twenty-one to twenty-four years. Ten percent of all internet users are minors between the age of ten and fifteen, rising to 30 percent for sixteen- to twenty-five-year-olds (Salas Zamora 2013). Being on the internet exposes these youths to a number of potential dangers, including verbal aggression, physical threats, loss of control over personally identifying information, and the introduction to strangers with malintent, among others. There is also a risk of falling prey to a cyberbully or experiencing other forms of sexual misconduct or inappropriate behavior. To mitigate against these harms, the government and other entities have worked to pass legislation that criminalizes certain behaviors online.

By November 2012, Costa Rica already had a law protecting its citizens against cyberbullying. The law indirectly referenced the ability to criminalize people who created fake social media profiles for other people, impersonating another person online, or using social media to harass other people. The law established these activities as crimes. For adults, they carried a sentence of up to six years in prison; for incidents involving children, the maximum penalty raised to up to eight years (Q24N 2013). Despite the seriousness of potential penalties, the law proved insufficient to prevent cyberbullying incidents.

In 2015, the Ministry of Public Education (MEP) took additional steps to rectify the problem. Between 2012 and 2014, reported cases of bullying rose from 59 to 186, though only 4 of the later cases referenced cyberbullying (Lopez 2015). The MEP worked with public and private schools in response to the growing number of cases to find solutions that would help students and educators at both private and public schools. Some of its activities included inviting specialists, such as psychologists, to speak with victims and offer emotional support. The MEP also advised parents to discuss anti-harassment policies with schools and encouraged schools to communicate more openly about their reactions to offenders. The strategy's effect was not publicized; there is no publicly available information about the metrics used to assess the MEP's progress. However, as incidents continued to rise and it received more complaints about cyberbullying, the strategy was less effective than expected.

Fundación Paniamor, a nonprofit focused on children's rights, recognized the hazards that the internet could introduce to kids. The organization was specifically

concerned about cyberbullying, also called *cyberassault*, so it pressured the government to enact legislative protections for children. It proposed the Law for the Prevention and Establishment of Corrective Measures and Formatives Against School Assaults or Bullying, law number 9404. This law is one of the few worldwide that acknowledges cyberbullying may occur in different forms and through various technologies. It defines cyberbullying as the act of using information and communications technologies to carry out bullying physically at school or cyberbullying through the internet, social media, mobile phones, online video games, YouTube, or any other virtual media that appears in the future. In a later section if the law, the definition is further expanded to include blogs, email, messages, videos, audio recordings, and cell phone pictures or recordings (Ley para la prevención y el establecimiento de medidas correctivas y formativas frente al acoso escolar o "bullying" 2016). This definition and its subsequent examples demonstrate its comprehensiveness and ensures that it will apply new technologies or platforms.

Decree 9404 offers protection under the law, but it is not the only action the government has taken to ensure minors' rights. The law protects minors from online abuse but also imposes sanctions against the children who participate in acts of bullying. Sanctions start with a warning placed into the child's file and notification to the parents and escalates depending on the offense. Schools that choose to ignore child harassment can also be found negligent under this law. There is also a special provision for web pages or social media posts that use harassing language or attempt to harm the victim in some way.

In addition to the law, the government created a National Children's Trust with two primary purposes. The first is to protect children against all crimes, including cyberbullying. With that mission, the site allows teachers, parents, and other adults the opportunity to report cyberbullying instances on an online portal. The second is to provide resources to inform the population how they should respond to cyberassault. For instance, the trust's initial recommendation is to report offenses to the police when the actions involve minors. Their website also features audio and video resources along with a virtual library. Although the organization primarily supports children six years old and under, many of its resources and recommendations apply to older children.

A 2016 study suggests that this law may be effective for preventing the severest outcomes in bullying cases. In some cases worldwide, news media has reported that cyberbullying has led to an increase in suicide rates. In late 2016, Romo and Kelvin conducted research on teenage schoolchildren across Latin America. They determined that Costa Rica had the lowest rates of attempted suicide due to bullying, at 8.4 percent, versus Bolivia, where 20.9 percent reported at least one suicide attempt. They found that bullying led to self-medication, which in Costa Rica translated into the heaviest alcohol use, though they also admitted the findings could be a result of higher acceptance of alcohol drinking in the country (Romo and Kelvin 2016). Though one study is not conclusive, there is minimal research available on the effects of bullying or cyberbullying in Costa Rica.

Besides the government, other groups want to alleviate the situation in the country. In 2018, the Costa Rican national soccer team won a spot in the international FIFA games. On June 3, 2018, after their last game when they beat Northern Ireland, the team seized the opportunity to promote human rights issues at home. At a press conference, they announced a joint effort with like-minded organizations to raise awareness about the state of human rights in the country. They distributed 28,000 copies of a new book produced for the occasion, which highlighted several areas where Costa Rica should improve, namely reducing or eliminating child labor, sex trafficking, domestic violence, and bullying (Press Release 2018). The Children's Museum hosted Claro Costa Rica's Digital Village conference for the second year to discuss technology-related issues and accomplishments. It promoted robotics education and virtual reality, while inviting experts to discuss the darker side of technology, such as cyberbullying.

Costa Rica understands the dangers that the internet poses for its children and young adults. It views the risks to society as perils, and to this end, the country has created additional government organizations to assist in alleviating the problems in general and specifically when geared toward children. Costa Rica's efforts to enact laws and programs to combat bullying, both physical and cyber, are admirable, yet they have not proven effective when compared to the rising number of bullying cases reported. While it is admirable that, apart from Honduras, no other Central American nations have adopted laws to combat cyberbullying except for Costa Rica, the government alone cannot eradicate the problem. The private organizations that have claimed the reduction of cyberbullying to be an important issue may provide the additional support needed to raise awareness. Their efforts may be enhanced from collaborative efforts that capitalize on the celebrity angle brought to the issue through the national soccer team. Whether divided or united, more must be done if the Costa Rican society wishes to alleviate the physical and psychological risks posed by cyberbullying.

Laura Steckman

Further Reading

Ley Para La Prevención y El Establecimiento de Medidas Correctivas y Formativas Frente Al Acoso Escolar o "Bullying." 2016. "Sistema Costarricense de Información Jurídica Costa Rica: La Asamblea Legislativa de la República de Costa Rica." Accessed July 20, 2018. http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=83200&nValor3=106726&strTipM=TC.

Lopez, Jaime. 2015. "Bullying in Public and Private Schools in Costa Rica." *Costa Rica Star News*. Accessed July 20, 2018. https://news.co.cr/bullying-public-private-schools-costa-rica/36621/.

Press Release. 2018. "Costa Rica Kicks Off Their Human Rights Campaign." Accessed July 20, 2018. https://www.pressrelease.com/news/costa-rica-kicks-off-their-human-rights-campaign-126464.

Q24N. 2013. "Law Makes Cyberbullying a Crime." *Q Costa Rica*. Accessed July 20, 2018. https://qcostarica.com/law-makescyberbullying-a-crime/.

Romo, Matthew L., and Elizabeth A. Kelvin. 2016. "Impact of Bullying Victimization on Suicide and Negative Health Behaviors among Adolescents in Latin America." *Revista panamericana de salud pública—Pan American Journal of Public Health* 40 (5). Accessed July 20, 2018. https://www.scielosp.org/article/rpsp/2016.v40n5/347-355/.

Salas Zamora, Gabriela. 2013. "Formas de Protección Jurídica Del Derecho a La Imagen y a La Dignidad de Las Personas Menores de Edad En Internet y Redes Sociales." *Revista de Sala Segunda* 10. Accessed July 20, 2018. https://www.poder-judicial.go.cr/salasegunda/revista/Revista_N10/contenido/PDFs/05proteccion_menores_redes.pdf.

IRELAND

Ireland has experienced a heightened focus on cyberbullying and online safety issues in recent years. The media in particular have covered many high-profile cases where children and young people have been victimized through electronic and/or digital forms. For example, in 2018, the case of Nicole Fox Fenlon (c. 1997–2018), a young woman who took her own life after being bullied online, was well publicized through a courageous campaign by her mother. At the moment, there are many national debates regarding best practices for online child protection in Ireland. Safeguarding solutions have ranged from cell phone bans in schools to legislation aimed at penalizing cyberbullies. In the following sections we outline the current evidence base regarding cyberbullying in Ireland. We also outline the current initiatives that are happening locally and ultimately argue for the young person's voice to be at the heart of the prevention and intervention efforts that schools undertake.

What We Know from Irish Research

A recent meta-analysis of all published cyberbullying studies in Ireland found that approximately one in ten Irish teenagers have been victimized online (Foody, Samara, and O'Higgins Norman 2017). In a more recent study of over 2,000 adolescents aged between twelve to sixteen years old, we found gender differences where victimization was more likely to occur through messaging platforms and social networking sites such as WhatsApp for females and on gaming platforms for males (Foody, McGuire, Kuldas and O'Higgins Norman 2019). The same study found that certain elements such as being female, having poor friendship quality, and being involved in cyberbullying were associated with higher emotional problems and self-reported depression.

With regard to privacy, we found a tendency for young people, particularly fifteen-year-olds to have public social media accounts and to engage in less privacy-related behaviors compared to other age groups (Challenor, Foody, and O'Higgins Norman 2018). All of this points to a scenario much like that which exists internationally. Young people are at a higher risk of developing mental health problems when they are victims of cyberbullying. Understanding their actions online, from the sites they visit to the privacy settings they engage, is essential for

us as researchers and parents to come up with practical and effective prevention and intervention strategies.

What Is the Government of Ireland Doing to Tackle Cyberbullying?

In 2013, the government of Ireland published The Anti-Bullying Procedures for Primary and Post-Primary Schools. These procedures were developed to give direction and guidance to school authorities and personnel in preventing and tackling bullying (including cyberbullying). The Anti-Bullying Procedures and the associated Department Circular 0045/2013 apply to all recognized primary and postprimary schools in Ireland and arose out of the following activities: a review of existing Guidelines on Countering Bullying in Schools (1993), a forum hosted by the minister for education and skills with the minister for children and youth affairs (2012), and the Action Plan on Bullying—Report of the AntiBullying Working Group to the minister for education and skills (January 2013). As such, they represent the most significant development in relation to tackling bullying in schools over the last twenty years. In these Anti-Bullying Procedures, responsibility for tackling bullying and cyberbullying falls to the individual school.

Subsequent to the introduction of the Anti-Bullying Procedures for Primary and Post Primary Schools, further concerns arose in relation to cyberbullying and other online safety issues. Consequently, in 2018, the government published an Action Plan for Online Safety. This followed on from an open policy debate hosted by the government in March 2018 and a report from the Oireachtas (Irish Parliament) Committee on Children and Youth Affairs. A number of actions were introduced under this plan, most notably the establishment of the National Advisory Council on Online Safety and promised legislation for new criminal offences related to online harassment. In late April 2019, the government agreed to draft legislation to tackle cyberbullying, digital harassment, stalking, and the nonconsensual sharing of sexual images.

What Are Schools in Ireland Doing to Tackle Cyberbullying?

Recent research shows that most principals in Ireland take cyberbullying seriously by including an antibullying policy in their schools and have a clear understanding of the negative consequences for students. However, the same report found that they are struggling to know how to support their students in terms of specific anticyberbullying programs and would like more guidance from the government about how to handle cases appropriately (Foody, Murphy, Downes, and O'Higgins Norman 2018).

Very recently, and due to extensive funding from Facebook, a new antibullying program is being developed in Ireland named FUSE—Tackling Bullying and Online Safety Together. This program aims to use the whole-school approach to promote digital safety and positive online interactions for young people. At its heart, the whole-school approach is concerned with bringing together all major stakeholders

within the school community; students, parents, and school staff come together to form a collective understanding of what bullying (including cyberbullying) is, how best to prevent it, and how to intervene if it happens. The approach is also concerned with creating a positive school climate that is based on inclusivity and promotes diversity (O'Higgins Norman and Sullivan 2017).

Positive relationships are stressed not only between students and students, students and school staff, but also between school staff themselves and staff and parents. In addition, more and more programs promote student voices as one of the core aspects of this approach, where students are involved in the schools anti(cyber)bullying policy formation and/or other student-led activities such as raising awareness (Baldry, Blaya, and Farrington 2018). In Ireland, for example, young people were asked to be coresearchers in a qualitative study on cyberbullying. Adult researchers met with young people in several separate sessions that focused on building the adolescents' ability to engage with research, design a follow-up qualitative study, and interpret findings and evaluation of the collaboration process (Dennehy, Cronin, and Arensman 2018). This approach recognizes that young people's voices should be a core consideration for interventions rather than relying purely on adult researchers, educators, and politicians to come up with these constructs based on what they think young people might experience (as has been the norm to date). Adults should invite, encourage, and foster students to be more involved in solutions, especially so when navigating the new research and applied spaces relating to cyberbullying and online safety.

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Further Reading

Baldry, A. C., C. Blaya, and D. Farrington. 2018. *International Perspectives on Cyberbullying: Prevalence, Risk Factors and Interventions.* London: Palgrave Macmillan.

Challenor, Liam, Mairéad Foody, and James O'Higgins Norman. 2018. "An Observation and Analysis of Profiles among Adolescents on the Yellow Application." *Pastoral Care in Education* 36 (4): 286–296.

Dennehy, Rebecca, Mary Cronin, and Ella Arensman. 2018. "Involving Young People in Cyberbullying Research: The Implementation and Evaluation of a Right-Based Approach." *Health Expectations* 22: 54–64.

Department of Education and Skills. 2013. "Anti-Bullying Procedures for Primary and Post-primary Schools." Accessed July 2, 2019. https://www.education.ie/en/Publications/Policy-Reports/Anti-BullyingProcedures-for-Primary-and-Post-Primary-Schools.pdf.

Foody, Mairéad, Lian McGuire, Seffetullah Kuldas, and James O'Higgins Norman. 2019. "Friendship Quality, Gender and Their Role in Cyberbullying Involvement and Psychological Well-Being." *Frontiers in Psychology.* https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01723/full.

Foody, Mairéad, Helena Murphy, Paul Downes, and James O'Higgins Norman. 2018. "Anti-Bullying Procedures for Schools in Ireland: Principals Responses and Perceptions." *Journal of Pastoral Care in Education* 36: 126–140.

Foody, Mairéad, Muthanna Samara, and James O'Higgins Norman. 2017. "A Meta-Analysis of Bullying and Cyberbullying Studies on the Island of Ireland." *The British Journal of Educational Psychology* 87: 535–557.

Gleeson, Helen. 2016. *The Prevalence and Impact of Bullying Linked to Social Media on the Mental Health and Suicidal Behaviour of Young People: A Literature Review*. Dublin: Department of Education and Skills.

McGuire, Lian, and James O'Higgins Norman. 2018. "Parents Coping with Cyberbullying: A Bio-ecological Analysis." In *Reducing Cyberbullying in Schools: International Evidence Based Best Practices*, edited by M. Campbell and S. Baumann, 61–72. Cambridge, MA: Academic Press.

O'Higgins Norman, James, and K. Sullivan. 2017. "Reducing School Bullying: A Whole-School Approach." In *Bullying in Schools: Intervention and Prevention*, edited by H. Cowie and C. A. Meyers. Oxfordshire, UK: Routledge.

O'Moore, Mona. 2010. *Understanding School Bullying: A Guide for Parents and Teachers*. Dublin: Veritas.

Vanderbosch, Heidi, and Lelia Green. 2019. *Narratives in Research and Interventions on Cyberbullying among Young People*. Cham, Switzerland: Springer.

ITALY

Italy's online environment has exposed teenagers and schoolchildren to the positive and negative sides of the internet. The negative aspects, such as cyberbullying and cybervictimization, have received ample attention from researchers who have been studied these phenomena in the country for more than a decade. Italian law has fallen behind the dangers posed by technology, and particularly information communications technologies, similar to many countries across the globe.

In the case of cyberbullying and cybervictimization, policymakers and community leaders, encouraged by teachers and parents, have worked to rectify the discrepancies to protect the nation's children. In some ways, every step forward is a step sideways or backward; as fast as the government has criminalized cyberbullying, new forms, such as the imported Blue Whale game, have reached Italy's borders and complicated potential solutions. At the same time, Italy has started to see measurable progress designed from studying the phenomena. Several anticyberbullying programs have shown significant improvements because they resulted from the extensive research conducted in the country.

Cyberbullying, the act of using digital communication to harass or intimidate, has another component. While cyberbullying is the act and the bully is the initiating actor, the person who is cyberbullied is also a victim. *Cybervictimization* generally refers to a person who has received offensive or insulting messages directed at them through electronic communications. Additional behaviors that suggest someone has been cybervictimized include reports that the person is receiving anonymous or offensive calls intended to intimidate or scare, being subject to public online defamation, or experiencing blackmail or threats (González-Calatayud 2018). Italian researchers consider the relatedness between cyberbullying and cybervictimization in terms of prevention and intervention. They recognize that the interrelationship between the two can play a strong role in mitigating their effects, which in turn creates a more resilient youth. Researchers in other countries

tend to separate the two or examine their psychological effects differently, which can lead to treating the symptoms rather than the problem.

Italy has experienced several high-profile cases related to cyberbullying that have had severe consequences. Many of the incidents have ended in suicide. In 2012, Andrea Spezzacetena (1997–2012) committed suicide after someone created false rumors online that he was gay. After being tormented by obscenities and horrible names, he killed himself at home. In 2014, under the pseudonym "Amnesia," a fourteen-year-old posted on Ask.fm. She had recently broken up with a boyfriend and sought anonymous advice on how she could recover from heartbreak. The responses she received instructed her to kill herself. She decided to follow that advice. Although later reports suggested that she may already have been suicidal or unstable, other questions she posted months earlier received strings of obscenities in response. Her parents and hometown were shocked and terrified. They asked the authorities to shut down Ask.fm, although it did not happen (BBC 2014).

A similar case occurred a year earlier to Carolina Picchio (1999–2013). At a party, Carolina got drunk and fainted. While she was unconscious, several boys filmed as they mimed sexual acts with her. The video made rounds on YouTube. Within twenty-four hours, Carolina received thousands of derogatory, obscene messages. She wrote a quick note to her father with words that translated to "words hurt more than the blows" and defenestrated herself in an act of suicide (Felisi 2018). Carolina's case is credited as a significant catalyst for the country's anti-cyberbullying law. Friends and family claimed that they reported the bullying to sites like Facebook, but that the sites took no action. Prosecutors considered trying to hold Facebook, one of the main social media sites where Carolina was bullied, culpable, but chose not to when Facebook promised to reform its system.

In a more recent case, a contestant in the Miss Italy contest has faced cyberbullying since the beauty pageant. In early 2018, Alessia Spagnulo (c. 1994–) learned before the swimsuit competition that her babysitter was unavailable. She decided to strap her daughter Chloe (2017–) to her chest and compete. Her decision was controversial; soon after the event, she started receiving death threats and insulting messages online. She was outraged at the cybervictimization. Even when she avoided the messages, they continued to exist on the internet.

In May 2018, the Italian parliament passed a long-awaited bill against cyberbullying. After three years of debates, the bill passed with 432 votes for and 1 abstention. The bill makes acts of harm against a minor punishable by law. It also requires schools to take action in response to bullying and service providers a window of forty-eight hours to remove offensive content. The bill, which started as Senate Act No. 1261 and evolved in Law No. 71/17, had unusual origins. Cyberbullying has been heavily studied in Italy. There has been ample evidence that the phenomenon was real, affecting students around the country daily. In May 2015, the bill moved from the Lower House of Parliament, where it had received approval, to the Senate. After many discussions and several modifications, the bill became known as C. 3139 in September 2016. It moved again, as S. 1261-B, with additional modifications in January 2017. It finally became an official law in May 2017, called

the Provisions for the Protection of Minors for the Prevention and Control of the Phenomenon of Cyberbullying (Government of Italy 2017). Its final name is the GU No. 127.

The law took effect after the 2017 European Union Kids Survey in Italy. This is a longitudinal study, which means it is conducted over time, to demonstrate trends affecting the country's children. The study found that from 2010 to 2017, Italian kids experiencing rising levels of exposure to hateful speech and messages online; the same study showed that the trend remained steady over time for cyberbullying, hovering at 10 percent since 2010 (London School of Economics 2018). The study noted that the growing amount of cyberhate correlated with political tensions online, especially with political campaigns occurring domestically. Many teenagers opted to avoid online forums and discussions involving politics because involvement often led to experiencing cybervictimization or cyberaggression.

In 2017, the Blue Whale Challenge, a social media game of fifty steps that encourages kids to perform acts of self-harm until dying by suicide, gained popularity in Italy. Said to have originated in Russia, the game has spread all over the world. Awareness of the game reached Italian teenagers primarily after a story aired on the show *La Iene*; in a poll, 70 percent of Italian teenagers reported having learned about it for the first time through the Italian media (Statista 2018). Although officials reported the actual number of events attributed to the game to be low (approximately 9 of 170 alleged cases), the game concerned most Italians. The minister of the interior instituted a campaign to stop the Blue Whale in schools and asked supporters to wear a button carrying that message (Lunghini 2017). The game is serious not only for individuals who wish to follow it to a tragic end but also for cyberbullying. In June 2017, police arrested a nineteen-year-old man for convincing a twelve-year-old girl to start playing the game over Instagram.

Italy's high-profile cyberbullying cases, the rise in reported incidents, and the slow progress the anticyberbullying law made through parliament prompted the police to launch a hashtag campaign to alert people to the danger. #Unaparolaeunbacio, which translates into *a word and a kiss*, launched in early 2016. The campaign partnered with Baci Perugina, a theater troupe that would tour across the country with a show depicting a theatrical representation of the realities of cyberbullying. The presentation ended with a discussion involving the audience. The main goal was to raise awareness of the challenges involved with use of the internet, such as experiencing cyberbullying, and to alert the public about how to face the issues appropriately. Baci Perugina is known for spreading messages about love and tolerance.

One of Italy's premiere treatment centers for bullying and cyberbullying is the Fatebenefratelli Sacco, a medical center in Milan. Since 2008, it has specialized in pediatric care for teenagers suffering the effects of these phenomena. The center receives more than 1,200 cases annually, noting that around 80 percent are related to the internet. Apart from cyberbullying, teenagers also suffer ill effects from sexting, the exchange of sexy or sexual messages with another person, internet-related addiction, and gambling (ANSA 2017). The hospital was also one of the most vocal

advocates for an anticyberbullying law due to its firsthand experience treating the effects. The director appears on television and is quoted by the media often to promote awareness of the serious psychological harm that can stem from online interactions.

There are several types of programs available in Italy that claim to reduce cyberbullying. A for-profit program, KiVa, claims to use decades of scientific research to prevent, intervene, and monitor bullying cases. Developed in Finland, the program has run experiments across Europe, including Italy. A domestic program, Noncadiamointrappola, or NoTrap!, uses peer educators to facilitate school events. The program reports having success against cyberbullying. Within Italy, there are also online programs that students can take to learn more about cyberbullying and prevention. These programs can be in conjunction with a school-based effort or taken as a separate course.

In all of these approaches, researchers report that a critical factor is the involvement of the community: students, teachers, parents, and other trusted adults (Cyberbullying.org 2017). In a study that reviewed the evaluations of nine cyberbullying intervention programs in Italy, only KiVa and NoTrap! conclusively reduced cyberbullying and cybervictimization. They were also the only programs that had dedicated tracks, one for all children and one for those who had had involvement in cyberbullying (Istituto degli Innocenti 2016).

The Italians are aware of how serious cyberbullying can be. Between the new laws and the extensive research on all aspects of cyberbullying, the country, from the government to its people, takes the act very seriously. Together, they are attempting to address the challenges that the internet has posed for their society.

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Further Reading

ANSA. 2017. "Cyberbullying up 8% in Italy, Study Says." Accessed July 24, 2018. http://www.ansa.it/english/news/general_news/2017/02/01/cyberbullying-up-8-in-italy-studysays_6b0ca66d-7b7d-43b0-9559-c7ed7071f130.html.

BBC. 2014. "Cyberbullying Suicide: Italy Shocked by Amnesia Ask.Fm Case." Accessed July 24, 2018. https://www.bbc.com/news/world-europe-26151425.

Cyberbullying.org. 2017. "Cyberbullying Research in Italy." Accessed March 17, 2020. https://cyberbullying.org/research/map/italy.

Felisi, Annalisa. 2018. "'Mai Più Un Banco Vuoto', Il Toccante Video Ispirato Alla Storia Di Carolina Piccho." *Novara Today*. Accessed July 24, 2018. http://www.novaratoday.it/attualita/video-carolina-picchio.html.

González-Calatayud, Víctor. 2018. "Victims of Cyberbullying in the Region of Murcia: A Growing Reality." *Journal of New Approaches in Educational Research* 7 (1): 10–16.

Government of Italy. 2017. "Disposizioni a Tutela Dei Minori per La Prevenzione Ed Il Contrasto Del Fenomeno Del Cyberbullismo." Accessed May 28, 2020. https://www.gazzettaufficiale.it/eli/id/2017/06/3/17G00085/sg.

Istituto degli Innocenti. 2016. "Anti-Bullying Intervention Mapping." Accessed May 28, 2020. https://www.istitutodeglinnocenti.it/sites/default/files/anti-bullying_interventions_mapping_italy_0_0.pdf.

London School of Economics. 2018. "More Hate Speech and Hateful Content for Italian Children Online." Parenting 4 Digital Future. Accessed March 17, 2020. http://blogs.lse.ac.uk/parenting4digitalfuture/2018/01/31/italianchildren-online/.

Lunghini, Roberta. 2017. "The Truth about the Blue Whale Phenomenon in Italy." West-Info. Accessed July 24, 2018. https://www.west-info.eu/the-truth-about-the-blue-whale-phenomenon-in-italy/.

Statista. 2018. "Italy: Awareness of Phenomenon Blue Whale Suicide Game among Teenagers 2017." Accessed July 24, 2018. https://www.statista.com/statistics/709658/awareness-of-new-phenomenon-blue-whale-suicidegame-among-teenagers-italy/.

MEXICO

Recently in Mexico, mobs on social media have started to ridicule and bully the entitled behavior of the country's elite via the hashtags of #Lord or #Lady, plus the insolent behavior the elite was caught doing. For example, the hashtag #LadyChiles was used to mock a wealthy woman who had mistreated her housemaid for allegedly stealing a chili from her kitchen (Nájar 2014).

The Lords and Ladies of Mexico first came to the spotlight in 2011, when two rich, drunken women were recorded insulting and physically attacking a police officer in the wealthy Mexico City neighborhood of Polanco. The women assaulted the police officer after he had simply called after them for being intoxicated on the street, which is illegal in Mexico. Social media was suddenly filled with the hashtag #LadiesPolanco to criticize what people considered to be arrogant and erratic behavior by Mexico's elites. Similarly, a scandal in 2016 led to the emergence of the hashtag #LadyCoralina, to criticize a rich, young woman who cheated on her fiancé in the upscale beach club Coralina in Cancun. Emma Alicia Paz Ayala (c. 1999–) kissed a man she was not engaged to at her bachelorette party. Someone recorded a video and posted it online. After seeing the social media posts, her fiancé immediately called off the wedding. Pictures of the infidelity became an online meme, and Paz Ayala's family believed that her reputation had been permanently damaged. Her actions received a lot of negative attention on social media that could be classified as cyberbullying, with rhetoric not only mocking but also criminalizing her behavior and humiliating her for her actions (Posta 2016).

Along similar lines, elites and businesspeople have often gotten caught on film for bad behavior. Driving and/or auto-involved incidents have become popular for highlighting arrogant, corrupt behaviors. One example is the hashtag #LordAudi, used in 2016 to criticize a man who drove his Audi down a Mexican bike line. The driver almost ran over a bicyclist, argued with a police officer, and then drove away angrily. He also told the policeman to call his father, ostensibly to make the matter go away quietly. However, the bicyclist filmed the exchange, starting his phone after the Audi touched his back tire. He then posted the video to social media, where it went viral.

A second example from the same year was #LordRollsRoyce. Emir Garduño (c. 1974–) got enraged after a man cut off his car in traffic. He beat and intimidated the man with a gun, only later learning that the victim was an off-duty policeman

(Hernandez 2016). A passerby filmed the confrontation and posted it online. A similar incident occurred with #LordFerrari. Filming and posting the videos is one way that the nonelites combat corruption and abuse of the system, which seems to favor the rich and powerful.

Why is there so much commotion in social media around these Mexican Lords and Ladies? According to Mexico's national survey about discrimination, one of the main factors that Mexicans felt divided them as a society was wealth, a constant fight between "the rich and the poor" (Bucio Mújica 2012). It is not just the poor who are organizing brigades to attack the elites with the #Lady and #Lord hashtags. The hostility has been mutual. This cyberbullying fight has even entered the political hemisphere; Mexicans supporting the left (and who typically represent the lower classes) have been called "chairos," while Mexicans supporting the right (who are typically the upper class) have been named "fifís."

Chairo is a pejorative word usually used in Mexico to discriminate against someone because of their social origin. In the political arena, it has started to be used to describe a person who supports the left (the poor), especially Mexico's current leftist president Andrés Manuel López Obrador (1953–), also known as AMLO. The chairos represent the common citizen on the streets and in the subway and working in the fields with their bare hands. They represent the lower class, the people of Mexico ("el pueblo"). *Fifís* is another derogatory word, which is used to represent those who support the right in Mexico; according to the stereotype, they are usually conceived as high-level, educated businessmen.

In the 2018 Mexican presidential election, the cyberbattle between fifís and chairos was aggravated. While the fifís had in the past been able to organize smear campaigns against the left using bots and TV commercials, the chairos in this presidential election were able to organize both offline and online massively to harass and fight the fifís. Chairos considered that people in Mexico, especially those from the lower levels of society, might not always have a strong internet connection. In response, they crafted dynamics to attack opponents that could work with intermittent internet (Quinto Poder 2018). Examples included creating printable instructions, facilitating offline protests, and mobilizing offline collective action such as orchestrating people online to paint murals on the street.

Mexicans have a history of actively bullying and mocking their peers. According to the Organisation for Economic Co-operation and Development, Mexico is currently the country with the highest number of bullying cases in elementary schools. With respect to the bullying between the elites and the lower classes, historians believe that this fight arose during the days of the Spanish conquest and is a process that has neither stopped nor finished. The Spanish conquest had the ultimate goal of pushing the natives into religious and political submission. One way of creating this submission was through social stratification, where the citizens who were born in Spain or were the sons of the Spanish could rule everything, while everybody else (especially the natives) could only take lower-level jobs.

The modern Mexican state was born from these social class divisions, and they continue to be heavily present in modern society. However, the Spanish were never

able to control the Mexicans entirely. Mexicans never fully assumed the roles the Spanish wanted from them. In Mexico, there has been a continuous violent battle between the upper and lower classes to readjust their power and redefine the roles that each actor can play in society.

Mexico's cyberbullying could be seen as a rebel dance that attempts to fight submission and bring justice to its social classes. However, it is perhaps not the most effective dance, as the best ways to fight classism are unlikely to occur through vicious public attacks that bring permanent infamy to others' characters or personae. Moving forward, it might help Mexicans to consider how much social justice their #Lord and #Lady hashtags have brought. Participating in the cyberbullying might make them feel better. But it is still necessary to think about how they could bring true justice. Could the same creative energy they are putting into insulting and attacking each other be used to bring true social change?

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Further Reading

Bucio Mújica, R. 2012. "Clasismo y racismo, sinsentido de la democracia." Conapred. Accessed September 5, 2019. https://www.conapred.org.mx/index.php?contenido=noticias&id=1814&id_opcion=108&op=214.

Camacho Servín, Fernando. 2014. "México, primer lugar mundial de *bullying* en secundaria: CNDH." *La Jornada*. Accessed September 5, 2019. https://www.jornada.com.mx/2014/03/15/sociedad/034n2soc.

Hernandez, Alan. 2016. "Driver Tells a Cop to 'Call My Dad, Dude' in the Latest Video Shaming Mexico's Elite," Vice. Accessed September 5, 2019. https://www.vice.com/en_us/article/59exz3/driver-tells-a-cop-to-call-my-dad-dude-in-thelatest-video-shaming-mexicos-elite.

Livier Gomez, M., and Martha Frías Armenta. 2015. "The Use of Freedom of Expression against the Implementation of Cyberbullying Regulation in Mexico." ResearchGate. Accessed December 8, 2019. https://www.researchgate.net/publication/271507821_The_use_of_freedom_of_expression_against_the_implementation_of_cyberbullying_regulation_in_Mexico.

Nájar, Alberto. 2014. "Lady Chiles, el escándalo en México por el maltrato a una empleada doméstica." *BBC Mundo*. Accessed September 5, 2019. https://www.bbc.com/mundo/noticias/2014/08/140827_mexico_lady_chiles_internet_an.

Posta. 2016. "VIDEO: Recrean la historia de 'Lady Coralina' en TV." Accessed September 5, 2019. https://www.posta.com.mx/youtube/video-recrean-la-historia-de-lady-coralina-en-tv.

Quinto Poder. 2018. "Un grupo de simpatizantes se unió para contrarrestar los ataques." Accessed September 5, 2019. https://quintopoder.mx/trendy/tremendos-crean-manual-para-defender-a-lopez-obrador-de-la-guerra-sucia/.

Valdés Cuervo, Angel Alberto, Ernesto Alonso Carlos Martínez, Jesus Tanori Quintana, and Teodoro Rafael Wendlandt Amezaga. 2014. "Differences in Types and Technological Means by Which Mexican High Schools Students Perform Cyberbullying: Its Relationship with Traditional Bullying." *Journal of Educational and Developmental Psychology* 4 (1). https://doi.org/10.5539/jedp.v4n1p105.

QATAR

Qatar is a small country located in the Middle East. With a population of 2.72 million people and 99 percent urbanization, it is no surprise that the country has one of the world's highest internet penetration rates at 99 percent. The Qatari population also has high social media penetration rates. The country's active social media user and mobile social media user penetration rate also runs at 99 percent; it is, therefore, one of the most connected, active online populations in the world (We Are Social 2019). With nearly the entire population online, the Qatari government chooses to harness the power of the internet to address social problems the country faces.

Cyberbullying is one of those social issues. The Qatari government addresses cyberbullying by actively campaigning online as well as providing a website full of resources for teachers and parents to combat cyberbullying. Although these tools have only been available for the past few years, the Qatari government has quickly developed one of the strongest and comprehensive anticyberbullying campaign plans. Specifically, the Ministry of Transport and Communications (MoTC) has teamed up with Vodafone and the Ministry of Interior (MoI) to use a variety of techniques, strategies, and programming to raise awareness about the signs of cyberbullying and to offer concrete recommendations that address the phenomena in different online scenarios.

Cyberbullying is a common problem around the world and is typically at the forefront of any conversation when discussing children's internet safety. In Qatar, the full extent of cyberbullying is understudied. In fact, only two studies on cyberbullying in the country existed in 2016. A Microsoft study from 2012 reported that 32 percent of students had been bullied, although it did not differentiate between traditional bullying and cyberbullying, while another study's sample population indicated that 36 percent of Qatari youths were victims, with the bullies more likely to be local than foreign (Foody et al. 2016).

Bullying is not a new phenomenon. As it has survived the transition to the digital age, in some ways, it has become more public, or more accessible, as digital

Moustafa El Sisi (c. 1998–), an Egyptian student, launched Advice Seekers in 2014 with the help of his friends. Advice Seekers is an organization dedicated to advancing an antibullying initiative in Egyptian schools. It wants to curb bullying on- and offline. El Sisi came up with the idea after a friend committed suicide due to bullying. He started the organization to raise awareness about bullying, especially after encountering teachers and students who believed that bullying did not exist in local schools (Abdulaal 2018; Cairo Scene 2017). Today, Advice Seekers speaks to students around the country and has an active Facebook page that posts inspirational messages and videos to support people who experience or witness bullying in any format. Similar programs have yet to be adopted in other Middle Eastern nations.

technologies have made it easier to lash out and, at times, hide behind a wall of perceived anonymity. The rising popularity of social media platforms has also enabled some aspects of cyberbullying and cybervictimization. In 2015, about five in ten children were aware of online bullying in varying degrees (Latibu 2015). By 2017, 85 percent of Qatari children, ages nine through eighteen, used the internet. Of that 85 percent, about 10 percent reported being bullied online, 18 percent reported exposure to inappropriate material, and 42 percent received requests from unknown persons (Bukhari 2017).

As of 2019, with 2.70 million active social media users, Facebook ranks as the most popular social media platform in the country. It is followed by 930,000 people on Instagram and 708,500 on Twitter (We Are Social 2019). However, these numbers change when exploring the Qatari youth's online presence and usage. An average of 31 percent of students spend about eight hours online every day. While watching videos is one of the more popular activities for Qatari youth at 35 percent, it is followed by social media usage at 25 percent. Of the social media platforms, 43 percent of Qatari youth used Instagram, and 38 percent used Snapchat (Vodafone 2018).

The Qatari government recognizes the amount of time the country's youth and the country as a whole spend online and has developed programming to reduce risks related to cyberbullying. Qatar's Ministry of Transportation and Communication created several campaigns and programs to help teachers and parents recognize and address the signs of cyberbullying exhibited by children. One campaign, Keep Them Safe, Keep Them Curious, urges Qatari parents and teachers to be involved with the country's youth to promote online safety and advocate the youth to be "cybersmart" while perusing the internet. MoTC also encourages parents to set positive examples while using technology (Begum 2018). By addressing cyberbullying early with children, the Qatari government hopes to instill healthy and safe online habits.

The MoTC has also partnered with Vodafone Qatar to help facilitate its campaign efforts and streamline online programs (Vodafone 2018). By partnering with Vodafone Qatar, developer of the award-winning online-safety program AmanTECH and one of the largest telecommunications companies in the country, the MoTC has greater access to the Qatari population. Since 2017, the partnership has hosted as many as thirty workshops, with plans to host twenty more in 2019, to address cyberbullying and online safety at different schools. Nearly 3,000 students from years three through eight have participated in the workshops, where they performed tasks relating to online safety and participated in scenarios geared to deal with cyberbullying (Gulf Times 2019).

In 2018, the MoTC launched an online awareness campaign using hashtags to illustrate the fact that information is key in fighting cyberbullying. It used social media platforms to educate people about the negative psychological effects that cyberbullying has on children. Hashtags, such as #secure4safety, are used to raise awareness about cyberbullying and cybersecurity (Bukhari 2018).

View of the Vodafone headquarters building in Qatar. Vodafone and Qatar's Ministry of Transportation and Communication have partnered to establish AmanTECH, an award-winning online safety program to instill healthy digital hygiene practices and prevent dangers such as cyberbullying. Through the partnership, thousands of students, parents, and educators attend workshops teaching online safety and anti-cyberbulling annually. (Bennymarty/Dreamstime.com)

In addition, the MoTC created a safe space online to discuss cyberbullying. The website safespace.qa helps teachers and parents keep children safe online by posting videos and articles about cyberbullying and proven methods for reducing risk. Not only is the website a useful tool for adults but there also are special sections for kids and teens to learn more about preventative measures. The site also hosts an interactive game that educates students about online safety (Ministry of Transport and Communications 2019). The videos show different scenarios that children may face online and ways to address each situation with the children's safety in mind. Cyberbullying is no longer something that can be ignored. It is now an individual's, as well as a community's, responsibility to protect today's youth from the extreme and violent activities that are easily accessible online (Bukhari 2017).

Qatar's Ministry of Interior also fights cyberbullying. While the MoTC raises awareness about cyberbullying, the MoI takes legal action against violators. After the passage of the 2015 cybercrime law, cyberbullying has become a criminal offense punishable by the MoI. It is against the law to commit libel or slander against another person online or by using any kind of IT equipment to commit the crime. Persons prosecuted under the cybercrime law can face up to a year of prison and/or pay a maximum fine of QR100,000 or approximately US$2700.

Telecommunication providers, such as Vodafone, must comply with any court requests for evidence, keep user information for a year, and/or block websites ordered by judicial officials.

These activities mirror other activities considered crimes before the cybercrime law when conducted through other means, such as through printed resources (Fahmy 2015). However, with the country's population online, the cybercrime law addresses many of the challenges associated with the digital age. The government also provides a telephone hotline for victims to call and report cases of cyberbullying. These reports are then collated by the Cyber Crime Center (CSC) at the MoI. The Cyber Security Center's purpose is to detect cybercrimes, investigate them, and turn in violators to the court. On average, the Control Room at the CSC receives 35,000 e-incidents per second. This equates to about 8.6 billion e-incidents daily (Mohamed 2018).

Since the creation of Qatar's antibullying campaigns, the country's plans have become more comprehensive, as cyberbullying has evolved across the internet. The internet is plagued with several online hoaxes and urban myths year after year. At the end of 2018 and beginning of 2019, the Momo Challenge became a worldwide event that terrified parents, and warnings went out to Qatari parents on some news sites. Reportedly, a video personality was encouraging young viewers to do harmful activities, such as dying by suicide or hurting family members through this challenge (Gulf Times 2019). The hoax spread primarily on WhatsApp and YouTube. Concerns grew worldwide over the potential harm this messaging could do to the youth population, with many people worried about how the naivete of young users would make them fall victim to the supposed challenge.

The Momo Challenge turned out to be a hoax that spread quickly throughout all social media platforms. Interestingly, the Momo Challenge worked similarly to the Blue Whale scare, wherein an online game also encouraged youths to take increasingly dangerous steps until committing suicide. Qatari parents did not express concern over either game, possibly because they were forewarned of the hoax through AmanTECH and the news. Experts believe that the hoax diverted attention from more serious threats, such as cyberbullying, although it is possible to consider the hoax itself a form of cyberbullying because it supposedly pressured children to harm themselves and others. These hoaxes are also dangerous because they can overshadow other real, pressing online issues. Most research indicates that as long as Qatari parents continue to monitor their children's use of technology, they will be prepared to address, and possibly prevent, cyberbullying incidents affecting their children.

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Further Reading

Begum, Khadiza. 2018. "Internet Safety Tips for Parents in Qatar." Accessed April 2, 2019. https://www.iloveqatar.net/guide/living/internet-safety-tips-for-parents-in-qatar.

Bukhari, Irfan. 2017. "Ministry Urges Parents to Track Kids' Online Activities." Accessed May 28, 2020. https://www.thepeninsulaqatar.com/article/20/07/2017/Ministry-urges-parents-to-track-kids%E2%80%99-online-activities.

Bukhari, Irfan. 2018. "MoTC Creating Awareness on Cyber Bullying." Accessed May 28, 2020. https://thepeninsulaqatar.com/article/23/06/2018/MoTC-creating-awareness-on-cyber-bullying.

Fahmy, Heba. 2015. "Insulting People Online Is a Criminal Offense in Qatar, MOI Warns." Accessed May 28, 2020. https://dohanews.tumblr.com/post/136251032513/insulting-people-online-is-a-criminal-offense-in/amp.

Foody, M., et al. 2016. "A Review of Cyberbullying Legislation in Qatar: Considerations for Policy Makers and Educators." *International Journal of Law and Psychiatry* 50. Accessed October 4, 2019. https://www.researchgate.net/publication/309898581_A_review_of_cyberbullying_legislation_in_Qata r_Considerations_for_policy_makers_and_educators.

Gulf Times. 2019. "Empowering Children Is Key to Their Online Safety." Accessed March 31, 2019. https://m.gulf-times.com/story/624536/Empowering-children-is-key-to-their-online-safety.

Hammond, Ashley. 2019. "Blue Whale and Momo Challenge Suicide Games Distracting From Real Threats, Say UAE Experts." *Gulf News*. Accessed April 1, 2019. https://gulfnews.com/uae/blue-whale-and-momochallenge-suicide-games-distracting-from-real-threats-say-uae-experts-1.62513404.

Latibu, Kadija. 2015. "Bullying in Qatar." Qatar Living. Accessed March 27, 2019. https://www.qatarliving.com/forum/welcome-qatar/posts/bullying-qatar-0.

Ministry of Transport and Communications. 2019. "Safespace." Accessed April 3, 2019. http://www.motc.gov.qa/en/digital-society/digital-literacy/safespace.

Mohamed, Sidi. 2018. "MoI Cyber Security Center to Link 100 Govt Entities by End of 2019." Accessed May 28, 2020. https://thepeninsulaqatar.com/article/24/05/2018/MoI-Cyber-Security-Center-to-link-100-govt-entities-by-end-of-2019.

Vodafone. 2018. "Vodafone Qatar Delivers Online Safety Workshops at Schools." Accessed March 29, 2019. https://www.vodafone.qa/pressrelease/vodafoneqatar/delivers/online/safety/workshops-at-schools.

We Are Social. 2019. "Digital 2019: Qatar." Accessed March 28, 2019. Datareportal. https://datareportal.com/reports/digital-2019-qatar.

SOUTH AFRICA

Cyberbullying is the use of social media and digital technology to harm and harass people online in a deliberate, targeted, repetitive, and hostile manner. South Africa is a technically advanced country on the African continent. As of February 2019, it had an estimated population of 57.73 million, with internet penetration at around half the population (31.8 million) and a social media penetration of 40 percent (23 million). The most popular social media platforms in the country are WhatsApp, YouTube, and Facebook (Kepios 2019). The use of social media, coupled with the popularity of mobile phones for internet access, has increased the number of cyberbullying cases in South Africa, with South Africa having the fourth-highest rate of cyberbullying in the world (South African College of Applied Psychology 2019).

The rising rate of mobile devices connecting to the internet has contributed to the cyberbullying problem. Thirty-eight percent of the population (28.9 million) use social media on their mobile phones (Statista 2019). South Africa has the fourth fastest-growing mobile phone market in the world (Newzoo 2019). Ipsos (2019) interviewed 20,793 adults aged sixteen to sixty-four across twenty-eight

countries about cyberbullying. The results highlighted that 54 percent of South African parents knew of a child who had been cyberbullied, and South Africa had the highest prevalence of cyberbullying from all the countries surveyed. Throughout the years, there have been various cyberbullying methods used in South Africa such as the following:

- Harassment—sending rude and threatening messages persistently
- Flaming—heated online fighting that involves exchanging vulgar messages
- Identity theft—obtaining and using another person's personal information illegally for personal gain
- Cyberstalking—the use of the internet or other digital means to stalk or harass another person
- Trolling—starting arguments and upsetting people by posting inflammatory or untrue material in an online community
- Outing—extracting true information from a person via devious methods and then sharing it online to cause distress to the person
- Exclusion—isolating a person from their friends and family
- Denigration—the posting of material online that is harmful to a person's character, including private sexual images. (Willard 2011)

With mobile phone use, two popular methods of cyberbullying occur via text message and photos/videos, including sexting. Sexting is a crime when texts, pictures, or videos of an explicit nature are sent to minors; it can also be a crime when sent to unconsenting adults. Burton and Mutongwizo (2009) released a study of 1,726 South African young people. The results highlighted that 46.8 percent had experienced cyberaggression via phone. Young people have bullied others using various media. Specifically, 18.3 percent have used SMS (text messaging), 16.9 percent phone calls, and 9.2 percent photos or videos.

Cyberaggression includes harmful acts carried out by electronic means directed at an individual or group of individuals. These acts can be offensive, unwanted, and derogatory (Grigg 2010). The study by Farhangpour, Maluleke, and Mutshaeni (2019) surveyed eighty high school students and performed detailed interviews of six students and found more than half the students experienced cyberbullying with sexual offences. In South Africa, a recent case of cyberbullying involved a thirteen-year-old girl from Pretoria who allegedly committed suicide due to circulation of a photo the girl had sent her friend. The friend put the photo on a WhatsApp group. The girl was heavily teased about the image (Gous 2019). Although news reports do not mention what the photograph showed, there was a correlation between the online teasing and the circulated photograph.

Policies and How to Stem Cyberbullying

In 2013, the South African government signed the Protection from the Harassment Act 71. The act provides protection orders to victims of bullying and cyberbullying. The victim can apply through the court for an interim protection order. The

order will be granted if the court is satisfied the victim has been harassed. If perpetrators breach the protection order, they can be fined or imprisoned (Department of Justice and Constitutional Development 2019).

There are issues with the act, because courts can grant protection orders without the knowledge of the perpetrator, as prior warning to the perpetrator can lead to undermining the order if that person decides to escalate attacks against the victim. Victims under eighteen years of age can approach the courts without their parents knowing. Tracking cyberbullies is an issue because of how limited the information is that social media platforms and service providers will hand over. According to the act, service providers can be forced to provide information on cyberbullies such as full name, address, identity number, IP address, mobile number, and email address. However, the question of whether platforms such as Facebook and Instagram will comply with such requests for user information is less clear (Laas and Boezaart 2014; Mawson 2019). Another issue is that it is not possible to prosecute all children under the harassment act. Children under ten years old cannot be prosecuted against the act, but children above ten can be, if they are aware of their actions and the difference between right and wrong (Ngqakamba 2019).

Despite instances of cyberbullying increasing annually due to the popularity of the mobile web and social media, South Africa needs to do more in terms of policy. Countries such as China and Singapore have taken a more aggressive approach to cyberbullying. Singapore has criminalized cyberbullying with a mixture of fines and jail time (Singapore Government 2019). China passed a law requiring Chinese citizens to register their real names online (Lee and Liu 2016). These requirements allow for the tracking of perpetrators of cyberbullying. Countries such as the Philippines, Japan, and Belgium also have advanced antibullying laws, which include laws to address cyberbullying.

There are various applications and tips available to help curb cyberbullying in South Africa. STOPit is an app that enables school pupils to report their cyberbullying experiences via messages, videos, and pictures from anywhere with an internet connection. STOPit is used around the world including South Africa (STOPit 2019). The South African government and universities intend to build on the education of cybertechnology in schools, including increasing students' knowledge of the cyberworld and its dangers (Farhangpour, Maluleke, and Mutshaeni 2019). Both the South African College of Applied Psychology (2019) and the South African Police Force (2019) have published tips on how to deal with cyberbullying. These tips can be applied by victims from a wide range of ages. They include the following:

- Becoming familiar with privacy settings and using them (e.g., passwords)
- Keeping evidence of cyberbullying (e.g., offensive posts and online messages)
- Blocking cyberbullies or reporting them via social media or the police
- Taking a break from social media
- Trying not to react or retaliate to the cyberbullies' actions, as retaliation can keep the cycle of aggression going

- Remembering that cyberbullying is not the fault of the victim so they should not blame themselves and reaching out to others if you suspect cyberbullying or are a victim yourself
- Staying off sites where identities are hidden.

These tips will empower cybervictims to fight against bullies by presenting them with practical steps they can take.

Steps are being taken to curb cyberbullying in South Africa. As the popularity of the mobile web and social media grows, the instances of cyberbullying will increase. Guidance exists in South Africa, but more targeted policies on cyberbullying and the use of digital applications are needed to stem cyberbullying. Collaborating with countries that possess a more aggressive strategy toward tackling cyberbullying will help South Africa.

Sophia Alim

Further Reading

Burton, P., and T. Mutongwizo. 2009. "Inescapable Violence: Cyber Bullying and Electronic Violence against Young People in South Africa." *Centre for Justice and Crime Prevention* 8: 1–12.

Department of Justice and Constitutional Development. 2019. "Protection from Harassment Act, 2011 (Act 17 of 2011)." Accessed July 22, 2019. http://www.justice.gov.za/forms/form_pha.html.

Farhangpour, P., C. Maluleke, and H. N. Mutshaeni. 2019. "Emotional and Academic Effects of Cyberbullying on Students in a Rural High School in the Limpopo Province, South Africa." *South African Journal of Information Management* 21 (1): 1–8.

Gous, N. 2019. "Pretoria Girl Commits Allegedly after Cyberbullying," *Timeslive*. Accessed July 22, 2019. https://www.timeslive.co.za/news/south-africa/2019-02-19-pretoria-girl-commits-suicide-allegedlyafter-cyberbullying/.

Grigg, D. W. 2010. "Cyber-Aggression: Definition and Concept of Cyberbullying." *Journal of Psychologists and Counsellors in Schools* 20 (2):143–156.

Ipsos. 2019. "Global Views on Cyberbullying." Accessed July 22, 2019. https://www.ipsos.com/en/global-views-cyberbullying.

Kepios. 2019. "Digital 2019." Datareportal. Accessed August 4, 2019. https://datareportal.com/reports/digital-2019-south-africa.

Laas, A., and T. Boezaart. 2014. "The Legislative Framework Regarding Bullying in South African Schools." *Potchefstroom Electronic Law Journal* 17 (6): 2667–2702.

Lee, J. A., and C. Y. Liu. 2016. "Real-Name Registration Rules and the Fading Digital Anonymity in China." *Washington International Law Journal* 25: 1.

Mawson, N. 2019. "Cyber Bully Act Becomes Law," ITWeb. Accessed July 22, 2019. https://www.itweb.co.za/content/mraYAyqow3KqJ38N.

Newzoo. 2019. "Newzoo's Global Mobile Market Report." Accessed July 22, 2019. https://newzoo.com/solutions/standard/market-forecasts/global-mobile-market-report/.

Ngqakamba, S. 2019. "Children as Young as 10 Can Be Charged for Bullying—Expert." News24. Accessed July 22, 2019. https://www.news24.com/SouthAfrica/News/children-as-young-as-10-can-be-charged-for-bullyingexpert-20190227.

Singapore Government. 2019. "Protection from Harassment Act." Singapore Statutes Online. Accessed July 22, 2019. https://sso.agc.gov.sg/Act-Rev/PHA2014/.

South African College of Applied Psychology. 2019. "What Young Adults Need to Know about Cyberbullying in South Africa." Accessed July 22, 2019. https://www.sacap.edu.za/blog/counselling/cyberbullying/.
South African Police. 2019. "Child Safety." Accessed July 22, 2019. https://www.saps.gov.za/child_safety/teens/teens.php.
Statista. 2019. "South Africa: Digital Population 2019." Accessed July 22, 2019. https://www.statista.com/statistics/685134/south-africa-digital-population/.
STOPit. 2019. "New STOPit App Aims to Deter Cyberbullying." Accessed July 22, 2019. https://stopitsolutions.com/news/new-stopit-app-aims-to-deter-cyberbullying/.
Willard, N. 2011. *Cyberbullying and Cyberthreats*. Champaign, IL: Research Press.

UNITED STATES

Cyberbullying in the United States is a nationally recognized social problem. Every state has legislation that guides school administrators, law enforcement, and parents on how to best address the problem. The United States' broad engagement with cyberbullying and cyberaggression makes it one of the more progressive countries on the issue. That said, the approach the United States has adopted is far from perfect and has not been successful at eradicating the problem. Despite widespread efforts, the average rate of bullying in the United States remains in line with the worldwide average. Complications in addressing the issue may arise from the lack of federal law regulating the issue, inaccurate framing of the repercussions of cyberbullying by the media, and parental feelings of technological inadequacy. Despite these complications, the United States remains dedicated to addressing the problem of cyberbullying with various public and private initiatives.

Stopbullying.gov, a website managed by the U.S. Department of Health and Human Services, uses a definition of bullying, encompassing cyberbullying, developed by the Centers for Disease Control (CDC) and the Department of Education to inform media outlets and the general public and help them identify the issue. Bullying involves unwanted aggressive behavior, an observed or perceived imbalance of power, and a pattern of repetition of the behavior or the likelihood of repetition. This definition distinguishes two modes and four types of bullying: the two modes are direct bullying, which occurs in the physical presence of the targeted

> The word *bully* has an interesting history. According to one etymology, it originated from the Middle Dutch word *boele*, meaning lover or brother, which evolved in Modern Dutch to *boel*, meaning mistress. By the mid-1500s, it crossed into English with the meaning of sweetheart or darling. It eventually became one of William Shakespeare's (1564–1614) favorite terms of endearment in his plays. In 1688, the word had developed an additional meaning: ruffian. It is not known how the term changed from positive to negative, or whether the evolution of two separate words eventually took the same spelling. It is the second sense of the term, more akin to ruffian, that people understand today (Liberman 2012).

Elementary school students participate in a classroom program that teaches prevention and resilience toward cyberbullying. In the United States, cyberbullying is a serious issue affecting the nation's youth, and despite rising efforts to prevent it, statistics about cyberbullying have stayed generally unchanged. Advocacy from parents, teachers, schools, communities, and non-governmental agencies seeks to eradicate cyberbullying from schools, adopt state and federal laws defining and addressing the issue, and continue to promote programs to assist victims across the country. (Claraaa/Dreamstime.com)

person, and indirect bullying, which occurs via communication toward the targeted person when not in physical proximity.

This second mode, indirect bullying, encompasses cyberbullying, sometimes referred to as *electronic bullying*. The four types of bullying identified are physical, verbal, relational, and damage to property. Cyberbullying in the United States is primarily of the verbal and relational type. *Verbal aggression* involves verbal harassment and threats of harm, while *relational aggression* threatens the relationships of the targeted person and often occurs through the spreading of rumors. While cyberbullying can occur between adults, nearly all research, discussion, and debate regarding the behavior assumes a targeted youth.

The proliferation of smartphones in recent years and ready access to them by most teens have made cyberbullying far easier to perpetrate and thus a growing cause for concern. Between this belief, media coverage of the correlation between suicide and bullying in the United States, often referred to as *bullicide*, and multiple mass school shootings since 1999, the general public has called for stronger legislation when it comes to cyberbullying. Critics of this attitude, however, have called into question the validity of the perceptions that cyberbullying correlates with these events, the purpose of laws to help combat the problem, and the efficacy of the laws when they are adopted.

While it may be true that more teens have access to the internet through their smartphones today than at any other point in history, it may not be true that cyberbullying is on the rise. According to data collected by the CDC, the incidence of cyberbullying has generally decreased since 2011. However, despite regular research and surveys conducted by various research entities, statistics on cyberbullying and the way those statistics are framed tend to vary greatly. According

to 2017 survey data from the CDC, only about 14.9 percent of high school students surveyed reported having experienced cyberbullying in the previous twelve months (19.7 percent of young women and 9.9 percent of young men), which was a small increase from what was reported by middle school students (CDC 2017).

However, this number doubled when reported by the Cyberbullying Research Center, a private organization dedicated to disseminating information and education about cyberbullying. According to the series of studies the CRC conducted over a ten-year period, the lifetime victimization rate of cyberbullying was on average 27 percent, with a 2016 average of 34 percent. A Pew Research Center survey conducted in early 2018 said that 59 percent of students surveyed reported having been the target of cyberbullying at some point. The Pew Research data also reports on the types of bullying experienced; 42 percent of surveyed youth report having been the target of name-calling (verbal), and 32 percent of surveyed youth report having been the target of rumors (relational; Anderson 2018).

Media coverage of cyberbullying that correlates it with unproven consequences, such as suicide, further serves to cloud the facts. The term *bullicide* is commonly used in media and refers to incidents where a young person with mental health issues is bullied and, as a result, dies by suicide. Causally linking the two misrepresents the relationship between the bullying behavior and the suicidal act, because the majority of youth who are cyberbullied do not die by suicide. While the impact of the behavior is most assuredly not without effect and cyberbullying may exacerbate preexisting mental health issues, research suggests that it alone does not drive a youth to suicide. That said, LGBTQ youth are at a far higher risk of experiencing cyberbullying, and this group is also already at a higher risk for suicide; therefore, there is a dangerous correlation between the two that should never be ignored. Media reports also often refer to cyberbullying or bullicide as a crime, which in many cases may not be true. Nevertheless, this idea of cyberbullying as a criminal act has taken hold in the minds of media consumers, which is one factor contributing to the assumption that cyberbullying is always a legal issue.

While the general public may clamor for more legislation regarding cyberbullying, as of 2015, every U.S. state has adopted some kind of law to address the problem, with the exception of Alaska, which has bullying legislation but does not include language for cyberbullying. However, there is no federal law concerning cyberbullying, which means that each state has its own way of dealing with the problem. The first state law regarding bullying, adopted in Georgia in 1999, had been in development before the 1999 Columbine High School mass shooting; however, that and subsequent mass school shootings have been cited as a motivating factor in the development of state laws. The last state to adopt anticyberbullying legislation was Montana in 2015. Montana's law is very basic and provides for little more than identifying bullying as a prohibited behavior and includes procedures for determining which jurisdiction is best suited to respond.

Other states have far more robust policies and detailed procedures. After the original 2002 law was revised in 2011, New Jersey has often been cited as having the strictest legislation for bullying. In New Jersey, school districts are required not

only to have a policy in place to deal with bullying but also to employ multiple antibullying specialists. Additionally, each year, districts are required to provide the state government with multiple detailed reports on all incidents of bullying.

Statistical data to corroborate the effectiveness of these laws is difficult to find. The CDC only reports survey data for New Jersey on the years 2011 and 2013. That data indicates a decrease of 0.8 percent over the two-year period from 15.6 percent to 14.8 percent of youth surveyed who reported having experienced cyberbullying in the previous twelve months. That said, there was a 1.3 percent increase of direct bullying on school grounds during that same period. While Montana's law was adopted in 2015, CDC survey data reports that incidents of cyberbullying had already been declining when the law was adopted, decreasing from 16.2 percent in 2011 to 15.5 percent in 2015 and even further to 14.9 percent in 2017 (CDC 2017).

In addition to determining efficacy, when evaluating state legislation on cyberbullying, one important question that arises is the purpose of the law. Particularly as cyberbullying is primarily considered a problem among youth, are these laws meant to be punitive, normative, or preventative? Often, laws are thought to exist in order to punish deviant behavior; however, in the case of most state laws regarding cyberbullying, this purpose is not clear, and usually unless the cyberbullying extends into the realm of harassment or assault (offenses governed by separate laws), it is not prosecutable.

One reason why states do not include explicit avenues for punishing bullying is that crimes that are punishable must be clearly identified; determining where the line exists between free speech and cyberbullying is tremendously difficult. Additionally, in order for a law to identify a "crime" to be punished, there must be a "criminal," and there is hesitation to treat underage cyberbullies as criminals. The reasons for this are similar to the ones that question the efficacy of cyberbullying laws as deterrents. Essentially, youth are often impulsive and legally illiterate, and they often believe they will not get caught because of the anonymity of the internet or because adults do not understand the social media they use. Most youth simply do not know the law, and unless an incident occurs that is dealt with harshly, they may not even be aware of the severity of their actions.

While it may be true that many adults view children as "digital natives" because they have grown up with the technology, youth often do not have a complete understanding of the technology they use or the way that social media messages they put out there can be traced back to them. Similar laws to deter certain behaviors among youth, such as underage sex, have not been shown to be effective. As a result, cyberbullying law is normative, meaning it endeavors to set a standard norm that discourages cyberbullying rather than eliminate it, which is what U.S. Education Secretary Arne Duncan (1964–) suggested in a 2010 letter to schools and governors. He stated that laws exist only to "send a message" about the importance of immediately addressing incidents of bullying and to promote the understanding that the behavior is not to be tolerated. Instead of focusing on legal enforcement, he urged the adoption of a comprehensive approach to the problem that involves

the cooperation of multiple entities. He also reminded schools and governors of the importance of establishing safe school environments for victims and perpetrators alike (Duncan 2010).

While cyberbullying may not be the sole cause for a teen to die by suicide, it can certainly be a factor, and multiple studies demonstrate other short- and long-term psychological effects of the behavior. Young women generally experience cyberbullying at a rate of about double that of young men, and over half of LGBTQ youth experience cyberbullying. Some of these incidents of cyberbullying are dealt with in the legal sphere, and when that happens, prosecutors must find an appropriate law to apply to the perpetrator.

A commonly cited example of cyberbullying that led to prosecution deals with the suicide of Tyler Clementi (1991–2010), an eighteen-year-old gay male, who was a freshman at Rutgers University in 2010. Clementi's roommate, Dharun Ravi (c. 1992–), used a webcam to spy on Clementi as he engaged in sexual acts with another man and then used Twitter to advertise that and invite others to spy on Clementi with him. Days after Clementi found out what Ravi had done, he jumped off the George Washington Bridge to his death. While Ravi was not charged with Clementi's death, the case attracted a great deal of attention to the plight of cyberbullying directed toward LGBTQ youth, and general public consensus was that Ravi was to blame for Clementi's death. In 2012, he was convicted of fifteen other counts including invasion of privacy and a uniquely New Jersey law called *bias intimidation*. However, in 2016 on an appeal related to the unconstitutionality of the bias intimidation charge, all fifteen of Ravi's original convictions were overturned when he accepted a plea deal of one count of invasion of privacy.

Other instances of what many consider to be cyberbullying that led to prosecution involve using social media to make threats. In anticipation of the 2018–2019 school year, the Federal Bureau of Investigation (FBI) rereleased information on "hoax threats" communicated via electronically, reminding students that they are considered serious federal crimes and that students risk beginning their adult life with a felony record over what they may consider a simple joke. While these hoax threats are often dealt with by suspending or expelling the student, there are numerous examples of students also being convicted of a felony charge and placed on probation.

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Further Reading

Anderson, Monica. 2018. "A Majority of Teens Have Experienced Some Form of Cyberbullying." Pew Research Center: Internet and Technology. Accessed January 2, 2019. http://www.pewinternet.org/2018/09/27/a-majority-ofteens-have-experienced-some-form-of-cyberbullying/.

Campbell, Marilyn A., and Ales Završrik. 2013. "Should Cyberbullying Be Criminalized?" In *Cyberbullying through the New Media: Findings from an International Network*, edited by Peter K. Smith and Georges Steffgan, 65–82. London and New York: Psychological Press.

Centers for Disease Control and Prevention (CDC). 2017. "United States 2017 Results." High School Youth Risk Behavior Surveillance (YRBS). Accessed January 1, 2019. https://nccd.cdc.gov/Youthonline/App/Results.aspx?LID=XX.

Duncan, Arne. 2010. "Key Policy Letters from the Education Secretary and Deputy Secretary." U.S. Department of Education. Accessed January 2, 2018. https://www2.ed.gov/policy/gen/guid/secletter/101215.html.

Federal Bureau of Investigation (FBI). 2018. "Think before You Post; Hoax Threats Are Serious Federal Crimes." Accessed January 4, 2019. https://www.fbi.gov/news/stories/hoax-threats-awareness-100518.

Hinduja, Sameer. 2018. "Emoji as Threats in Student Messages and Social Media." Cyberbullying Research Center. Accessed January 4, 2018. https://cyberbullying.org/emoji-as-threats-in-student-messages-and-social-media.

Marimow, Ann E. 2018. "Is Cyberbullying of Students Like Bomb Threats or Protected Speech? A Court Weighs the Issue." *Washington Post*. Accessed January 4, 2019. https://www.washingtonpost.com/local/public-safety/iscyberbullying-of-students-like-bomb-threats-or-protected-speech-a-court-weighs-theissue/2018/05/08/e0a88800-522f-11e8-9c91-7dab596e8252_story.html.

McGeehan, Patrick. 2016. "Conviction Thrown Out for Ex-Rutgers Student in Tyler Clementi Case." *New York Times*. Accessed January 4, 2019. https://www.nytimes.com/2016/09/10/nyregion/conviction-thrown-out-for-rutgersstudent-in-tyler-clementi-case.html.

Patchin, Justin W. 2016. "Summary of Our Cyberbullying Research (2004–2016)." Cyberbullying Research Center. Accessed January 2, 2019. https://cyberbullying.org/summary-of-our-cyberbullying-research.

Temkin, Deborah. 2015. "All 50 States Now Have a Bullying Law. Now What?" *Huffington Post*. Accessed January 2, 2019. https://www.huffingtonpost.com/deborah-temkin/all-50-states-now-have-a_b_7153114.html.

U.S. Department of Health and Human Services. 2017. "Facts about Bullying." Stopbullying.gov. Accessed December 31, 2018. https://www.stopbullying.gov/media/facts/index.html.

Chapter 3: Cybercrime

OVERVIEW

Cybercrime refers to the act of breaking the law online. It occurs when people decide to violate the law, usually for monetary or other personal gain. It is a fast-growing criminal industry because it can be extremely profitable and has natural, built-in barriers to being caught due to the technologies employed. According to the International Criminal Police Organization, INTERPOL (2018), "more and more criminals are exploiting the speed, convenience and anonymity of the Internet to commit a diverse range of criminal activities that know no border, either physical or virtual, cause serious harm and pose very real threats to victims worldwide." The cost to individuals and national economies is serious; in February 2018, estimates placed the cost of cybercrime at over US$600 billion annually (Lewis 2018). The growing rate of emerging and evolving technologies contributes to the rising costs associated with combating cybercrime.

Law enforcement agencies recognize multiple types of cybercrime that generally fall into one of two categories: high-tech crime and cyber-enabled crime (INTERPOL 2018). *High-tech crime* occurs when the criminal's target is the disruption or destruction of computer hardware or software. The creation of malicious viruses intended to spread across the internet and prevent computer systems from booting is an example of high-tech crime. *Cyber-enabled crime* refers to either the adaptation of crimes usually committed offline to cyberspace or the invention of new methods or means to steal information, such as a person's identity or financial information, over the internet. The lines between these two categories are not always clear. For example, hacking is a cybercrime. A hacker who attempts to rewrite code to modify computer software is committing a high-tech crime. If that code rewrites software to send banking information to the hacker for the purpose of stealing the money in the account or to create unauthorized credit cards based on that account, the hacker has committed a cyber-enabled crime.

Laws addressing cyberspace are not always identical to noncyberlaws. For example, the rule of cyberlaw can mirror the regulations of the offline world. There are also laws that are designed specifically to regulate the behaviors and actions that people take on the computer, over the internet, and through the World Wide Web. In some cases, these behaviors or actions only occur online, such as hacking, stealing virtual money, or phishing, which by definition is a type of social engineering under false pretenses designed to commit a crime by gaining access to personal information. Criminals who go phishing often do so to perform such acts

as stealing a person's identity or creating fake credit cards in someone else's name, leaving the victim to suffer from financial loss. In other cases, the crimes are perpetrated through the internet, such as trading for illegal goods on the dark web. This crime is often committed to obscure both the illegal purchase and the identities of the buyer and seller from law enforcement.

National governments regulate most of laws related to cybercrime. Local government supplements the laws based on the needs of local populations. In addition, many online sites and platforms enforce their own *netiquette*, a term that refers to etiquette or norms for politeness, on the internet. In most countries, laws governing cyberspace generally reflect a society's norms about appropriate behaviors both online and offline. These laws, however, often differ between countries and territories, as they represent the values, morals, and behaviors considered appropriate in each society, which can have varying belief systems and worldviews due to culture, history, religion, and many other combinations of factors.

One of the challenges surrounding online governance is that it is difficult to police the internet. The rapid development of new technologies has made it easier for criminals to circumvent the law, and it is equally challenging to pass laws that encompass all possible aspects of cybercrime. Another concern is that while cybercrime is relatively new and frequently evolving, lawmakers do not always have a solid grasp of the technology. Without a basic, and sometimes even advanced, understanding of how internet or internet-enabled technologies function, it is difficult to assess how they could be used to break the law. For example, since early 2018, governments across the world have been considering the fallout of Facebook giving third-parties user data without user consent. Because the data is generated and stored online, the limitations of Facebook's right to use the data however it deemed fit were never challenged.

In 2018, after the Cambridge Analytica scandal revealed that the company had collected people's data unethically and in violation of Facebook's terms of service, several governments explored whether Facebook and Cambridge Analytica violated their privacy laws. In Europe, governments passed a strict privacy law in response to Facebook's actions. Facebook agreed to comply but also changed its terms of service and switched where it stores user data. For 1.5 billion people who might have been protected under European privacy laws, this data warehouse switch stripped them of those protections (BBC 2018). It will take lawmakers time to determine if the switch violates privacy laws or if there is not yet sufficient law to address terms of service changes, whether intentional or accidental, that may directly infringe upon rights guaranteed under the law.

A second challenge for cyberlaw is the difficulty in identifying actual criminals. Most cybercriminals avoid prosecution and capture because the internet allows them to operate anonymously. For those who use social media and social networking tools, most sites do not require users to register with their actual name or location. There are also tools that obscure location and identity. Examples of these tools include virtual private networks, which make users appear to be physically located in another area, and special browsers such as Tor, the onion router that

obscures a user's location from visited sites and prevents those sites from tracking, or being tracked, back to the original user. New ways to stay anonymous online are under development, and over time, some law enforcement has learned to crack, or address, some of the old methods. Currently, the anonymity enjoyed by many people online extends to those who choose to commit cybercrimes. The anonymity creates obstacles to identifying the perpetrator of a crime and then discovering the person's or group's true identity.

Another complication for law enforcement is that police cyberspace jurisdiction is not always clear. Often, cybercriminals operate at a geographic distance from where they commit crimes. For example, Nigerian scammers have become infamous for the 419 scam, named after the section of the Nigerian Criminal Code dedicated to punishing fraud (International Centre for Nigerian Law 2018). The 419 scam, also referred to as the "Nigerian Prince" scam, where an allegedly wealthy man sends an email telling the recipient that he needs to transfer his wealth out of the country, offering to pay the recipient a percentage of the haul. The catch is that the scammer receives banking information, which is then used to drain the owner's accounts. There is also a romantic version of this scheme where the scammer pretends to be a beautiful woman who falls in love over email and needs a small amount of money to move to the person's country of residence.

While the Nigerian police actively pursue these criminals, the internet and development of technology has made them more successful and harder to track; after decades of various versions of this scam, technology has made these criminals bolder and more prolific (Newman 2018). Nigeria is one of many countries that combat large-scale scamming schemes operating domestically; other governments, alone or in cooperation with the Nigerian or other local law enforcement, work with victim of these cybercrimes. The United States' Federal Bureau of Investigation has an Internet Crime Complaint Center that investigates alleged cybercrimes, such as those reported by victims of 419 scams.

Another facet to the problem of law enforcement jurisdiction is how it collides with the interests of the tech industries. The rights of law enforcement and the way that tech companies encrypt devices sparked a debate in the United States in 2016 when the FBI wanted to access the phone of the San Bernardino shooter, Syed Rizwan Farook (1987–2015). The FBI used the courts to compel Apple to unlock the shooter's phone and develop an alternate operating system that would allow law enforcement to circumvent encryption in the future. After a legal battle where Apple fought the order to develop new software and revealed that the company had provided assistance to the police, the FBI withdrew its case, stating that a third-party entity had successfully unlocked the phone.

The debate over encryption and the amount of access law enforcement should legally have without violating a citizen's rights remains unresolved. Most of the backlash against the FBI's position asserted that building backdoor access to ignore encryption actually makes people less secure online, potentially more susceptible to cybercriminals and cyberattacks (Cuthbertson 2017). A future case where law enforcement demands access to encrypted data could renew the debate and the

legal challenge. Although Farook did not commit a cybercrime, the technology supporting the commission of a crime raises the question of the balance between rights guaranteed in the Constitution and the needs of law enforcement operating in the unknown, fluid area known as cyberspace.

An increasing trend related to cyberlaw, though moving at a slow rate, is the rising number of international politicians or elites who are codifying new punishments and sanctions for citizens who commit acts that threaten their power. In these cases, they are restructuring the law to criminalize activities or behaviors that do not support their interests. The Malaysian government passed the Anti-Fake News Act 2018 to penalize people who posted or exchanged untruths online. Critics viewed the bill, which was hurried through parliament on the wake of former prime minister Najib Razak's (1953–) scandal of extorting billions of dollars from the government, as a way for the politicians in power to censor embarrassing news. In fact, the bill seemed to allow the government to determine what it considered truth or falsehood and punish offenders based on their determination (Hutt 2018). To most people, the bill portended to curb free speech and democratic rights.

In other countries, governments turn off the internet for political reasons. As of late 2017, the Internet Society (2017) documented sixty-one government-initiated shutdown events, an increase from the fifty-five recorded cases in 2016. The majority occurred in India, Pakistan, the Middle East, and sub-Saharan Africa. The law in many countries assigns the government control over the internet explicitly. In others, this right is not as clearly defined and could theoretically be challenged by affected populations. Regardless, internet shutdowns often lead to rights violations and societal imbalances.

Cyberspace has created outlets for new types of crimes and criminals. Cybercrime has revealed a number of deficiencies, especially related to legal issues, that exist in the various systems around the world. Legal reforms and policies have not changed at the pace of technology. In some ways, this is by design, as all political systems have processes for writing and approving laws, and those systems require time for review and implementation. Because cybercriminals work at their own pace, learn about the strengths and weakness of technologies, are not beholden to any laws, and have the ability to hide on the internet, they present a pressing challenge for law enforcement. Legal systems have developed multiple tactics and processes for addressing cybercrimes.

The state of cyberlaws and processes vary widely around the world, often paralleling the general level of online technology used in a nation. Some countries have developed advanced laws and techniques for addressing cybercriminals. Others have few-to-no laws. Most countries, having noted the rise of cybercrime affecting their populations or those of other nations, fall somewhere in the middle. The following section showcases how countries from varied geographic regions address cybercrimes, based on what they view as a cybercrime and how serious those crimes affect them and their allies. Although the cases may vary, they show that cybercrime is a real problem around the world.

Further Reading

BBC. 2018. "Facebook to Exclude Billions from European Privacy Laws." Accessed July 1, 2018. https://www.bbc.com/news/technology-43822184.

Cuthbertson, Anthony. 2017. "FBI Chief Says Encryption Is 'Huge Problem.'" *Newsweek*. Accessed July 1, 2018. http://www.newsweek.com/fbi-encryption-christopher-wray-apple-whatsapp-690523.

Hutt, David. 2018. "The Real Problem with Malaysia's Fake News Law." Diplomat. Accessed June 25, 2018. https://thediplomat.com/2018/04/the-real-problem-with-malaysias-fake-news-law/.

International Centre for Nigerian Law. 2018. "Criminal Code Act—Part VI to the End." Accessed June 25, 2018. http://www.nigerialaw.org/Criminal Code Act-Part VI to the end.htm.

Internet Society. 2017. "Policy Brief: Internet Shutdowns." Accessed July 1, 2018. https://www.internetsociety.org/policybriefs/internet-shutdowns.

INTERPOL. 2018. "Cybercrime." Accessed June 25, 2018. https://www.interpol.int/Crime-areas/Cybercrime/Cybercrime.

Lewis, James. 2018. "Economic Impact of Cybercrime—No Slowing Down Report." Washington, D.C. Accessed May 28, 2020. https://assets.website-files.com/5bd672d1924b9893a632c807/5c171d5e85ed62697a79e351_economic-impact-cybercrime.pdf.

Newman, Lily Hay. 2018. "Nigerian Email Scammers Are More Effective Than Ever." *Wired*. Access June 25, 2018. https://www.wired.com/story/nigerian-email-scammers-more-effective-than-ever/.

BRAZIL

Brazil has had one of the fastest-growing technology sectors in South America over the past twenty years. With the increase in access to technologies, and especially with the development of emerging or disruptive technologies, there are also inherent dangers. Brazil has become one of the world's epicenters for cybercriminal activities. To combat the problem, the Brazilian government has enacted a series of laws and programs to address the rising number of cybercrime incidents. It has involved the police and the military in its efforts, though it has experienced several controversies over its approach to cybercrime. These anticipated solutions have not slowed cybercriminals; in spite of government efforts, the country has seen a spike in criminal cybergangs with a deepening knowledge base of how to create, and sell, tools that facilitate cybercrimes.

Brazil's first cybercrime law went into effect in 2013. The law criminalized the misuse of personal data and hacking. It did not, however, impose strict penalties for violators. The maximum penalty was two years in prison. In comparison to other countries, such as the United States, where similar crimes could warrant up to ten years in jail, these penalties did not serve as a strong deterrent. Officials named the law the Carolina Dieckmann Law, or the Cyber Crimes Act, Law No. 12,737/2012, after a national soap opera star (Presidência da República 2012). Hackers penetrated Dieckmann's (1978–) personal computer and stole several dozen nude pictures. They then blackmailed her with threats to release them online and damage

her reputation. This law was an initial step, but it was not sufficient to address Brazil's growing cybercrime problem.

The next attempt to strengthen Brazil's laws regarding the internet came in 2014, with the Marco Civil da Internet, Law No. 12,965/2014, which established basic rights around access and use of the internet. It provided some guaranteed rights to users, such as privacy rights and net neutrality, and defined some legal frameworks to determine when authorities could access personal data (Presidência da República 2014). While this law lacked details about liability, the people seemed to accept it. Their contentment with the bill showed when thousands petitioned the government in 2016 to prevent new amendments to the bill. Specifically, the CPI, or Inquérito dos Crimes Cibernéticos (Inquiry Commission on Cybercrimes), suggested several modifications that critics viewed as stripping away guaranteed rights. It eventually curbed many of those modifications due to public sentiment. However, even with modifications, the new version still lessened the threshold for access to electronic communications. Instead of having a judge issue a warrant, police officers gained the right to request records with the claim that the request relates to an investigation. It did, however, remove the provision that internet sites be required to remove content that politicians found offensive, regardless of whether it was legal, within twenty-four hours.

In 2015, research institutions examining Brazilian cybercrime found that it ranked second highest in the world for financial fraud and malware, with cyberattacks having grown 197 percent and online financial fraud having increased 40 percent in 2014 (Igarape Institute 2015). In Latin America, Brazil ranked first for cybercrime incidents. Reasons for this included a public uneducated about cybersecurity, weak network security, and short sentences for criminal offenders. In fact, the controversial blockade of WhatsApp in 2015 occurred because of an official investigation into cybercrime. A suspect allegedly used the service to participate in drug trafficking and robbery, and WhatsApp did not immediately turn over the records the government requested. The government justified its action under the Marco Civil da Internet because the bill allowed it rights to sanction foreign companies not in compliance with national laws. The decision was highly controversial, and the government restored access within forty-eight hours.

Another case involving WhatsApp led to multiple controversies in 2016. Marcela Temer (1985–), Brazil's first lady, had her cell phone hacked. The hacker then used its contents to blackmail her over WhatsApp. Temer went to the courts to have news stories surrounding the incident removed, claiming they violated her privacy. The courts then initially ordered several online news sites to remove stories about the incident, including those that published screenshots of the exchanges over the platform. The decision was eventually overturned. Critics decried the court's decision, claiming that it amounted to censorship. Multiple civil organizations followed suit. The blackmailer was eventually arrested, although it was not clear whether or not WhatsApp provided information to support the criminal investigation.

Prior to the 2016 Summer Olympics in Rio de Janeiro, experts warned locals and tourists to be on high alert for cybercriminals. In the months leading up to the games, around 4,000 fake websites appeared with *gov.br*, the usual designation for an official government website (Francescani 2016). These websites contained malware and other techniques designed to capture and exploit personal information. Malware cases also rose over 80 percent in Brazil, almost four times the average of the rest of the world. The Brazilian gangs may have even surpassed the Russians for the development of mobile malware, a program that freezes a phone system until a ransom is paid; it is essentially ransomware for phones. After extorting or stealing money, it was common for hackers to take selfies with their loot. Some even posted them online. As one of the outcomes of the Olympic cybercrime experience, Brazil sought additional collaborators to combat cybercrime. For example, Brazil signed an agreement with Europol in 2017 to promote cooperative cybercrime fighting, especially in cross-border cases.

The civilian population has not been the only segment affected by criminal cyberactivities. The Brazilian army initiated its Strategic Defense Cyber Project in 2011 after hackers invaded the military's computer system. Under this strategy, the army operates a Cyber Defense Center to research cybersecurity approaches and tools. Since the center's inception, the army has focused on developing training programs and partnerships with other organizations, such as those in academia, to ensure that its workforce is ready for current and future threats. This advanced preparation has proven important; in 2014, for example, the country reported over a million unique cyberattacks against military and civilian computers (Barretto Lemos 2015). The Brazilian government further invested in its cyber defense with the creation of the Cyber Defense Command (ComDCiber) to prepare for anticipated cyber threats and cybercriminal activity prior to the 2016 Summer Olympic games.

Despite Brazil's attempts to thwart cybercrime, the country has earned a reputation as one of the world hotbeds for it, alongside Russia and North Korea. Not only has it seen a rise in domestic cybercrime, but it has also become a major destination for external cyberattacks. At one point in 2016, Brazil was considered second only to Russia for its domestic cybercriminal gangs. These gangs intensified the dangers within the country, as they were no longer reliant on purchases to obtain state-of-the-art hacking tools; instead, they had increased their technical expertise enough to design and implement their own unique tools. In fact, cybercriminal gangs developed their own tools and also designed websites to sell them to interested parties. In 2018, statistics show that cybercriminals cost the population, and therefore the economy, over US$22.5 billion in online credit card fraud (Leahy 2018). This figure does not account for other cybercrime losses that have impacted the country.

Despite its challenges, the Brazilian government has made progress in reducing some aspects of cybercrime. One of the country's most successful actions has been in the reduction of child pornography online. In Brazil's largest sting against

internet child pornography, the police sent 2,500 agents to arrest over 250 suspects across twenty-four states; overall, they seized thousands of electronic devices and over a million computer files (Cabral 2018). Another area where the country has made progress in the name of preventing cybercrimes is criminalizing most types of online anonymity. Under the law, people must use their real names to access private internet connections and to purchase devices that can access the web.

Officials are considering additional legislation to prevent anonymity, which could complicate some criminal activity, although it is not clear how effective these measures will be if passed. The police have also developed methods to catch cryptocurrency thieves. They arrested a ring of Bitcoin thieves who stole twenty-eight Bitcoin, worth about US$178,000, through the account data of more than 390,000 individuals in twenty-three different states (Crypto Economy 2018). After siphoning money out of these individuals' banking accounts, both virtual wallets and electronic accounts, the criminals converted some of the money into cryptocurrency. Police recovered the cryptocurrency using technology that reverse engineered the hackers' technique.

The Brazilian government has a difficult prognosis when it comes to combating cybercrimes. Through the laws, police, and military, the government has had some successes. It has also experienced growing cybercrime and has become a safe haven for cybercriminals. The response to increased cyber activity has been to tighten the laws, adding restrictions to internet use and allowing police greater access to information. News and social media companies, both foreign and domestic, have received sanctions for not complying with the government's requests, which has led to a desire to add additional restrictions on the services and the population. This situation is likely to worsen until the country finds a balance between citizens' rights and the need to combat online crime.

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Further Reading

Barretto Lemos, Andrea. 2015. "Brazilian Armed Forces Strengthen the Nation's Cyber Defense." Dialogo Americas. Accessed July 25, 2018. https://dialogo-americas.com/en/articles/brazilian-armed-forces-strengthen-nationscyber-defense.

Cabral, Paulo. 2018. "Brazil Conducts Large-Scale, Cyber-Crime Operation to Fight Child Porn." CGTN America. Accessed July 25, 2018. https://america.cgtn.com/2018/05/22/brazil-conducts-large-scale-cyber-crimeoperation-to-fight-child-porn.

Crypto Economy. 2018. "28 Stolen Bitcoins Were Recovered by the Brazilian Police." Accessed July 25, 2018. https://www.crypto-economy.net/en/28-stolen-bitcoins-were-recovered-by-the-brazilian-police/.

Francescani, Chris. 2016. "Brazil Superhackers Stalk Olympic Tourists." NBC News. Accessed July 25, 2018. https://www.nbcnews.com/storyline/2016-rio-summer-olympics/brazil-superhackers-stalkolympic-tourists-n625661.

Igarape Institute. 2015. "Brazil's Cybercrime Problem: Time to Get Tough." Accessed July 25, 2018. https://igarape.org.br/en/brazils-cybercrime-problem/.

Leahy, Joe. 2018. "Brazil Looks to Data for Solutions to Rising Crime." *Financial Times*. Accessed July 25, 2018. https://www.ft.com/content/b3e08f08-2623-11e8-b27e-cc62a39d57a0.

Presidência da República, Brasil. 2012. "Casa Civil. Subchefia para Assuntos Jurídicos *LEI No 12.737, DE 30 DE NOVEMBRO DE 2012*." Accessed July 25, 2018. http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12737.htm.

Presidência da República, Brasil. 2014. "Casa Civil. Subchefia para Assuntos Jurídicos *LEI No 12.965, DE 23 DE ABRIL DE 2014*." Accessed July 25, 2018. http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l12965.htm.

ECUADOR

Ecuador is not among the top ten countries most afflicted by cyberattacks, but it did harbor one of South America's most wanted hackers and cybercriminals continue to victimize Ecuadorians. Cybercrime is a growing issue (Cook 2017; AFP 2016); it includes the actions of people who use the technologies to commit crimes like abuse and harassment as well as to perpetrate financial crimes. Individuals are not the only victims of cybercrime; Ecuadorian banks have been targeted by the North Korean Reconnaissance General Bureau when Western banks proved too difficult to victimize (McAfee 2018).

In 2018, as organized bot attacks grow worldwide with a record one billion bot attacks seen in the first quarter of the year, Ecuador was one of the new and emerging economies contributing to this growth. Transactions originating from Ecuador are likely to be bots, predominantly targeting e-commerce merchants, contributing to the overall bot attack volumes seen worldwide. More than half of the bot attacks originating from Ecuador target account creation transactions (Threatmatrix 2018). In spite of these developments, Ecuadorian officials have a history of taking action. More than twenty years ago, the first laws were passed to criminalize many cybercrimes. Governmental departments, coordinating with police throughout the country, were established to mitigate these criminal activities. Ecuadorian laws continue to evolve to counter the threat. Yet, as in many countries, the incidents of cybercrime continue to rise and expand beyond its borders.

Ecuador has taken the matter of cybercrime quite seriously for more than twenty years. It has enacted proactive laws and updates them to reflect the cybercrime landscape. In 1999, Ecuadorian officials began to discuss and draft laws on electronic commerce, messages, and electronic signatures. After a series of revisions, the new laws were added to the criminal code in April 2002, giving rise to criminal prosecution of cybercrimes in Ecuador. The minister of Ecuador used his constitutional powers and the newly created criminal laws to form the Computer Crime Unit of the Public Ministry (Del Pino 2007). Ecuadorian police ask that victims of cybercrime make a report at the nearest Citizen Services of the Prosecutor's office instead of at a police station (National Police of Ecuador 2015). Since the creation of these bodies, the country continues to address cybercrime through domestic and international collaborations.

Ecuador's government and police coordinate with many international organizations to adopt legal best practices to prevent and prosecute cybercrimes. As part of its membership in the Organization of American States (OAS), Ecuador has adopted the recommendations of the international OAS working group on

Cybercrime and the Convention of the Council of Europe on Cybernetic Crime by criminalizing specific online crimes. These crimes, as listed in Law No. 2002-67, include illicit access, data interference, system interference, abuse of devices, computer fraud, and computer falsification, a crime that includes phishing and the reproduction and sale of software protected by copyright with the intent to imitate and deceive. Ecuador first criminalized child pornography in 2000, making it punishable by up to sixteen years of prison, as described in Article 528.7 of the Criminal Code (OAS 2018).

Hacking a system, such as a university grading system with the goal of changing grades or financial information, is also a criminal offense under Section I, Article 415 of the Ecuadorian Criminal Code (Pinasco 2013). Ecuador is also considering adhering to the Convention on Cybercrime, also known as the Budapest Convention, which was signed by fifty-seven countries and became effective in 2004. In 2005, Ecuador passed stricter laws against child pornography and developed the Open Your Eyes, or Abre los Ojos, campaign to combat it in conjunction with UNICEF. In 2014, the country passed Article 178 to combat privacy violations, which prohibited the use of audio or visual technology without consent and can apply to perpetrating cybercrimes.

In addition to Ecuador's membership in the OAS and its cooperation with other international organizations, the government also works directly with other countries to share knowledge and increase training opportunities. In March 2016, the Child Rescue Coalition and the U.S. State Department shared knowledge and experience with thirty Ecuadorian prosecutors and police. Investigators from three different police departments in the United States trained the attendees on online investigative techniques (U.S. Mission Ecuador 2016).

In spite of these laws, incidents of cybercrime continue to rise in the country. According to the Ministry of the Interior, in 2015, there were 704 registered cases of cybercrime, and officials detained ten people for cybercrimes. This number represents a 100 percent increase over the five people detained the year before (Suarez 2016). Although cybercrimes occurred before the start of the millennium, criminals continue to innovate and use new methods, which may indicate a continued rise in the commission of these crimes. As such, Ecuadorian officials have adapted and adopted new strategies and laws to combat cybercrime. For example, in August 2014, the criminal code of Ecuador published a list of crimes committed through social networks and the internet. These include phishing, identity theft, extortion, electronic fraud, harassment, grooming, and the spread of malware.

Some of the worst cybercriminal offenses in Ecuador involve using the internet for sexual or other abusive crimes. In 2017, the police arrested a school worker in Quito for requesting photos of victims under the age of eighteen. He then used the photos to extort his victims for money. The Technological Crimes Unit indicated that this case involved grooming, when a sexual predator sets the stage for another's abuse, and stated that they receive ten complaints per month for similar crimes (Alarcón 2017). In 2018, a girl was raped after being groomed on Facebook to meet a perpetrator in person. The Gender Violence Unit of the Guayas Attorney's Office

states that there were twenty-seven reports of grooming from December through August 2018, with most of the victims approached via popular social media like Facebook, Instagram, instant messenger, and WhatsApp. According to the Judicial Council of Guayas, the courts convicted sixty-three people of online grooming between 2015 and 2018 (Paucar 2018). These convictions occurred despite existing laws that criminalize grooming and other sexually explicit cybercrimes.

Grooming is a crime in Ecuador defined in Article 173 of the Comprehensive Criminal Code, punishable by a prison sentence between one and five years. As defined in the law, people commit the crime of grooming if they use electronic means to arrange a meeting with a person under the age of eighteen, provided that such a proposal is accompanied by material acts aimed at sexual or erotic purposes. When the meeting is obtained through coercion or intimidation, the prison term is increased for a period of three to five years. In Ecuador, since 78 percent of young people between sixteen and twenty-four years of age affirmed that they use computers and 63 percent of minors between the ages five and fifteen claim to use social media, many young people and children are vulnerable to grooming (Berrones 2017). In 2010, before the law considered grooming a crime, there were 866 complaints for what was then called *illegal appropriation*. In 2011, the number of complaints for similar crimes rose to 3,200. When the Computer Crime Unit began to operate in 2012, it could categorize 60 cases specifically as grooming; by 2013, that figure rose to 433 (Telégrafo 2014).

While the numbers are alarming, grooming is not the most common cybercrime. In 2013, electronic fraud represented 46 percent of complaints, followed by virtual bank transfers, which accounted for 37 percent of complaints. The criminals behind these bank transfers used stolen access codes to achieve their aims (Telégrafo 2014). A similar type of fraud, akin to identity theft, involves the cloning of cellular SIM cards in order to steal money. Fraudulent appropriation by electronic means is punishable by one to three years in prison. As of May 2016, of the 530 cybercrimes reported that year, 368 were classified as fraudulent appropriation by electronic means. Victims of the crime experience an outage as their phone begins to lose signal or its battery drains mysteriously. Once a victim is able to regain access to a noncellular network, such as Wi-Fi, they realize the damage has already been done; someone has already used their personal information. Criminals use the cloned cellular phones to change bank account passwords and drain the money from accounts, all the while posing as the victim (El Comercio 2016). These crimes directly impact victims and their families and pose a difficult recovery process, especially as police cannot always restore the stolen money.

The Ecuadorian government has long recognized the threat of cybercrime on its citizens and continues to take cybersecurity seriously. Long-standing cybercrime laws gained strength in 2014, and training of prosecutors and police improve with the help of global experts. Yet, as bots begin to affect victims outside of Ecuador, further efforts are needed to protect international citizens who fall prey to Ecuadorian-based cybercrime. As children and young adults continue to maintain a strong presence on internet-connected devices, the threat of grooming and

extortion will likely grow. Growth is also likely for online fraud and identity theft. Government officials will need to expand how it identifies, detains, and prosecutes offenders in order to lower the threat.

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Further Reading

AFP. 2016. "Colombia: capturan a miembro de banda de hackers que delinquía en Ecuador." *El Comercio*. Accessed December 29, 2018. https://www.elcomercio.com/actualidad/colombia-capturan-hacker-operaba-ecuador.html.

Alarcón, Isabel. 2017. "Investigan a un hombre por posible caso de Grooming en redes sociales." *El Comercio*. Accessed May 29, 2020. https://www.elcomercio.com/actualidad/investigan-caso-grooming-redessociales-quito.html.

Berrones, Talia. 2017. "'Grooming,' the Danger That Hides in Social Networks." Gráficos Nacionales S. A. Accessed December 26, 2018. https://www.extra.ec/actualidad/acoso-virtual-grooming-delito-ecuador-CE1897703.

Cook, James. 2017. "The World's 10 Biggest Cybercrime Hotspots in 2016, Ranked." *Business Insider*. Accessed December 21, 2018. https://www.businessinsider.com/worlds-10-cybercrime-hotspots-in-2016-rankedsymantec-2017-5.

Del Pino, Santiago. 2007. "Operative Plan for the Creation of the Computer Crime Unit of the Public Ministry." Accessed December 26, 2018. http://www.oas.org/juridico/spanish/cyb_ecu_plan_operativo.pdf.

El Comercio. 2016. "Criminal Gangs Clone Mobile Phone Chips to Steal Money." Accessed December 29, 2018. https://www.elcomercio.com/actualidad/bandas-clonacion-chips-robo-dinero.html.

McAfee. 2018. "A Map of the Most Dangerous Sources of Cybercrime." Accessed December 21, 2018. https://securingtomorrow.mcafee.com/business/map-dangerous-sources-cybercrime/.

National Police of Ecuador. 2015. "Computer Crimes or Cybercrimes." Accessed December 26, 2018. http://www.policiaecuador.gob.ec/delitos-informaticos-o-ciberdelitos/.

OAS. 2018. "National Legislation of the OAS Member States." Accessed December 29, 2018. http://www.oas.org/juridico/spanish/cybersp_legis.htm.

Paucar, Elena. 2018. "In Social Networks the Child Finds Dangerous 'Friends.'" *El Comercio*. Accessed December 26, 2018. https://www.elcomercio.com/actualidad/redes-sociales-jovenes-amigos-peligro.html.

Pinasco, G. 2013. "Understand the Cybercrimes That Are Illegal in Ecuador." *Ecuavisa*. Accessed December 29, 2018. https://www.ecuavisa.com/articulo/noticias/actualidad/25274-conozca-los-delitos-informaticos-que-se-penalizan-en-ecuador.

Suarez, J. 2016. "Redes Wi-Fi: el nuevo 'blanco' de la delincuencia." *Ecuavisa*. Accessed December 30, 2018. https://www.ecuavisa.com/articulo/noticias/actualidad/127682-redes-wi-fi-nuevo-blanco-delincuencia.

Telégrafo. 2014. "600 Cases of Cybercrime in 17 Months." Accessed December 26, 2018. https://www.eltelegrafo.com.ec/noticias/judicial/12/hay-600-casos-de-delitoselectronicos-en-17-meses.

Threatmatrix. 2018. "2018 Cybercrime Report." Accessed May 29, 2020. https://policehorizonscanning.files.wordpress.com/2018/06/q1-2018-cybercrime-report.pdf.

U.S. Mission Ecuador. 2016. "Course on the Investigation of Cyber Crimes in Order to Prevent Child Exploitation." Accessed December 29, 2018. https://ec.usembassy.gov/es/curso-sobre-investigacion-de-delitos-ciberneticos-paraprevenir-la-explotacion-infantil/.

EGYPT

Cybercrime in Egypt has been a persistent problem for almost as long as the country has been connected to the global internet. Increasingly, Egyptians have been the victims rather than the perpetrators of international attacks, because of their inability to defend their networks successfully. Following the revolutions during the so-called Arab Spring, the government reorganized the policing forces devoted to investigating and prosecuting cybercrimes and introduced new laws to increase their abilities and purview. In early 2018, the Egyptian government passed new laws that radically expanded the definition of cybercrime to include facilitating the dissemination of content that threatened national security and "family values."

The percentage of Egypt's population that is online has more than doubled since 2010, with between 45 and 50 percent of the country actively using the internet. Fixed telephone subscriptions (landlines) have been decreasing since 2008 and are now at their lowest level since 2000. Mobile cellular subscriptions also began dropping after the 2011 uprising, meaning that internet communications are becoming a relatively larger part of how Egyptians communicate with each other and the world. Globally, Egypt ranks 18th in the number of computers in use despite ranking 132nd in the percentage of the population with access to the internet (World Bank 2019; International Telecommunications Union 2019). The country's online population is much more vulnerable than before to various forms of cybercrimes, as there are many new users who do not know how to protect themselves adequately, and there is little active effort from the government to catch and prosecute cybercriminals. Most news regarding cybervulnerabilities in Egypt reported in the media, in fact, comes through the U.S. embassy's travel advisements.

As a source of cybercrime, Egypt has never ranked highly relative to other countries of its size, especially in Europe. However, the countries in which most attacks originate do not necessarily have the most victims. In 2014, the FBI reported that Egypt ranked forty-fifth in the number of complaints it received regarding cybercrimes and sixth in the Middle East, although this report only included crimes reported to the organization (FBI 2014). The number of unreported crimes, while unknown, may indicate higher levels of cyberthreats to citizens, whose complaints are compounded by a government that is using the threat of cybercrime to censor and control its population, even going so far as to infiltrate its own citizens' computers with malware meant to censor their online activity.

The WannaCry ransomware attack that caused global damage in 2017 greatly affected Egypt. More Egyptian computers were infected by the ransomware virus than any other country on the African continent, and Egypt ranked in the top twenty most affected countries. This same virus took down the British National Health System in 2015 and infected over 300,000 computers globally (Egypt Today 2017). Egypt was also a possible source of the Shamoon virus that took over more than 30,000 computers belonging to the petroleum and natural gas company Saudi Aramco in 2012. As the virus spread from one computer to the entire network, it uploaded valuable data, sent it offsite the cyberattacker, and deleted it from the system. The company was unable to access important parts of

A screenshot of the WannaCry ransomware attack from 2017, where cybercriminals encrypted computer files and extorted money to release them. In Egypt, the ransomware was particularly devastating; Egypt was the most affected country in Africa and one of the top 20 worldwide. On the other side, Egypt has also allegedly been the source of ransomware viruses such as Shamoon, which has hacked and damaged companies internationally. (Jarretera/Dreamstime.com)

its own computer network for an entire week, causing it to lose revenue; in hindsight, some researchers have dubbed Shamoon the world's "biggest hack." In this instance, attackers explicitly referenced that some of the hacking group's members were Egyptian, although it allegedly contained members from many Middle Eastern nations.

Malware like Wannacry and Shamoon either encrypts information and demands payment to release it or maliciously uploads and deletes it. However, the most common type of cybercrime in Egypt is hijacking user computers for use in botnets and mining Bitcoin. *Botnets* are created when malware infects a number of computers and uses parts of their processing power and storage for the attacker's benefit without the owner's knowledge or control. They have become a worsening problem in the Middle East, where internet users may not have valuable information to steal but do have computing resources that can be hijacked and used for other purposes. In 2015, the telecommunications company Level-3 identified Egypt as third in the Middle East in terms of computers communicating with command and control servers (C2s, the servers that control botnets) and tenth globally (Level-3 2015, 3). Although these computers can be used for many different purposes, including adding new computers to the botnet, they are usually classified as victims, because users are unlikely to know what is wrong with their computer.

A report by the Citizen Lab in 2018 indicated that the Egyptian government was using Telecom Egypt, the government-owned telecommunications company, not only to censor traffic but also to divert legitimate traffic to advertisers and mine for Bitcoin (Marczak et al. 2018). The company employed technology from a Canadian company. The government-controlled telecommunications provider diverted users who attempted to download legitimate applications to versions that contained spyware. While the government may have sanctioned this activity, it highlights the vulnerability of the Egyptian population to cyberattacks and manipulations. Through concerted efforts such as these along with restrictive cybercrime laws, the Egyptian government is thought to play a heavy hand in leaving Egyptian internet users vulnerable by either targeting them directly or strictly delimiting their internet use.

Law and Ethics

Ratified in August 2018 by President Abdel Fattah el-Sisi (1954–), Egypt's latest cybercrime law, the Anti-Cyber and Information Technology Crimes legislation, radically expanded the number of online acts that are illegal and the penalties for those already considered criminal. As described by advocates, the law aims to combat terrorism, extremism, and the spread of "fake news." The law's forty-five articles outline the legal responsibilities and penalties for users as well as service providers, including individuals who run websites, internet service providers, and telecommunications companies.

Under the law, what constitutes a cybercrime in Egypt is much broader than it is in countries like the United States or United Kingdom. In addition to crimes like disseminating malware, committing fraud, and disseminating amoral content like child pornography, the new law also criminalizes activities that would endanger national security. These activities include any type of act that uses the internet, even if the activity itself is not cyber in nature. It also outlaws a large swath of content that could endanger "family values." As a result, content that promotes LGBTQ rights or supports abortion can also constitute a cybercrime in Egypt.

Since the ratification of the law, the government has been criticized by nongovernmental organizations, companies, and other governments that claim that the new law gives the government sweeping censorship powers by closely monitoring internet traffic and enabling authorities to arrest anyone who posts or facilitates criminal activities or content deemed oppositional to the state. Vaguely defined elements of the law give the government more leverage in moderating content it deems threatening and ultimately limits free speech. The law does provide for increased penalties for cybercriminals, but since many of them reside in other countries, it is unclear that the law itself will do more to protect the Egyptian population.

The law also makes it illegal to facilitate a cybercrime, even if it is done unknowingly. Facilitating a cybercrime may be owning or moderating a website where illegal content is found, sharing illegal content on different websites or social media,

providing the original creator with funding or other means, and even being the internet provider allowing access to the content. This also means that anyone whose computer is infected with malware without their knowledge can be found as guilty as the original perpetrator if that malware infects others or is used to support criminal activity.

Given Egypt's large number of victims in international bot networks, anyone owning a computer that has been infected may be charged with a crime and imprisoned even if they did not know their computer was infected. Users are punished for not protecting their computers and other devices from malware even though the software to do this is often unavailable or much too expensive for the average Egyptian citizen. Even if robust anti-malware software were available, no program to date is capable of intercepting and detecting all types of malware, meaning that it is impossible for users to protect themselves completely from prosecution under this new law.

Under the law, anyone who creates or hosts such content can be charged with a crime. This includes website administrators and even telecom workers. It does not necessarily matter if individuals knew that the content was on their site or wanted it there. This new approach provides considerable incentives for social media platforms and internet forums to self-police since the company and its specific workers can each be held accountable under the law.

Cybercrime, as defined by the government, is thus much more rampant in Egypt than in other parts of the world and is usually perpetrated unwittingly. The government can use the law to arrest not only those who criticize Egyptian leaders and the policy but also those who are the primary consumers of that content. Individuals who frequent websites and forums that propagate ideas contrary to vaguely defined principles of morality can be found guilty of cybercrimes. Therefore, it is difficult for Egyptians to navigate the internet in their day-to-day lives.

International human rights organizations have criticized the new cybercrime laws in Egypt for constraining freedoms of speech and the press while doing very little to address the more serious cybercrimes that target Egyptian citizens. Egypt's laws and enforcement, however, have ranked quite highly according to the International Telecommunications Union, both in the Middle East region and globally, for its legal and technical capacity to address cybercrimes. Egypt has well-developed agencies devoted to detecting and addressing problems such as child pornography. The new law goes beyond the initial success in fighting cybercrimes and use the issue to give the government broad powers to arrest dissidents who are not guilty of what is generally understood to be criminal behavior on the internet.

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Further Reading

Egypt Today. 2017. "Egypt among Top Countries Hit by Massive Ransomware Virus." Accessed August 17, 2019. http://www.egypttoday.com/Article/1/5055/Egypt-among-top-countries-hit-by-massiveransomware-virus.

FBI. 2014. "2014 Internet Crime Report." Internet Crime Complaint Center. Accessed August 17, 2019. https://pdf.ic3.gov/2014_IC3Report.pdf.

International Telecommunications Union. 2019. "Statistics." Accessed May 2, 2019. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

Level-3. 2015. "Safeguarding the Internet: Level 3 Botnet Research Report." Accessed August 17, 2019. http://www.level3.com/~/media/files/white-paper/en_secur_wp_botnetresearchreport.pdf.

Marczak, Bill, Jakub Dalek, Sarah McKune, Adam Senft, John Scott-Railton, and Ron Deibert. 2018. "Bad Traffic: Sandvine's PacketLogic Devices Used to Deploy Government Spyware in Turkey and Redirect Egyptian Users to Affiliate Ads?" Citizen Lab. Accessed August 17, 2019. https://citizenlab.ca/2018/03/bad-traffic-sandvines-packetlogic-devices-deploygovernment-spyware-turkey-syria/.

Sayadi, Emna, Carolyn Tackett, and Juliana Castro. 2018. "Would Your Internet Activity Put You at Risk of Going to Jail in Egypt?" Access Now. Accessed August 17, 2019. https://www.accessnow.org/wouldyour-internet-activity-put-you-at-risk-of-going-to-jail-in-egypt/.

Shires, James. 2018. "Between Multi-Stakeholderism and Sovereignty: Cyber Norms in Egypt and the Gulf States." War on the Rocks. Accessed August 17, 2019. https://warontherocks.com/2018/10/betweenmultistakeholderism-and-sovereignty-cyber-norms-in-egypt-and-the-gulf-states/.

World Bank. 2019. "Egypt, Arab Rep. Data." Accessed May 2, 2019. https://data.worldbank.org/country/egypt-arab-rep.

NIGERIA

In the popular imagination, Nigeria has become synonymous with internet scams. Before spam farms, phishing, or ransomware entered the lexicon, there was the "Nigerian prince." The email scam involved a promise of millions of dollars in exchange for a small fee. It quickly became a punchline for jokes about an impossibly good offer designed to ensnare the gullible.

The scam took on a life of its own in the early 2000s, becoming fodder for news reports and late-night talk-show monologues and was the subject of an award-winning film. But despite the scam's absurdity, the damage inflicted on victims and the harm to the reputation of the West African nation has been lasting. The tech media company IDG reported that cybercrime has been "an image nightmare for the country" (Africa Defense Forum 2019). So how did Nigeria become the launching point for the first wave of internet scams and a warning about the dark side of the web? What is Nigeria doing today to reverse this legacy? The story dates back nearly one hundred years.

History of the 419 Scam

According to *This Present Darkness*, a history of organized crime in Nigeria, the first recorded occurrence of the advance-fee scam in Nigeria was committed in 1920 by a man calling himself "P. Crentsil Professor of Wonders" (Ellis 2016). The man sent out letters claiming to have supernatural powers. He told recipients the powers could be put to use in exchange for a small fee. Crentsil was charged by British colonial authorities at the time under section 419 of the criminal code,

which outlined the crime of fraud. Although the charges were later dropped, the criminal tactic lived on.

In the 1940s, authorities in Nigeria were intercepting thousands of letters from foreign addresses containing cash. These letter writers had been duped to respond to promises of love potions, magical cures for illnesses, and immense wealth in the form of diamonds or ivory. By the advent of transatlantic phone calls and cheap wire transfers, the advance-fee scam had a set formula. The scam artist promised a vast amount of money and, in exchange, requested a small advance in the form of a wire transfer or some other untraceable currency. The scam also had a name, 419, in honor of the criminal code.

In the 1980s, as corruption rotted many sectors of Nigeria's government and economy, the scammers multiplied. They mailed letters with forged stamps or used the newly invented fax technology. When the internet came to West Africa two decades later, the tactic took on an industrial scale as groups of young men nicknamed "Yahoo boys" crowded into cybercafes. As Brunton (2013) notes, cybercafes "created a venue for sending massive streams of messages, without even the labor involved in forging postage" and the switch to e-mail "meant they could now incorporate links to corroborating sites and documents, bolstering the pretense of realism on which the con relies. Today, it is as easy to adjust the scam's specifics to a new crisis as it is to cut and paste." Although the scam is now widely known, it is not dead. A 2019 report by ADT Security Services found that scammers were still raking in US$700,000 per year from Americans using some version of the Nigerian prince story (Leonhardt 2019).

Internet Boom

The internet has brought both threats and opportunity to Nigeria. The net first came to the country in 1995, part of an effort supported by UNESCO. In a workshop organized by the Yaba College of Technology, representatives of a number of institutions, including the Nigeria Communications Commission (NCC) and the National Data Bank, formed a nongovernmental organization known as the Nigerian Internet Group. Its mission was to support the propagation of the net throughout the country. The following year, the NCC licensed thirty-eight internet service providers. In 1999, with the support of a grant from the United Nations, Nigeria invested US$1 million to increase internet penetration in the country and train technicians.

The growth was rapid. Between 2000 and 2008, internet use grew from 0.3 percent of the population to 15.9 percent, according to the Nigerian newspaper the *Vanguard* (2010). Since then, access has continued to expand. In 2008, the Lagos-based telecommunications company Main Street Technologies announced the construction of a 14,000-kilometer submarine cable system connecting Portugal to South Africa with landing points in Accra, Ghana, and Lagos. In 2010, the company launched a high-capacity fiber-optic cable system in Ghana and Nigeria.

The internet is now woven into the fabric of the lives of most Nigerians who live in mid- to large-sized cities. According to the global survey and statistics company Statista, in 2018, Nigeria had 92.3 million internet users in 2018, a penetration rate of 47 percent; by 2023, usage is expected to double in total numbers and reach 85 percent penetration (Statista 2019). Nigeria's experience roughly mirrors that of the continent as a whole. Africa was a relatively late adopter of the internet, but in recent years, it has shrunk the digital divide. In 2005, only 2.1 percent of the continent used the internet. By 2018, that number had risen to 24 percent, the fastest growth rate in the world. Between 2017 and 2018, that figure grew at a rate of 20 percent. African nations are spending money on fiber-optic cables, believing that high speed internet is the key to making gains in the twenty-first century economy. A total of fifty-two African countries are connected to a submarine internet cable or a fiber optic network. Forty-four percent of the continent's population lives within twenty-five kilometers of a fiber node carrying high speed internet.

The continent's experience is unique, in that it largely bypassed desktop and even laptop computers in favor of mobile phones. In some countries, a mobile phone is more commonly owned in the poorest households than a toilet. In Nigeria, 80 percent of the population own a mobile phone of some sort (Pew Research Center 2018). About 32 percent of Nigerians own a smartphone, and smartphone usage increased by 13 percent between 2013 and 2017. More than half of sub-Saharan African mobile phone users told Pew that they use the phone to make or receive payments. This transformation is essential for Africa's economies, which currently rely heavily on natural resource wealth but are looking to diversify. By 2022, 60 percent of the global economy is expected to be digitized, according to CNBC (2019). This transformation carries the potential for economic growth, but it must be protected. "The digital environment is like our natural environment," said Derek O'Halloran (n.d.), the head of the Future of Digital Economy and Society at the World Economic Forum, "we all—governments, businesses, individuals—have a duty to ensure it remains clean, safe and healthy" (Schmitt 2018).

Net Insecurity on the African Continent

The growth of commercial activity on the internet has attracted criminals. Nigeria and other West African nations have been both the victims of cyberattacks and the launching point for attacks on other parts of the world. According to the Nairobi-based cybersecurity firm Serianu (2017), cyberattacks cost Nigeria's economy US$649 million per year. Continentwide, the figure is US$3.5 billion. The most common targets for attacks are banks and financial services companies, followed by government websites and e-commerce sites. The most significant attacks in Nigeria come in the form of botnet attacks, where command and control software uses infected computers in Nigeria to attack systems in other countries. The country has also been the victim of "hactivist" attacks targeting the government. In 2016, a group calling itself Anonymous Friday took over the websites for Nigeria's

Finance, Foreign Affairs, and Justice Ministries as well as the Federal Capital Territory Administration.

Although these attacks are alarming, they represent only a fraction of the true threat. Serianu (2017) reported that 81 percent of attacks in Nigeria go unreported. Domestic cybercriminals are also growing more sophisticated. The early practitioners of the online advanced-fee scam were young, poorly educated men who fired off grammatically incorrect emails by the thousands. Today's attackers are more likely to be focused on "business email compromise" (CrowdStrike 2018). This crime seeks to fool employees into giving up corporate email login details. According to CrowdStrike, Nigerian criminals caused losses of US$5.3 billion using this tactic between 2013 and 2016. "The magnitude of this criminal threat has only recently begun to be understood," CrowdStrike (2018) said in its report.

Fighting Back

Nigeria is eager to rid itself of its reputation as a cybercrime hot spot. In 2015, the country enacted the Nigerian Cybercrime Act, with strict penalties for criminals, a plan to protect critical national infrastructure, and funding to train cybersecurity experts at national universities. The nation proposed a 0.005 percent tax on telecommunications companies to finance enforcement.

In 2018, it created the first military cybercommand on the continent, staffed with 150 officers. The command is designed to track threats, repel attacks from foreign adversaries, and respond to extremist propaganda. In a press conference announcing the launch of the command, Nigerian army chief of staff Tukur Buratai (1960–) said that cyberspace represents the fifth domain for warfare after land, sea, air, and space. "The intrinsic features of cyberspace can be easily exploited for information warfare by actors with malicious intent to plant and disseminate fake news and instruct paid users to spread online manipulated content," Buratai told the newspaper *Leadership* (David 2018). The country has also created a national Computer Emergency Response Team under the direction of the national security adviser. The team works on preventing cyberattacks, educating stakeholders about the risks of cybercrime, and coordinating incident response following attacks.

Nigeria is gaining a reputation as a center for tech innovation. The Yaba area just outside of Lagos has been nicknamed "Yabacon Valley" for its abundance of tech start-ups. In 2019, Microsoft announced that it was creating a development hub in Lagos to study "mixed-reality systems" and had plans to hire 500 engineers and to invest $100 million between two African hubs. Microsoft regional director Amrote Abdella (c. 1982–) said the country has an abundance of highly motivated, tech-savvy young people.

"Nigeria is an important innovation hub—one which is largely influencing the digital transformation of West Africa," Abdella said (Alade 2018). Leaders hope that the cybertools that were once used to commit crimes can be used for innovation. "The same technology that enables cybercrime in Nigeria is also the very

tool that can transform the lives of millions of young people in the country," wrote 'Gbenga Sesan (1977–), executive director of Paradigm Initiative Nigeria. "What erring youth need to know is that if they're tech-savvy enough to defraud, then they're smart enough to build a business online" (Sesan 2017).

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Further Reading

Africa Defense Forum. 2019. "Africa Takes on Cyber Crime." Accessed May 29, 2020. https://adf-magazine.com/africa-takes-on-cyber-crime/.

Alade, Benjamin. 2018. "There Are More Opportunities to Transform Nigerian Industries." *Guardian*. Accessed September 1, 2019. https://guardian.ng/technology/there-are-more-opportunities-to-transform-nigerian-industries/.

Brunton, Finn. 2013. "The Long, Weird History of the Nigerian E-mail Scam." *Boston Globe*. Accessed August 26, 2019. https://www.bostonglobe.com/ideas/2013/05/18/the-long-weird-history-nigerian-mailscam/C8bIhwQSVoygYtrlxsJTlJ/story.html.

CrowdStrike. 2018. "Intelligence Report: Csir-18004 Nigerian Confraternities Emerge as Business Email Compromise Threat." Accessed May 29, 2020. https://www.crowdstrike.com/wp-content/uploads/2020/03/NigerianReport.pdf.

David, Tarkaa. 2018. "As Nigerian Army Launches Cyber Warfare Command." Leadership. Accessed September 1, 2019. https://leadership.ng/2018/10/26/as-nigerian-army-launches-cyber-warfare-command/.

Ellis, Stephen. 2016. *This Present Darkness: A History of Nigerian Organized Crime*. London: Oxford University Press.

Leonhardt, Megan. 2019. "'Nigerian Prince' Email Scams Still Rake in over $700,000 a Year—Here's How to Protect Yourself." CNBC. Accessed August 26, 2019. https://www.cnbc.com/2019/04/18/nigerian-prince-scams-still-rake-inover-700000-dollars-a-year.html.

Pew Research Center. 2018. "Internet Connectivity Seen as Having Positive Impact on Life in Sub-Saharan Africa." Accessed August 27, 2019. https://www.pewresearch.org/global/wp-content/uploads/sites/2/2018/10/PewResearch-Center_Technology-use-in-Sub-Saharan-Africa_2018-10-09.pdf.

Schmitt, Georg. 2018. "World Economic Forum Report Addresses Crisis of Trust, Slowing Growth in Our Digital World." World Economic Forum. Accessed May 29, 2020. https://www.weforum.org/press/2018/12/world-economic-forum-report-addresses-crisis-of-trust-slowing-growth-in-our-digital-world/.

Serianu. 2017. "Africa Cyber Security Report 2017: Demystifying Africa's Cyber Security Poverty." Accessed August 27, 2019. https://www.serianu.com/downloads/AfricaCyberSecurityReport2017.pdf.

Sesan, 'Gbenga. 2017. "Forget Internet Scams: Young Nigerians Now Use Digital Tech for Good." World Economic Forum. Accessed May 29, 2020. https://www.weforum.org/agenda/2017/04/nigeria-internet-scam-digital-social-entprepreneurs/.

Statista. 2019. "Number of Internet Users in Nigeria from 2017–2023." Accessed August 27, 2019. https://www.statista.com/statistics/183849/internet-users-nigeria/.

Vanguard. 2010. "Internet: 13 Years of Growth from Ground Zero in Nigeria from 1960–1996." Accessed May 29, 2020. https://www.vanguardngr.com/2010/10/internet-13-years-of-growth-from-ground-zero-in-nigeria-from-1960-1996/.

NORTH MACEDONIA

A republic of the former Yugoslavia formerly known as Macedonia, North Macedonia is a European country north of Greece. It has been working to improve its position for detecting, investigating, and prosecuting cybercrimes. Located in a region that could be considered a rising hotbed of cybercriminal activity, the country is investing in strategies and capabilities to increase cybercrime enforcement. Currently, the National Cyber Security Index (2018) ranks the country sixty-seventh in the world, based on forty-six indicators of how well the government performs on issues related to cybersecurity, a portion of which relate to cybercrimes. Improving the capacity to address cybercrime, and cybersecurity more broadly, is important to North Macedonia, because doing so is a prerequisite for membership in many international organizations, such as the European Union and the North Atlantic Treaty Organization (NATO), that bring with them economic, political, and social opportunities for national growth and advancement.

Cybercrime in North Macedonia is likely underreported; of the reported incidents, little publicly available research details the types of cybercrimes committed in the country or by its citizens. The U.S. Overseas Security Advisory Council (OSAC) reports that cybercrime is an increasing concern for the country. It reported sixty-nine cybercrimes committed in the country in 2018. The majority of these crimes centered on hacking and damaging computer systems, followed by online fraud (OSAC 2019). Earlier research classified North Macedonia a "phishing specialist country," although not all countries categorized as such participate heavily in phishing scams.

Based on reported crimes, countries also assigned to this group tend to experience crimes such as those perpetrated through advance-fee frauds, malicious emails, spam, and sophisticated phishing schemes (Kigerl 2016). While this analysis provides a sense of cybercrimes in the country, it used a dataset from 2012. Since cybercriminals have new technologies and have developed new approaches, the analysis forms a basis for understanding initial types of local cybercrimes but may not be up to date with current criminal activity. Additional research would be required to understand contemporary cybercriminal activity in the country.

North Macedonia has started to shift its legal approach to combating cybercrime from a piecemeal process to one that is more holistic. Within the country, the primary legal mechanisms for addressing cybercrime fall under the criminal code. The code covers many aspects of cybercrime, although it does not constitute a comprehensive legal framework to address it. In 2013, the Law on Criminal Procedure enhanced the existing laws by focusing, in part, on cybercrimes, criminal activities committed through electronic means, and the use of digital evidence for investigative purposes. The government also increased its effectiveness against cybercrimes by merging two cybercrime units into the Cybercrime and Forensic Department, which placed all of the expertise and capabilities together. In addition, the government seeks out opportunities to collaborate and participate in international programs aimed at strengthening the country's cybercrime efforts.

North Macedonia is a signatory to several international agreements on cybercrime. It signed the Budapest Convention on Cybercrime in 2001, ratified it in 2004, and implemented it in 2005. The treaty calls for the creation of international cybercriminal policy and emphasizes the need to share information and promote cooperation among the signatories. In 2003, it also signed the Additional Protocol to the Convention on Cybercrime, a treaty that expanded the definition of cybercrime to include racist and xenophobic propaganda and again highlighted the importance of international cooperation. This treaty took the government longer to ratify; it was eventually implemented in 2010.

North Macedonia is also a founding member of the international, albeit regional, South-East European Cooperation Process (SEECP), established to promote regional stability and cooperation since 1996. In 2008, the SEECP issued the Common Declaration Regarding the Strengthening of Cooperation in Combating Cybercrime, where member states agreed to cooperate and create legal frameworks to address cybercrime. The SEECP further issued the Bucharest Summit Declaration in 2014, stating that cybernetic threats are a regional threat and calling for increased regional integration. Similarly, North Macedonia was a founding member of the Centre for Security Cooperation, a policy-level organization that has prioritized cybersecurity since 2010. It also participates in the South Eastern European Dialogue on Internet Governance and often hosts summits that feature cybersecurity-related discussions.

In addition to large multinational agreements, North Macedonia participates in programs and partnerships designed to strengthen its ability to combat cybercrime. For example, the Organization for Security and Cooperation in Europe, which has traditionally been heavily involved with Serbia to help combat cyberthreats, started a pilot program in Skopje, North Macedonia's capital, to help the government better understand and assess risks related to cybersecurity. In 2014, Macedonia hosted a conference with Turkey to discuss and prevent the use of cyberspace by terrorists. It has hosted other conferences related to cybersecurity over the past decade, often in conjunction with other nations.

In addition to international and regional cooperation, other indicators suggest that North Macedonia is increasingly prioritizing the need to combat cybercrime. On a visit to London in February 2019, Minister of Information sSociety and Administration Damjan Manchevski (n.d.) stated that his country has become a growing target for cybercriminal activity (North Macedonia, Minister of Information Society and Administration 2019). As a result, North Macedonia produced its first National Cyber Security Strategy 2018–2022 in 2018. As part of its strategy, the country strives to improve its performance researching, preventing, and responding to cybercrime.

The document lists the following activities as priorities: improving the processes surrounding cybercrime management, aligning national and international policies and frameworks on cybercrime, creating a comprehensive legal framework, creating laws and regulations to address cybercrime, establishing and improving procedures related to reporting cybercrimes, creating mechanisms to share information

on cybercriminal activity, increasing international cooperation, enhancing educational and training opportunities to increase domestic expertise, participating in international conferences and exchanges, and improving assessments related to government efforts to combat cybercrimes (North Macedonia 2018a).

Despite the large number of objectives, the country has developed a plan to achieve them that lays out funding and time lines; the National Cyber Security Strategy 2018–2022 Action Plan 2018–2022 details the efforts required to meet the country's goals (North Macedonia 2018b). The strategy is significant because while it is not a comprehensive legal framework, it seeks to use multiple levers and approaches to protect the country and its people.

North Macedonia's progress in combating cybercrimes and enhancing national cybersecurity safeguards is significant. Though the realm of cybersecurity will always constitute an area that needs continual improvement and vigilance, the state of progress has allowed the country to move forward in its endeavor to join some international organizations. The cybersecurity issue was not the only point of tension regarding membership; there was also contention over the country's official name, as Greece disputed the country's desire to remain known as Macedonia, its name in the former Republic of Yugoslavia. With the naming dispute resolved, in addition to meeting minimum qualifications for membership such as the cybersecurity standards, North Macedonia's membership bids have been moving forward.

In 2018, the European Union agreed to start accession talks. The naming resolution and the country's participation in the program Cooperation on Cybercrime under the Instrument of Preaccession (IPA), and later iPROCEEDS, the continuation of IPA, the European Union's multinational effort to improve cybersecurity efforts in the Balkans and Turkey demonstrated that North Macedonia was closer to meeting the organization's accession criteria. IPA focused on increasing national capacities to address cybercrime, while iPROCEEDS builds on IPA, especially regarding the confiscation of cybercrime assets and the prevention of money laundering via electronic systems or networks. In February 2019, the NATO member states signed the protocol on the accession of North Macedonia to NATO. Once these discussions are completed and ratified, North Macedonia will be able to join. When this happens, North Macedonia will remain responsible for improving its anticybercrime efforts and meeting international and organizational standards for cybersecurity.

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Further Reading

Kigerl, Alex. 2016. "Cyber Crime Nation Typologies: K-Means Clustering of Countries Based on Cyber Crime Rates." *International Journal of Cyber Criminology* 10 (2): 147–169.

National Cyber Security Index. 2018. Accessed August 18, 2017. https://ncsi.ega.ee/ncsi-index/.

North Macedonia. 2018a. "Republic of Macedonia National Cyber Security Strategy 2018–2022." Accessed May 30, 2020. http://mioa.gov.mk/sites/default/files/pbl_files/documents/strategies/cyber_security_strategy_macedonia_2018-2022_-_eng.pdf.

North Macedonia. 2018b. "Republic of Macedonia National Cyber Security Strategy 2018–2022 Action Plan 2018–2022." Accessed August 17, 2019. http://mioa.gov.mk/sites/default/files/pbl_files/documents/strategies/ap_cybersec_v1.13_eng.pdf.

North Macedonia, Minister of Information Society and Administration. 2019. "Minister Manchevski Held a Speech at the Global Conference on Cyber Security." Accessed May 30, 2020. http://mioa.gov.mk/?q=en/node/2251.

Overseas Security Advisory Council (OSAC). 2019. "North Macedonia 2019 Crime & Safety Report." Accessed August 17, 2019. https://www.osac.gov/Content/Report/0ea4cf69-2682-43e4-871f-15f4aeae3da3.

PHILIPPINES

Cybercrime in the Philippines has existed for almost as long as the internet has existed in Asia. The problem affects Filipinos at home and abroad as the country's law enforcement arms attempt to dismantle internal cybercrime syndicates. They also address cyberattacks of domestic and international origins that impact people, industry, and infrastructure. The Philippines ranks tenth globally for the number of annual cyberattacks (Usman 2018). To combat the real and psychological damage caused by cybercrime, the government has established several offices with the sole purpose of mitigating criminal cyberactivities. Although the government has implemented laws and policy to fight cybercrimes, the number of incidents continues to rise annually, and the list of cybercrimes is slowly expanding as criminals operate more creatively. The challenge increases incrementally as more and more Filipinos go online. The next step for the Philippines is to join international organizations that collaboratively fight cyber threats and participate in information exchanges.

The first official cybercrime in the country occurred in 2000. Onel de Guzman (1977–) created the ILOVEYOU, or Love Bug, virus to attack Windows computers. The virus arrived through email with an attachment indicating that it was a love letter, and it appeared to arrive from a sender known to the recipient. Once it invaded a computer, the virus would send itself out to all of the email addresses stored in the account. It also stole internet passwords and other sensitive information. Ten days after the virus launched, more than 50 million computers had been affected, equivalent to 10 percent of the world's computers (Techspirited 2018). The worst areas affected were Asia, Europe, and the United States. De Guzman's experiment, which started as a university thesis that he failed, was technically not a crime. His actions prompted the Philippine government to pass its first cyberlaw in 2000. The Electronic Commerce Act criminalized piracy and hacking. It could not be used retroactively to punish de Guzman.

The Philippines passed its current cyberlaw, Republic Act No. 10175, or the Cybercrime Prevention Act, in 2012. The law appointed the Department of Justice as the primary organization responsible for handling cybercrimes and established the Office of Cybercrimes within it. Prior to this act, the police had established a cybercrimes division in 2003. Through multiple reinventions, it became the

Anti-Cybercrime Group (ACG) in 2013 and assists the government in cyber response, digital forensics, and addresses cybersecurity-related issues. Together, these entities apply their resources to prevent cybercrimes and prosecute offenders.

Cybercrime is growing in the country, with the number of incidents rising between 2015 and 2016. In 2015, the Department of Justice's Office of Cybercrime (OOC) received 2,567 complaints, a total that increased to 3,951 the following year (Office of Cybercrime 2017). The government couched these crimes in terms of core cybercrimes, computer-related offenses, content-related offenses, and crimes committed with ICTs. Core cybercrimes in the Philippines are hacking, cybersquatting, and data interference. Examples of computer-related offenses are forgery, fraud, and identity theft. Content-related offenses include cybersex, child pornography, and libel. The final category, crimes committed with ICTs, addresses conventional crimes carried out through the technology. In 2016, crimes in this category included online scams, serious threats, and voyeurism, at 607, 345, and 329 cases reported respectively (Office of Cybercrime 2017).

In addition to the OOC cybercomplaints, the police force's ACG conducts operations and investigations related to cyberincidents. In 2016, it reported forty operations against cybercriminals, twenty-seven entrapment operations, 1,693 investigations, and 715 digital forensic requests, and it presented seventy-nine awareness lectures (Philippine National Police n.d.). The 2015 and 2016 numbers are higher than the number of total reported cybercrimes in 2014.

Fraud and online scams, which represent the most prevalent cybercrimes in the country, are potentially the most challenging to address. Often, these scams cross national boundaries and are hard to trace. One 2018 example demonstrates the international nature of online fraud schemes. In June, the Philippines ACG raided a call center in Pampanga based on complaints received from South African and Australian authorities. They arrested all 482 people present in the center, including eight Israeli citizens. The company, International Branding Development Marketing, was connected to a defunct Israeli trading firm. For the scam, it acted as a stockbroker selling shares for a fictitious corporation in the United Kingdom. Employees called potential investors in Australia and South Africa, and when investors indicated a willingness to invest, the callers solicited their credit card and, later, bank details (De Wet 2018). This operation appeared to have run for several years prior to being shut down. Without the tips from abroad, the scam may have continued for significantly longer. This is not the only complicated case. The police also contend with Nigerian scamming rings that operate in the country, often with local employees, as well as assist victims of cybercrimes conducted domestically and internationally.

Philippine society's main fear about cybercrime is the possibility of identity theft. Losing one's identity can have long-reaching and long-lasting consequences. The ramifications include financial losses, lawsuits, and loss of reputation, which is an extremely important part of national culture. Identity theft became a topic of national attention when Alberto Abet Uy (c. 1966–), bishop of the Diocese of Tagbilaran in Boholo Province, had his identity stolen. In late 2017, an individual

used photos from Uy's real Facebook page to create a fake account in his name. Fraudulently posing as the bishop to encourage people to send money, the fake account asked for financial assistance. Uy tried to warn potential scamming victims through posts. This type of identity theft, also called *Facebook cloning* because a second individual essentially duplicates the account of a real person, is not a new technique for cybercriminals.

Regardless of the technique employed, with the amount of sharing many Filipinos participate in online, identity theft is a crime that could affect anyone without their immediate knowledge. The reality of data loss and potential identity theft made the news again in early 2018, when the Facebook–Cambridge Analytica scandal revealed that more than 1 million Filipinos had their data stolen in the breach. The full impact of the data loss is not yet known; many experts state that it is time to ensure Filipinos understand the risks involved when interacting online.

The Philippines is considered a world leader in social media usage, a fact that has created new challenges. Although internet penetration has only reached 63 percent of the population, individuals in the Philippines spend more time online every day than any other nation (Camus 2018). The use of social media has led to a new phenomenon. Social media friends are beginning to file complaints of cyberlibel, the act of posting untrue information online to harm another individual, against each other. Presently, government prosecutors investigate cyberlibel complaints; this issue is not covered under the Department of Justice's cybermandate.

Cases are challenging to investigate, as social media is often foreign owned and operated. For example, Facebook and Twitter, two heavily used social media sites, belong to U.S. corporations. Working across international legal systems creates its own problems, and ultimately, the corporations do not have to assist. In most cases, there is not enough evidence to prosecute. There is also a push within the country to decriminalize cyberlibel, which further complicates the issue.

The Philippines has recognized the importance of protecting cyberspace in collaboration with its international partners and allies. In 2017, it joined nine other Southeast Asian nations to sign the Association of Southeast Asian Nations' Declaration to Prevent and Combat Cybercrime. In 2018, the nation joined a list of fifty-six others as signatories to the Budapest Convention, an international agreement to detect, investigate, and prosecute cybercrimes. Because crimes can take place outside of national jurisdictions, the convention facilitates information sharing and coordinates assistance to address illegal activities in cyberspace.

The Philippine government recognizes the importance of cybersecurity, especially protecting its people, industries, and infrastructure. Along these lines, it has turned its focus to strengthening cybercrime laws and creating harsher sentences for violators. It does so domestically as a sovereign nation but also in conjunction with international bodies and policies that call for international support. As internet penetration increases, the volume of reported cybercrimes will likely rise and will include those committed at home as well as those perpetrated from a more distant part of the globe. Laws and policies will need to adapt to stay current on the techniques that criminals employ. The Philippines' current strategy keeps it

Members of the Philippine Internet Freedom Alliance, Bayan Muna, Piston, and Gabriela conducted a silent protest in front of the Supreme Court in Manila to ensure that the country's cybercrime law remained upheld. The Philippines is ranked as the country that spends the most time online, which exposes its population to greater risk for cybervictimization, compounded by the fact that cybercrimes are on the rise in the country. Legal discussions and frameworks in the country continue to be developed and will require refinement domestically and internationally. (Hrlumanog/Dreamstime.com)

focused on post facto crimes. While the country desires to arrive at a point where it effectively prevents cybercrimes—although no country has completely achieved this major milestone—it will require additional investment, agile policies, and training to educate the people on indicators of criminal cyberactivity.

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Further Reading

Camus, Miguel R. 2018. "PH Is World Leader in Social Media Usage." *Inquirer Business*. Accessed July 17, 2018. http://business.inquirer.net/246015/ph-world-leader-social-media-usage.

De Wet, Phillip. 2018. "Philippine Police Stormed a Call Centre, Arrested 482 People They Say Were Running a Stock Market Scam on South Africans." *Business Insider South Africa*. Accessed July 18, 2018. https://www.businessinsider.co.za/ibd-marketing-raid-in-the-philippines-shuts-down-israel-scamlinked-to-itrader-2018-6.

Office of Cybercrime. 2017. "2016–2017 Philippine Cybercrime Report." Accessed May 30, 2020. https://doj.gov.ph/files/OOC/OOC%20REPORT%20FINAL.pdf.

Philippine National Police. n.d. "Annual Report 2016." Accessed July 17, 2018. http://www.pnp.gov.ph/images/publications/AR2016.pdf.

Techspirited. 2018. "History of the 'ILOVEYOU' Virus and Its Devastating Effects." Accessed July 17, 2018. https://techspirited.com/history-effects-of-iloveyou-virus.
Usman, Edd K. 2018. "FBI Says PH Is 10th Most Attacked Country Online." Newsbytes Philippines. Accessed July 17, 2018. http://newsbytes.ph/2018/01/04/fbi-says-ph-is-10th-most-attacked-country-online/.

RUSSIA

Russia has long been a hub for cybercrime, often employing it as a tool for asserting the government's will over foreign companies and nations. Due to the country's heavy use of cyberproxies, the line between criminal hackers and state-sponsored actors is blurry at best. Because of this state involvement, Russia's criminal syndicates have some of the most technologically advanced tools available and are able to act with impunity, as long as they direct their attacks externally. Russian hackers have even been known to design malware that skips over computers used by native Russians. Between top-notch technologies, excellent higher education leading to highly developed technical skills, and high rates of unemployment, cybercrime is an attractive business.

This is not to say that Russia has no internal problems with cybercrime. A 2018 Economic Crime Survey in Russia (PwC Russia 2018) indicated that 24 percent of respondents had experienced a cybercrime attack in 2017–2018. That figure is, however, lower than the global average of 31 percent over the same time frame. When cybercrime does occur in the country, security officials are quick to act. In 2012, hackers were arrested after stealing about US$4 million from several banks, including ones in Russia (Maurer 2018). Cybercrimes are prosecuted under the Criminal Code of the Russian Federation from 1996, which was amended in 2012 (UNCTAD 2019).

On the other hand, when crimes are committed outside of the country, law enforcement does not seem to investigate or prosecute them. Furthermore, the Russian government actively denies and obstructs outside requests for information or extradition. In exchange for this protection, cybercriminals are expected to provide help to the Russian government when asked, acting as proxies in state-sponsored hacking operations. John Carlin (1973–), the U.S. Assistant Attorney General for national security during the Obama administration, told the news program *60 Minutes*, "Increasingly, you cannot tell which is which when it comes to the criminal and the intelligence agency. So one day, the same crook may be doing something purely to make a buck. But that same crook may be directed by a trained intelligence operative using the same tools and techniques to steal information from them for the goals of the state" (Stahl 2019). This degree of separation provides the Russian government with plausible deniability, making attribution more difficult.

More notable than its own criminal code are the international conventions Russia has failed to sign, specifically the 2001 Budapest Convention on Cybercrime, where Russia was the only major European country that did not sign. The Russian

government has since campaigned to replace this convention with something more to its liking (Ignatius 2018), eventually introducing the Countering the Use of Information and Communication Technologies for Criminal Purposes resolution to the UN General Assembly in late 2018 (United Nations General Assembly 2019). Even when it does endorse cybercrime documents, Russia regularly ignores the basic principles. For example, it agreed to the 2015 Group of Governmental Experts report regarding the protection of critical infrastructure, even while reportedly conducting attacks against U.S. and European nuclear, water, and electrical systems.

Since 2006, Russia and China have been the biggest source of cyberattacks worldwide, according to a study by the Center for Strategic and International Studies (CSIS 2019). But Russian hacking can be traced back long before 2006, to at least 1986, when a system administrator at Lawrence Berkeley National Laboratory noticed numerous intrusions into the lab's computers. The attacks targeting military and nuclear secrets were traced back to a German hacker who was selling the stolen information to Russia (Denning 2017).

The 1990s ushered in more of these Russian cyberintrusions, largely targeting military and government computers, in a wave of cyberespionage campaigns. One such attack, named Moonlight Maze after the U.S. Federal Bureau of Investigation's code name, lasted years and targeted networks primarily in the United States. Other victims included the United Kingdom, Canada, Brazil, and Germany. The attack consisted of hackers proxying in through universities and small businesses to gain access to sensitive information at important research institutions. While they weren't the first such espionage attacks, they came to represent the new reign of constant cyberespionage (Raiu, Moore, Guerrero-Saade, and Rid 2017). Russia, at least according to researchers, remains one of the prominent actors in this space.

Sponsoring what was arguably the first cyberattack against another country, in April and May 2007, Russian bots allegedly conducted denial of service (DoS) attacks against numerous Estonian online services. Heavily reliant on cyberservices, Estonia is a tech-savvy nation that was part of the former Soviet Republic. In April 2007, tensions ran high as Estonia relocated a Soviet-era war memorial in its capital of Tallinn. For retribution, Russia sponsored an assault against key nodes to disrupt Estonia's entire digital infrastructure. Multiple government services were temporarily unavailable, and online banking was terminated. Lasting almost three weeks, the attack was finally ended when Estonia shut off major systems from outside access. While the Estonians responded well to the attacks, the episode has been dubbed "Cyber War I" and put fear into other nations that were heavily dependent on their online access (Ruus 2008).

Since the attack on Estonia, Russia has employed a mix of cyberattacks and conventional warfare when engaging in conflict. In its 2008 war with Georgia, this hybrid strategy was used to put pressure on the Georgian government to bend to Russian will. Cyberattacks only mildly disrupted services, but they were certainly an annoyance as hackers posted graffiti on official websites, a crime sometimes

referred to as *cybervandalism*. These attacks were accompanied by conventional military attacks on the Transcaucasia region. Since 2014, Russia has also mixed cyberattacks and military action against Ukraine. The most prominent alleged example is a series of power outages in December 2015 throughout Ukraine, which were the result of Russian cyberattacks against several regional power companies (CSIS 2019).

In addition to direct interference, Russian hackers have attempted cyberinfluence operations, flooding social media with disinformation to manipulate and control public opinion. Utilizing professional trolls to worsen political divides within the United States, Russian agents conducted a multiyear campaign to influence the 2016 federal elections. In perhaps the most comprehensive open source paper to date, Robert S. Mueller (1944–), U.S. special counsel, issued the *Report on the Investigation into Russian Interference in the 2016 U.S. Presidential Election*, in which Russian government involvement is noted up to and including Russian president Vladimir Putin (1952–). The campaign included direct attacks against the Democratic National Convention and subsequent leaking of emails associated with Hillary Clinton's (1947–) presidential campaign. These emails provided further fodder for the trolls' disinformation operations (Mueller 2019). Combined, this interference highlights the willingness of Russia to use cyberoperations to influence international affairs, not just bilateral spats.

Since the 2016 operations against the U.S. election, Russia has continued its offensive cyberoperations. Continued attacks against Ukraine, infiltration into various U.S. critical infrastructure sites, attempts to influence multiple countries' elections, and countless other Russian cyberefforts have wreaked havoc across the globe. The most damaging to date has been dubbed "NotPetya" after the family of encrypting ransomware from which it originated, which was itself a reference to a 1995 *James Bond* movie. The attacks began in June 2017 and affected companies worldwide, although the vast majority of attacks targeted Ukraine. The malware spread, ultimately causing more than US$10 billion in damages. In February 2018, the United States and United Kingdom formally accused Russia of spearheading the ransomware attack (CSIS 2019). The Australian government also made similar statements.

Recorded cybercrimes originating in Russia are reportedly rising, yet many groups appear to be successful well before they are identified. MoneyTaker, a group believed to be Russian, targeted banking systems in the United Kingdom, United States, and Russia. From 2016 to 2017, the group stole close to US$10 million from banks, financial service providers, and other organizations. The group's techniques involved using difficult-to-detect malware so that it maintained persistence on a network. A cybersecurity firm established that the group entered at least one network after penetrating an employee's home computer (Barth 2017). It is unknown how many other, similar groups may be operating to infiltrate financial and other online networks.

Throughout all of these attacks, Russia has made itself clear when it comes to cybercriminals: don't attack at home and be ready to serve the needs of the states when asked. It appears that when the criminals follow these rules, they are able to act with impunity, enjoy state protection, and have access to all of the best cybertools. Russia has also established its line for the rest of the world: do something Russia does not like, and it will not hesitate to employ every cyberweapon in its arsenal to achieve its goals.

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Further Reading

Center for Strategic and International Studies (CSIS). 2019. "Significant Cyber Incidents." Accessed June 23, 2019. https://www.csis.org/programs/technology-policy-program/significant-cyber-incidents.

Denning, Dorothy. 2017. "Tracing the Sources of Today's Russian Cyberthreat." The Conversation. Accessed June 24, 2019. https://theconversation.com/tracing-the-sources-of-todays-russian-cyberthreat- 81593.

Ignatius, David. 2018. "Working with Russia on Cybercrime Is Like Hiring a Burglar to Protect the Family Jewels." Accessed June 22, 2019. https://www.washingtonpost.com/opinions/global-opinions/working-with-russia-on-cyber-regulation-is-like-paying-a-bully-for-protection/2018/09/04/b16787ea-b08e-11e8-9a6a-565d92a3585d_story.html.

Maurer, Tim. 2018. "Why the Russian Government Turns a Blind Eye to Cybercriminals." Slate. Accessed June 23, 2019. https://slate.com/technology/2018/02/why-the-russian-government-turns-a-blind-eye-to-cybercriminals.html.

Mueller, Robert S., III. 2019. "Report on the Investigation into Russian Interference in the 2016 Presidential Election." United States Department of Justice. Accessed July 3, 2019. https://www.justice.gov/storage/report.pdf.

PwC Russia. 2018. "Combating Fraud: Measures Taken by Companies: Russian Economic Crime and Fraud Survey 2018." Accessed June 23, 2019. https://www.pwc.ru/en/forensic-services/assets/PwC-RECS-2018-eng.pdf.

Raiu, Costin, Daniel Moore, Juan Andrés Guerrero-Saade, and Thomas Rid. 2017. "Penquin's Moonlit Maze." Secure List. Accessed June 23, 2019. https://securelist.com/penquins-moonlit-maze/77883/.

Ruus, Kertu. 2008. "Cyber War I: Estonia Attacked from Russia." European Institute. Accessed June 24, 2019. https://www.europeaninstitute.org/index.php/component/content/article?id=67:cyber-war-i estonia-attacked-from-russia.

Stahl, Leslie. 2019. "The Growing Partnership between Russia's Government and Cybercriminals." *60 Minutes*. Accessed June 24, 2019. https://www.cbsnews.com/news/evgeniy-mikhailovich-bogachev-the-growing-partnership-between-russia-government-and-cybercriminals-60-minutes/.

UN Conference on Trade and Development (UNCTAD). 2019. "Cyberlaw Tracker: The Case of Russian Federation." Accessed June 24, 2019. https://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D Legislation/CountryDetail.aspx?country=ru.

UN General Assembly. 2019. "A/RES/73/187: Countering the Use of Information and Communications Technologies for Criminal Purposes." Accessed June 24, 2019. https://undocs.org/en/A/RES/73/187.

UNITED STATES

Cybercrime in the United States, also known as *computer-oriented crime*, is a crime that includes a network and a computer (Moore 2005). The computer could be the target, or it could have been used in the commission of the crime (Kruse and Heisner 2002). Cybercrimes can be defined as "Offences that are committed against individuals or groups of individuals with a criminal motive to intentionally harm the reputation of the victim or cause physical or mental harm, or loss, to the victim directly or indirectly, using modern telecommunication networks such as Internet (networks including chat rooms, emails, notice boards and groups) and mobile phones (Bluetooth/SMS/MMS)" (Halder and Jaishankar 2011). Cybercrime has a vast reach and can threaten anyone from a person, to an organization, to an entire nation's security and financial health (Morgan 2016). Issues surrounding cybercrimes in the United States have become high profile, particularly those surrounding hacking, copyright infringement, unwarranted mass surveillance, sextortion, child pornography, and child grooming (Halder and Jaishankar 2011). Cybercrime is a serious threat to everyone, from the casual internet user, to commercial businesses, to critical infrastructure, to government functions—and the threat is growing.

In addition to threatening the security of people and their information, cybercrime is expensive, costing consumers in the United States an estimated $19.4 billion in 2017. The United States has the third-highest monetary loss from cybercrime, behind China (US$66.3 billion) and Brazil (US$22.5 billion) (Statista 2019). The economic damage done by cybercrime continues to grow worldwide. In 2014, the global cost of cybercrime totaled $455 billion (Sandle 2014), while a 2018 report puts the cost at $600 billion (Lewis 2018). Cybercrime is on the rise in the United States, as it is around the world. In 2017, more than 143 million Americans were impacted by it (Symantec 2018). Due to its climbing rate, far-reaching impacts, and expense, Americans are more worried about it than about other crimes (Reinhart 2017).

The top five cybercrimes in the United States are malware, debit or credit card fraud, data breaches, compromised passwords, and unauthorized email and social media access (Symantec 2018). The annual Norton Security Insights Report of 2017 identified that 57 percent of their surveyed population had a device or knew someone with a device that was infected by a virus or in some way threatened. Malware-related cybercrimes are often carried out by malware being secretly downloaded to a device while visiting a spoofed website. Fifty-four percent of the U.S. population report having been a victim of credit or debit card fraud. This type of crime includes theft of the card number if it is entered on a fake website and theft resulting from a hacker eavesdropping on a public Wi-Fi network where users do online shopping.

While the number of Americans impacted by data breaches is tied with those impacted by credit card fraud at 54 percent, high-profile data breaches in the United States may have made this cybercrime more visible to average consumers.

For example, the 2017 data breach of Equifax, a U.S.-based credit monitoring company, impacted more than 145 million people. When the news media report such incidents, it raises awareness, both that data breaches occur and also the way they work and can be prevented.

Forty percent of Americans report that they encountered hacking of their email or social media accounts (Symantec 2018). Often, this unauthorized access can be a result of user carelessness such as not logging out of a shared or public device, but it can also be the result of someone maliciously hacking into an account. No matter who is to blame, being hacked is a gateway cybercrime, often leading to the victim being further exploited, since often the social media or email accounts are rich with personal information or linked to other online credentials. Last on the list of common American cybercrimes is compromised passwords, with 40 percent of Americans reporting having been victims of this particular crime. Sharing passwords or having easy-to-guess passwords makes internet users easier targets for password compromise.

With the rise of cybercrime in the United States and around the world, educational campaigns that range from sales products to educational courses to children's games have sprung up seeking to educate users of the risks of network use. The quick advancement in technology, along with its integration into schools and workplaces, has given an overwhelming number of the U.S. population access to network-connected devices, but up until recently, there has been no educational or societal focus on also creating a "network user common sense" where users are conscious of how to navigate safely around the hidden dark alleys that can hijack the usefulness of their network user experience.

The Federal Bureau of Investigation is the government organization charged with fighting cybercrimes—a threat that it finds to be incredibly serious and growing. The FBI says that cyberintrusions are becoming both more common and sophisticated. The risk to U.S. critical infrastructures, to American companies targeted to gain access to trade secrets, and to universities targeted to gain access to their cutting-edge research is a threat the FBI takes seriously. So seriously, in fact, that the FBI states that just as it transformed itself to fight terrorism, so it is again transforming itself to address the cyberthreat. The FBI is working toward this goal by enhancing its investigative capacity to better detect and respond to intrusions into both government and private computer networks (FBI 2019).

While cybercrime has its technical side, the notion that it is too technical to be a public problem empowers the criminals behind it. The general public plays a vital role in cybersecurity, as it interacts with cybersecurity in many ways. For example, the public forms opinions about cybercrime and then uses those opinions to vote and elect politicians who develop the government's cybercrime policy. Much of the cost of fighting cybercrime rests upon the public as well, in the form of taxes or in higher cost of goods and services produced by companies that also pay taxes.

Most important, however, is the power that the public has to influence what is done about cybercrime. Public attitudes can influence the way that companies respond to the issue of cybersecurity. If they think that the public considers

In mid-2018, five nations announced the formation of a new organization to fight transnational tax crime, the Joint Chiefs of Global Tax Enforcement, or the J5. Representatives from Australia, Canada, the Netherlands, United Kingdom, and the United States have joined forces to investigate international incidents where criminals are using emerging technologies to commit tax fraud or engage in money laundering. The group is particularly focused on how cryptocurrencies, or online currencies such as Bitcoin, further cybercriminals' activities (Stucky 2018). Cryptocurrencies can be used to anonymize transactions and make payments or investments and are also now considered taxable assets that must be accounted for during federal taxation. To trace these cryptocash flows, the J5 will be exploring new processes for tracking and accountability.

cybersecurity to be a critical issue, then companies may be more inclined to spend more on contributing to a secure cyber experience, which includes investing in data protections. Economics is also impacted by public perception of cybersecurity. If deterrence is not prioritized, then systems and data will continue to be taken advantage of by malicious actors, further reducing the public's trust in technology and significantly impacting the United States' technology-driven economy.

The threat that cybercrime poses to the nation is serious and growing. Cyberintrusions are becoming more commonplace, more dangerous, and more sophisticated. The nation's critical infrastructure, including both private and public sector networks, is targeted by adversaries. American companies are targeted for trade secrets and other sensitive corporate data, and universities are targeted for their cutting-edge research and development. Citizens are targeted by fraudsters and identity thieves, and children are targeted by online predators. Just as the FBI transformed itself to better address the terrorist threat after the 9/11 attacks, it is undertaking a similar transformation to address the pervasive and evolving cyberthreat. This means enhancing the Cyber Division's investigative capacity to sharpen its focus on intrusions into government and private computer networks.

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Further Reading

Federal Bureau of Investigation (FBI). 2019. "Cyber Crime." Accessed May 12, 2019. https://www.fbi.gov/investigate/cyber

Halder, D., and K. Jaishankar. 2011. *Cyber Crime and the Victimization of Women: Laws, Rights, and Regulations*. Hershey, PA: IGI Global.

Kruse, Warren G., and Jay G. Heisner. 2002. *Computer Forensics: Incident Response Essentials*. Boston: AddisonWesley.

Lewis, James. 2018. "Economic Impact of Cybercrime—No Slowing Down." McAfee. Accessed May 30, 2020. https://assets.website-files.com/5bd672d1924b9893a632c807/5c171d5e85ed62697a79e351_economic-impact-cybercrime.pdf.

Moore, R. 2005. *Cyber Crime: Investigating High-Technology Computer Crime*. Cleveland, MI: Anderson.

Morgan, Steve. 2016. "Cyber Crime Costs Projected to Reach $2 Trillion by 2019." *Forbes*. Accessed May 30, 2020. https://www.forbes.com/sites/stevemorgan/2016/01/17/cyber-crime-costs-projected-to-reach-2-trillion-by-2019/.

Reinhart, R. J. 2017. "Cybercrime Tops Americans' Crime Worries." Gallup. Accessed May 12, 2019. https://news.gallup.com/poll/221270/cybercrime-tops-americans-crime-worries.aspx.

Sandle, Paul. 2014. "Cyber Crime Costs Global Economy $445 Billion a Year: Report." Reuters. Accessed May 12, 2019. https://www.reuters.com/article/us-cybersecurity-mcafee-csis/cyber-crime-costs-global-economy-445billion-a-year-report-idUSKBN0EK0SV20140609.

Statista. 2019. "Countries with the Largest Losses Through Cybercrime." Accessed May 2, 2019. https://www.statista.com/statistics/799875/countries-with-the-largest-losses-through-cybercrime/.

Symantec. 2018. "2017 Norton Cyber Security Insights Report Global Report." Accessed May 30, 2020. https://now.symassets.com/content/dam/norton/global/pdfs/norton_cybersecurity_insights/NCSIR-global-results-US.pdf?promocode=DEFAULTWEB%20.

Chapter 4: E-Learning Issues and Trends

OVERVIEW

E-learning, or electronic learning, is a process by which a student uses the internet to take classes for enrichment, skill development, or an online degree. It is also referred to as *m-learning*, or mobile learning, to emphasize the fact that people can now learn on the go, at almost any place and time of their choosing, using a mobile device and internet connectivity. Since the internet made e-learning possible, it has grown in popularity worldwide; the top four nations furthering the e-learning industry are the United States, India, China, and South Korea. The demand for e-learning is not limited to a few countries. Forecasts indicate that Africa is the fastest-growing market for e-learning services, with e-learning growth rates ranging from 15 percent to 30 percent annually in Senegal, Zambia, Zimbabwe, and Kenya (Adkins 2013). E-learning can bring great diversity into the classroom by connecting geographically dispersed people.

The idea of distance learning has existed for more than a century. Originally, classes were conducted via postal mail. Students received and returned assignments to complete correspondence courses. The first correspondence courses developed in London in the mid-1800s and spread to the United States, as they attracted students who did not live close to the schools offering classes that interested them. Decades later, when radio and television grew in popularity and access, they became part of the distance education movement, either as the sole means of imparting information or as a supplement to correspondence courses. The internet made the rise of distance classes, which then became known as *online classes*, possible, as it offered students the ability to interact with the instructor, work alongside classmates, and cut the transmission time and cost for submitting assignments. It also became cost-effective because universities could earn similar revenue to a comparable class taught at a traditional, brick-and-mortar institute while providing instruction of the same quality. From the mid-1990s forward, e-learning has become a permanent system for many schools, extending to elementary and high school education programs and developing certificate programs designed to convey technical or vocational skills. Today, e-learning is a vibrant global industry. In 2017, the industry was valued globally at US$240 billion. By 2024, experts predict the value will reach or exceed US$994 billion (Rake 2018). Thus, e-learning is quickly becoming an integral part of education globally.

There are several types or styles of e-learning. *Synchronous learning* is when learning occurs at a predetermined time and day. Class members and the instructor meet together online to work and discuss the subject matter in real time. *Asynchronous learning* occurs at the times most convenient to the learners and the instructor. Generally, there are set weekly deadlines that students must meet, such as posting by a certain date. Students may work online at any time that fits their schedule to meet the deadline. Both synchronous and asynchronous courses are entirely online. These courses can be offered directly by a university, through a course provider that offers course options from multiple sources, or through a massive open online course (MOOC), where the categories are not necessarily mutually exclusive. A MOOC is typically a free course offered online to a large number of people at the same time. Another method is *blended learning*, a style that combines some e-learning with time in a traditional classroom. All of these methods allow students to select the style that best fits with their home and work life. They give students significantly more flexibility, making online classes more accessible than traditional classrooms.

Most e-learning currently runs on learning management system (LMS) software. Through this software, students can read, watch videos, submit assignments, and interact over a discussion forum. The systems track student progress and allow them to access grades, keeping this information private through the use of a unique user id and password. On the business side, there are multiple models and pricing options for institutional licensing. They range from cloud based to desktop hosting and allow for set or subscription fees. Many LMS provide basic functionality, whereas others integrate more advanced technology options. LMS examples include Moodle, Blackboard, and Design2Learn. Institutions and freelance instructors can hire their services and customize learning content for students based on subject and curriculum requirements. Some organizations run their own courses with internally developed software. Microsoft and IBM are two front-runners in this category.

Advances in e-learning technologies will include the integration of emerging technologies that promote student learning and retention. Of those technologies, several hold promise. Virtual and augmented reality can transport students to ancient historical sites or take an individual to the beginnings of the universe to explore the physics behind its creation. These technologies can make e-learning experiential, involving all or most of the senses, rather than relying on book and rote memorization. Developments in chatbots could lead to virtual assistants or librarians embedded within an LMS who help students explore topics in greater detail or answer questions about unclear content.

Game-based learning, or *gamification*, requires students to interact with the material in new, sometimes different, ways. Not only can it increase interest by making learning more fun, but also some students can feel more motivated when they receive instant feedback through points and earn badges or other rewards for making progress. In some cases, allowing users to compete with each other

encourages students to continue playing, which can also increase learning. *Microlearning*, though not a technology, involves chunking, or breaking learning into small, short pieces. A lesson lasts three to five minutes and may involve watching a video or completing a short task. Together, multiple microlearning bits can teach larger, more complex subject matter. *Holography* is another technology that would allow students to interact with their teacher during the learning process. It could also be used to perform virtual organ dissections for medical or biology students. The price tag on the equipment needed to make holography a viable e-learning option puts it out of reach for the present, but as the costs drop, it may become a viable addition to other e-learning technologies.

E-learning is not limited solely to schools. It is also growing in importance in the business sector, as it allows employees to be trained efficiently, with little or no cost involved for travel or physical classroom space. Businesses can offer mandatory training electronically, and they can also allow employees to take charge of their own training by selecting additional courses that interest them and furthering their career aspirations. Lynda is an e-learning site aimed at people with personal and professional development goals. Its course offerings include data analysis, information technology skills, and other business or technologically oriented subjects. Similar tech-focused e-learning platforms include Pluralsight, Coursera, Skillshare, Udemy, and Treehouse. While these sites generally require fees or a subscription, businesses are finding it cost-effective to keep their employees' skills up to date and also keep them engaged and productive.

Platforms that specialize in online classes following more traditional educational disciplines are abundant. The top-performing sites are edX, Khan Academy, and OpenCulture. Coursera straddles the line; it offers college-style themed classes, such as psychology, history, and foreign language learning, as well as business-focused options. Some of these programs offer course completion certificates for a fee. In 2017, Coursera's most popular courses included Machine Learning, Neural Networks and Deep Learning, Learning How to Learn, Introduction to Mathematical Thinking, and Bitcoin and Cryptocurrency Technologies (Coursera 2017). Some course options offer specializations that require a student to take a block of four to six classes and complete a final exam. Passing grades earn specialization certificates—also for a fee. Other sites like OpenCulture provide free courses with no assignments or deadlines so that students can complete at their own pace. These courses generally do not provide completion certificates, however.

Some countries now have their own domestic e-learning systems to compete with the corporate enterprises. India's Designmate incorporates 3D graphics to facilitate learning understanding. International organizations are also developing e-learning platforms to allow their content to reach audiences worldwide. The United Nations has its multiple e-learning platforms to reach people globally. Other international bodies, such as the Inter-American Development Bank, the International Monetary Fund, and Amnesty International, have developed courses for sites like edX. Teaching large audiences worldwide, in addition to connecting

people through course work and dialogue, help these organizations fill their missions while offering a valuable service.

E-learning does have some barriers to entry. The most immediate is the ability to access the internet, and to do so on a stable connection that allows students to consume course content. Without the ability to access and complete assignments, students cannot successfully take classes. The second is cost. If the cost to access the internet and tuition fees is high, some people may be unable to participate. The third relates to computer literacy. Every person who takes an online course must possess enough computer literacy to perform all the tasks related to the assignment. For example, if an assignment requires creating a YouTube video, a student must have the knowledge and equipment to make that video and upload it to the correct location. The fourth relates to the belief that e-learning is not as effective as a traditional classroom. While some of this perception relates to individual learning styles, a well-designed and implemented course has the potential to be equally effective. Not all programs are the same, however; there are differences between courses, programs, and institutions. In general, students in the United States have described their online experiences as at least as good as traditional classrooms, with 87 percent stating that they are of the same quality and 7 percent deciding that they are superior (Lokken 2017).

Another barrier is language. The majority of e-learning classes are offered in English. Many people around the world know enough English to take the courses or will learn the appropriate vocabulary during the course. Some people may feel that their language skills are insufficient to understand the lessons. To address this barrier, some courses are offered in other languages, while others may have subtitles available for learners using English as a second language. These courses may not meet the needs or interests of every student, but they are a step to becoming more inclusive learning platforms. To mitigate the reliance on courses taught in the English language, some countries have realized the importance of having their own MOOCs. ThaiMOOC has become the official MOOC platform in Thailand. Latin America launched its own Spanish-language MOOC platform in 2013, MiríadaX. Mexico and Italy have also developed their own platforms.

Countries with high and low internet penetration rates have accepted e-learning. South Korea, in which approximately 99.2 percent of the country has wired internet connectivity and 80 percent has mobile internet penetration, uses e-learning to improve access to quality public education (Ramirez 2017; Statista 2018). To address rising dissatisfaction with the public education system, South Korea started the Cyber Home Learning System for its elementary to high school students in 2004. The system's goals were to improve the quality of public education, reduce costs associated with private tutoring, and allow all students the opportunity to prepare for the country's highly competitive university entrance exams (Shin and Albers 2015).

In contrast, North Korea has low internet penetration and is applying technologies to education. With one of the most restricted internet-access policies in the world, North Korea permits online learning through its national intranet.

Selected audiences can stream lectures from North Korea's Kim Il Sung University from locations across the country with advanced approval. The government is also expanding its Sci-Tech Center, which maintains over 3,000 computer terminals for users to stream telelearning programs (Talmadge 2017). The adoption of e-learning occurs not only in Asia but also around the world. It is increasing as more people gain internet access.

This section examines countries that rely on e-learning as well as those that are exploring how to improve their educational systems with it. These countries have a variety of educational policies and different educational systems, which require consideration when implementing e-learning solutions. The global trend of people looking toward the internet for educational skills and opportunities will continue to increase, while schools and instructors will continue to experiment with new technologies in order to deliver education as a service.

Further Reading

Adkins, Sam S. 2013. "Ambient Insight Regional Report the Africa Market for Self-Paced E-Learning Products and Services: 2011–2016 Forecast and Analysis." Ambient Insight. Accessed May 30, 2020. www.ambientinsight.com; http://www.ambientinsight.com/Resources/Documents/AmbientInsight-2011-2016-Africa-SelfPaced-eLearning-Market-Abstract.pdf.

Coursera. 2017. "Year in Review: 10 Most Popular Courses in 2017." Coursera Blog. Accessed July 7, 2018. https://blog.coursera.org/year-review-10-popular-courses-2017/.

Lokken, Fred. 2017. "Online Courses as Good as In-Person Classes." Inside Higher Ed. Accessed July 7, 2018. https://www.insidehighered.com/digital-learning/views/2017/08/02/online-courses-good-personclasses.

Rake, Rachita. 2018. "Allied Market Research Smart Education and Learning Market by Component (Software, Services, Educational Content, and Hardware), Learning Mode (Virtual Instructor-Led Training, Simulation-Based Learning, Social Learning, Blended Learning, Adaptive Learning, and Collaborative Learning), and End User (Academics and Corporate)—Global Opportunity Analysis and Industry Forecast, 2018–2024." Allied Market Research. Accessed July 7, 2018. https://www.alliedmarketresearch.com/smart-education-learning-market.

Ramirez, Elaine. 2017. "Nearly 100% of Households in South Korea Now Have Internet Access, Thanks to Seniors." *Forbes*. Accessed July 7, 2018. https://www.forbes.com/sites/elaineramirez/2017/01/31/nearly-100-ofhouseholds-in-south-korea-now-have-internet-access-thanks-to-seniorss.

Shin, Ji Hye, and Peggy Albers. 2015. "An Analysis of the Effect of a Cyber Home Learning System on Korean Secondary School Students' English Language Achievement and Attitude." *TESL Canada Journal/Revue TESL du Canada* 32 (2): 45–66.

Statista. 2018. "Mobile Phone Internet User Penetration in South Korea from 2015 to 2022." Accessed July 7, 2018. https://www.statista.com/statistics/284204/south-korea-mobile-phone-internet-user-penetration/.

Talmadge, Eric. 2017. "North Korea's Digital Divide: Online Elites, Isolated Masses." *Chicago Tribune*. Accessed July 7, 2018. http://www.chicagotribune.com/bluesky/technology/ct-north-korea-digital-divide-20171111-story.html.

ARGENTINA

One of the richest countries in South America, Argentina has been able to integrate the technology movement into its education systems. Through a 2006 Education Finance Law, nearly 6 percent of the country's gross domestic product (GDP) has been allocated for education. This funding has allowed Argentina to focus on creating one-to-one classrooms throughout the country. National initiatives related to e-learning at the primary and secondary levels took off strong a little less than a decade ago, but since then, they have seemed to have tapered off. However, MOOCs in the corporate sector and for private citizens are currently widespread in Argentina and dominate the e-learning opportunities in the country.

Despite the economic woes the country has faced since the turn of the millennium, Argentina remains one of the richest countries in South America. It is one of only two countries in South America listed as having "very high human development" according to the Human Development Index (Monroy 2018). This reality is reflected in Argentina's literacy and education enrollment and completion rates. From 1980 to 2015, the country saw a 4.2 percent increase in literacy; in 2015, about 98.1 percent of the population (both men and women) were literate (Monroy 2018). Relative to worldwide data, Argentina has high primary and secondary graduation rates, and in South America, Argentina was second only to Chile in net enrollment in secondary education, at 88.2 percent (Monroy 2018).

However, this early educational success does not lead to the successful completion of tertiary, or university, degrees. In 2010, Argentina's net enrollment in tertiary education was again second only to Chile, but at 73 percent, the country had one of the highest tertiary dropout rates in the world (Monroy 2018). During the same period, Brazil's dropout rate was 50 percent, Chile's was 41 percent, and Mexico's was 39 percent (Monroy 2018). According to Argentina's Ministry of Education, many students took longer to graduate than in other countries; in 2015, 36.3 percent of students in the tenth grade were older than the official age for sophomore students (Monroy 2018). Finally, the country as a whole performs poorly on standardized, comparative tests, as shown by the results from the 2012 Program for International Student Assessment administered by the Organisation for Economic Co-operation and Development (OCED) that placed Argentina fifty-seventh among sixty-four countries (Monroy 2018).

It is possible that students from rural and poorer areas may influence these data, but considering the high GDP of the country, more likely, the cause can be found elsewhere. Suggested reasons for these negative statistics are that the country faces low student motivation and possible structural problems within the education system. One of the ways in which Argentina has attempted to address this problem is with the 2006 National Education Finance Law that states that a minimum of 6 percent of the country's GDP should be spent on education. While this goal had not quite been reached by 2015, at which time only 5.87 percent of the country's GDP was dedicated to the education sector, it was a vast improvement over the less than 3 percent Argentina had been spending in 2003 (De Hoyos, Holland, and Troiano 2012; Monroy 2018). Most of this money is dedicated to teacher salaries

and infrastructure. In 2011 and 2012, more than half of this infrastructure investment was dedicated to information and communication technology (De Hoyos, Holland, and Troiano 2015).

One of these infrastructure improvement initiatives, the Mobiles for Supervisors Program, was introduced in 2010 by the Mendoza Province General Directorate of Schools, or DGE (Lugo and Schurmann 2012). This program was limited in scope to that specific province but succeeded in its goal to provide Mendoza's 350 public school supervisors and principals with a BlackBerry smartphone. The intention was to improve secondary education administration by improving communication and information access. Each phone had unlimited internet access and provided access to various information, such as education portals, the DGE intranet, and school infrastructure systems, even when the internet was not available.

An important policy focus of the country's educational infrastructure improvement for online learning was the concept of the one-to-one classroom. That is, every student should have a laptop or other electronic device with access to the internet. Over the past decade, there have been several initiatives to help make this a reality. In 2008, Seeds of Empowerment, a global nonprofit, launched its project in Argentina (Lugo and Schurmann 2012). Originally, this initiative provided students with a device called TeacherMate, designed specifically to work with the organization's learning management system. However, while the LMS continues to thrive today, the TeacherMate device was soon abandoned, as more than 80 percent of students between the age of ten and eighteen owned a mobile phone by 2008 (Leighton 2012). The advent and proliferation of mobile phones made access to the internet and e-learning opportunities far more affordable than even the lowest-cost computers. While this continues to be the case, one challenge lies in reliable network coverage. Only just over half of Latin America has 3G or 4G coverage, which can limit the use of the mobile phone in e-learning initiatives.

Another such project that sought to make the one-to-one classroom a reality is Conectar Igualdad. Its mission was to distribute 3.65 million netbooks to students and teachers of public schools in Argentina; this goal was met in 2013. Netbooks, or small laptops, were chosen over tablets, which were relatively new at the time, in order to facilitate writing skills. Initially, netbooks were given on loan to students, many of whom came from lower-income families. Upon successful graduation in a timely fashion, ownership of the device passed to the students.

At the postsecondary level, a program called Postítulo de Especialización Superior de Educación a Distancia began in 2010 in partnership between the Universidad del Salvador in Rosario and the Fundación para los Estados Internacionales (Lugo and Schurmann 2012). This program provided BlackBerry smartphones to students enrolled in the distance learning program. The cost of the device was included in tuition. The content of courses taught via this program were also accessible on personal computers, but the BlackBerrys came with an unlimited web browsing data plan and 300 minutes of calls each month. At the time, most classes required two face-to-face meetings per online module. While it appears that this program is no longer running, the Universidad del Salvador has

maintained its distance learning program and continues to offer online courses in various departments.

A challenge that Argentina faces in its efforts to realize the one-to-one classroom is that in attempting to saturate the education setting with ICT, the government may feel like it would be dividing its efforts by also focusing on e-learning programs. While this focus delays those opportunities at the secondary level, it may be a blessing in disguise. Instead of rushing to implement e-learning programs and thereby conflating the message with the medium by making those opportunities about the technology itself, the development of e-learning in the classroom will remain centered around content. That said, the lack of federal initiative in this area does not mean that e-learning is absent in the classroom. In 2010, Seeds of Empowerment launched its Stanford Mobile Inquiry-Based Learning Environment (SMILE) in Latin America (Leighton 2012; Lugo and Schurmann 2012). This program largely capitalizes on the prevalence of smart devices in Argentina, but it can also be taken advantage of by schools with laptop carts that can be shared by multiple classrooms. Students work together via SMILE to complete inquiry-based learning objectives, while the teacher monitors progress and can provide immediate feedback and opportunities for class discussion.

While e-learning opportunities are not yet ubiquitous at the elementary and secondary levels, Argentina, along with Brazil and Chile, remains a leading adopter of e-learning in Latin America. There are many opportunities for online learning in Argentina through local universities, such as the Universidad del Salvador, international providers of MOOCs, and LMSs designed for private companies. The most common providers of MOOCs to the Argentinian population are MiríadaX, Coursera, edX, Microsoft, and RELPE, the Pan-Regional Latin American Network of Educational Portals (Kendall 2017). RELPE is the collective effort of various Latin American ministries of education. Each participating country develops its own free content based on the needs of its population. RELPE provides a common space but considers itself a web of portals where each country's efforts can benefit from nodes of connectivity. Argentina's participating portal is called Educ.ar.

Coursera, edX, and Microsoft are all U.S.-based companies that offer MOOC content in Latin America. Some of this content is free, but not all. Coursera offers

The growing demand for online courses has increased demand for native language instruction. MiríadaX is the Spanish language version of edX and Coursera. Founded in 2013 by Banco Santander y Telefónica in Spain in conjunction with Universia in Latin America, the site boasts over 4 million students who take online classes from 105 institutions with more than 650 distinct courses (MiríadaX 2018). It is one of the largest collections of Massive Open Online Courses in the world, allowing students to take free online classes and offering a paid certificate option for students to use on the resumes or with employers. Other countries are also developing national language MOOCs, such as China's XuetangX.

financial aid in Latin America in an effort to attract more students from the region. At present, only one Argentine university offers content through this platform: Universidad Austral. EdX is supported by the Massachusetts Institute of Technology, Harvard, and University of California, Berkeley and offers certificates upon successful completion of a course. Microsoft started offering free courses in 2014 and has enrolled more than a million students in Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, and Peru (Kendall 2017).

MiríadaX is by far the most common provider of e-learning in Argentina. It is a Spain-based company that offers free online classes in the form of MOOCs to the Argentine people. In 2014, the company had expanded to more than 1,200 institutions throughout Latin America, including Argentina, Colombia, Peru, and Mexico. It claims to have hundreds of million registered users across all its participating countries. In 2016, its most popular course in Argentina (and the second most popular MOOC on the entire platform) was the Universitat Oberta de Catalunya's Introducción al Business Intelligence y al Big Data, or Introduction to Business Intelligence and Big Data (MiríadaX Lab 2016).

While e-learning in Brazil and Mexico mainly centers on schools and government respectively, these opportunities in Argentina can mainly be found in the corporate sector (Kendall 2017). MiríadaX's most popular course reflects this reality. The most common websites to appear in a search on e-learning and Argentina are entities that cater to companies desiring to implement or expand their corporate training via e-learning. Additionally, according to 2016 data published by the World Health Organization (WHO), while e-learning is used throughout the health sciences fields, it is slightly more widespread in professional in-services, rather than student learning opportunities. While Argentina's e-learning initiatives still have a long way to go, particularly in the education sector, opportunities abound in the country, offering a model to the rest of Latin America.

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Further Reading

De Hoyos, Rafael, Peter A. Holland, and Sara Troiano. 2015. "Understanding the Trends in Learning Outcomes in Argentina, 2000 to 2012." World Bank Group Policy Research Working Paper 7518. Accessed May 16, 2019. documents.worldbank.org/curated/en/993331467992515270/pdf/WPS7518.pdf.

Kendall, Matt. 2017. "E-Learning Platforms Could Be Latin America's Solution to Tech Talent Shortage." Nearshore Americas. Accessed May 14, 2019. https://wwww.nearshoreamericas.com/e-learning-latin-america-solution-talent-shortage/.

Leighton, Paula. 2012. "Paving the Path to Mobile Learning in Latin America." Sci Dev Net. Accessed May 14, 2019. https://www.scidev.net/global/icts/feature/paving-the-path-to-mobile-learning-in-latin-america.html.

Lugo, María Teresa, and Sebastián Schurmann. 2012. "Turning on Mobile Learning in Latin America." UNESCO Working Paper Series on Mobile Learning. Accessed May 15, 2019. https://unesdoc.unesco.org/ark:/48223/pf0000216080.

MiríadaX Lab. 2016. "Top diez de los cursos que más interés generaron en MiríadaX (2016)." Miríada X. Accessed May 16, 2019. https://miriadax.net/documents/10157/0/Cursos+

que+m%C3%A1s+inter%C3%A9s+provocaron+en+2016++Mir%C3%ADada+X+LAB/c167064c-ec9d-41ac-9f9b-a814a59892c3.
Monroy, Carlos. 2018. "Education in Argentina." WES WENR. Accessed May 15, 2019. https://wenr.wes.org/2018/05/education-inargentina.
Rubin, C. M. 2013. "The Global Search for Education: Got Tech?—Argentina." *Huffpost*. Accessed May 16, 2019. https://www.huffpost.com/entry/the-global-search-for-edu_b_4074212.
World Health Organization (WHO). 2016. "Argentina." Accessed May 16, 2019. http://origin.who.int/goe/publications/atlas/2015/arg.pdf.

ETHIOPIA

Ethiopia is an intriguing place to live. Westerners from all over Europe and the United States come to help with compassion services and industry start-up programs. The Peace Corps attracts high school and college graduates who want to live in villages and learn the local language and culture. In those villages, they help teach basic skills and promote a positive understanding of America. Other American citizens, particularly graduate students and professors, apply for Fulbright scholarships to conduct research and teach at universities in this nation of over 100 million people.

How Can E-learning Advocates in Africa Work around Hindrances to Implementation?

Using the internet in Ethiopia is improving, but it is still no easy task to help students effectively learn to use digital devices and internet strategies. It is challenging to even teach doctoral education students how to use a computer to prepare them to apply the technology to teaching as a career field. Even the best technology lab in the entire university is often inadequate. However, like other Ethiopians, teachers can look for ways around these problems. In one instance, a teacher ended up borrowing space at a small private school so that every student could use the internet at the same time. Initial challenges to teaching Africans often include simple typing skills, basic computer knowledge, and the importance of checking email for communication. If the students are determined, they can eventually begin to use free online platforms, write collaborative papers, and develop websites for sharing with their own students. So, curriculum specialists in African nations can effectively work around problems to develop faculty who can use appropriate twenty-first-century skills within their educational environments.

Furthermore, by 2016, many more people in Ethiopia were using 3G on their phones to do much of their work. Now, 4G is finally available, making the cell phone an excellent means for research and collaboration between teachers and students. While Western nations are moving to 5G, less developed nations in Africa are trying to afford 4G networks. Mobile learning is certainly developing faster than the computers that most students can afford and that are available. Mobile

devices provide access to learning materials, collaboration with other students, and communication with instructors. Even during class, students use their cell phones to access PDFs that innovative teachers give them. If lack of electricity makes slide presentations impossible, students can still take pictures of the slides from the instructor's iPad so that they can follow the lecture. This method works as long as enough students have sufficient space on their phone. Unfortunately, the cost of cell phones and data packages still limits some students who are doing well academically just to pay school fees. According to the United Nations, this is typical for more than half of the fifty-four nations of Africa listed by UNCTAD as least developed nations.

What Do African Online Students Need to Know about Learning?

Africans are certainly looking for relevant twenty-first-century teaching and learning. They want to be connected with global learning and global opportunities for work. However, because of local education models, some misunderstandings about education need to be addressed before these students can effectively learn using online learning environments. One is knowing what individual learning really is and what it should look like. Many African students need to be taught how to learn in this way. Because Ethiopians are less individualistic than people from Western nations, they perceive that learning happens communally, or in a community. This focus is wonderful, in that the communities really help one another. Sadly, it also includes writing someone's paper for them as well as other unethical behaviors—as modern education defines them.

Another problem with this community approach is that some Ethiopian students often do not realize that the things they do for the grade are also the things that are designed to help them learn. Without doing those assignments themselves, they miss the opportunity to grow and learn. For example, if they are required to write a paper, some students do not recognize how writing the paper adds to their understanding of the course material and ability to think critically. Then, if they copy and paste someone else's ideas as their own, they miss an opportunity to deepen their own understanding of the material. Many Ethiopian, and sometimes African students more broadly, often think in terms of *seat time*; if they put in the seat time, then they should pass the course, and if they put in seat time, they believe that they are prepared for the next level. But that is not necessarily true.

Students need to realize that seat time does not produce learning. Truly, it is those students who engage themselves with the content and in discussions—whether in class or online—who learn the material best. While working with Ethiopians, innovative teachers do a lot of collaborative projects because they learn well with that approach; however, some individuals let the more motivated students do all the work. In the end, teachers in Africa need to know what each person knows and understands. Giving a final exam that includes essay and short answers can reveal what individual students have understood and can apply in their lives.

Misunderstandings about education can certainly challenge the development of e-learning programs. Designers of e-learning platforms should account for these challenges in their design. For example, in Ethiopia, Jimma University offers an online graduate degree with an online course platform that includes content with quizzes and discussion groups over the content. The university has a portal for these activities and for uploading assignments. Nevertheless, Jimma University wisely requires students to come in person to take the final exam (Jimma University 2019). The developers of this online program recognized that a face-to-face final exam would be necessary to confirm how well an individual student understands the material.

Although Jimma University (and, at this point, three other Ethiopian universities) offer progressive online programs with the help of Lucy Academy, most other government universities in Ethiopia do not have the technology infrastructure, nor the faculty who understand e-learning to offer effective online programs. Yet, in Africa, there are opportunities to study online or with hybrid programs through private institutions. Some American universities offer an American accredited master's degree throughout Africa. The platform is hybrid, meaning that there is some face-to-face time and some online aspects to the program. In these programs, there are precourse assignments over the readings that are submitted online before class, in-class collaborative assignments, and a final assignment that is submitted digitally.

Another misunderstanding is how our brains are designed to learn. According to Jensen (2008), our minds our poorly designed for rote learning. Historically, African children learned through storytelling from the village elders, which is a more holistic approach, but when Western education arrived in Africa, it brought an emphasis on memorizing with no practical application. Thus, lack of problem-solving and creative-thinking skills hinder true learning and negatively impact e-learning implementation. Therefore, using authentic learning strategies—such as having students use software to develop brochures to sell their hypothetical products—will help students learn better, because they are thinking and being creative. Regrettably, many African students think of creativity as play. They think the teacher is being lazy to use such methodologies. However, creative thinking is actually a vital prerequisite for good twenty-first-century jobs.

To make the problem of developing creativity even harder, some African nations have had many economic and political challenges that have caused them to rely on the Western world for help. Because of that, there is often a general *learned helplessness* in the society that influences learning and students' motivation to solve something themselves or to be creative. This learned helplessness must be addressed before effective e-learning can take place, since e-learning puts the responsibility of learning on the student.

As various locations throughout Africa collaborate with the rest of the world and function with twenty-first-century learning skills, African students need a better understanding of how to learn. They need to take the initiative to develop their own skills and understandings as well as to set personal learning goals.

Even if they are from a socioeconomically poor background, they need to realize that they are not helpless but can solve some of their own learning problems ethically.

The key trends and guiding principles for improved twenty-first century instruction indicate that the curriculum should not be completely content driven (i.e. memorizing lists of words). Additionally, the curriculum should promote a realistic context for solving problems, collaboration, communication, and ethical completion of students' own products. Moreover, Beckford (2018) argues that students whose teachers apply innovative teaching strategies that develop complex problem-solving and critical-thinking skills as well as creativity will have an advantage in the twenty-first century job market and will have a higher employability index. These strategies are also necessary for effective digital learning. Finally, global understandings are necessary for the development of learning skills that improve employability. Obtaining a better job is one of the main reasons African students are interested in studying with programs that can prepare them with twenty-first century skills for twenty-first century opportunities.

What Is Essential in the Design of a Digital Learning Platform in Africa?

As technology is increasingly integrated into global society, the preparation of African students to use technology to enhance their work and learning should be a top priority for schools. If the use of technology increases student responsibility, engagement, and motivation, then it is well worth the effort to incorporate technology within instruction. Thus, using technology to enhance thinking strategies, collaboration, and communication will more fully prepare learners around the world. However, it must be stressed that the focus is not on technology itself but on its use. It is a tool as well as the means to reach objectives. So, with the ever-increasing and ubiquitous use of technology in our world, we should ask if studying with digital learning platforms will improve learning.

Unfortunately, some technology resources are just digital versions of textbooks. If that is the case, then there may be little benefit from changing to a digital format. Certainly, accessibility and mobility are beneficial; nevertheless, as e-learning designers, the goal is to use media in such a way that students will be increasingly self-motivated, engaged, and self-regulated learners. If the digital platform cannot accomplish that, then the designers need to go back and analyze everything from the perspective of what the goals and objectives are for students. They should also consider the cultural context surrounding education.

When earning a degree through a digital-learning platform, student learning should be just as effective as face-to-face models; otherwise, the degree is not useful. Therefore, it is essential that when developing e-learning curricula, designers focus on fostering a sense of personal responsibility in students and relevancy to heighten interest. The e-learning platform should include critical thinking, collaboration, creativity, and personal reflection that will help students cultivate relevant thinking strategies.

To have effective digital learning for Africans, and especially Ethiopians, in the twenty-first century, methodologies for effective teaching need to be taught in conjunction with using the new media. Yet, whether in the classroom or online, the focus of curriculum design should be on the appropriate use of technology in conjunction with effective teaching practices to prepare African students to be successful in the twenty-first century global society.

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Further Reading

Beckford, Abil. 2018. "The Skills You Need to Succeed in 2020." *Forbes*. Accessed June 5, 2019. https://www.forbes.com/sites/ellevate/2018/08/06/the-skills-you-need-to-succeed-in2020/#75a8eb4a288a.

Jensen, E. 2008. *Brain-Based Learning: The New Science of Teaching and Training*. 2nd ed. San Diego, CA: Brain Store.

Jimma University. 2019. "Online Education in Partnership with Lucy Academy." Accessed June 4, 2019. https://www.lucyacademy.com/ju/index.php/programs/about-our-programs/.

GHANA

After years of working on distance and later, e-learning education, Ghana has made progress in recent years. Ghana's government has been interested in applying e-learning since the internet reached the continent, although it was not until broadband rates increased that the country made significant headway. With foundational policy in place and long-standing approaches to provide distance education through local learning centers, various universities began experimenting with blended learning, the combination of classroom and online education, to allow more flexibility in how and where students complete classwork. Most recently, the country has experimented with MOOCs and continues to determine the utility of this capability to deliver high-quality instruction.

Ghana has invested heavily in education for decades. Despite this spending and an interest in increasing access to online education, Ghana did not appear on lists of African countries with high growth rates for e-learning until 2015. At that time, it was on the list of top twenty countries experiencing e-learning growth, with a reported potential for 45 percent market growth by 2020 (Budu, Wilson, and Ackah 2016). One of the reasons for this change was an uptick in internet broadband that improved speeds in 2013, although connectivity remained nonetheless unreliable through the universities, causing students to rely on their own personal, paid internet access for educational purposes. Another contributing factor to the expansion was the UN Sustainable Development Goals, which in 2015 set targets for education in developing nations. It aspired to expand equity in higher education on or before 2030. Ghana also participated in other regional, Africa-focused initiatives to increase online learning.

Ghana first expressed a desire to implement e-learning, which it then called *distance learning*, in 2002. It established a distance learning program to provide

alternatives to traditional learning with the potential to reach more people and improve its citizen's lives. The original model had students attend classes at specially designated centers and then take exams at university campuses, with a second model solely relying on distance learning centers for all the students' educational needs, removing the need for them to travel to university main campuses. Originally, the government felt that distance education should be funded through private institutions and did not devote significant resources to it. By 2002, only three universities had active distance learning programs, making 2002 a major push for policy on e-learning rather than a watershed moment for adoption. This was not the first time Ghana had experimented with ICTs for e-learning; in fact, Ghana participated in an early consortium to bring e-learning to Africa. The World Bank set up the consortium in 1996, with the online university established in Ethiopia, administered from Kenya, and operating across four other African nations including Ghana. This project never took off, as Kenya rejected the funding, but it marked one of the first attempts to set up a regionally focused online university.

Ghana finalized its policy on information and communications technology requirements for education in 2007. The idea of incorporating ICTs into education was included in the country's Education and Strategic Plan 2003–2015 as one method of increasing the reach of public education beyond the urban areas. The policy was also followed the ICT for Accelerated Development Policy, which the parliament passed in 2004. In these early years, the country allowed multiple ICT projects focused on education to run across the country. The majority of these involved partnerships with industry and nongovernmental organizations to prepare individuals and schools for ICT integration. Some focused specifically on girls' education, as girls were often not offered opportunities to study science and math. More broadly, this initial policy developed the framework for furthering education with ICTs.

Subsequent policy extended the original framework of 2004. In 2008, the Ministry of Education drafted the ICT in Education Policy to outline the use of ICTs in secondary schools. It mandated curriculum to teach ICT courses as well as to incorporate ICTs into nontechnological subjects. The document also addressed issues surrounding infrastructure, e-readiness, access, and facilities. A 2009 follow-up commissioned a study that determined one of the limiting factors was low computer literacy across Ghana's high schools. The government also released a revised version of the 2008 policy, known as the National ICT in Education Policy for Ghana, that described in greater detail how Ghana's schools should prepare for and implement ICTs in the classroom.

More and more schools are experimenting with online learning; for example, the University of Ghana had an Institute of Continuing and Distance Education to spread e-learning opportunities across the country in the form of curricula and training for educators. This organization is now called the Department of Adult Education and Human Resource Studies and offers programs by distance and blended learning formats. The university also now has a School of Continuing and Distance Education, part of the Department of Distance Education, that uses

a platform called SAKAI to deliver courses at nine different in cities across the country.

One trend among public universities is to create blended learning courses, defined as those that combine elements of e-learning with traditional, classroom-based instruction. The advantage of these courses is that working students have more flexibility to complete classes because they do not always need to block out periods of time to be on campus. The University of Professional Studies of Accra, one of such universities to use online learning in a blended classroom, experienced a decline in blended learning enrollments after a few years. A research study determined that blended classrooms, while accepted as an idea, were not immediately popular. Students tended to avoid the online aspects of the class due to poor infrastructure, technical support, low connectivity speeds, and low instructor proficiency (Asampana, Akanferi, and Ami-Narh 2017). In addition, some school and university staff exhibited a reluctance to change, which hampered adoption of e-learning. Staff resistance to change played a role in the slow acceptance of blended classes, because the educators who designed and led the courses did not want to do so and showed little enthusiasm. However, with the appropriate support and resourcing, this obstacle can be removed, making it easier for instructors and students to work on e-courses.

Entrepreneurs experimented with an online school based in Ghana. In 2011, two men founded the Open University of West Africa in Ghana. The school emphasized the need to utilize the country's growing use of mobile technologies as a tool for spreading low- or no-cost educational opportunities to educate people who would not otherwise have access to education. The school had more than 200 students enrolled, primarily in MOOCs, before it closed four years later. No information is available as to why the university closed. The founders moved on to another project, creating an app that would allow access to training for aspiring entrepreneurs.

MOOCs appear to be popular in Ghana, as demonstrated by students who used the Open University of West Africa to access them. Researchers have conducted several studies on their feasibility to enhance existing educational institutions, and the Open University of West Africa enabled students to take MOOC offerings, with the U.S.-based Coursera being frequently mentioned. However, actual statistics for how many Ghanaians enroll in international MOOCs in unavailable; in fact, the major MOOCs only announce estimated worldwide usage statistics. There is local interest in developing MOOCs. As of early 2019, the University of Ghana has partnered with universities in Belgium, South Africa, Zimbabwe, and Rwanda to develop a course about clinical nutrition (University of Ghana 2019). The partnership will allow local instructors to gain experience in developing, and potentially managing, a MOOC. If successful, the university may develop additional courses.

Ghana is still working to achieve goal four of the UN Sustainable Development Goals, which encourages nations to ensure that quality education is available to everyone equally. A 2019 study found that the country's ability to reach the goal is not related to spending; in fact, Ghana spends more on education than the

The Coursera headquarters building in Silicon Valley, California. Coursera exemplifies the numerous international online learning platforms that reach African nations like Ghana and enhance educational opportunities in the country. The success of platforms such as Coursera has started to inspire local professors to collaborate with other educators across the continent to create online courses tailored to local populations and their educational needs. (Andrei Gabriel Stanescu/Dreamstime.com)

top-ranking countries, meaning that its return on spending is lower than in other nations. The study found that the reasons for the disparity between spending and performance are related to low completion rates, gender imbalances, insufficient teacher-student ratios, and a need to ensure high-quality teachers at all levels (Kwadwo 2019). While this study did not specifically focus on e-learning, the same hindrances and challenges exist to making online learning more widespread and effective. They may be key to aiding Ghana to achieve goal four and may highlight why additional spending on education may not be the answer to improving access to education. Diverting some of that spending to improve ICT infrastructure and increasing access, on the other hand, may be a potential solution, although it too is not addressed in the research.

Overall, Ghana has had some success with e-learning. The combination of e-learning in blended instruction, which overlaps with the accepted approaches to distance education, a longer-standing educational construct, has provided adult students with greater flexibility. The full, optimized impact of e-learning has not yet been achieved; training, infrastructure, and access must be improved to reach the wider student population, especially those residing outside urban areas. Purely online classes, as well as MOOC series or programs, require further exploration; there may be further benefit from developing a national or regional platform

tailored to the needs of Ghana's students. As the demand for e-learning is projected to grow through 2030 at minimum, Ghana will have to work to determine how best to package and market e-learning, which may also include computer literacy and other individual training to improve confidence with the software in order to encourage more students and instructors to invest time in online learning.

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Further Reading

Asampana, I., A. A. Akanferi, and J. Ami-Narh. 2017. "Reasons for Poor Acceptance of Web-Based Learning Using an LMS and VLE in Ghana." *Interdisciplinary Journal of Information, Knowledge, and Management* 12: 189–208.

Budu, Kenneth Wilson Adjei, and Owusu Ackah. 2016. "What Challenges Affect the Implementation of E-Learning in Ghana Tertiary Institutions?" *International Journal of Innovation and Scientific Research* 23 (1): 214–225.

Kwadwo, Victor. 2019. "Ghana Needs More Efficient Spending to Fix Gaps in Education." United Nations University—Maastricht University. Accessed August 24, 2019. https://www.merit.unu.edu/ghana-needs-more-efficient-spending-to-fix-gaps-in-education/.

University of Ghana. 2019. "Workshop on Massive Open Online Courses (MOOCs)." Accessed August 24, 2019. https://www.coe.ug.edu.gh/news/workshop-massive-open-online-courses-moocs.

INDIA

E-learning is a large and growing phenomenon in India. As internet and broadband connections continue to improve, the market continues to expand. People in India are users of both international and in-house e-learning platforms. The national government in India has also been involved in the promotion and growth of e-learning, has supported university platforms, and has built its own national e-learning platform. E-learning is not without its particular challenges in India; however, it shows all signs of playing an ongoing role in both formal and informal education in the country.

India has the second-largest market of massive open online course subscribers after the United States. On the Coursera platform, which is the largest MOOC platform globally, approximately 3.4 million users are located in India (Goyal 2018). India also has one of the fastest growing bases of MOOC learners, which is also coupled with one of the fastest internet growth rates. The online education industry in India is estimated to grow to six times its current size by 2021, reaching an estimated 9.6 million users (KPMG and Google 2017).

All of the top international MOOCs are available and used in India, including Coursera, edX, and Udacity. There are also e-learning MOOC platforms that have been developed in India. The Indian Institute of Technology (IIT) Kanpur, for example, developed MooKIT, a MOOC management system that is used by IIT Kanpur as well as others around the world to host online courses.

Similarly, IIT BombayX is another MOOC platform built by IIT Bombay. They offer typical MOOC-style courses that can be either instructor paced or self-paced.

However, IIT BombayX specializes in hybrid MOOCs, similar to a flipped classroom model. It allows IIT Bombay registered students to take a course from one of their remote centers where they will periodically engage in video conferencing with their instructor while primarily using the MOOC platform. As of 2019, IIT Bombay has over 500 remote centers throughout almost all of the states in India.

Other e-learning companies and efforts in India are focused beyond the open MOOC system. There are some, for example, that are primarily engaged with corporations to deliver online corporate training, such as Dexler Education. Others work closely with schools and K–12 education, such as BYJU and Educomp. EduKart, on the other hand, is an online higher education platform that offers fully online certificate and degree programs through affiliations with institutions of higher education.

Online learning in India started developing as early as the late 1990s. The first virtual campus in India launched in 1999 at the Indira Gandhi National Open University, or IGNOU. Established in 1985 by the central government of India, IGNOU focused specifically on distance and open education; as such, developing strategies for distance education has been a primary thrust of this institution. The School of Computer and Information Sciences offered the first online courses. Offerings have expanded greatly since that time and continue to be offered via the larger Study Webs of Active Learning for Young Aspiring Minds, or SWAYAM, platform.

The national government of India has engaged in other e-learning efforts as well. With the third-largest higher-education system in the world, India continues to fund efforts to educate its growing population. Some of these efforts focus on the expansion of digital tools and resources for classroom use and beyond, while another addresses internet access. Other government-funded projects focus on e-learning programs and platforms directly. One example is the National Programme on Technology Enhanced Learning (NPTEL), a project funded by the Ministry of Human Resource Development that combines the efforts of a number of Indian Institutes of Technology. Beginning in 2003, this project originally developed online courses in engineering and science. In 2014, NPTEL moved to a MOOC system with an expanded scope of subjects, while also offering the possibility of certification via an optional in-person exam with one of the IITs. From 2014 to 2019, NPTEL offered 1,300 courses with a total enrollment of over 6 million.

In July 2017, the Indian Ministry of Human Resource Development (MHRD) launched a new e-learning platform called Study Webs of Active Learning for Young Aspiring Minds, or SWAYAM. SWAYAM is intended to bring together the e-learning resources of multiple institutions, similar to Coursera. It is coordinated by nine national coordinating institutions, including IGNOU and NPTEL that serve to moderate quality of content. Quality of new courses is also assessed through a process involving subject matter experts, multimedia experts, and an all-India academic advisory committee. The courses hosted on SWAYAM are both self-paced and instructor paced, and they allow students the possibility to earn certificates or

Commuters on the Mumbai metro use their smartphones to access content. Students of all ages can use their connectivity to access e-learning programs such as the Study Webs of Active Learning for Young Aspiring Minds (SWAYAM), a platform created by India's Ministry of Human Resource Development, as well as a wide variety of global e-learning platforms, for degrees or professional development on demand. (Emmanuel Nalli/Dreamstime.com)

course credits via an in-person exam. As of August 2018, SWAYAM had delivered over 800 MOOCs, listed over 1,500 courses, and announced the goal of hosting 2,000 courses by 2020 (Press Information Bureau 2018).

SWAYAM was partially enabled by a regulation approved by the University Grants Commission in around the same time as SWAYAM's official online debut in 2018. This regulation granted approval to higher education institutions to offer certificate and degree programs in a fully online mode. This regulation also set up what is now the standard model for SWAYAM, as well as some other Indian e-learning efforts: a four-part model of video lectures, online reading material, self-assessment, and a discussion forum.

Education has been a central priority in recent years for India. E-learning is one potential avenue that the central government views as a solution to meet the challenges of educating its citizens. E-learning also comes with its own challenges in India, however. While internet connectivity and the penetration of mobile devices continue to expand, they have not yet reached all parts of the country, especially the rural regions. In order for e-learning platforms to function for students, they must have connectivity that allows for a reliable, high-speed connection. As SWAYAM, in particular, attempts to develop for-credit e-learning options alongside in-person exams, there will be additional limitations depending on the resources available locally for the exams.

At the 2018 Open Education Consortium's (OEC) Open Education Awards for Excellence (Huggins 2018), Saudi Arabia's National Center for E-Learning tied for the best open education repository. The OEC evaluates e-learning programs around the world and formally recognizes centers with outstanding programs and resources. Saudi Arabia's center was announced at the end of 2017 as part of the country's Vision 2030 initiative. It received the award shortly after launching, demonstrating the Saudi government's commitment to developing a high-quality institution from its inception. The other winner was Vidya-Mitra's integrated e-content portal and library in Gandhinagar, India.

Another challenge for these government-driven efforts in particular is that the e-learning efforts are decentralized. Multiple projects exist within various institutions and are supported through various ministries, including the Department of Information Technology and the Ministry of Human Resources and Development. With the recent push for SWAYAM, there is a strong effort to centralize many of the various institutional and government efforts, including assigning designated coordinators and being centrally supported through MHRD and the National Mission on Education through Information and Communication Technology, an initiative of the MHRD.

Finally, India has the additional challenge of reaching speakers of multiple vernacular languages, including some that are not well supported in the current online environment. In fact, currently, only 12 percent of the Indian population uses English (Baxi 2018). Some of the current platforms offer content in Hindi in addition to English; however, the use of other Indian languages is extremely limited. While technology is changing to accommodate this, e-learning will remain limited to a certain population in India in the meantime.

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Further Reading

Balaji, B. S. 2018. "Transforming the Experience." *Hindu*. Accessed June 15, 2019. https://www.thehindu.com/education/transforming-the-experience/article25345452.ece.

Banchariya, Sheetal. 2019. "MHRD's SWAYAM Programme Aims to Make Study Material Available to All." *Times of India*. Accessed June 1, 2019. https://timesofindia.indiatimes.com/home/education/news/mhrds-swayamprogramme-aims-to-make-study-material-available-to-all/articleshow/67955817.cms.

Baxy, Abhishek. 2018. "Tech Startups, Take Note: More Indians Access the Internet in Their Native Language Than in English." *Forbes*. Accessed June 10, 2019. https://www.forbes.com/sites/baxiabhishek/2018/03/29/moreindians-access-the-internet-in-their-native-language-than-in-english/.

Federation of Indian Chambers of Commerce and Industry (FICCI) and EY. 2013. "Higher Education in India: Vision 2030." Accessed June 1, 2019. http://ficci.in/study-page.asp?spid=20328&sectorid=11.

Goyal, Malini. 2018. "Massive Open Online Courses Have Got a Second Wind." *Economic Times*. Accessed May 1, 2019. https://economictimes.indiatimes.com/industry

/services/education/massive-open-online-courseshave-got-a-second-wind/articleshow/65914966.cms.

Kandhari, Monica Malhotra. 2018. "E-learning Is Transforming the Face of Education in India." *Business World*. Accessed May 23, 2019. http://www.businessworld.in/article/E-Learning-Is-Transforming-The-Face-OfEducation-In-India/01-12-2018-164717/.

KPMG and Google. 2017. "Online Education in India: 2021." KPMG. Accessed May 31, 2019. https://assets.kpmg/content/dam/kpmg/in/pdf/2017/05/Online-Education-in-India-2021.pdf.

Kumar, Soni Ravindra. 2015. "A Study of Problems and Prospects of E-Learning in India." Shodhganga. Accessed June 5, 2019. http://hdl.handle.net/10603/112974.

Press Information Bureau, Government of India. 2018. "Project 'SWAYAM' of HRD Ministry Provides One Integrated Platform and Portal for Online Courses." Accessed June 1, 2019. https://mhrd.gov.in/sites/upload_files/mhrd/files/ru2637.pdf.

OMAN

Located on the southeast Arabian Peninsula, Oman has increasingly implemented online learning as an alternative to traditional, brick-and-mortar classrooms. Many Omanis see digital technologies as a key tool to encourage students to invest more time and interest into their studies. Omani youths use technology daily; it makes sense to incorporate the technologies that they are already using to promote advanced learning. Within the country, there is a growing interest in developing and applying educational technologies to e-learning as well as m-learning, the transition of electronic learning to mobile devices. Educators are slower to accept e-learning than the population, although researchers continue exploring new e-learning enablers, such as LMS with Arabic-language interfaces and MOOCs. The country has the potential, as well as the aspiration, to be a leader in e-learning in the Middle East.

Omani educators recognized the importance of integrating technology with curriculum relatively early to acceptance of the internet. In 2007, they formed a professional society, the Omani Society for Educational Technology. It has three major goals: perform research to understand the impact of educational technologies within Oman and, comparatively, across the Middle East; develop an understanding of how these technologies enhance and contribute to society; and provide educational specialists with professional development opportunities (Al Musawi 2018). From the government's standpoint, e- and m-learning hold great potential for Omani society. The Information Technology Authority determined that Omanis under the age of thirty-five spend three to five hours online daily. Combining the time youth already spend online with flexible, low-cost education has the potential to transform Omani education.

Most Omani cultural and social life occurs in Muscat, the capital. Because it is not feasible for people outside the city to travel to events and workshops, introducing e-learning and better ways to communicate have facilitated greater inclusion. For this reason, the Omani government has invested heavily in e-learning. In 2015, it invested OMR 3 billion into quality education, which included e-learning,

and saw an increase in online enrollment of 19.6 percent (Smith 2016). As of 2017, data from Omani universities indicated that 80 percent of the student body participated in e-learning for at least a portion of their education (Kutty 2017). As these numbers rise, e-learning should connect even more students from all around Oman with affordable, high-quality education.

At the university level, many schools offer e-learning. Sultan Qaboos University, the state-sponsored school, encourages the use of e-learning to deliver instruction. It offers two course types: academic and nonacademic. Academic courses are those for credit that have approval from the school's leadership to be online or have an online component. Nonacademic courses are those typically considered continued education. They can also help train the population to acquire new skills or update a current skill set.

In addition to course offerings, the university has several faculty members who research e-learning in Oman extensively. Individually or on research teams, the university faculty study student acceptance of e- and m-learning, assess trends in e-learning, and present their findings through conferences and published papers. Many public universities also offer e-learning courses or course components to reach more students. One of the innovate e-learning programs coming out of Oman teaches about the Holy Quran, the religious text for the Muslim religion.

In the business sector, industry leaders and business professionals have discovered that e-learning can upskill workers, keeping them current on the latest developments in the field. For example, Muscat University launched two cybersecurity courses in 2018. Cybersecurity Awareness, a course developed with the British government, teaches trainees to be cognizant of proper cyberhygiene and cyberthreats. The second course is on the General Data Protection Regulation (GDPR), which governs all organizations that process EU citizens' data. Omanis wishing to work with European data in any capacity must follow these regulations (Oman Observer 2018). Because these courses address new fields and emerging data requirements, e-learning is the most viable way to convey this knowledge and keep businesses in compliance with strict data collection policies.

Omani entrepreneurs have created a domestic e-learning platform called Edlal, which means *pointing out* in Arabic. Developers intended this platform the bridge the skill gap between university and the demands of the business world. As of 2017, the site had 15,000 registered students, with the majority from Oman and the remainder from across the region; it offered twenty-two free video courses, with aspirations to add more courses from Omani and eventually foreign educators (Sekka 2017). The platform started with Omani experts giving instruction in Arabic, which filled a gap in the lack of available Arabic-language instruction online, and plans to add English subtitles to recruit more international students. Omantel, in partnership with several organizations, sponsored the platform development.

There are cultural considerations in education that extend to e-learning. In Oman, students must receive permission from the Ministry of Higher Education before enrolling in a program. The approval usually includes the study mode, such as online or traditional learning. Universities or schools that offer e-learning must

In the Middle East, all Arabic-speaking people have been invited to participate in the Translation Challenge, an effort designed as part of the Arabic e-Learning Project. Based in Dubai, the project aims to crowdsource the translation of more than 11 million terms used in math and science education (Arabian Business 2017). Once translated, these terms will be used to upgrade e-learning courses and produce educational videos in the Arabic language, with the ultimate goal to provide quality online education to millions of Arabic speakers. The effort intends to decrease the educational gaps found in different parts of the Middle East. Everyone who speaks Arabic and has internet access may participate in the challenge.

also receive approval from the ministry (Kutty 2017). Therefore, it is critical that students approved for e-learning enroll at a school and in a program with government approval. Some disciplines, such as those involving medicine and health, are barred from e-learning; the government requires that these programs involve in-person, face-to-face education (Kutty 2017). Projections from across the Middle East suggest that demand for e-learning will continue to grow with time.

While the government touts e-learning as a success—and indeed, it has made significant progress within the country—some studies suggest that Oman's university system has hesitated to embrace e-learning. According to the research, only a small number of universities has made an attempt to incorporate e-learning into the curriculum, compared to the total number of possible schools. Omani students have expressed interest in using educational technologies to enhance learning but feel that the technologies have limited utility and are not easy to use (Al-Hajri, Amor, Ghayas, and Echchabi 2018). Improving educational technologies promises to increase utility and usability. Changing course design and format are other ways that Omani instructors can promote student success in e-learning courses.

There are additional challenges to e-learning, such as cost to the institution and widespread acceptance. Omani schools are currently working to address these issues. Developing online courses to best-practice standards takes resources. In many cases, a well-designed online course costs more to develop than delivering a traditional, classroom-based one. The cost per student drops over time depending on enrollment and the length of time the course remains relevant or current, based on content. Technology courses, for example, may have shorter shelf lives than literature courses due to rapid changes in technology. For students, online courses are usually cheaper than traditional ones, so the start-up course costs are not immediately evident to them. Additionally, designing and implementing online courses also require that instructors devote time and patience to develop the skills to create worthwhile online instruction. Because the learning curve is steep and the initial benefits are low, some Omani professors have expressed reluctance to experiment with e-learning. To address these barriers, both the government and the schools are investing in e-learning.

Due to investments by the government, schools, and industry, Omani e-learning will grow, with the potential to grow the fastest in the Middle East. Current

e-learning trends suggest that the most substantial growth will be in workforce development to upgrade and upskill workers. Efforts to increase digital skills are already underway, with the domestic platform Edlal representing one way that Oman can reach its workforce online. There is also room for growth in schools, which will need to address instructor hesitancy and better convey the benefits to students, the ultimate consumer for online courses.

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Further Reading

Al-Hajri, Salim Amor, Syed Ghayas, and Abdelghani Echchabi. 2018. "Investigating the E-Learning Acceptance in Oman: Application of Structural Equation Modelling Approach." *Journal of Computer Science* 14 (3): 368–375.

Al Musawi, Ali Sharaf. 2018. "Oman." In *E-Learning in the Middle East and North Africa (MENA) Region*, edited by Alan S. Weber and Sihem Hamalaoui, 285–308. Cham, Switzerland: Springer.

Kutty, Samuel. 2017. "Do E-learning at Approved Centers." *Oman Observer*. Accessed May 30, 2020. https://www.omanobserver.om/e-learning-approved-centres/.

Oman Observer. 2018. "Muscat University Launches Two E-learning Courses." Accessed September 5, 2019. https://www.omanobserver.om/muscat-university-launches-two-e-learning-courses/.

Sekka. 2017. "First E-learning Platform in Oman Is Bringing Knowledge to All." Accessed September 4, 2019. https://sekkamag.com/2017/10/01/first-e-learning-platform-in-oman-is-bringing-knowledge-to-all/.

Smith, Larkin. 2016. "E-Learning: How Oman Is Leading Education in the Middle East." *Borgen Magazine*. Accessed September 3, 2019. https://www.borgenmagazine.com/e-learning-oman-leading-education/.

RUSSIA

As the global job market grows more competitive and depends more heavily on technology, the need to invest in and nurture human capital effectively becomes a ubiquitous part of international development. One of the pillars of closing the human capital gap in the modern world is investing in education to attain greater equity and economic growth. Russia acknowledges the need to develop its human capital and is thus investing in e-learning as a means to achieve a well-educated workforce that can adapt to changing market demands and become more fluent in the use and development of technology.

The boom in online education is driven primarily by a growing desire for flexibility and wider accessibility. First, as the number of students seeking to acquire degrees and certificate programs in nontraditional ways grows, the education sphere has to adapt. Second, for many individuals who may not have the opportunity to enroll in on-campus programs for different reasons (e.g., distance to a good, quality university and existing life commitments, such as work or family), online learning provides an opportunity for continued education, breeding inclusivity and allowing more people to attain a higher level of education and professional development. Generally, there are two types of online learning programs: purely online courses

with no in-person contact with the instructor and hybrid courses, which are a blend of in-person contact with the instructor and time online with digital content.

While research suggests that face-to-face instruction or hybrid courses are still preferred to fully online programs due to better outcomes, perceptions about online learning are nevertheless shifting. The pervasiveness of technology has already altered education in the developed world, and it is making significant headway in the developing world. For example, according to the Babson Survey Research Group, an organization that tracks online enrollment, as of fall 2016, 31.6 percent of all higher education enrollments in the United States were students taking at least one distance education course. This includes students taking all of their courses remotely and those who were engaged in hybrid models (Seaman, Allen, and Seaman 2018), While in the United States and other Western nations online learning is already widely accepted as the norm, in many developing countries, it is only beginning to carve out a space for itself.

In Russia, interest in online learning is similarly growing. Ten years ago, it may have seemed counterintuitive to advocate for e-learning in the developing world; however, the online learning model has the potential to help countries move closer to universal access to quality education. In fact, the fourth sustainable development goal) set by the United Nations for the year 2030, which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (Sustainable Development Goals Fund 2019), emphasizes the importance of digital education and using information technologies more effectively to advance this goal. E-learning has the potential to reduce costs usually associated with education and it can be used for skills acquisition.

Education in the Russian Federation

The Russian Federation, the world's largest country by landmass, is complex and diverse in terms of geography, ethnic composition, and spoken languages. It is made up of eighty-five federal subjects and is home to roughly 145 million people (World Bank Data 2019). In part thanks to its Soviet heritage—a time when education was universal and highly centralized—Russia boasts the second-highest share of adults attaining tertiary-level education out of all countries belonging to the Organization for Economic Cooperation and Development and partner countries, with 54 percent of twenty-five- to sixty-four-year-olds holding tertiary degrees (OECD Library Country Note 2016). Despite Russia's long-standing status as one of the most educated nations in the world, the level of education has been dropping quickly in the last two decades, and there is a pressing need to modernize and upgrade the education system, especially at the tertiary level. The country's leadership has recognized this need and ambitiously pledged to revamp higher education, placing an emphasis on quality and international standards, with one of the goals being to enhance the global ranking of Russian universities by 2020.

As part of this initiative, in October 2016, the Ministry of Education and Science launched a high-priority project, the Modern Digital Education Environment in the Russian Federation, which falls under the 2013–2020 Education Development

Program, as well as the overarching aim to digitalize the Russian economy. Recognizing that laying the foundation for a digital economy requires creating a highly competent well-trained workforce, the Russian leadership has emphasized the need to introduce online education programs that include professional development and training certificates as well as tertiary-degree programs.

In addition, an important long-term goal of this initiative is to provide citizens with opportunities for lifelong continued education, tailoring each program to meet anyone's needs anywhere in the country. The program is also developing massive open online courses, free online courses available for anyone to enroll, which serve as a flexible way to learn new skills and to advance one's career. The MOOC model was first introduced in 2006, and by 2012, it had become a very popular model of distance learning, with such providers as Coursera, Udacity, and edX leading the way with proven success reaching students across the world. In order to bring this ambitious initiative to fruition, the project incorporates leading technological advances, the best international practices in e-learning, and scientific resources of the country's leading universities, as well as the ongoing experience of existing online education platforms and projects. At its outset, the project envisioned that by 2017, approximately 140,000 learners would have engaged in some form of e-learning, while by the end of 2025, the number of participants is expected to reach 11 million.

The Modern Digital Educational Environment project encompasses several key components: developing a legal framework to formalize the development of online learning; creating a single-window resource center for e-learning courses, uniting existing e-learning platforms under one roof; creating 35,000 online courses for upper secondary, tertiary, and continuing education levels by the year 2020, involving developers from the government and private sectors; establishing a quality assessment system of the content of the online courses; and setting up ten regional e-learning training centers to train 10,000 instructors and experts in the field of online education.

The National Platform of Open Learning

Under the auspices of the Modern Digital Educational Environment project, the National Platform of Open Learning, or simply the Open Learning Platform, was founded. It is an e-learning platform offering online courses in all core disciplines studied at universities across Russia. The platform was created by the National Platform of Open Learning Association, managed by a team of leading Russian universities: the Lomonosov Moscow State University, Peter the Great St. Petersburg Polytechnic University, the St. Petersburg State University, the National University of Science and Technology, the National Research University Higher School of Economics, the Moscow Institute of Physics and Technology, Ural Federal University (UrFU), and the Information Technologies, Mechanics and Optics University.

The Open Learning Platform offers free-of-charge open-learning courses that do not require a diploma to apply. Despite being open to all, degree-seeking students have the option of obtaining certificates for the courses they successfully complete,

test on, and pay for, to be later counted towards a degree at their respective universities. The Open Learning Platform differs from other Russian e-learning platforms in that it offers courses developed in accordance with the federally regulated requirements on educational standards and also with the academic requirements developed by universities.

The platform also has an evaluation mechanism to control the effectiveness and quality of the e-learning courses, as well as to monitor assessment procedures for measuring learning outcomes. To ensure the highest quality, the Open Learning Platform selects the best-rated courses by the best professors in the field, and each university offers courses in its strongest field(s). Quality standards are also guaranteed by an internal review board that makes sure that all courses are aligned with the requirements established by the developers of the platform. In addition, evaluation mechanisms for the courses are reviewed by academic and methodological organizations. As of mid-2019, the National Platform of Open Learning included fifteen universities, eight of which are the original founders, 369 online courses, and 906,000 subscribed learners.

Another unique feature of this project is that it envisions a strong collaboration between universities to deliver the highest-quality product to learners. While traditional e-learning courses are already available at many Russian universities, they each exist in a vacuum; however, the Open Learning Platform encourages active cooperation between providers. As such, the platform's online courses may be included in a student's curriculum from any university in Russia. The National Platform of Open Learning Association manages the agreements between the student's home university and the university that developed the online course. In addition, the student's home university has access to the information regarding the learner's performance in the course, allowing for early intervention should problems arise, as well as continuous support throughout the learner's education.

While a student's home university program already has a syllabus for each of its courses, the Open Learning Platform offers several benefits to supplement traditional syllabi. By using the courses offered by the platform, the student's home university is able to fill in any existing gaps in the resources of a given program, limit costs of teaching core subjects, expand the variety of courses offered in a given program, guarantee a student flexibility of the learning process, provide an individualized approach, enhance the quality of student learning by motivating learners with innovative approaches to the educational process and a fresh curriculum, ensure an unbiased evaluation of the student's performance, increase the competitiveness of its programs by including courses with the brand of Russia's leading universities, and free up some of the professors' time to dedicate to research.

The Ural Federal University: A Case in Point

In March 2019, the Ural Federal University, one of the founding partners of the National Platform of Open Learning, became the first Russian university to be accredited for programs using open learning courses of partner universities. The

Federal Government Educational Standards granted initial accreditation for the duration of six years, attesting that the content and quality of UrFU's programs comply with federally set standards of higher education.

UrFU is a leading public university in Russia with nearly a century-long history, over the course of which the university has prepared more than 300,000 graduates. In addition, UrFU scores high in the rankings in the field of engineering among Russian universities. For over ten years, UrFU has been using e-learning technologies in its programs. Also, UrFU is one of the founders of the Open Learning Platform and, thus, one of the key members of the association, UrFU's. Its professors have substantial experience building virtual laboratories and developing online courses. Seeing as the university's main strengths lie in engineering, UrFU began its participation with the Open Learning Platform by offering online courses mainly in the engineering career tracks.

The Ural Federal University is just one example of a higher learning institution in Russia making strides to modernize the education system. While enhancing e-learning is no panacea for revamping the education sphere in the country, it marks an important step to bringing tertiary education closer to international standards. If the ambitious goals of the National Platform of Open Learning and more generally of the Modern Digital Educational Environment project are achieved, the approach to educating Russian citizens will change drastically, putting the country on better footing to advance in the digital era and become more competitive on a global scale.

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Further Reading

OECD Library Country Note. 2016. "Education at a Glance 2016: Russian Federation." Accessed May 30, 2020. https://www.oecd-ilibrary.org/docserver/eag-2016-76-en.pdf?expires=1590854702&id=id&accname=guest&checksum=67EA026269D0D1F3CC65759370C6617D.

Seaman, Julia, Elaine Allen, and Jeff Seaman. 2018. "Grade Increase: Tracking Distance Education in the United States." Babson Survey Research Group. Accessed June 26, 2019. http://onlinelearningsurvey.com/reports/gradeincrease.pdf.

Sustainable Development Goals Fund. 2019. "Goal 4: Quality Education." Accessed June 25, 2019. https://www.sdgfund.org/goal-4-quality-education.

World Bank Data. 2019. "Russian Federation." Accessed June 27, 2019. https://data.worldbank.org/country/russian-federation.

SOUTH KOREA

It is undeniable that the government has played a pivotal role in promoting e-learning in South Korea. This entry will review how the government has implemented policies to lay the foundation for e-learning and advance e-learning. Next, it will explain the current state of major governmental initiatives that impact practice of teaching and learning such as digital textbooks, Korea Open CourseWare (KOCW), and the Korean Massive Open Online Course (K-MOOC) in terms of success and issues.

South Korea has been renowned for its exceedingly fast internet connections and the highest rates of internet usage in the world (IDG Connect 2017; ITUNews 2018). Since announcing its goal to transform the country into an information society, the government has implemented a series of master plans, such as the National Informatization Master Plan (1996–2000), Cyber Korea 21 (1999–2002), e-Korea Vision 2006 (2002–2006), Broadband IT Korea Vision 2007 (2003–2007), and u-Korea Master Plan (2006–2010; National Information Society Agency 2018). With these master plans, South Korea has striven to build a world-class information-technology infrastructure and internet facilities to allow universal internet access across the country. As of July 2018, more than 90 percent of the Korean population uses the internet, and nearly 90 percent of the population obtains wireless access on their smartphones (Ministry of Science and ICT and Korea Internet and Security Agency 2019).

As the country becomes equipped with the necessary infrastructure for e-learning, the government has established a legal framework to support the development and adoption of e-learning. With the E-Learning Development Act that was enacted in 2004, South Korea has implemented three master plans to advance e-learning. With the ultimate goal to complement public education, support lifelong learning, and close the knowledge divide among the population, the government has provided direction and strategies for the diffusion of e-learning, especially for primary and secondary education, higher education, corporate training, and adult education (Ministry of Commerce Industry and Energy 2005; Ministry of Knowledge Economy 2011; Ministry of Trade, Industry, and Energy 2017).

The First Master Plan for E-Learning (2006–2010) focused on the quantitative growth of e-learning in order to create a virtuous circle of supply and demand for e-learning (Ministry of Commerce Industry and Energy 2005). The government laid the foundation to foster the growth of the e-learning industry and, at the same time, established the e-learning standardization and certification system to suggest directions for improvement. It also encouraged research and development for the use of the latest technologies in e-learning and promoted the use of e-learning in every sector of the society. Regional e-learning support centers, which had remained at seven in total, were designated in three more regions in 2007 to support the development and diffusion of e-learning across the country. KOCW was initially launched in 2007 in order to increase open access to educational content. The R & D of the digital textbook project was also initiated in 2007 for the purpose of practical use in primary and secondary schools (Ministry of Education and Korea Education and Research Information Service 2018).

The Second Master Plan for E-Learning (2011–2016) aimed for qualitative improvement of e-learning so that types of e-learning could be diversified and the various needs of learners could be better served (Ministry of Knowledge Economy 2011). The regional e-learning support centers were emphasized as a regional hub to support the development and dissemination of e-learning for the uses of individuals, businesses, and schools. Mobile learning was suggested as an area for R & D and the standards and infrastructures (e.g., wireless network, cloud system)

of mobile learning were established to support mobile learning. K-MOOC was also initiated in 2015 to improve the quality of university education through open education and to expand opportunities for lifelong learning (Ministry of Education and Korea Education and Research Information Service 2018).

The Third Master Plan for E-Learning (2017–2019) stresses e-learning that involves innovative technologies such as AI, VR, and AR for customized and immersive learning (Ministry of Trade, Industry, and Energy 2017). Expansion of the use of the digital textbook is also highlighted, as elementary, middle, and high schools have used digital textbooks since from 2018. Advancement of K-MOOC is also pursued by inviting more universities and public institutions to participate in the development of courses (Ministry of Education and Korea Education and Research Information Service 2018).

As a result of such endeavors, the number of e-learning suppliers increased from 381 in 2005 to 1,753 in 2018. At the same time, the e-learning market grew up from KRW 1.47 trillion in 2005 to KRW 3.8 trillion in 2018. While just 13.6 percent of individuals adopted e-learning in 2005, the rate rapidly increased to 59.0 percent in 2018. The rate of e-learning adoption increased from 2.6 percent in 2006 to 6.7 percent in 2018 in businesses with fewer than 300 employees, whereas the rate of e-learning adoption increased from 39.2 percent in 2006 to 69.8 percent in 2018 in businesses with more than 300 employees.

In the case of formal education, the rate of e-learning adoption increased from 26.5 percent in 2005 to 88.5 percent in 2018. In the case of government and public institutions, the rate of e-learning adoption increased from 43.0 percent in 2005 to 83.7 percent in 2018 (Ministry of Commerce Industry and Energy and Korea Institute for Electronic Commerce and 2007; Ministry of Trade, Industry, and Energy and National IT Industry Promotion Agency 2019). Overall, e-learning usage in South Korea increased more than twofold in every sector of society since the master plans for e-learning began to be implemented. Cleary, the Korean government played a momentous role in masterminding such rapid increases in a short time.

In terms of primary and secondary education, digital textbooks are considered a major initiative that impacts the current and future practice of e-learning. In fact, digital textbooks have been used since 2018, after educators and the government have spent years of research developing prototypes and testing their effectiveness at pilot schools. Importantly, an e-textbook contains learning materials (e.g., multimedia contents, glossaries, advanced learning materials), learning support and management systems, and links to other learning materials as well as the contents of an existing textbook in print. As of March 2019, 117 digital textbooks have been distributed for primary and secondary education in subjects such as social studies, science, and English (Ministry of Education and Korea Education and Research Information Service 2019).

Interestingly, 160 pieces of content involving reality technologies (e.g., AR, VR) have been included in digital textbooks for social studies and science. Digital textbooks have been found to increase student-centered activities, such as self-directed

individual learning, information search, discussions, and project-based activities. As a result, digital textbooks have been found effective in the development of students' self-directed learning, creative thinking, information literacy, and collaboration ability (Kye, Choi, Gwak, and Jun 2015; Seo et al. 2017). Contrary to general concerns, no negative effects have been found from digital textbooks, such as addiction to devices or decrease of sociability (Kye, Choi, Gwak, and Jun 2015; Seo et al. 2017).

Digital textbooks are currently provided through EDUNET, a one-stop information-service platform operated by the government to support primary and secondary education, with research studies and case reports in relation to digital textbooks. As the use of digital textbooks is expanded, more content needs to be developed in subject areas other than social studies, science, and English. Considering that log data and test scores are accumulated in digital textbooks, content and support systems need to be supplemented in a way that data-based customized learning can be provided to learners.

Also initiated by the Korean government, KOCW and K-MOOCs have gained attention as they open university education to the general public online. KOCW started with 150 open lectures from 40 universities in South Korea in 2007 and has grown to offer 32,500 open lectures from 225 universities and institutions in and outside of South Korea as of 2018 (Ministry of Education and Korea Education and Research Information Service 2018).

Most of the content is related to humanities, social sciences, natural sciences, engineering, and education, and relatively little content is available in the fields of medical and pharmacological sciences and arts. Once content is produced, providers classify it into disciplines, and then group it by topic, such as popular lecture, foundation course, social work education, and the Fourth Industrial Revolution. In regard to the type of the content, video accounted for 63.3 percent, followed by PDFs (29.6 percent), flash-type lecture material (6 percent), and other resources including audio (1.1 percent), as of 2018. In order not to remain just as a data warehouse but to encourage active use of the content, KOCW has provided guidance about how to use KOCW through casebooks published every year since 2016. Through these guides, users can learn how others with similar interests have made the best use of the content for their purposes.

KOCW has been available through the website and the mobile application; however, limited content and functionality have been available on the app due to compatibility issues. As of 2018, 32,679 lectures and 396,415 lecture materials were available on the Web, but only 5,335 lectures and 71,073 lecture materials were accessible on the app. Content with incompatible extensions, content available through links given by the providers, and flash-based content have not been accessible through the app (You and Lee 2013). Other problems are that the advanced search options have been limited and video clip function has not been available on the mobile app. Due to delayed update of the app, problems have been reported, such as the user interface not working on tablets and there not being sound on lecture videos operating on the latest operation system. Simpler

and more user-friendly platforms are needed with compatibility ensured across devices.

K-MOOC started with just seven courses from ten selected leading universities in 2015 and has gradually increased the number of participating universities every year (Ministry of Education and Korea Education and Research Information Service 2018). KMOOC provides courses where interest and demand are high in general and has added content in areas where strategic supports are requested, such as the Fourth Industrial Revolution, Korean studies, foundation courses, and vocational education. Starting in 2018, four to five course bundles were added along with courses from universities overseas and public institutions in South Korea. Before opening new courses, providers have required permission from the quality inspection committee comprised of experts from the content areas as well as instructional technology and Web accessibility experts, who require them to make modifications where requested if necessary. K-MOOC Insights, a website with a course-data analysis system, has been provided to help instructors with data-based course management.

As of 2018, K-MOOC offers 510 courses from eighty-seven universities. Visitors increased from 446,832 in 2005 to 1,842,219 in 2018, and the number of users who signed up for a K-MOOC increased from 55,559 in 2005 to 205,515 in 2018. As the number of K-MOOCs increases and more institutions recognize K-MOOC, the number of those complete courses with certificates has increased from 2,058 in 2005 to 22,212 in 2018. As of 2018, those in their twenties account for 42.0 percent of the learners, followed by people under the age of twenty (17.7 percent), those in their thirties (14.3 percent), and those in their forties (13.9 percent).

K-MOOC has provided quality content but still lacks the quantity and variety of courses when compared to MOOCs overseas (e.g., 1,980 courses at Coursera and 1,500 courses at edX). Considering that the majority of K-MOOCs are related to the humanities (28.0 percent), social sciences (23.7 percent), and engineering (21.2 percent), more courses need to be added overall, including in fields such as natural science, medicine, and art. K-MOOC has started to diversify the level of courses by providing bundle courses for professional development. Considering that K-MOOC mostly consists of introductory-level courses, more courses are needed for the intermediate and advanced levels so that learners can choose courses by level of difficulty.

K-MOOCs have provided guidance to users by collecting best-use cases from individuals and institutions and sharing them through a website. For the promotion of quality improvement, excellent MOOCs are awarded blue ribbons based on the results of annual evaluation, and the courses that scored high on learner satisfaction surveys are displayed with the score on a five-star scale. K-MOOC has been driven by the Korean government, but as the number of courses increases and requests for customized support for learners grow, a sustainable business model needs to be explored.

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Further Reading

IDG Connect. 2017. "Five Reasons South Korea Has the Fastest Internet." Accessed September 29, 2019. https://www.idgconnect.com/idgconnect/opinion/1027153/reasons-south-korea-fastest-internet.

ITUNews. 2018. "How the Republic of Korea Became a World ICT Leader." Accessed September 29, 2019. https://news.itu.int/republic-korea-leader-information-communication-technologies/.

Kye, B., K. Choi, B. Gwak, and K. Jun. 2015. *2014 Study on the Effectiveness of Digital Textbooks*. Seoul: Korea Education and Research Information Service.

Ministry of Commerce Industry and Energy. 2005. *The First Master Plan for E-Learning (2006–2010)*. Seoul: Ministry of Commerce Industry and Energy.

Ministry of Commerce Industry and Energy and Korea Institute for Electronic Commerce. 2007. *2006 Survey of E-Learning Industry*. Seoul: Ministry of Commerce Industry and Energy and Korea Institute for Electronic Commerce.

Ministry of Education and Korea Education and Research Information Service. 2018. *White Paper on ICT in Education Korea 2018*. Seoul: Ministry of Education and Korea Education and Research Information Service.

Ministry of Education and Korea Education and Research Information Service. 2019. *2019 Our School with Digital Textbooks*. Seoul: Ministry of Education and Korea Education and Research Information Service.

Ministry of Knowledge Economy. 2011. *The Second Master Plan for E-Learning (2011–2015)*. Seoul: Ministry of Knowledge Economy.

Ministry of Science and ICT and Korea Internet and Security Agency. 2019. *2018 Survey on the Internet Usage*. Seoul: Ministry of Science and ICT and Korea Internet and Security Agency.

Ministry of Trade, Industry, and Energy. 2017. *The Third Master Plan for E-Learning (2017–2019)*. Seoul: Ministry of Trade, Industry, and Energy.

Ministry of Trade, Industry, and Energy and National IT Industry Promotion Agency. 2019. *2018 Survey of E-Learning Industry*. Seoul: Ministry of Trade, Industry, and Energy and National IT Industry Promotion Agency.

National Information Society Agency. 2018. *National Informatization White Paper*. Seoul: National Information Society Agency.

Seo, J., J. Kim, Y. Jung, J. Jung, J. Lee, and I. Shin. 2017. *2016 Pre and Post-Tests at Pilot Schools for Verification of the Effectiveness of Digital Textbooks*. Seoul: Korea Education and Research Information Service.

You, H., and T. Lee. 2013. *A Study on the Expansion of KOCW Service*. Seoul: Korea Education and Research Information Service.

UNITED STATES

The internet and education are becoming inseparable. With ease of access to an endless stream of information, internet users are learning all the time. For education, the internet can be utilized as a virtual tool to reach students in new ways despite time and geographic limitations. Today, higher education institutions around the world are expanding their online learning services to meet student demands. Over the past few years, the United States has seen a steady 5 percent growth in students taking online courses, averaging 350,000 students per year.

For-profit colleges have seen the largest growth, but public and nonprofit colleges have likewise seen an increase in numbers (Lederman 2019). Online learning is an experimental process, one filled with trial and error as students and educators must constantly assess the effectiveness of online learning and learning the necessary technologies to facilitate learning. Beyond online courses, educators and administrators have incorporated internet technology through the processing and analysis of student data, virtual on-demand help, multimodal learning methods, and even AI for student assessment. Among these many uses, the internet-education relationship in the United States flourishes, posing new challenges regarding the ethics and effectiveness of online learning.

The internet has experienced multiple transitions, starting with Web 1.0 in the 1990s, characterized by stable web pages and hypertext mark-up language (HTML) code. In terms of education, most Web 1.0 courses generally consisted of WebQuests and simple tasks involving reading and memorization. Web 2.0 and 3.0 introduced new ways to enhance learning and training as digital technologies continued to develop (Choudhury 2014). Currently, we are in the throes of the next anticipated evolution for innovative, digital education: Web 4.0, which, while still under development, should incorporate the world of artificial intelligence (AI) and, in particular, machine learning to improve online learning (Almeida 2017). Student and teacher decisions will be made based on the data inputs and analysis, and then users will have the chance to make decisions based on the results. Web 4.0 requires both human and machines to work together to optimize the functionality of the web for human decision making.

According to the *Wall Street Journal*, 47 percent of companies have embedded some type of AI process (Wladawsky-Berger 2019); as this number grows, AI usage will also increase in online training programs and digital learning platforms. Some of most notable examples include Amazon, the music streaming service Spotify, and even the athletic brand Under Armour. All these companies use AI to produce more customized recommendations for users. With new technologies utilizing machine learning and AI under development, Web 4.0 will evolve as an organic and flexible tool to help support education, among a variety of additional applications across social, economic, and other sectors.

Web 4.0 can impact education in perhaps some of the most crucial ways as it eases and increases access to education. Moreover, the integration of the internet and education can radically change commonplace misconceptions of each: the internet disconnects us from "real life," and education is a rigid system of obligations and tasks. Even if there is some truth to these ideas, the integration of the internet and education can dispel both stereotypes by providing new modes of building relationships and adding flexibility to the time and distance confines of typical degree programs. Generally speaking, the current state of online education is one of growth in interest, enrollments, and possibilities, even as higher-funded schools can grow these programs more easily. Beyond online classes, the internet and its many related technologies can supplement in-person classes, provide open-access information and textbooks, help optimize student evaluation and data

analysis, and even support alternative communication modes for instructors and students.

Online education in the United States has exploded as new virtual platforms, programs, and resources support not only students but also institutions as a whole. According to the Online Learning Consortium (2015), there are three primary desires motivating the growth of online education: the administration's smooth functioning as a business, the faculty's teaching quality, and the students' learning conditions. Online programs can help administrators increase revenue through high-volume courses, enhance institutional reputations for innovation, reduce the amount of physical classroom space, and stay competitive with market demands. With the increasing demand for virtual learning, faculty rely on online research networks and resources to stay current with teaching trends and technologies. These developments benefit the students; they want easier access to quality courses while maintaining affordability and a flexible lifestyle. Online learning delivers, in that it helps students maintain a work-life balance and graduate on their own schedules. Work-life balance is an ongoing process of managing one's time, finances, and needs and can include incorporating online education when students choose.

Online education has perhaps the greatest potential for the increasing number of adult learners and returning students because it offers enough flexibility to permit greater work-life balance. Often, adult students deal with many familial and financial obligations and find that the only way to further their studies is through online education. Other students, despite their age, also find online education attractive. A 2016 study reported that 31.6 percent of all higher education students in the United States, totaling approximately 6.4 million students, had taken at least one online course (Babsom Survey Research Group 2018). Furthermore, this number is increasing; Seaman, Allen, and Seaman (2018) describe the change: "It stood at 25.9% in 2012, at 27.1% in 2013, 28.3% in 2014, and 29.7% in 2015." Furthermore, the Online Learning Consortium (2015) found that 70.8 percent of students reported online education as a critical part of their learning and path to graduation.

These numbers demonstrate why U.S. institutions must adapt to offer more online learning without diminishing the quality of education or increasing costs. There are challenges to achieving these goals, such as ensuring everyone has fair access to technology, which can become expensive. Software is extremely pricey for schools to buy, especially top AI and machine learning programs. There are also considerations surrounding student engagement and the many health risks of spending too much time on a screen (e.g., attention, eyesight, lowered memory retention, and posture).

One experimental method of delivering online education comes in the form of free and low-cost MOOCs and universal access tools. These are courses or programs developed by renown institutions and offered to anyone, anywhere, either on demand or in large groups that can number in the thousands per course. Top universities like Harvard, Massachusetts Institute of Technology, and Stanford tailor their courses for the online environment; they can be free and adapted into

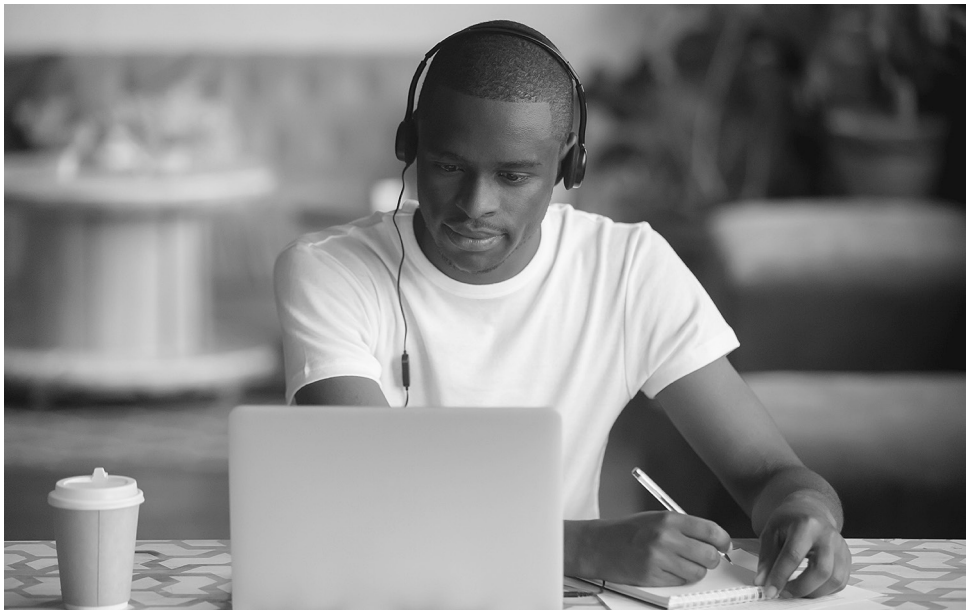
different formats and languages and can be accessed on laptops and smartphones, making them extremely portable. MOOCs provide education that bridges social strata and classes; all people, regardless of income, mobility or other special needs, and native language have greater access to quality education. While MOOCs do not solve every potential barrier, such as access to a stable internet connection, they do remove significant barriers to receiving quality education. Some of the major platforms for MOOCS in the United States include Coursera, edX, and Udacity.

Dynamic online courses and MOOCs are only possible through the development of the internet and associated digital technologies. The earliest iterations of the internet supported the use of visual connections via virtual webinars and other platforms to ensure that learners felt the instructor was working alongside them. Web 4.0 promises a new model of user interaction for faculty and students through personalization and intelligence. For example, assignments can be reviewed via machine learning, and the feedback can be given in real time. Although not currently in use in the United States, various testing service programs are already experimenting with these programs to improve learning outcomes. This approach could be expanded into the higher education space to ensure learning occurs on a continual basis tailored toward individual students rather than static classroom time frames.

Adaptive learning, learning that changes according to a student's needs, may also change entire curricula and have added benefits such as reducing time to graduation time. Adaptive learning is also sometimes referred to as *just-in-time learning*, meaning that students can request on-demand learning modules once they need a skill or choose to upskill their current knowledge. For instance, many university libraries now offer online tutorials for students to learn how to access resources and perform scholarly searches. These tutorials include chat features, like Ask a Librarian, where students can consult a librarian twenty-four hours a day, seven days a week (UW Libraries 2019). The virtual chat features are particularly important because they imply that instructors and learners can develop relationships through ongoing virtual connections. In addition, faculty can benefit from these same on-demand resources as a part of their work environment. Rather than training all new faculty at once on the library system, faculty can learn their own time and place as they adjust to their new workplace.

On-demand learning also plays a growing role for the workplace. Some employers rely on these online learning platforms, such as Skillsoft and Adobe Captivate Prime, to keep workers' skills and knowledge up to date, benefitting both the worker and the employer. Skills needed for a particular job or task can be learned at the time they are most needed. The growing demand for new and specialized skills attests to how online learning can create new learners, not just service current ones. The potential to create and sustain lifelong learners is more seamless than ever before, at school and work, because of online education. In a world of accelerating change, lifelong learning is of high value.

Combining online education with emerging technologies also holds great promise. One notable aspect of Web 4.0 includes applying intelligence technologies to



A young man attends a class online from a coffee shop. Online education in the United States has risen sharply as students, institutions, and corporations have grasped the benefits of just-in-time training and on-demand education, and also as educational institutions have responded to the COVID-19 pandemic. With growing demand for flexible learning, there has been a sharp increase in the number of platforms, courses, and programs available at the touch of a button, delivered by expert educators from around the globe. Most recently, in the United States, as well as around the world, e-learning has grown rapidly due to the COVID-19 pandemic and in response to requirements to meet local shutdown and social distancing policies. (Fizkes/Dreamstime.com)

automate tedious tasks, including data analysis. More specifically, machine learning can benefit higher education by processing large data sets to determine students' needs. For instance, Yates and Chamberlain (2019) used machine learning to ask university donors, "Can we identify a group of students who need an additional scholarship that would eventually lead to increased retention?" They took advantage of machine learning to process student data, and the effort paid off. Students in need of scholarships were identified, and these students' retention rate rose from 64 to 90 percent. Machine learning and other artificial intelligence–enabled technologies could revolutionize online learning and the services associated with it.

Online education is not without challenges. Questions about ethics must become an evolving conversation, as these programs pose new challenges and new questions with continued use. In general, ethicists argue that we need to keep continual vigilance over acceptable use of the internet (Bostrom and Yudkowsky 2014). In addition, cybersecurity may be an issue, as the number of hackers continues to grow. Protection of private, personal information is of utmost importance. In addition, protections surrounding intellectual property must also be enhanced. Thus, educational institutions must continuously update policies to manage this data and comply with privacy, copyright, and trademark rights.

Internet usage, and specifically online education, will play an increasing role in the overall learning experience for educational institutions and workplace environments. To benefit fully from it, institutions and employers will need to embrace Web 4.0 developments in strategic planning. Interdisciplinary teams will need to form and collaborate to move toward a dynamic future learning environment accessible for lifelong learning. It is an exciting time for online education and full of great promises for technological enhancement and advancement.

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Further Reading

Almeida, F. L. 2017. "Concept and Dimensions of Web 4.0." *International Journal of Computers & Technology* 16 (7): 7040–7046.

Babsom Survey Research Group. 2018. "Higher Education Reports: Online and Distance Education." Accessed July 7, 2019. https://www.onlinelearningsurvey.com/highered.html.

Bostrom, N., and E. Yudkowsky. 2014. "The Ethics of Artificial Intelligence." In *The Cambridge Handbook of Artificial Intelligence*, Vol. 1, edited by Keith Frankish and William M. Ramsey, 316–334. Cambridge: Cambridge University Press.

Choudhury, N. 2014. "World Wide Web and Its Journey from Web 1.0 to Web 4.0." *International Journal of Computer Science and Information Technologies* 5 (6): 8096–8100.

Lederman, Doug. 2019. "New Data: Online Enrollments Grow, and Share of Overall Enrollment Grows Faster." Inside Higher Ed. Accessed May 20, 2019. https://www.insidehighered.com/digital-learning/article/2018/11/07/new-dataonline-enrollments-grow-and-share-overall-enrollment.

Online Learning Consortium. 2015. "Online Report Card—Tracking Online Education in the United States, 2015." Accessed June 19, 2019. https://onlinelearningconsortium.org/read/online-report-card-tracking-online-education-united-states-2015/.

Seaman, Julia E., I. Elaine Allen, and Jeff Seaman. 2018. "Grade Increase: Tracking Distance Education in the United States." Babson Survey Research Group. Accessed June 18, 2019. https://onlinelearningsurvey.com/reports/gradeincrease.pdf.

UW Libraries. 2019. University of Wisconsin. Accessed May 16, 2019. https://www.library.wisc.edu/.

Wladawsky-Berger, Irving. 2019. "The Current State of AI Adoption." *Wall Street Journal*. Accessed May 9, 2019. https://blogs.wsj.com/cio/2019/02/08/the-current-state-of-ai-adoption/.

Yates, Heather, and Craig Chamberlain. 2017. "https://www.library.wisc.edu/." *Educase Review*. Accessed May 30, 2020. https://er.educause.edu/articles/2017/12/machine-learning-and-higher-education.

Chapter 5: Online Privacy

OVERVIEW

One vision that precipitated the internet's creation was the idea that people would freely exchange information online. As the internet has matured and more people and corporations have gained access, the internet has also become a marketplace for data and information. Individuals and companies collect data with the intent to study and monetize it. In recent years, the monetization has led to questions about online privacy rights. *Online privacy*, or *internet privacy*, refers to the control that people have over their personal online data, including who has permission to access it and how it is used. The level of individual privacy and data usage, including data repurposing, storing, repackaging, and reselling, varies according to how a person chooses to use the internet, websites, and apps. Rights to online privacy are, in some cases, guaranteed all or in part as legal rights in some areas, while they do not exist in others. The question of internet privacy and whether it constitutes a right that should be guaranteed under the law has led to varying levels of debate over who owns the data and the expectations attached to securing the data.

While using the internet is educational and entertaining, there are privacy risks and sacrifices involved with participating in almost any activity online. Using a web service or website usually entails agreeing to a terms of service, which spells out the rights that as user is supposed to have and includes a section on how the site or company will use any data collected. These terms are often as long as hundreds of pages, which many users choose not to read, and use vague or heavily jargoned legal language, which makes it challenging to understand what the document says. Agreeing to those terms of service always favor the company and often requires the user to give up most, or all, control over how the company uses the data. For example, Facebook's terms of service have historically contained wording that allow it to collect everything about how people use the site and what devices they use, and they even have mechanisms to track internet browsing through internet cookies. In 2014, its terms of service allowed Facebook to use any user's content, including uploaded photographs that would normally be subject to copyright laws, in any way it wanted without compensation to the user (Scherker 2014). In response to Facebook's data collection, which it allegedly performs through browser tracking techniques even when a person is not logged in, the Mozilla Firefox browser offers an extension that blocks the Facebook trackers to increase personal privacy.

Internet privacy laws vary greatly in strength and protections across the world. In technologically advanced countries, laws protecting citizens' privacy tend to be

stronger and more developed. Japan's updates to its Act on the Protection of Personal Information, or APPI, went into effect in 2017. While APPI does not guarantee online privacy, it regulates how companies must explain the purpose for which they are collecting and using data and limits a corporation's rights to transfer data to third parties without obtaining permission directly from the individual.

The European Union has some of the most advanced online privacy rights protections. In May 2018, it passed the General Data Protection Regulation, a bill that puts privacy controls and permissions into the hands of consumers rather than corporations. Essentially, the law changes the business model to require consumers to opt in to data collection rather than the traditional model of the consumer opt out. The GDPR also allows users to view the data the company has collected, permits them to correct errors, and requires companies to grant the "right to forget" if users would like to delete portions of that information (Tiku 2018).

In contrast, the United States has no federal law or regulation that requires companies to offer the option to refuse or limit collection, and even when the option is available, it is often very difficult or requires the sharing of additional personal information to the company. Some sites that claim to scrape data and put together detailed profiles of an individual ask people to send copies of official identification, such as a photocopied driver's license or passport, before they will consider deleting information. The state of California passed state laws to improve online privacy rights in June 2018. Across the rest of the country, and around the world, online privacy remains an open question that tends to favor less regulation, which ultimately places personal data under the auspices of for-profit companies.

Nations focused on developing their internet and telecommunications infrastructures and advancing technologies domestically are also joining the debate over internet privacy rights. As many people around the world gain access to the internet, their governments must begin to address the political, economic, social, and cultural implications of their populations interacting online. In many cases, online privacy laws generally do not exist; it is unusual to consider laws and their implications prior to people changing behavior, including going online and regulating future online exchanges. In instances where internet privacy laws do exist, they are often not enforced due to lack of resources. Article 19, a registered charity in the United Kingdom that works to promote freedom of expression worldwide, determined in early 2018 that more than half of African countries had no data or online privacy laws; of the fourteen countries that had them, the organization found nine did not have the ability to enforce those regulations (Reuters 2018). Europe's GDPR has sparked debates over the "right to be forgotten" in Latin America. Being forgotten is a right with serious implications in the region, because of the region's experience with corruption, impunity, freedom of expression, and manipulation of historical memory (Sendoun 2017).

There is also a lack of consistent laws surrounding usage and monitoring of the internet. Panama, for example, has no regulations on the monitoring of internet traffic, while more than half the countries have some legal mechanisms to

address privacy rights. Thus, questions surrounding basic internet privacy issues need resolution before tackling more nuanced issues. There are efforts worldwide seeking to improve online privacy education to ensure that people understand the importance of privacy and the regulations surrounding it. At this time, there is no one standard for even the most basic internet privacy rights. There are also governments that believe online privacy is not an individual right.

Governments grapple with internet privacy because they view that maintaining privacy for individuals requires trade-offs with security interests. For democratic societies, finding a balance between the people's rights and the government's need to protect itself and its interests is especially critical. The Internet Society (2017) found that governments' need for security often entails surveillance policies and lower transparency. In Asia, it noted an increase in the number of national biometric programs that collect data for identity verification to access financial and social services. With national databases, especially ones that contain personally identifying information, there are built-in privacy concerns. In addition, large databases are often prized targets for hackers and cybercriminals. There is also a risk when the database requires combining data from other sources; the more ways to access a system, via network or people, the greater the possibility that the data will be intentionally or unintentionally breached.

There are tools online for people who consider online security an important aspect of their internet activities. These tools vary in availability from country to country, and in some countries, they are strictly prohibited by law. The tools generally fall into several categories: virtual private networks, password managers, privacy search engines, spyware removal tools, and privacy browsers. A *VPN* is a service that creates a protected or encrypted connection between a computer and the service. After connecting with the service, all internet traffic is then blocked from tracking by the sites visited. The information can still be tracked by the VPN, so this method is not foolproof. A *password manager* is a service, usually available in a downloadable format, that will store passwords for online sites. These managers often generate complex passwords that can be used when creating new passwords for new site accounts. The advantage is that a privacy manager only requires memorization of one strong password; however, if it is forgotten, there is no way to retrieve the file with all of the passwords.

Spyware removal tools are products designed to detect and remove programs embedded in downloads or online ads that, once clicked, secretly install on the computer to track movement and content. The tools also help reduce the possibility of a malware infection, as viruses or worms can spread through invisible spyware. A *privacy browser* is an internet browser, akin to Google Chrome or Microsoft Edge, that is designed not to track and collect data as those popular browsers do. Most of these browsers are not well known; some of them only work on computer operating systems that developers prefer over the average user. The mainstream browsers do have extensions that can block ads and help protect from intrusions of privacy, although none of them guarantee close to 100 percent protection. *Privacy*

search engines allow for web searching without the fear of those searches being tracked. DuckDuckGo is an example of a free privacy browser. More sophisticated privacy browsers exist for a fee.

New privacy protection tools reach the market frequently. Researching options and pricing is a good first step when considering online privacy and data protection tools. Online privacy tools also carry risks. No online tool is infallible. It is possible to use all of the different tool types and encounter instances where there is data leakage or the ability to connect the user's IP address to a particular service. The risk with using a combination of tools is unknown. The price, however, can be very high in some countries. VPNs, for example, are not legal everywhere. While they are legal in most of the world, as of early 2018, they were banned in Belarus, Iraq, North Korea, and Turkmenistan; they were heavily restricted and under government control in China, Iran, Oman, Russia, Turkey, and the United Arab Emirates (Mason 2018). The laws apply to visitors in the countries as well as citizens, demonstrating the need to check on the legal status of online privacy tools when traveling. VPNs are only one example of tools that can lead to arrest, fines, and/or imprisonment when used in unauthorized locations.

The differences and variation in online privacy laws occur due to each nation's unique political, social, and cultural circumstances. Israel is a country built on collectivism where privacy has historically played a lesser role due to the need for physical security. However, in recent years, local civil society organizations have pushed for official policy supporting digital privacy rights (Daskal 2017). Policies that work well in one context may not transfer easily to another country. No one has all of the answers, and there is no way to predict how important the consequences of establishing, or not establishing, online privacy laws may be in the future.

Most countries are considering if there is a need to protect online privacy and how to do so effectively. This section examines a wide variety of responses from nations that severely limit internet privacy rights to those that believe such rights are critical for populations online who could otherwise be exploited by companies and services with interests that are not benign. Online privacy sits at the heart of discussions about how the internet affects societies, acknowledging that the need to address it increases with the emergence of new technologies and the speed that information is collected online.

Further Reading

Daskal, Efrat. 2017. "The Israeli Digital Rights Movement's Campaign for Privacy." *Internet Policy Review* 6 (3).Accessed May 30, 2020. https://policyreview.info/node/711/pdf.

Internet Society. 2017. "Issue Paper: Asia-Pacific Bureau—Online Privacy." Accessed July 4, 2018. https://www.internetsociety.org/resources/doc/2017/issue-paper-asia-pacific-bureau-online-privacy/.

Mason, John. 2018. "Are VPNs Legal in Your Country (196 Countries Reviewed)." TheBestVPN. Accessed July 4, 2018. https://thebestvpn.com/are-vpns-legal-banned-countries/.

Reuters. 2018. "African Internet Users' Privacy Highly Vulnerable." The National. Accessed July 4, 2018. https://www.thenational.ae/business/technology/african-internet-users-privacy-highly-vulnerable1.720338.

Scherker, Amanda. 2014. "Didn't Read Facebook's Fine Print? Here's Exactly What It Says." *Huffington Post*. Accessed July 4, 2018. https://www.huffingtonpost.com/2014/07/21/facebook-terms-condition_n_5551965.html.

Sendoun, Anastasia. 2017. "Corruption, Internet Freedom, and Online Privacy in Latin America." InterAmerican Dialogue. Accessed July 4, 2018. https://www.thedialogue.org/resources/corruption-internet-freedom-and-onlineprivacy-in-latin-america/.

Tiku, Nitasha. 2018. "How Europe's New Privacy Law Will Change the Web, and More." *Wired*. Accessed July 4, 2018. https://www.wired.com/story/europes-new-privacy-law-will-change-the-web-and-more/.

COLOMBIA

Colombia has had aspirations to grow its international and online business opportunities for the past decade. As part of this strategy, the government noted early in the process that with the increasing demand for internet and electronic transactions, it had an obligation to ensure that online activities aligned with its citizens' guaranteed privacy rights. Using legal channels and drawing upon other sectors as needed, Colombia has sought to legislate and regulate online privacy. It actively seeks to punish offenders who violate privacy regulations and protections. While it has enjoyed success in this area, the country has found it challenging to keep up legally with changes in technology and the internet, especially as they apply to online privacy, a facet of the privacy rights guaranteed under national law.

Colombia enshrined its first privacy law in 1991, within the Political Constitution. Under this law, citizens have a fundamental right to personal and familial privacy, which includes the concept of protecting their names and reputations. This law provided the constitutional basis for privacy rights and served as the foundation of succeeding laws focused more specifically on internet users as well as those who use or provide personal information through other types of electronic means.

The introduction of the internet led to the need for new and, in many cases, supplemental laws to cover new forms of data collection, processing, and transmission. In 2008, Law 1266 placed privacy protection rights on the financial sector, in particular on credit reporting agencies. As part of these protections, citizens gained the right to know, rectify, or modify data held about them. Law 1273 of 2009 criminalized activities that sought to "obtain, gather, subtract, offer, sell, exchange, send, buy, intercept, divulge, modify or use personal data . . . for personal purposes or of third parties without being authorized to do so" and placed the penalty at four to eight years in prison and a maximum US$220,000 fine on the commission of these acts (Pulecio Velásquez 2012). Some researchers use this law to claim that Colombia enacted the first laws on cybercrime.

In 2012, Colombia enacted its first law to address online privacy and regulate personal data protection. The law places responsibilities on parties or entities

that process personal online data. Companies that process this data, according to the law, must include a privacy notice in easy-to-understand Spanish that details exactly what the data will be used for and how long it will be retained, must receive notice of consent from the individual for collection and use of the data as well as for the use of cookies on websites, and are expressly prohibited from processing sensitive personal data, such as characteristics about demographics or other information that could lead to discrimination. In addition, if the data must be transferred for the specific purpose for which it was collected, any third-party organization processing the data must also agree to uphold the same protections.

International data transfers are mostly prohibited unless the country where data will be processed has the same or higher standards for data protection. Initially, only countries in the European Union, Japan, Australia, and Argentina met these standards, although in recent years countries such as the United States have been deemed to have "adequate" enough protections to participate in data transfers with Colombian firms (Hunton 2017). In 2013, the government added an addendum, Decree 1377, to designate the Superintendency of Industry and Commerce (SIC) to enforce violators with high fines and a suspension of operations for six months with an option for permanent suspension if corrections have not been implemented sufficiently.

The Colombian government decided to add to these laws with Decree 1074 of 2015 to update the requirements for registration with the National Database Registry (RNDB), officially established under Law 1581. This decree outlined who must register, including people and companies that process personal data. In many cases, these entities were similar to those that had to register with the Chambers of Commerce and Companies of Mixed Economy or those required to register under Law 1266. The decree required all involved entities to register in the RNDB within one year's time. Further updates to RNDB registry occurred with Decree 886 of 2014, Decree 090 of 2018, and Resolution 090 of 2018. For example, Decree 090 delineated when companies must register their databases based on tax value units, or UVTs, a value set by the Colombian tax authority; companies valuing between 100,000 and 610,000 UVTs, the equivalent of approximately €5.8 million, had to register prior to September 30, 2018, while companies with higher UVTs had until January 2019 (Nelson-Daley 2018).

As part of Colombia's commitment to data privacy, it hosted the First Latin American Congress on Data Protection in 2013. 300 individuals from across the region and Europe gathered at the Irotama Resort in Santa Marta, Colombia, to discuss the major concerns surrounding data privacy. Discussions revolved around the definition of personal information, guidelines and limitations on consent, and the privacy challenges involved in the use of mobile devices. The presentations and subsequent conference discussions covered policy shaping and development, international data transfers, accountability, and the importance of Big Data. To show Colombia's position as a regional leader in data protections, José Alejandro Bermúdez (n.d.), the Deputy Superintendent for Data Protection, spoke about the county's data protection system and the importance of Law 1581 of 2012.

In South America, new technologies provide commercial benefits while bringing into question digital privacy rights. Brazilian advertisers adopted a new system in 2017 to track responses to advertisements. The Audience Analytics System, which relies on artificial intelligence, tracks people waiting for subway trains in Sao Paulo. When ads are displayed on specialty doors, sensors identify the number of people waiting on the platform and characteristics about them such as age, gender, time spent waiting, and facial expressions. The data is sent at fifteen-second intervals to a dashboard that allows advertisers to customize the ads shown immediately in order to increase sales and product engagement (Metro Magazine 2018). Marketers view this program as a way of using artificial intelligence to respond to customers' interests while reaching them while they are performing their daily routines. However, the system also raises questions about data privacy and protections that remain unaddressed.

After attending the summit, the Ibero-American Data Protection Network, which focuses on collaboration between Spain and the Americas, held a meeting in Colombia. This group advocated expanding data protection considerations to cloud computing and advertising and creating regulations around the "right to be forgotten," a concept that dictates individuals should be able to ask online platforms to remove content, although the rules and guidelines surrounding the right to be forgotten remain opaque. Online platforms do not have to comply with requests.

The government takes privacy breaches seriously. In 2016, it penalized Uber for a data breach that affected at least 260,000 residents. Oddly, while Uber is illegal in Colombia, it is a fairly popular app because it offers a high-demand service, although drivers can face suspension of their licenses for up to twenty-five years for driving with the company. Despite not sanctioning Uber as a service, the Colombian government gave the company four months to improve its data protection services substantially. Along with proving that personal data has higher safeguards, the government required the company to employ a third-party entity to certify its compliance. In an interesting turn of events, Uber announced its plan to open a support center in country.

In 2019, the SIC penalized the organizations Banco Falabella and Rappi with monetary and behavioral sanctions for not allowing people to control their data under the current law. Specifically, the SIC found that these companies did not allow people to opt out of their data being used for advertisers, nor were they offered the ability to delete data under legally sanctioned circumstances. It fined Banco Falabella COP$496 million and Rappi COP$298 million for improperly processing personal data and disrespecting people's privacy rights, respectively (SIC 2019).

Despite Colombia's seemingly comprehensive systematic approach to online privacy and data protection laws, some critics claim that while those these laws demonstrate significant progress, they are often missing key, clarifying information.

For example, Law 1581 places restrictions on companies about how they must uphold privacy rights but does little to specify the requirements that they must meet. The laws also state that companies must have a data protection group within the corporation to ensure compliance with the law; however, companies are not technically required to have a data protection officer whose primary responsibility would be to run such a group. The group structure itself has also not been prescribed; questions such as who must participate in the group or how many people the group should contain depending on the size of a firm remain unanswered. Thus, Colombia must, at minimum, issue these guidelines in the future. If the past is reflective of the future, it also suggests that Colombia will continue to issue new laws and decrees to address the gaps in the legal framework as well as to address unanticipated consequences that affect online privacy with the emergence of new technologies and cyberspace.

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Further Reading

Hunton. 2017. "Colombia Designates U.S. as 'Adequate' Data Transfer Nation." Hunton Andrews Kurth. Accessed May 30, 2020. https://www.huntonprivacyblog.com/2017/08/15/colombia-designates-u-s-adequate-data-transfer-nation/.

Ibero-American Data Protection Network. 2017. "Standards for Personal Data Protection for Ibero-American States." Accessed August 17, 2019. http://www.redipd.es/documentacion/common/Estandares_eng_Con_logo_RIPD.pdf.

Magrani, Eduardo. 2017. *Digital Rights: Latin America and the Caribbean*. Rio de Janeiro: FGV Direito Rio.

Nelson-Daley, Rachael. 2018. "Colombia: Database Registration Amendments Tackle 'Complex and Expensive' Obligations for SMEs." OneTrust Data Guidance. Accessed August 17, 2019. https://www.dataguidance.com/colombiadatabase-registration-amendments-put-end-complex-expensive-obligations-smes/.

Pulecio Velásquez, Juliana. 2012. "Data Privacy: Colombia." Lex Mundi. August 17, 2019. www.lexmundi.com/Document.asp?DocID=4356.

Superintendency of Industry and Commerce (SIC). 2019. "Rappi y Banco Falabella Sancionados por Incumplir Ley de Protección de Datos." Accessed August 17, 2019. http://www.sic.gov.co/Rappi-y-Banco-Falabella-sancionadospor-incumplir-Ley-de-Proteccion-de-Datos.

FINLAND

Finnish privacy laws are some of the most liberal in the world. In 2009, the government declared internet access a legal right, the very first nation to make this determination. Laws in the country uphold the value of privacy, both online and offline. With few exceptions, the Finnish government has sought to strengthen them. In response to the growing risks of internet connectivity, Finland has started reassessing some of its laws; these reevaluations are tied to data breaches and increased cybersecurity risks. At the same time, Europe's General Data Protection Regulation, which came into force in May 2018, has left several key areas for national

governments to address. In these cases, Finland seeks to regulate, and often boost, those areas for which it can legislate for greater protections.

The Finnish take privacy and the protection of data seriously. In fact, the country convicted seventy-two authorities, members of government and the police, of illegal snooping into electronic medical records in 2013. One of the country's skiers, the controversial six-time Olympic medal winner Mika Myllylä (1969–2011) died in 2011 of unknown causes. After his death, many authorities accessed his records trying to learn about what happened. Although they cited curiosity and professional development as reasons for checking his records, the courts found their actions a violation of his privacy. Most defendants spent fifteen days in jail (Reinboth and Teivainen 2014). More recently, in July 2018, the Jehovah's Witnesses took their case to a top European court. Finland banned them in 2013, in part because they took notes when they visited people's homes without permission, violating Finnish privacy laws. The European courts upheld this ruling and determined that religious groups must adhere to privacy laws. While these cases did not specifically refer to online privacy, Finland also holds privacy in electronic communications to high legal standards.

Over the past few years, Finland has sought to simplify and boost internet protections. With the passage of the Information Society Code in early 2015, the government significantly reduced the number of rules placed on electronic communications, increased consumer protections and privacy rights, enhanced security, and promoted competition among telecommunications companies. Within the code, Finland imposed higher standards on data providers and media platforms. It required media companies such as Facebook and other social media platforms to guarantee confidentiality of all electronic communications. The code requires a user or subscriber to opt in to data collection and requires service providers follow the agreement for the handling and processing of that data. Once processed, all data must be disassociated from the individual, and barring a valid legal reason, that data cannot be stored in any way that reidentifies the person (Government of Finland 2014). In addition, the code guarantees net neutrality, the idea that service providers cannot show preference for certain sites while restricting others, such as by slowing speeds, unless the situation fits clearly into one of four exemptions.

Other countries have viewed Finland's move toward greater privacy as a potential model for how to address online privacy issues. In 2015, the courts invalidated the European Union's Safe Harbor policy, which allowed for the transfer of data between Europe and the United States, because the United States had insufficient oversight in place to protect European citizens' privacy and data. In 2016, the Privacy Shield framework replaced Safe Harbor. While it included stronger protections for data and privacy, many people felt the framework provided inadequate protections. In July 2020, the European Union rejected the framework for exactly these reasons, believing that the United States and global technology companies were not protecting citizens' privacy adequately.

Germany, one of the countries particularly concerned with data privacy, worked with the Finnish government to build a special, 685-mile-long cable to connect the two nations. The cable followed a route designed to avoid shallower water because the Germans feared wiretapping (Williams 2015). Finland also worried that its

reliance on Sweden as a conduit for information posed a risk because of television reports that Sweden had assisted in American efforts to spy on Russia. This event marked Finland's quest to brand itself as a truer safe haven for data and privacy protections, all while keeping personal data away from American companies that had previously misused it.

Finnish researchers actively pursue projects that seek to enhance privacy. The Finnish Geospatial Research Institute's National Land Survey has been an active participant in efforts such as MyGeoTrust (mygeotrust.org), an experiment in crowdsourcing geolocated data with privacy controls intact as an alternative to the model used by large corporations, and the Insure project (insure-project.org), an effort to secure vulnerabilities in devices that process geotagged data while increasing privacy protections.

Finland is one of the few countries to have laws against spamming, which it defines as the receipt of unsolicited commercial communications. The country enacted its first antispamming law in 1999, the Protection of Privacy and Data Security in Telecommunications, also known as Act No. 565. Under this law, consumers have control over what they do and do not receive. They must opt in, or agree, to receive communications from a company or marketer. Even when they do opt in, they must always have a mechanism to opt out. Corporations that violate these terms may be forbidden to contact Finnish people or may even be prosecuted for violating the law.

The European Union has similar directives established after the Finnish law. European Directive 2002/58/EC on Privacy and Electronic Communications also imposes restrictions on spamming and supports a consumer's right to accept or reject commercial communications. Finland boosted these provisions again with the Act of the Protection of Privacy in Electronic Communications in 2004 and amended in 2011. This law deepened the privacy rights attached to electronics communications like email and text messaging. Some of the additions it made included requiring any person or entity who mistakenly received a message to maintain that confidentiality under penalty of sanctions and allowing consumers to use a technical means at their disposal to protect their messages, provided that those means do not violate or circumvent the law (Government of Finland 2011).

The days of Finland's open, unrestricted internet and liberal privacy protections may be waning. In early 2018, Finland's National Bureau of Investigation partnered with the Save the Children Foundation to designate a list of websites to block. Together, the organizations developed a list of 1,600 websites suspected of hosting child pornography. Critics worried that the organizations may not have taken due diligence in identifying the sites to block. Using a previous version of the block list, researchers found that 1 percent of the sites contained actual child pornography and less than 4 percent contained links to illicit material (Wilmoth 2018).

The country is also deciding if and how to use the internet for surveillance purposes, although it is currently restricted to certain limitations under the constitution. Presently, authorities can only access personal data when investigating

a crime or during a trial; exploring data at any other time is impermissible under the law. Imposing increased restrictions could require amending the constitution, an act that the citizenry may condemn. However, Finland must balance the legal right to use the internet, strict privacy and data protection laws, and the fact that criminal schemes and other events could jeopardize national interests.

Another reason for the reassessment of policy and regulations concerning privacy is the country's third-largest recorded data breach in April 2018. The company Helsingin Uusyrityskeskus, or New Business Center, in Helsinki lost 130,000 user ids and passwords when hackers managed to breach a website that it operated (Kumar 2018). Finland has not typically required notification in the event of a data breach, although Europe's GDPR requires that all European citizens be notified within seventy-two hours of any data breach that might affect them. The loss of user ids and passwords encouraged the government to consider not only the upcoming regulation but also whether its current laws provide sufficient protection and notification. In an unusual data breach case, hackers found a vulnerable smart fish tank at a North American casino, used it to gain access to the casino's systems, and sent the data to Finland before being discovered. It is unknown if the hackers were Finnish, but the case does demonstrate the dangers of data breaches due to unsecured devices connected to the internet. Though this case did not prompt new laws in Finland, it is a reminder that data breaches can send data over great distances very quickly.

On top of potential and actual data breaches, the Finnish Communications Regulatory Authority has noted an increase in phishing and data loss through Office 365. Company executives are common targets because they make decisions and often have access to online bank accounts. Although the companies often suffer significant financial loss, they are not required to report the effects of these scams to the government. Thus, the Finnish government has attempted to increase awareness surrounding the dangers attached to phishing and other fraud scams.

In spite of the potential dangers criminals may pose, many Finnish organizations oppose any change to the laws that lessens the country's strong privacy rights. Groups such as Electronic Frontier Finland and politicians from the Left Alliance have spoken out against measures that restrict privacy rights. They feel that these actions will start chipping away at what has been considered a fundamental right. They cite other nations, like the United States, as having traded its citizens' privacy rights ultimately because of fear as well as laws that allow for internet and social media monitoring. These repercussions are something these groups would prefer to avoid; instead, they advocate for maintaining, if not enhancing, the high privacy and data protections in the country.

Regardless of whether Finland pursues new or amended legal frameworks, the country must adhere to Europe's GDPR, which went into effect in May 2018. The regulation left several areas for the individual members to legislate domestically. To strengthen protections, Finland is debating the adoption of HE 9/2018, the Data Protection Act, to enhance the GDPR's privacy provisions (Government of Finland 2018). The act was still under discussion as of July 2018. Other laws under

consideration include an enhancement to the Act on the Protection of Privacy in Working Life to maintain privacy rights and increase protections with the passage of GDPR. The current law limits employee monitoring and supervision, especially through technical means, and strictly regulates how and when an employer can read employee emails. The enhancements address surveillance and the sanctions that employers breaking the law may experience.

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Further Reading

Government of Finland. 2011. "Act on the Protection of Privacy in Electronic Communications." FINLEX. Accessed July 23, 2018. https://www.finlex.fi/en/laki/kaannokset/2004/en20040516.pdf.

Government of Finland. 2014. "Information Society Code." Ministry of Transport and Communications. FINLEX. Accessed July 23, 2018. https://www.finlex.fi/en/laki/kaannokset/2014/en20140917.pdf.

Government of Finland. 2018. "HE 9/2018: Hallituksen Esitys Eduskunnalle EU: N Yleistä TietosuojaAsetusta Täydentäväksi Lainsäädännöksi." FINLEX. Accessed July 23, 2018. https://www.finlex.fi/fi/esitykset/he/2018/20180009.

Kumar, Mohit. 2018. "Finland's 3rd Largest Data Breach Exposes 130,000 Users' Plaintext Passwords." *Hacker News*. Accessed July 23, 2018. https://thehackernews.com/2018/04/helsingin-uusyrityskeskus-hack.html.

Reinboth, Susanna, and Aleksi Teivainen. 2014. "Police Officers Snooped into Death of Mika Myllylä out of Curiosity." *Helsinki Times*. Accessed July 24, 2018. http://www.helsinkitimes.fi/finland/finland-news/domestic/10013police-officers-snooped-into-death-of-mika-myllylae-out-of-curiosity.html.

Williams, Christopher. 2015. "Finland Builds Submarine Link to Germany to Avoid US Internet Spying." *Telegraph*. Accessed May 30, 2020. https://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/telecoms/11581707/Finland-builds-submarine-link-to-Germany-to-avoid-US-internet-spying.html.

Wilmoth, Josiah. 2018. "Finland's ISPs Begin Censoring Websites on Government Blacklist." Private Internet Access Blog. Accessed July 23, 2018. https://www.privateinternetaccess.com/blog/2018/04/finlands-ispscensoring-websites-on-government-blacklist/.

INDIA

India does not have a data privacy law that governs how companies, such as social media and mobile app providers, decide to utilize user data. The country, however, is in the midst of its Digital India initiative, which encompasses major socioeconomic changes such as moving toward becoming a cashless society. Digital usage has raised questions about the protections that individuals have when using government and private apps. At the same time, the Supreme Court recognizes the right to privacy as a fundamental right. This discrepancy places India at a dilemma; experts and even some policy makers acknowledge the need to enact laws to regulate how the data is used and even mined for information. The debate intensified in March 2018, when sources revealed that Cambridge Analytica had essentially stolen data from 50 million Facebook users, including those located in India.

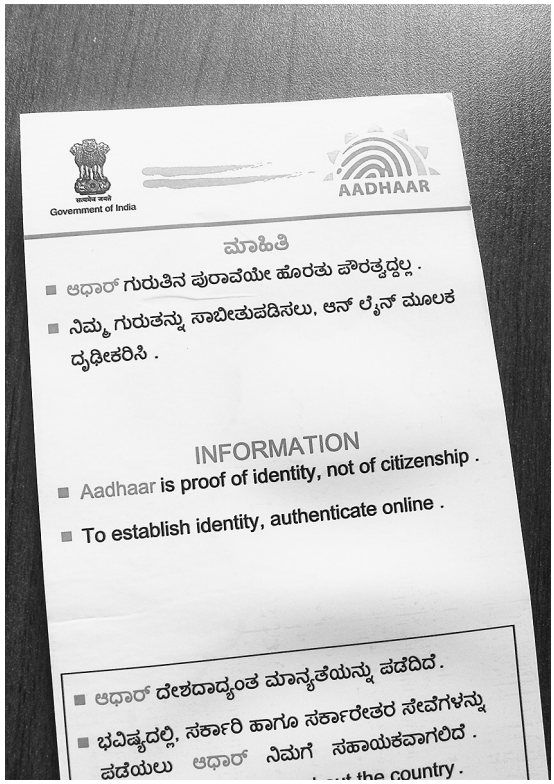
The idea of data protection and privacy laws is not new in India. In 2010, a group of government experts contemplated the need for such a law. By 2011, they concluded that India needed a framework to address rights and restrictions as they relate to personal data collection and usage. The group released a paper in 2012 explaining its recommendations. The paper outlined nine privacy principles and suggested a legal framework to address violations. Although the report lacked some detail, such as operational definitions and criteria for compliance, it laid the basis for further discussions. In 2017, the group produced another report updating those earlier findings to address the internet's maturity. This version asked citizens to provide feedback and comments for additional consideration. While it may foster debate and solicit needed commentary, the paper does not substitute for a federal law.

Some laws partially protect personal data. The Information Technology Rules, released in 2011, state that a corporate body must maintain reasonable security practices or compensate the injured party. The Consumer Protection Act of 2015 is another law expected to provide additional privacy protections. This law explains that corporations cannot misuse data in unfair trade practices or in ways that could cause emotional or psychological harm. Additional law includes the Right to Information Act, which allows citizens to request data the government has on them. These three laws together, however, do not equate to strong privacy protections. The issue is complicated further by the fact that India does not have a body to oversee data protection or privacy.

Some Indian politicians have attempted to write bills that regulate data privacy. Prime Minister Narendra Modi (1950–) has admitted that data is a valuable commodity. Member of Parliament Shashi Tharoor (1956–), now controversial because of his alleged involvement in his wife's death in 2014, drafted a bill that outlines a framework for data protection, which he argues is urgently needed to align with the Supreme Court's ruling. As of mid-2018, Congress had not yet considered the bill. Tharoor has refused to provide details on the framework until it reaches Congress but did state that he believes that data generated is owned by the person who generates it. When a user requests it removed, he stated that companies should be required to destroy that data (Tharoor 2018). These ideas are represented in his proposed bill.

Tharoor is not alone in the idea to push laws through parliament; other policy makers seek to do the same to regulate the data privacy issue. Other politicians are considering whether a model such as Europe's General Data Protection Regulation, which places data ownership in the hands of its creator, would be suited to India. It is also a question of how the GDPR will affect trade with Europe, as companies the European continent does business with will have to conform to the law or risk exclusion. Similarly, a GDPR-like policy for India could have extensive implications for business and trade.

Questions about data protections and privacy are becoming more important in the country, especially considering the amount of personal information collected for national and personal reasons. In an attempt to reduce welfare



The Aadhaar identity program allows residents and passport holders of India to register their biometrics to receive a unique, 12-digit identity number. The number, while currently part of a voluntary registration process, allows individuals access to online and offline benefits and services in the country. There are concerns, however, that this massive data trove will become a target for hackers and lead to identity theft-related crimes. (Maneesh Upadhyay/Dreamstime.com)

corruption and improve access to resources, the government instituted Aadhaar, a national biometric database whose name translates into *foundation* in English. This database collects mandatory fingerprints, photos, and eye scans as part of the national identity system; the government has already collected the information for the majority of the 1.3 billion people residing within its borders. The database is the largest worldwide and, as such, has also become a potential target for hackers and other groups that might profit from large amounts of personal information. It also has the potential to grow; some states are considering linking e-health records to the database, increasing the value of the data and the potential for privacy violations. On top of this, India is considering a DNA profiling database for law enforcement agencies. The proposal does not address privacy concerns or the people's rights, nor does it include much information on data protection.

The second side to the Aadhaar and privacy concern debate is that the government wants to link it to every service and possible use. For example, the database will play a role in banking, pensions, education, healthcare, food for the malnourished, traffic tickets, and countless other examples. The system originated as a tool to stop the production of fake documents and has transformed into a tool that will control everything related to identity. Linking these pieces of information entails additional security concerns that extend well beyond privacy. The database has captured the attention of many other nations; Russia, the United Kingdom, and the Philippines have expressed interest in its progress. Other countries, such as Sri Lanka, have announced they will develop a similar national system.

Despite international curiosity, Aadhaar has already become embroiled in controversy. In early 2018, a journalist claimed to purchase administrative access rights to the database for approximately ₹500 (Indian rupees), the equivalent of about US$8, over WhatsApp (Cameron 2018). This episode marked the second major data breach, as the system leaked 130 million residents' data in early 2017. Other improper data access issues have arisen, such as government websites displaying the information unexpectedly and employees using the database for their own enrichment (Doshi 2018). Between the breaches and the leaks, privacy invasion is no longer the biggest concern. With the amount of information available on each individual, identity theft is a growing concern. The current lack of laws to address data protection leaves these individuals without much recourse in the event their identities are stolen.

The Indian government employs other technical solutions to address political and social issues. As a result of the 2008 Mumbai terrorist attacks and the need to protect its citizens, the government has proposed a Central Monitoring System to intercept communications on most devices. The system would also allow for data mining, which would require a database of user data and other information collected while running the program. It has been under development since 2009. In addition, the government also uses and considers other monitoring systems to maximize its ability to prevent violent and criminal activities (Privacy International 2018). While safety is a clear concern, these systems also raise questions about online privacy.

Privacy is also a concern on social media, where people share personal information that each company collects for its own use and enrichment. India has the second-highest number of internet users after China, at approximately 462.12 million (PTI 2018). Many of the people enjoying social media platforms are unaware of future consequences of data collection. There's also an economic facet to the issue of social media and other data collection. Improving data protection and privacy could affect some local businesses. Some Indian IT firms accept cross-border and third-party data transfers for processing. Data transfers occur worldwide due to third-party purchases of that data and because storage and usage laws vary depending where the data storage is physically located. In India, this data mining, processing, and analysis leads to employment. Other industries, such as entrepreneurs with ideas for apps that will collect data, could also be hurt by data restrictions. Thus, there are two sides to the data protection issue that impact the entire society.

India's current use of data and media indicates there is a need to institute regulations for data protection and online privacy. The country's politicians and experts have considered the need for almost a decade. At this point in time, Indians must provide data to the government that allows them to access public services, as in the case of the national biometric database. They are also freely providing data to collectors on social media and other outlets, which will grow in volume as more people gain access to the internet. This increase in data sharing, whether

mandatory or voluntary, raises many questions about the amount of control people have over this data. Over the next few years, India must address these questions about online privacy in addition to other ethical and legal issues on the horizon when dealing with emerging technologies.

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Further Reading

Cameron, Dell. 2018. "Full Access to India's National Biometric Database Reportedly Sold over WhatsApp for About $8." Gizmodo. Accessed July 18, 2018. https://gizmodo.com/full-access-to-indias-national-biometricdatabase-repor-1821772876.

Doshi, Vidhi. 2018. "India's Biometric ID Program Was Supposed to End Welfare Corruption. But the Neediest May Be Hit Hardest." *Washington Post*. Accessed May 30, 2020. https://www.washingtonpost.com/world/asia_pacific/indias-vast-biometric-program-was-supposed-to-end-corruption-but-the-neediest-may-be-hit-hardest/2018/03/24/bb212a86-289c-11e8-a227-fd2b009466bc_story.html.

Privacy International. 2018. "State of Privacy India." Accessed July 18, 2018. https://privacyinternational.org/stateprivacy/1002/state-privacy-india.

PTI. 2018. "India Lacks Legal Framework to Ensure Data Protection and Privacy; Current Laws Inadequate: Experts." DNA India. Accessed July 18, 2018. http://www.dnaindia.com/technology/report-india-lacks-legalframework-to-ensure-data-protection-and-privacy-current-laws-inadequate-experts-2600000.

Tharoor, Shashi. 2018. "Create an Independent Privacy Commission for Data Breaches: Shashi Tharoor." *Print*. Accessed July 18, 2018. https://theprint.in/opinion/create-privacy-commission-to-probe-data-breaches-saysshashi-tharoor/45232/.

NIGERIA

Nigeria does not have a data privacy law that governs how companies, such as social media and mobile app providers, decide to utilize user data. Although government and corporate entities collect and process personal data, there is no comprehensive legal framework to protect personal data (Web Foundation 2018). Rather, following the rising global trend, Nigeria has data protection based on the country's constitution (Aderiibigbe 2018b). The country's existing regulatory frameworks that apply to personal data protection are from the broadly phrased Section 37 of the 1999 Constitution of the Federal Republic of Nigeria, which provides that "the privacy of citizens, their homes, correspondence, telephone conversations and telegraphic communications is hereby guaranteed and protected" (Web Foundation 2018). Industry has developed some protection frameworks, although they are often limited to specific circumstances. Even taken together, these frameworks provide little protection because they neither define the breadth and limitations of data protection nor specify how personal data must be handled to ensure adequate protection (Web Foundation 2018).

Nigeria has the fourteenth-highest number of internet users in the world, at approximately 47.8 million, or 25.7 percent of the population, and its consumers have little control over any aspect of the data value chain (Okunola 2018). A 2017 survey further reflects this problem: 97 percent of survey respondents indicated

that their highest security concern relates to use of their personal data (Web Foundation 2018). In the past, various data sets have been put up for sale; often, they include sensitive, personally identifying details, such as email addresses and phone numbers. For example, the Independent National Electoral Commission violated basic data protection in 2016 when it provided sensitive voter data—data it has a mandate to protect—to a third party. In addition, the government has tended not to consider and build data protection into the development of its electronic and computer systems, so hackers routinely gain access to government websites to steal data (Okunola 2018).

A campaign sign hangs from a Nigerian street corner during the 2015 presidential election. In a major breach of online privacy, an opposing candidate allegedly hired a firm to hack the current Nigerian President Muhammadu Buhari's medical and financial data to use against his political campaign. The company that supposedly hacked the president was Cambridge Analytica, a data firm tied to scandal through its dealings with Facebook and alleged attempts to use digital, private data to manipulate elections worldwide. (Billkret/Dreamstime.com)

An additional challenge related to data protection is the parallel data collection by individual government agencies. There is no robust or national data-management infrastructure, and different government systems frequently do not communicate with others to ensure that the same data is not collected and stored on each system. The issue is not unique to government, either; the situation is the same with banks, telecommunication and insurance companies, and start-ups. The common theme in Nigeria's data landscape is that there are many information silos without adequate measures of data coordination (Okunola 2018). Therefore, personal data may reside on multiple systems with varying degrees of protections while citizens have no control over what data is collected, stored, or shared.

Cybercrime is a major problem for Nigeria's financial sector. According to the Nigeria Electronic Fraud Forum, the financial sector lost 2.19 billion naira (approximately US$6.1 million) to cyberfraudsters in 2016. Moreover, Nigeria's financial sector experienced devastation in 2017 when the country's largest-ever

cyber–Ponzi scheme, popularly referred to as MMM, which stands for Mavrodi Mundial Moneybox, collapsed. As a result, the country lost around 11.9 billion naira. Despite this traumatic financial loss, public participation continues to drive support to cyber–Ponzi schemes. The evolution of these schemes may worsen if they transition from traditional monies to cryptocurrencies, where currency ownership allows for a high degree of anonymity and the currencies themselves are not regulated. The Nigerian government is concerned with the potentially fraudulent aspects of cryptocurrency and has set up a national committee to examine the regulatory frameworks required to regulate them (Kuit, Folabi, Ugochukwu Obi, and Seth Azubuike 2017). The intent is to reduce the potential for future cybercrime and limit the use of cryptocurrencies like Bitcoin in cyber–Ponzi schemes.

In 2018, Nigeria also uncovered its own Cambridge Analytica scandal, during the country's 2007 and 2015 elections. The Strategic Communication Laboratories' election services division, also known as SCL Elections, a Cambridge Analytica affiliate, organized antielection rallies to dissuade opposition supporters from voting in 2007. According to Nicholas Garba Shehu (1960–), a spokesperson for President Muhammadu Buhari (1942–), the government created a committee to investigate the claims surrounding a 2015 hack of President Buhari's personal data, which was allegedly perpetrated as oppositional research during the presidential campaign.

One part of the investigation included looking into Cambridge Analytica to determine whether it broke Nigerian law or interfered with other political campaigns illegally in conjunction with its work for the then-ruling People's Democratic Party. The UK-based Cambridge Analytica's political activities and potentially illegal actions in Nigeria are similar in scope to allegations that the organization improperly accessed data from the social media website Facebook to target voters prior to the U.S. presidential election and Britain's Brexit referendum in 2016 (Ohuah 2018).

Authorities Responsible for Data Protection	
Nigerian Information Technology Development Agency (NITDA)	The NITDA Guidelines for Data Protection 2013
Nigerian Communications Commission (NCC)	Nigerian Communications Commission (Registration of Telephone Subscribers) Regulations 2011
	The NCC Consumer Code of Practice Regulations 2007
Central Bank of Nigeria (CBN)	Central Bank of Nigeria's Consumer Protection Framework 2016
	Credit Reporting Act of 2017

There are multiple agencies responsible for some aspects of data privacy, as depicted in the table above listing each agency and the respective law(s) passed surrounding data rights. The number of agencies and laws have complicated Nigeria's response to data protections. Recent government reorganization has sought to rectify data privacy problems. In 2007, the country established the National Information and Technology Development Agency (NITDA), through the National Information and Technology Development Agency Act 2007, to develop guidelines for electronic governance and monitor the use of electronic data interchange. Through this statutory mandate, NITDA developed the 2013 Guidelines for Data Protection (NITDA Guidelines), which stand out from other legislation. Other policies that contain data protection provisions are merely supplementary to the legislation's primary objectives, whereas the NITDA Guidelines are principally for the purpose of prescribing guidelines for data protection (Aderiibigbe 2018a).

There are additional laws that aim to protect personal data. In 2017, the National Assembly enacted the Credit Reporting Act (CRA) 2017. Like similar acts in the United States, Jamaica, and Zambia, the CRA establishes regulations for credit bureaus to ensure that the personal information collected is accurate and reliable. In addition, it also includes some protection for data subjects, such as guarantees for confidentiality, data protection, and guidelines for when data can be accessed, by whom, and for which purposes.

The telecommunications sector has also started adding more protections to personal information. In 2011, the Nigerian Communications Commission (NCC), the regulatory body for the telecommunications industry, created policies to protect personal data that also extend to independent registration agents. These policies address data collected, aggregated, retained, and managed within the telecommunications industry. Other consumer data has also received increased protections. In 2007, the NCC issued the Consumer Code of Practice Regulations to regulate individual consumer information. Specifically, the NCC Consumer Code requires licensed businesses to comply with its policies, which include minimum standards for data protection (Kuit, Folabi, Ugochukwu Obi, and Seth Azubuike 2017).

There are also laws that address data privacy and protection under specific circumstances rather than blanketing an entire sector. For example, Nigerians may request public records and information under the Freedom of Information Act No. 4 of 2011, although the law exempts some personal data. Children's data is also protected under law. The Child Rights Act No. 26 of 2003 apply standards to data collected from children. Another example is the Cybercrimes Act 2015 that regulates electronic information to prevent its use in the commission of crimes. It also establishes penalties for using electronic means to perpetrate a cybercrime (Kuit, Folabi, Ugochukwu Obi, and Seth Azubuike 2017).

Official government agencies are not the only entities involved in developing privacy policies. Nongovernmental organizations, academics, industry, and advocacy groups also play a role in their development. These groups not only work to recommend improvements and create better privacy policies; they also assist with educating populations about them and improve implementation. The National

Youth Service Corp is one example of an NGO that has worked to increase awareness of the Freedom of Information Act (Kuit, Folabi, Ugochukwu Obi, and Seth Azubuike 2017). NGOs have become an important channel for creating better public awareness of data privacy and protection rights.

Nigeria's current use of data and media indicate that there is also a need to institute regulations for data protection and online privacy. Advocates for increased data protection, such as the African Academic Network on Internet Policy, have suggested that the National Assembly consider potential regulatory changes such as, but not limited to, the following: requiring that personal data be used solely for the purpose for which it was intentionally collected (purpose specification), ensuring that user consent is obtained prior to collecting personal information, and establishing procedures for individuals to have legal recourse for misuse and/or unauthorized access to personal data.

Civil society organizations also have a role to play in advocating for data protection. Specifically, they should focus on promoting the need for a comprehensive data protection framework and should take strong positions to promote greater protection. Possible positions include condemning data breaches that expose personal data, initiating litigation that supports data privacy laws and protections in the public interest, educating society about the need for data protection and the risks associated with data breaches, and promoting the use of privacy enhancing technologies, such as parental control programs (Web Foundation 2018).

Nigeria's next step forward in terms of data protection will be the reconsideration or recrafting of the Digital Rights and Freedom Bill, also sometimes known as the Anti-Social Media Bill. The house initially passed the draft legislation and sent it to President Buhari for assent. The president, however, rejected the bill in early 2019 because he claimed it covered too many topics and none in any substantial depth; he also stated that other draft legislation contained similar information and preferred for the bill to be narrower in scope. The purpose of the bill was to offer a better protective shell around data handling, collection, and use in Nigeria. Once Nigeria has established foundational policies for data privacy, the country can start to look at more comprehensive coverage in the likeness of Europe's recently activated General Data Protection Regulation (Okunola 2018).

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Further Reading

Aderiibigbe, Ngozi. 2018a. "Data Protection 2018, Nigeria." International Comparative Legal Guide. Accessed February 22, 2019. http://iclg.com/practice-areas/data-protection-laws-and-regulations/nigeria.

Aderiibigbe, Ngozi. 2018b. "Nigeria: Nigeria Has a Data Protection Regime." *Mondaq*. Accessed February 22, 2019. http://www.mondaq.com/Nigeria/x/721166/data+protection/Nigeria+Has+A+Data+Protection+Regime.

CIA. 2018. "Nigeria." World Factbook. Accessed February 22, 2019. https://www.cia.gov/library/publications/the-worldfactbook/geos/ni.html.

Kuit, Folabi, Ugochukwu Obi, and Seth Azubuike. 2017. "The Privacy, Data Protection and Cybersecurity Law Review Edition 4." The Law Reviews. Accessed February 22, 2019.

https://thelawreviews.co.uk/edition/the-privacy-dataprotection-and-cybersecurity-law-review-edition-4/1151293/nigeria.
Ohuah, Felix. 2018. "Nigeria to Probe Alleged Cambridge Analytica Involvement in Elections: Presidency." Reuters. Accessed March 16, 2019. https://www.reuters.com/article/us-facebook-cambridge-analytica-nigeria/nigeria-toprobe-alleged-cambridge-analytica-involvement-in-elections-presidency-idUSKCN1H913U.
Okunola, Akindare. 2018. "Data Protection in Nigeria." techcabal. Accessed February 22, 2019. https://techcabal.com/2018/05/31/data-protection-in-nigeria/.
Web Foundation. 2018. "Personal Data Protection in Nigeria." Accessed February 22, 2018. https://webfoundation.org/docs/2017/12/Personal-Data-Protection-in-Nigeria.pdf.

PHILIPPINES

Located in Southeast Asia, the Philippines is a country teeming with 107.7 million people with an internet penetration of 71 percent. The country's social media penetration reached 67 percent in 2019 (We Are Social 2019). As more and more of the Filipino population access the internet, the urgency for online privacy strengthens. While internet users recognize the importance of their personal data, they typically do not protect themselves online, thus putting their personal data at risk. To offset the risk, the Philippines' Data Privacy Act was introduced in 2012. This act addresses the Filipino population's personal data in relation to its growing online presence and activity. Not only did the Data Privacy Act set down rules and regulations for personal data, but it also created the National Privacy Commission (NPC) to oversee and enforce the privacy law (Jefcoat 2017).

As of 2019, the Philippines is the twenty-fourth most cyberattacked country in the world. Despite the initiative to protect the Filipinos' online privacy, Filipino online users need to be more proactive in protecting their personal information. There are exceptions in regards to the 2012 Data Privacy Act in which protections can lapse. While the internet has become a resourceful tool for the average Filipino, there is an insufficient awareness about the amount of personal data that is uploaded to the internet or shared on mobile apps; once it is uploaded, there are few, if any, means to control data usage by legitimate companies, nor from those who seek to exploit the data for more nefarious purposes.

In response to the Philippines' growing online presence, President Benigno "Noynoy" Aquino III (1960–) passed the Philippines Data Privacy Act of 2012. The purpose of this particular act is to protect the population's online privacy while ensuring the growth and innovation of the internet (Luces 2013). With more and more Filipinos spending time on the internet, their personal data had become at risk of being attacked or stolen. In 2017, the Social Weather Stations conducted a survey on data privacy and internet usage. Results showed that 85 percent of the Filipino participants agreed that data subjects' rights were important (Jefcoat 2017). However, this did not mean that individual Filipinos online took the necessary precautions to protect their personal data.

The Data Privacy Act serves as a series of protections to secure that data. By regulating the process of collecting personal information, the law ensures privacy

protection from public and private entities. These entities must notify any online user or subscriber of what personal information will be collected before consent is given. Without their consent, public and private entities cannot collect any personal information, nor can they sell and/or trade the collected data to another entity (Luces 2013). While businesses within the Philippines are policed by this comprehensive act, it also applies to international businesses with offices in the Philippines as well as any kind of equipment based in the Philippines used for processing personal information. The Philippines has a large population of citizens living outside the country as overseas workers. To ensure the protection of overseas workers while working abroad, the Privacy Act also encompasses the protection of Filipino citizens wherever they reside (Wall 2017).

Under the Philippine's Data Privacy Act, the National Privacy Commission officially formed until March 2016. The purpose of the NPC is to regulate privacy compliance by implementing, monitoring, and enforcing (when needed) the rules and regulations of the Data Privacy Act (Jefcoat 2017). With a comprehensive privacy law, the NPC ensures that the Philippines is set to international standards for data protection and brings the country more soundly into the digital age. The NPC strives to be the authority on data privacy, ensure accountability, and build a culture of privacy (National Privacy Commission 2019).

The NPC also serves as an enforcement agency that polices the country's businesses, as well as the multinational businesses in the country that collect personal information. If any entity violates the privacy law, the NPC enforces the penalties outlined in the Data Privacy Act. Entities can face imprisonment, ranging from three to six years, and/or a hefty fine, ranging from PHP$1,045,461 to PHP$5,227,425 or US$20,000 to US$100,000 (Wall 2017). However, even with legal protections, Filipinos online cannot be entirely reliant on the protection of the NPC. Experts urge Filipinos to be more aware of their data rights and to protect their personal data (Malig 2019).

Despite the comprehensive state of the Data Privacy Act and the NPC, there appears to be a gap in the legislation that allows for lapses in the protection of online privacy. While the Data Privacy Act includes stipulations requiring consent from data subjects to ensure data protection, consent is not required if the data subject, usually an individual, is subjected to contractual agreements outlined by the data controller. Consent is also not required when processing personal data is necessary for the legitimate interests of the data controller. These lapses restrict the data subjects' rights to determine how much or how little data they want to share (Wall 2017).

These lapses are also not the only challenges to privacy. As 67 percent of the population are active mobile users, they tend to download a variety of social media apps, such as Facebook, Instagram, and Twitter (We Are Social 2019). As part of the download process, users must give a variety of personal information before they are allowed access to the application in what is called *app permissions*. While the app discloses what information it wants access to, most users do not notice what the access list entails. Because users allow access to personal information

that may not be relevant to the purpose of the app and can neither accept nor reject some of the data streams collected, this allows the app unauthorized processing of personal data. For example, as part of its app permissions, the Philippine National Police (PNP) Know Your Rights application requested access to text messages, phone logs, media files, and photos. The PNP's app was later criticized for collecting unnecessary data when the purpose of the app was purely informational (Gavilan 2018).

Data privacy lawyers in the Philippines remind online users to be mindful and careful while perusing the internet, as the country's population spends an average of ten hours online daily (We Are Social 2019). While online, Filipinos are warned about oversharing personal information. As technology is routinely upgraded and improved for easier use and access, data is easier to obtain without consent (Gavilan 2018). One of the ways to protect an internet user's online privacy is to refrain from using an unsecured network. In 2017, President Rodrigo Duterte (1945–) signed the Republic Act No. 10929, in which free internet is made available to public locations, such as public hospitals, health centers, public education institutions, libraries, plazas, and any public transportation terminal (Ranada 2017). While this initiative was intended to make the country more connected and provide access to the internet, free Wi-Fi comes with a large amount of risks. Persons with the knowledge and ability to manipulate the connection can steal personal information and distribute malicious malware, as well as intercept and monitor all online activity while on the public network (Gavilan 2018).

Social media is another place where people do not think or worry about online privacy. Most of the Filipino population, at 71 percent penetration, spends about four hours every day on social media. The most popular social media platform in the Philippines is Facebook. On average, the monthly traffic is 423.3 million visitors, and they spend about fifteen minutes on Facebook per visit (We Are Social 2019). Data privacy lawyers suggest using social media platforms at a bare minimum, but considering how many Filipinos are present on Facebook, it is difficult to limit their online presence because they use it primarily for connectivity to family and friends, especially for the overseas foreign workers around the world.

The fact that Facebook is the favored social media platform creates other challenges for Filipinos' user privacy, particularly due to the numerous data breaches and unethical data sharing involving the company throughout 2018. Using the platform exemplifies why social media users need to utilize the privacy settings for added security. In September 2018, Facebook discovered a worldwide breach where data from at least 29 million users, initially reported at 50 million, were compromised (Snider 2019). Of the 29 million, a total of 755,973 Filipino users were affected. Facebook had exposed Filipino user information, such as full names, email addresses, phone numbers, and locations, for three days before it discovered the breach. Facebook then took an additional eleven days to fix the breach.

The exposure of personal data put these users, as well as others globally, at risk of cyberattacks, spam, phishing, and identity theft. Even though Facebook notified affected users through the app, with a breach of this magnitude, the NPC issued

a compliance order. The order required Facebook to put together a more comprehensive report and to notify and explain the breach's risks to affected Filipino users. In addition to this compliance order, the NPC instructed Facebook to either provide insurance for identity theft and phishing scams or install a help desk in the Philippines within a six-month time frame (Canival 2018).

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Further Reading

Canival, Roy Stephen. 2018. "755,973 FB Accounts in PH Hacked." Inquirer.net. Accessed May 30, 2020. https://technology.inquirer.net/80437/755973-fb-accounts-in-ph-hacked.

Gavilan, Jodesz. 2018. "Want Data Privacy? Here's How to Protect Your Personal Information Online." Rappler. Accessed May 30, 2020. https://amp.rappler.com/newsbreak/iq/198603-data-privacy-personalinformation-protection-tips.

Jefcoat, Katie Moss. 2017. "Philippines Data Privacy Act: Time's Up for Noncompliance." Blanco. Accessed April 4, 2019. https://www.blancco.com/blog-philippines-data-privacy-act-times-up-noncompliance/.

Luces, Kim. 2013. "How the Data Privacy Act Impacts PHL Businesses." GMA. Accessed April 5, 2019. https://www.gmanetwork.com/news/scitech/technology/330365/how-the-data-privacy-act-impactsphl-businesses/story/?related.

Malig, Kaela. 2019. "Experts Urge Increased Public Awareness of Data Privacy Rights." GMA. Accessed May 30, 2020. https://www.gmanetwork.com/news/news/nation/681981/experts-urge-increased-public-awareness-of-data-privacy-rights/story/?amp.

National Privacy Commission. 2019. "National Privacy Commission Mission and Vision." Accessed April 8, 2019. https://www.privacy.gov.ph/about-us/#visionmission.

Ranada, Pia. 2017. "Duterte Signs Law Providing Free Internet in Public Places." Rappler. Accessed May 30, 2020. https://www.rappler.com/nation/177540-duterte-free-wifi-internet-law.

Snider, Mike. 2019. "Your Data Was Probably Stolen in Cyberattack in 2018—And You Should Care." USA Today. Accessed May 30, 2020. https://www.usatoday.com/story/money/2018/12/28/data-breaches-2018-billions-hit-growing-number-cyberattacks/2413411002/.

Wall, Alex. 2017. "Summary: Philippines Data Privacy Act and Implementing Regulations." IAPP. Accessed April 4, 2019. https://iapp.org/news/a/summary-philippines-data-protection-act-and-implementing-regulations/.

We Are Social. 2019. "Digital 2019: The Philippines." Datareportal. Accessed May 30, 2020. https://datareportal.com/reports/digital-2019-philippines.

RUSSIA

Online privacy and censorship often go hand in hand, especially under authoritarian regimes. Russia has a long history of having little regard for the privacy of its citizens, so it is no surprise that they have very few privacy protections when it comes to their online dealings. Over the last several years, things have only gotten worse. The government has stripped away what few protections there were and has move toward a sovereign, highly surveilled internet for their citizens, much like China.

Within the European Union, privacy is treated as a fundamental human right. The European Union's privacy and protection laws are some of the most stringent in the world. But Russia and China see things differently; they see individual privacy as something that should not be kept from the state as an individual right but instead as a right both controlled and restricted by the government. In Russia, privacy and other laws are made at the federal level, and regions follow the federal laws, not issuing anything on their own. Although Russia has issued laws and mandates since the inception of the internet, it has focused more on mass surveillance, which has not been kept secret since the late 1990s. Citing several terror attacks foiled thanks to its monitoring efforts, the Russian state claims that such surveillance is necessary for the protection of national security.

By 1998, the Russian government had once again turned to Soviet-era technology to monitor communications, known as the System of Operative Search Measures (SORM). Over the years, this technology has been seriously upgraded, but the purpose is the same: to monitor Russian citizens' activities in the digital domain. The SORM model is to copy all internet communications and send one of those copies to the government, while sending the original to its destination. Russia's oppressive surveillance relies less on filtering information from its web and more on watching what is done with that information (Polyakova and Meserole 2019).

In 2006, privacy for Russian citizens on the internet was established based on initial privacy laws. Federal Law 149-FZ, "On Information, Information Technology and Protection of Information," established a right to be forgotten, a law in which inaccurate, outdated, or irrelevant information about a person should be removed from the internet. It also established procedures for failing to comply with the law, including the need to provide the Russian government with information it "required," including decryption keys (Gulyaeva and Sedykh 2015; Gulyaeva, Gorbushina, and Cohen 2019). Federal Law No. 152-FZ (Russian Federation Federal Law 2009) was legislated in 2006 and applied to the handling of personal data. Since that time, however, the laws have been slowly piling up to supersede those few protections.

The first major step in changing the data protection laws was Federal Law No 97-FZ of May 2014, which significantly amended 149-FZ. In July 2014, Russia introduced what are called *data localization laws*, which mandate that certain types of data collected in a certain country be stored and/or processed only in that country. Another law, Federal Law No. 242-FZ, was originally scheduled to be effective in 2016 but was moved up a year to come into effect on September 1, 2015 (Bowman 2015). Failure to comply with this law can result in the total ban of companies and websites. Some companies have quietly complied, but not all. In 2019, Russia fined Facebook and Twitter over the violations in the amount of 3,000 rubles, roughly US$47, for violating these laws. But be sure that the government has no problem banning sites outright, like it did to LinkedIn in late 2016 (Wei 2019).

Around the same time as the enactment of the 2014 laws, the government was pushing for more ways to assert control over privacy. In one attempt to make sure

that users could not hide, the government went so far as to offer prize money for anyone who could figure out a way to identify otherwise-anonymous users of Tor, a browser that protects the identity of its users to make them anonymous and difficult to link to an offline identity. To further complicate privacy rights, Russia has fought against the use of secure internet protocols like HTTPS.

In July 2017, Russian President Vladimir Putin (1952–) signed two federal laws that further eroded data privacy. The first of the new laws, Federal Law No. 276-FZ, banned owners of information and telecommunications networks and information resources from providing access to restricted sites. The interpretation of this law is a total ban on the use of internet proxy servers, like virtual private networks. The second act, Federal Law No. 241-FZ, prohibits the anonymous use of online messenger applications; citizens must use their cell phone numbers to login, and ISPs are required to restrict access if the user is suspected of violating Russian legislation (Global Legal Monitor 2017). The laws are enforced by the Federal Service for Supervision in the Field of Communications, Information Technology, and Mass Media, or Roskomnadzor. Between the Roskomnadzor and the Russian Federal Security Service (FSB), Russian internet privacy is virtually nonexistent.

Shortly after the aforementioned laws came into effect, in December 2017, Russia fined a popular instant messaging app, Telegram Messenger LLP, for failing to reveal its decryption keys. The FSB requested that the app maker give them codes that would compromise the privacy of its encrypted service, making user conversations easily available to the FSB. Critics worried that this point would be forced and that the FSB would come for other apps as well.

In one report from Agora, the Canadian Civil Liberties Association, over the ten years prior to 2017, the Russian courts had granted 98 percent of the requested wiretaps on telephone calls or other communications (Canadian Civil Liberties Association 2017). In 2019, Russia moved in on the dating app Tinder, ordering the company to share its user information with security services. Further, in 2019, Apple agreed to store the digital data of its users in Russia on a server in the country. This action has opened the door for the FSB to request decryption information from Apple, as it did with the Russian search engine company Yandex in June of 2019.

As a part of Russia's anti-terror legislation, Putin signed several laws, one of which required all mobile and internet companies to store all text messages, phone conversations, and chat logs for six months in data centers within Russia, and for up to three years in some cases. This part of the law came into effect in July 2018, presumably so that the FSB can require the providers share the information when requested. The law also did away with the requirement of a warrant from a judge when accessing this data.

To further assume control over internet data, Russia has taken a step even China has not: the parliament approved the Stable RuNet Law, which would allow the country to cordon off its internet and establish a "sovereign" internet. The censorship and privacy ramifications for this type of move are untold, as it has never been attempted before. There are major concerns over whether or not Putin can pull this

off and make it work, but Russia is swiftly moving toward the RuNet break from the worldwide internet.

Providers have to adopt new routing and filtering technology by November 2019 and allow authorities to monitor online communications at will. The big move, however, is that Putin intends to create a national domain name system by 2021. This would allow the country to keep internet traffic within its borders alone, cutting its populace off from the open internet and limiting communications with and from other parts of the world. More important for the state, any guise of user privacy would be eliminated, as it would have indirect access through numerous organizations to all communications over RuNet (Bremmer 2019).

When interviewing Russian citizens, opinion polls routinely show that Russians believe their privacy should be a right and the state should have no access to their data. But they have done little about their views, though not all of the public has complacently allowed the government to strip their privacy and rights away. As Putin cracks down on even more internet freedoms, a small group of lawyers and techies has risen up in defiance. They have dedicated themselves to mounting legal cases and unblocking websites with the final goal of not allowing Russia to firewall itself off from the broader internet as China has (Kantchev 2019). Whether they will have any success is as of yet unknown.

The Brookings Institution, a foreign policy think tank, refers to Russia's internet model as "digital authoritarianism," which they define as "the use of digital information technology by authoritarian regimes to surveil, repress and manipulate domestic and foreign populations" (Polyakova and Meserole 2019). This definition describes the country's situation perfectly. What is perhaps even scarier than the authoritarianism Russia imposes on its on its own citizenry is that it is exporting its model around the world. Countries throughout the former Soviet states, Latin America, and the Middle East have all used SORM-like systems. The country's model of imposing harsh legal and technical moves to tighten control is a low-cost way for other nations to establish their own control over their populace (Polyakova and Meserole 2019).

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Further Reading

Bowman, Courtney M. 2015. "A Primer on Russia's New Data Localization Law." Proskauer. Accessed June 26, 2019. https://privacylaw.proskauer.com/2015/08/articles/international/a-primer-on-russias-newdata-localization-law/.

Bremmer, Ian. 2019. "The Quick Read about . . . Russia's New Internet Law." *Time*. Accessed June 26, 2019. https://time.com/5578737/the-quick-read-about-russias-new-internet-law/.

Canadian Civil Liberties Association. 2017. "Crack-Down on Freedom of Expression in Russia Threatens Online Anonymity." Accessed June 26, 2019. https://ccla.org/crack-down-freedom-expression-russia-threatens-onlineanonymity/.

Global Legal Monitor. 2017. "Russia: New Legislation Restricts Anonymity of Internet Users." Library of Congress. Accessed June 26, 2019. https://www.loc.gov/law/foreign-news/article/russia-new-legislation-restricts-anonymity-ofinternet-users/.

Gulyaeva, Natalia, Alla Gorbushina, and Bret Cohen. 2019. "New Bill Imposing Increased Fines for Violations of Russian Data Protection Laws Under Consideration." Hogan Lovells. Accessed June 26, 2019. https://www.hldataprotection.com/2019/06/articles/international-eu-privacy/new-bill-imposing-increased-fines-for-violations-of-russian-data-protection-laws-under-consideration/.

Gulyaeva, Natalia, and Maria Sedykh. 2015. "Russia Introduces a Right to Be Forgotten." Hogan Lovells. Accessed June 26, 2019. https://www.hldataprotection.com/2015/08/articles/international-eu-privacy/russiaintroduces-a-right-to-be-forgotten/.

Kantchev, George. 2019. "Russian Web Activists Joust with Kremlin to Keep Internet Free." *Wall Street Journal*. Accessed September 2, 2019. https://www.wsj.com/articles/russian-web-activists-joust-with-kremlin-to-keep-internet-free11566471600.

Newton, Matthew, and Julia Summers. 2018. "Russian Data Localization Laws: Enriching 'Security' & the Economy." Henry M. Jackson School of International Studies. Accessed May 30, 2020. https://jsis.washington.edu/news/russian-data-localization-enriching-security-economy/.

Polyakova, Alina, and Chris Meserole. 2019. "Exporting Digital Authoritarianism: The Russian and Chinese Models." Brookings Institute. Accessed May 30, 2020. https://www.brookings.edu/wp-content/uploads/2019/08/FP_20190826_digital_authoritarianism_polyakova_meserole.pdf.

Russian Federation. 2009. "Federal Law of 27 July 2006 N 152-FZ ON PERSONAL DATA." Accessed June 26, 2019. https://pd.rkn.gov.ru/authority/p146/p164/.

Wei, Wang. 2019. "Russia Fines Facebook $47 Over Citizens' Data Privacy Dispute." *Hacker News*. Accessed June 26, 2019. https://thehackernews.com/2019/04/russia-data-localization.html.

SAUDI ARABIA

Saudi Arabia is the largest country in the Middle East and contains the fourth-largest total population, with one of the highest internet penetration rates in the region. Most of the population on the internet use multiple social media accounts and often carry more than one mobile phone. However, online privacy is extremely limited because the government monitors communications and has strict, enforced policies on content considered criminal. Despite the popularity of internet and social media use, the country monitors all internet communications and disallows many types of commentary; for these reasons, users often self-censor and utilize technologies that can help them evade detection and improve the chances of maintaining anonymity. While online privacy is limited, there have been government attempts to produce apps that enhance privacy; some are successful, and others are more controversial because they reinforce the patriarchal system and limit women's digital privacy.

Saudi Arabia's government is cautious when it comes to social communications. The Saudi government has invested profoundly in information and communications technologies since they became available internationally. It also prepared for them; before permitting public access to the internet in 1999, the Saudi regime spent two years constructing and updating the telecommunications infrastructure, aiming to circulate all communications through a regime-controlled database.

With the massive growth in wireless networks and emerging technologies, the government has maintained its strategy by permitting the expansion of new technologies while continuing to monitor and control social communications. This media monitoring is part of Saudi social and political culture, said to keep the country and people safe. The monitoring also suggests that most Saudis have little control of their data and limited rights to internet privacy.

Despite whether or not the population has online privacy, Saudi Arabia has rules related to privacy. For example, the *haq al-khososyah* allows an individual "the right to protect some aspects of his/her private life and maintain confidentiality to safeguard his/her reputation and aspects of his/her life that are kept away from the interference of people" (Abokhodair, Abbar, Vieweg, and Mejova 2017). Social communications are abundant in the country. In 2015, Saudi Arabia rated seventh globally in terms of the gross number of social media accounts per person, with the average individual having seven different social media accounts (Arab News 2015). It also showed that 26 percent of Saudi youths use Snapchat for at least an hour daily, ranking Saudi Arabia eighth globally for use of this platform; for WhatsApp, the country ranks fourteenth (Arab News 2015). The country's population is also active on Twitter (often via hashtag), Facebook, YouTube, and Instagram. The popularity of social media, coupled with the amount of time people spend online, implies that they produce substantial data, all which must process through the central filter. The government has access to all of this data and can monitor or use it at will.

Social communication continues to be the least oppressive space for communication despite Saudi Arabia's communications-monitoring infrastructure and restraints on voice over IP. In 2016, Saudi Arabia placed extreme restrictions over VoIP calls and voice communications apps such as Skype. In 2017, it announced that as part of its Customer First policy, the country would reinstate these technologies as long as they met their needs and expectations and did not harm public safety (Everington 2017). The restrictions were finally lifted in 2019.

To have a semblance of privacy and to access more content, a large number of people utilize devices such as virtual personal networks in order to be able to connect to prohibited content and services. Even using these technologies, most people self-censor; they are unwilling to be themselves due to severe legal punishments for communication on specific religious, political, or social issues. VPNs are popular for this reason, and their use is on the rise; as of 2018, one in five Saudis used a VPN, with 54 percent of the internet-using population reporting relying on VPNs to access content (Northwestern University in Qatar 2018). Social communication has profoundly transformed the way Saudi Arabia's young generations interaction with one another. However, they must be cautious not to create or share content online that treads near the country's cybercrime and anti-terrorism regulations, which have implanted some degree of fear into everyday social media consumers and activists alike.

Communicating about sensitive issues online can be potentially perilous for some internet users. The Council Ministers, Saudi Arabia's legislative body, issued

a number of laws in March 2007 that introduced regulations and policies for social media and other online communicators in Saudi Arabia. The policies established regulations on forbidden types of social communications, such as posting or sharing information that might encroach upon anything that violates the Saudi explanation of Islamic ideologies (directly or indirectly), blaspheming the purity of Islam and its Shari'ah laws, upending public decency, criticizing heads of the regime or heads of familiar diplomatic missions in the kingdom, critiquing official dealings with or policy toward other nations, spreading revolutionary philosophies or the disturbance of civic order, or supporting violence against individuals in any shape or form, among many other things.

While other nations share some of these policies about responsible online conduct, many are open to interpretation; when scrutinized, many comments can be designated to fall into one of these prohibited categories. When that occurs, the punishment is often extreme. For example, Fouad Al-Farhan (1975–), a Saudi Arabian blogger who had chosen not to use a pseudonym, spent more than a year in jail for posting on his blog about the advantages and disadvantages of being Muslim (Soares 2008). Saudi Arabia is often compared with China as having some of the most restrictive social communication access rules, although it has made some recent policies that seem to have relaxed some of these restrictions.

More recently, the government launched an app that it claims helps protects individual privacy. In 2017, the government launched Kolonna Amn, meaning *we are all security*, to monitor privacy violations. The app allows internet users to log an official complaint when they suspect that a violation of their privacy has occurred, allowing citizens themselves to become part of the state's security apparatus, should they choose to participate. When reported, violators could face heavy fines if convicted as part of the country's anticybercrime law.

While the media reported the app as a tool to stop the spread of malicious photographs online, the app also accepts reports of crimes or traffic accidents and dispatches the appropriate police or security forces in response. Thus, while the app could protect privacy, it also functions as a crime-watch app. In 2017, the government reported that citizens had used the app to make half a million reports in its first year (Saudi Gazette 2017). It is unclear how effective the app has been in protecting privacy, although it appears to have helped the country's police fight crime, ultimately improving public safety.

Another government app has been highly criticized for violating the individual privacy of a subset of the country's population. Absher, meaning *good tidings*, launched in 2015 as an e-service app to connect people with government services. It allows users to register vehicles, renew driver's licenses, make government appointments, and apply for visas, and in some cases, it can be used as an identification for crossing borders or showing when requested. However, this app has an extra, controversial feature: it allows men to set receive notifications on their wives' movements and set limitations on them. For example, if a man registers his wife's name and passport number, he can set in the app how many times she can

travel and for how long; for this reason, many people have dubbed the app the "wife tracking app."

While the app complies with Saudi Arabia's male guardianship law, which requires women to receive approval from their fathers or husbands for activities like travel, many tech advocates have asked major companies such as Google and Apple to remove the app from their app stores, stating that U.S. companies should not promote the discrimination—as well as loss of privacy rights—for women. Human Rights Watch has asked the Saudi government to remove the tracking feature from the app, which would still allow it to be used for e-governance, while allowing the companies selling or retailing these apps to remove themselves from promoting what it calls "gender apartheid" (Bostock 2019). However, the app remains available in their stores, and the tracking feature has not been removed.

Sanctioned under law, the app represents one way in which the Saudi government restricts women's online privacy rights. The Saudi regime has frequently reacted to external demands to change its deeply censored communications structure by proposing that civilians mostly self-regulate and self-censor, offering that the communications process follows quasi-democratic voluntary guidelines rather than represent government-imposed control. Still, this reply is too simple, as there is no rule in place to defend minorities from the broader spiritual community, controlled and frequently powered by conformist religious "scholars" or other pro-government interests.

Despite the debates and nuances surrounding social communication in the country, online communications have come to be instruments for promoting social transformation. Citizens are involved in broadcasting human rights violations and acting against them, illuminating issues that might otherwise stay under the radar. Furthermore, social communication is key for raising mindfulness among the other citizens. In some cases, technologies help individuals circumvent traditional social-communication restrictions, allowing them to assert their desire for increased privacy online and share information about human rights issues or other events that the censors often limit. In light of the so-called Arab Spring, wherein social media played an important role in information sharing, social communications have demonstrated themselves to be significant conduits for spreading announcements quickly for very little cost.

One of the central concerns regarding Saudi Arabia's position on communications is the need to modify existing rules to permit greater freedom of expression, equally offline and online. Like many other countries, the Saudi regime has difficulty balancing social communication safety concerns and human rights obligations. It has a wide backing from many domestic citizens and groups who press for added restrictions and monitoring for adherence to traditional Islamic values. On the other hand, the country's journalists and other citizens demand greater openness and information sharing to improve safety and ensure protections for human rights.

For Saudi Arabia to raise its stature as a front-runner for more open communications in the Middle East, it must endorse the free movement of social communication without intruding on the constitutional and human rights of individuals on the social network. To do so, the government would need to reconsider its communications restrictions and promote laws that increase online privacy. At the same time, it would need to find a balance that describes when content will be screened on national security or religious grounds. Additionally, the government could bolster its position by improving transparency, such as through distributing a list of all screened websites, including explanations for how these sites violated the law.

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Further Reading

Abokhodair, N., S. Abbar, S. Vieweg, and Y. Mejova. 2017. "Privacy and Social Media Use in the Arabian Gulf: Saudi Arabian & Qatari Traditional Values in the Digital World." *Journal of Web Science* 3. https://webscience-journal.net/webscience/article/download/38/32.

Arab News. 2015. "Saudi Social Media Users Ranked 7th in World." Accessed August 22, 2019. http://www.arabnews.com/saudiarabia/news/835236.

Bostock, Bill. 2019. "Apple and Google Accused of Helping 'Enforce Gender Apartheid' by Hosting Saudi Government App That Tracks Women and Stops Them Leaving the Country." Insider. Accessed May 30, 2020. https://www.insider.com/apple-google-criticised-for-saudi-government-app-activists-say-fuel-discrimination-2019-2.

Everington, John. 2017. "Saudi to Lift Block on Skype and Others Next Week." The National. Accessed September 20, 2019. https://www.thenational.ae/business/technology/saudi-to-lift-block-on-skype-and-others-next-week1.628337.

Northwestern University in Qatar. 2018. "Censorship & Digital Privacy." Accessed September 20, 2019. http://www.mideastmedia.org/survey/2018/chapter/censorship-and-digital-privacy/#s334.

Saudi Gazette. 2017. "Government and Tech: Kollona Amn App Registers Half Million Reports." Accessed September 21, 2019. http://www.saudigazette.com.sa/article/520895/TECHNOLOGY/Government-and-Tech-Kollona-Amnapp-registers-half-million-reports.

Soares, Claire. 2008. "Blogger Who Dared to Expose Saudi Corruption Is Arrested." *Independent*. Accessed May 15, 2019. www.independent.co.uk/news/world/middle-east/blogger-who-daredto-exposesaudi- corruption-isarrested-767807.html.

UNITED STATES

Online privacy is an increasingly complex issue in the United States, directly impacted by the growth of social media and the internet, online commerce, and political views surrounding privacy and regulation rights. In the United States, the key components of understanding privacy revolve around definitions and levels of privacy, risks to online privacy, the laws governing online privacy, and the public's views on the subject.

Online privacy involves having the right to maintain personal agency over what data is stored, provided to unknown third parties, repurposed, or displayed on the internet (Editorial Board 2017; Wheeler 2017). Online privacy is part of a larger conversation on data privacy and has been a concern since the inception of computer sharing (David and Fano 1965). In general, online privacy is broken down into two levels: personally identifying information (PII) and non-PII. PII encompasses any information that can be used to identify an individual person. For example, a birthdate and an address can identify an individual, even if their name is not known.

Non-PII information pertinent to the privacy conversation includes data such as websites users visit and their behavior on the site, as well as their online searches. Debate is ongoing about just how much information should be protected by being labeled "PII." For instance, GPS tracking data collected by various mobile applications show the daily routine and commute information of users and, in many cases, is unique enough to reveal an individual's home and workplace (Valentino-DeVries, Singer, Keller, and Krolik 2018). Currently, however, such data is not provided the same protections as PII under laws and regulations governing data privacy.

Traditionally, the concept of privacy has pertained to physical personal space (like vehicles and homes) and sometimes to personal decisions. Online privacy, however, has been slow to be recognized as a need by the public in the United States; in fact, it is often not a well-understood concept by citizens and lawmakers. However, online privacy is a public conversation that is increasingly surfacing, tied to heated debate and political views. In the late 1990s with the spread of the internet, it became clear that both the internet and companies that used it needed some regulation to protect an individual's privacy.

In 1993, Vice President Al Gore (1948–) created the Information Infrastructure Task Force (IITF). While the IITF did not touch privacy rights initially, in 1997, it developed privacy standards to coincide with the rise of internet commerce. At that time, the task force defined information privacy as "an individual's claim to control the terms under which personal information—information identifiable to the individual—is acquired, disclosed, and used" (Editorial Board 2017). Despite the definition, individuals did not gain much control over their data and, in many cases, did not understand what was being collected and for what purpose.

In 2011, the House of Representatives introduced a bill intended to "promote prosperity, creativity, entrepreneurship, and innovation by combatting the theft of U.S. property, and for other purposes" (H.R. 3261 2011). The bill quickly engulfed the country in controversy and was referred to as SOPA, the Stop Online Piracy Act. Although on its surface the bill seemed to offer to protect intellectual property holders and prevent online trafficking in counterfeit goods, enacting the bill would have required libraries and popular websites to delete or block links to any sites deemed to be in violation of the bill. Other provisions included requesting court orders to bar advertising networks and requiring internet service providers

to block access to websites. It would also have imposed a maximum penalty of five years in prison for those who streamed unauthorized content.

Although the bill's opponents didn't necessarily have an issue with protecting unauthorized streaming or piracy, they frowned upon the increased government policing of all internet users. Many opponents viewed the bill as the first step down a slippery slope of violating First Amendment rights. So great was the controversy over the bill that English Wikipedia carried out a twenty-four-hour blackout on January 18–19, 2012. Except for articles on SOPA, every Wikipedia page led to a black page that protested SOPA, asking page visitors to "imagine a world without free knowledge." Researchers estimated that more than 160 million people saw the banner (Engleman 2012). Congress could not come to a consensus on amendments that might make the bill acceptable enough to pass, so early in 2012, the bill died. While failing to impose laws on internet users that would infringe on their privacy, in a way, Congress ensured users' security from government scrutiny.

Part of the difficulty in obtaining any type of online privacy for users is not simply the risk of malicious actors stealing information; it also pertains more to the risks to internet privacy as a direct result of using the services the internet offers. In order to make money, companies that facilitate internet use gather a great deal of data about their customers and the users of their sites and, in some cases, the users of sites that carry their advertisements. Some companies observe the websites that users visit and then tailor advertisements to target those users based on their browsing histories.

Use of social networking sites further increases risks to user's online privacy: browsing logs, contents of a Facebook profile, or search queries can be immediately processed to infer more personal details about users, such as political and religious views, sexual orientation, intelligence, personality, and even substance abuse. While these may seem like an innocent gathering of data, those concerned with the lack of privacy cite concerns about what could be done with such a wealth of personal information if an organization or person became interested in causing, or doing, harm with it. For example, in 2007, Facebook launched a program called Beacon, where users' rental records were released for all their friends to see. So great was the backlash to this act, that the court case *Lane v. Facebook, Inc*, a class-action lawsuit filed against Facebook and its Beacon program in the U.S. District Court for the Northern District of California, ensued. When Facebook lost the suit in 2010 after several years of appeals, it had to cancel the program and put US$9.5 million aside for privacy and security issues. No users received any restitution for the data privacy breach.

In an absence of laws mandating online privacy regulations for the internet, users have to be the masters of their own online security. However, online security is increasingly complicated, requiring more and more education to enact. Inherent in this gap in education and protection is a general lack of comprehension that online security directly impacts real life. One such situation is the potential for identity theft. Although past trends showed that the public assumed the focus of

identity thefts was large corporations rather than individuals, recent reports show the trend shifting away from that belief. An internet security threat report released in 2007 indicated that approximately 93 percent of gateway attacks were targeted against unprepared home users. *Gateway attacks*, in this report, referred to attacks aimed at gaining access for future attacks rather than for immediate data theft (Krapf 2007).

Concerns abound that children growing up are becoming fluent in using online technology without being taught the skills to protect themselves adequately. To address this issue, in 1998, the Federal Trade Commission created the Children Online Privacy Protection Act. It limited the options for gathering information from children and created warning labels to be attached if potential harmful information or content was presented. In 2000, the government introduced the Children's Internet Protection Act to implement safe internet policies and filter software. These laws, along with parental and adult supervision strategies, can help to make the internet safer for children around the world (Valentino-DeVries, Singer, Keller, and Krolik 2018). Children, however, are not the only population about which online security proponents are concerned. But does the public want online privacy?

Public discussion regarding the issue of online privacy in the United States often comes back to a resounding question: is there actually any harm in collecting all that information about an individual or group? One response many people often offer in defense is, "I haven't done anything wrong, so what could I have to hide?" This sentiment is given further credence by the binary perception of either/or that surrounds the privacy debate: either you want law enforcement and government to be aided in their missions by having more ready access to data about everyone, or you have something to hide. This strict divide has hindered productive conversation on the subject throughout its history. Some researchers, however, believe that there may be personal harm in disclosure even if we have nothing to hide. For example, researcher Danah Boyd (2010) has written, "Often, privacy isn't about hiding; it's about creating space to open up." Jay Stanley (2012), a senior policy analyst for the American Civil Liberties Union (ACLU), notes that

> Privacy is about much broader values than just "hiding things." . . . [U]ltimately the fullest retort to the "nothing to hide" impulse is a richer philosophical defense of privacy that articulates its importance to human life—the human need for a refuge from the eye of the community, and from the self-monitoring that living with others entails; the need for space in which to play and to try out new ideas, identities, and behaviors, without lasting consequences; and the importance of maintaining the balance of power between individuals and the state.

In broadening the online privacy conversation to include more nuanced perspectives and definitions, scholars claim that we rise to the occasion and bring light to all the complex seriousness of online privacy issues in the United States. Irina Raicu (2017), director of the Internet Ethics program at the Markkula Center for Applied Ethics, claims that "In addressing issues such as the balance of power

between individuals and the state, weighing the benefits and harms that result from a particular privacy-related practice, or considering whether privacy is a right that must be respected, you are engaging in a process of ethical analysis." Because there have been no resolutions in the online privacy debate, the conversation will continue until a side wins, for privacy concerns, both online and offline, directly impact the present and the future of multiple generations.

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Further Research

Boyd, Danah. 2010. "Making Sense of Privacy and Publicity." SXSW Austin, Texas. Accessed April 20, 2019. http://www.danah.org/papers/talks/2010/SXSW2010.html.

David, E. E., and R. M. Fano. 1965. "Some Thoughts about the Social Implications of Accessible Computing." Proceedings of the 1965 Fall Joint Computer Conference. https://www.multicians.org/fjcc6.html.

Editorial Board. 2017. "Republicans Attack Internet Privacy." *New York Times*. Accessed March 29, 2019. https://www.nytimes.com/2017/03/29/opinion/republicans-attack-internet-privacy.html.

Engleman, Eric. 2012. "SOPA Bill Petition Collects 7 Million Signatures, According to Google." *Washington Post*. Accessed May 5, 2019. https://robinwestenra.blogspot.com/2012/01/sopa-bill-petition.html.

H.R. 3261. 2011. "Stop Online Piracy Act." House Judiciary Committee. Accessed August 13, 2019. https://www.congress.gov/bill/112th-congress/house-bill/3261.

Krapf, E. 2007. "A Perspective on Internet Security." *Business Communications Review* 37 (6): 10–12.

Raicu, Irina. 2017. "Loss of Online Privacy: What's the Harm?" Markkula Center for Applied Ethics, Santa Clara University. Accessed June 19, 2019. https://www.scu.edu/ethics/privacy/loss-of-onlineprivacy-whats-the-harm.

Stanley, Jay. 2012. "Plenty to Hide." ACLU. Accessed June 19, 2019. http://www.aclu.org/blog/technology-and-liberty-nationalsecurity/plenty-hide.

Wheeler, Tom. 2017. "How the Republicans Sold Your Privacy to Internet Providers." *New York Times*. Accessed March 29, 2019. https://www.nytimes.com/2017/03/29/opinion/how-the-republicans-soldyour-privacy-to-internet-providers.html.

Valcke, M., B. De Wever, H. Van Keer, and T. Schellens. 2011. "Long-Term Study of Safe Internet Use of Young Children." *Computers & Education* 57 (1): 1292–1305. https://doi.org/10.1016/j.compedu.2011.01.010.

Valentino-DeVries, Jennifer, Natasha Singer, Michael H. Keller, and Aaron Krolik. 2018. "Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret." *New York Times*. Accessed May 30, 2020. https://www.nytimes.com/interactive/2018/12/10/business/location-data-privacy-apps.html.

Chapter 6: Alternative Energy Technologies

OVERVIEW

Alternative energy refers to energy sources that do not rely on natural resources and do not harm the environment. The term can refer to any nontraditional energy form, source, or technology that people use to meet their energy consumption needs. Some of the more common examples of alternative energy are solar, wind, geothermal, hydroelectric, biomass, hydrogen, and tidal. Nuclear energy also falls into this category.

Of the alternative energy sources, solar energy is used across the world. Solar energy is easy to produce; when the sun's rays hit the planet's surface, it is stored in a container for later use. The most common containers are solar thermal technology and photoelectric cells. For solar thermal energy, the sun's rays heat water, which is then absorbed in dark glass tubes and piped into a storage tank. The heated water is used in household appliances, heating systems, and certain types of swimming pools. Photoelectric cells are made up of small cells made of silicon. When the sun hits them, it causes electrons to move in the same direction, creating an energy current that is stored in charge cells or inverters. When enough energy is stored, it can power a range of devices and reduce household energy costs.

Wind energy is another popular alternative energy because the wind is a free, naturally occurring resource. Windmills focused on producing energy appeared in the nineteenth century in the United States, Denmark, and Scotland. Since the 1990s, engineers have adapted the power produced by wind turbines to connect to major energy grids, making wind power more effective for a larger number of activities. Wind turbines located together, or wind farms, function best when they are constructed in areas that have high rates of continual wind flow across the land. Recent advances in technology have allowed turbine height to increase, which has increased the turbines' ability to produce electricity. The increased supply then translates into lower prices.

Today, countries around the world invest in wind power. They invested more than US$107 billion in wind energy technologies. At the end of 2017, twenty-nine countries possessed enough equipment to produce 1,000 megawatts of wind power, while nine have already installed enough for 10,000 megawatts (Global Wind Energy Council n.d.). Current goals focus on increasing power output, which will require more investment in developing taller turbines and larger blades. It also precludes creating stronger materials that can withstand the atmospheric

forces placed on the turbines and blades, because the pressures increase in correlation with the amount of surface area.

In addition to the more traditional forms of alternative energy, investors and researchers are experimenting with nontraditional options. The common forms of alternative energy include geothermal, or the heat emanating from the earth; hydroelectric, or the power of the water in moving rivers and other water sources; biomass, or energy produced from burning organic materials; tidal, the churning of the oceans and predictable tide tables; and nuclear, or techniques surrounding fission or fusion, energies. To identify additional energy sources with the potential to reduce harmful effects to people and the environment, experiments include working with human waste, coffee waste products, and plants or small organisms. This approach to alternative energy is similar to recycling, which seeks to reuse or repurpose resources to meet current and future energy demands. Identifying additional natural or abundant sources, such as the coffee grinds and containers worldwide, could also reduce the amount of materials buried in landfills and improve overall environmental health.

Alternative energies are often labeled *clean*, *sustainable*, or *renewable energy sources*, although none of these terms are completely synonymous. Renewable energy is considered infinite because it is always available. Examples include solar and wind energies that will exist as long as the Earth has a sun and an atmosphere. Alternative energy encompasses sources such as natural gas, fuel cells, or waste energy. These energy sources do not self-replenish. What renewable energy and alternative energy have in common is that both types emit lower levels of carbon than energy based on fossil fuels like oil or coal. Alternative energies can be clean when they do not add pollution to the atmosphere. Sustainable energy is also slightly different, as it refers to energy that can meet present-day demands without depleting the resources needed for future generations. Therefore, alternative energy can be synonymous with the other categories, but it can also refer to other sources that people consider healthier for the environment even if they are not unlimited.

In less developed nations, the need for new energy sources has led to increased interest in alternative energy. In fact, since 2015, developing nations have outspent developed nations in alternative energy development; in 2017, developing nations spent US$74 billion more in alternative energy investments than their counterparts (Loesche 2018). While people in the past viewed it as part of an alternative subculture, the move to harness alternative energies has now gone more mainstream, as more people understand how these energies can improve people's lives. Solar power has become increasingly popular in some parts of Africa where environmental conditions make it difficult to install power grids and lines. Interestingly, the rising number of cell phones has positively impacted the alternative energy market. Through electronic payments and various types of mobile money, people can easily pay power bills. When the community pays on time and easily, companies are able to keep costs low and provide their services to more people.

In addition to the ability to provide more people worldwide with power and electricity, another benefit of the expanding alternative energy sector is job creation.

Researchers estimate that by the end of 2017, more than 10 million people had jobs directly or indirectly as a result of the renewable energy sector. In breaking the jobs down by country, alternative energy technologies employed approximately 4 million people in China, 1 million in Brazil, 1.2 million in Europe, and less than a million in the United States, India, Japan, and Germany, when broken out separately from the European Union (REN21 2018). Employment as a result of the expanding energy job market should remain a long-term benefit while investment increases and there is opportunity for innovation in the sector.

Despite the appeal of alternative energy, there are a number of barriers to its development and distribution. The most prohibitive barrier to alternative energy is the capital, or start-up cost. Building the infrastructure to meet energy needs and demands requires significant up-front costs. In some parts of the world, loans may be easy to borrow based on credit score. In others, loans for start-ups are much riskier; credit or similar scores may not exist to offer money for investments. Costs for alternative energies and the required infrastructure are decreasing as the associated technologies improve. At the same time, the lower costs do not always spread to rural or remotes areas, especially when factoring in the price of installing lines to transmit the energy. Depending on the country, other barriers include competition from other well-established energy industries and well-funded lobby networks that are able to persuade policymakers to support them. The United States, for example, has wealthy oil and coal companies that can outcompete smaller energy industries. Oil and gas have powerful lobbyists who are heavily networked in the government. When they choose, they can exert tremendous influence to raise the barriers to entry to the energy marketplace.

Complicating the cost issue are misconceptions about alternative energy. Skepticism that the energy works has led many governments to not support its development in national policy or national development priorities. Without a strong commitment from the highest levels of government, viable large-scale alternative energy production may be unfeasible. Another misconception is that alternative energy costs are more expensive than fossil fuel-based sources. While the start-up costs to any new energy source are high, renewable energy can provide long-term savings in overall costs and prices. As the technologies continue to mature, prices are expected to decrease per unit of energy consumed. Another mindset is that clean coal, where *clean* refers to the idea that the technology captures potential pollutants during processing and burning, may provide better answers than newer energy sources. The reality is that using coal impacts human health and destroys geological features through the processes used to extract it from the ground. It is also a nonrenewable resource. When it is no longer available, coal will cease to exist in any substantive form underground. Other misconceptions exist; these examples reflect a portion of the myths surrounding alternative energy around the world.

An emerging threat to alternative energy technologies comes from cyberattacks. Alternative energies require additional infrastructure to connect to power grids. They can also require advanced command centers to control the energy

transfer and storage. Many command centers connect to a single computer or to a designated computer network. Once these networks connect to the internet, they become potential targets for cyber threats. To illustrate, in 2013, hackers targeted industries in Canada, the United States, and Europe in an operation later called Dragonfly and Energetic Bear. The hackers introduced two Trojan viruses to provide them backdoor access into the industries' computer operations. Cybersecurity firms determined that these programs gathered intelligence but could also be used to take control of the systems to hijack them (MSS Global Threat Response 2014). In 2015, a cyberattack targeting Ukrainian wind farm command centers successfully cut off power. Subsequently, the attackers damaged the computer system to delay recovery. Alternative energy technologies require sophisticated cybersecurity to protect against unwanted system intrusions. The economic impact of a sustained blackout has the potential to devastate an economy.

The three countries at the forefront of alternative energy technologies are China, India, and the United States. China is the largest investor in these technologies. Expected to account for 40 percent of the alternative, or renewable, energy technologies by 2022 (Smith 2018), China is the global market leader in hydroelectric and bioenergy. India and the United States rank in either the second or third place for alternative energy technology development; different sources place them at one rank or the other, making them fairly close in alternative energy production in 2018. Other countries lag behind, though many from the European Union and African continent continue to explore alternative energy options.

According to the United Nations, the international body that set the global goals for development milestones known as the Sustainable Development Goals in 2015, the world has fallen behind in meeting its 2030 targets. Renewable energy is one exception, though only in one area. The need to experiment with it has led to some progress in terms of electricity production and access. More people in lesser developed nations have electricity, in part due to these measures. At the same time, the sectors that need to address energy consumption the most, namely transportation and heating, have not kept the pace. These two sectors consume around 80 percent of the world's energy, yet they still lag behind in exploring opportunities to reduce fuel consumption or utilize a cleaner source through alternative energy (World Bank 2018).

This issue is serious, because reliance on fossil fuels releases carbon dioxide into the atmosphere. Once trapped, it raises temperatures, which can lead to other environmental problems. Researchers believe that at least 80 percent of all currently known fossil fuel deposits must remain in the ground to reduce the risk of climate change caused by people and industry (Ritchie 2017). These statistics suggest alternative energy sources are increasingly important to avoid significant global implications.

This section examines multiple countries with varied approaches to alternative energy technologies. Whereas some governments seek to innovate further in accepted technologies, such as solar or wind power, others focus on nontraditional

resources to resolve the global energy crisis. Each country is developing or updating existing policies related to energy production. Some are more advanced in their investments in alternative energy, while others are closer to the beginning of the process. Each has unique needs and challenges in their development efforts to harness alternative energy sources, invent improved ways of accessing existing resources, and explore even more new alternative energy sources.

Further Reading

Global Wind Energy Council. n.d. "Wind in Numbers." Accessed July 15, 2018. http://gwec.net/global-figures/wind-in-numbers/.

Loesche, Dyfed. 2018. "Developing Countries Invest More in Renewable Energy." Statista. Accessed July 13, 2018. https://www.statista.com/chart/13491/worldwide-new-investment-in-the-renewable-energy-sector/.

MSS Global Threat Response. 2014. "Emerging Threat: Dragonfly/Energetic Bear—APT Group." Symantec Connect Community. Accessed July 15, 2018. https://www.symantec.com/connect/blogs/emerging-threat-dragonflyenergetic-bear-apt-group.

REN21. 2018. "Renewables 2018 Global Status Report. Paris." Accessed July 13, 2018. http://www.ren21.net/wpcontent/uploads/2018/06/17-8652_GSR2018_FullReport_web_final_.pdf.

Ritchie, Hannah. 2017. "How Long before We Run Out of Fossil Fuels?" Our World in Data. Accessed July 13, 2018. https://ourworldindata.org/how-long-before-we-run-out-of-fossil-fuels.

Smith, Rob. 2018. "Three Countries Are Leading the Renewable Energy Revolution." World Economic Forum. Accessed July 13, 2018. https://www.weforum.org/agenda/2018/02/countries-behind-global-renewable-energygrowth/.

World Bank. 2018. "Progress on Global Energy Goals Slow, but Strong Gains in Countries Show Promise." Accessed July 13, 2018. https://www.worldbank.org/en/news/press-release/2018/05/02/sustainable-development-goal-sdg-7global-progress-report.

BOLIVIA

Since 2006, the Bolivian government has worked to alter its energy consumption from fossil fuels to alternative energies. By issuing policies and following its commitment with renewable energy initiatives, Bolivia has made progress achieving one of its primary energy goals, which is to make electricity produced through alternative sources universally accessible. The country has also devoted resources to enhancing its capacity for wind, solar, and hydroelectric power. In addition, it has been exploring how to integrate nuclear power as a renewable energy source. Although the country has made progress, and in some cases significant progress, toward its goals, not all of the projects it pursues are popular. Some may have long-term environmental and human consequences, all of which would be irreversibly damaging. While the country continues to explore these efforts as options, it also desires to enter the renewable energy market as a world leader in lithium production to manufacture lithium batteries for export.

Bolivia's desire to change its energy consumption to renewable energies is supported high in the government. President Evo Morales (1959–) has connected the

renewable energies effort to his commitment to fight climate change and global warming. Once he became president, Morales announced that energy would be a fundamental human right. Since that time, Bolivia has worked to accomplish this goal, tripling its renewable energy output. In 2019, Bolivia held a presidential election. Although the candidates had different visions for Bolivia, Carlos Mesa Gisbert (1953–), the opposing candidate to Morales, had a renewable energy plan, demonstrating high-level political support for alternative energies. Ultimately, Morales won the presidency, although he resigned shortly thereafter. His successor did not enact any environmental policies but will not run in the 2020 elections. Bolivia's next president may decline to pursue the country's shift toward alternative energy.

Bolivia has historically depended primarily on fossil fuels for energy. In 2015, only 14 percent of the country's energy came from alternative sources, mainly from hydro, solar, and wind power. One of the challenges is energy storage. Commonly used techniques include pumped-storage hydropower, where water and gravity capture some electricity during low-usage periods, store it above a turbine, and then release it when more power is needed. Another method is compressed-air energy storage, which compresses air into underground facilities, man-made or natural, and releases it as demand requires. Each of these methods has some degree of energy loss, which reduces the total capacity.

The government has spent years creating legislation and initiatives that support the dream of relying on alternative energies. Bolivia's 2009 constitution guaranteed that the state would devote resources to developing alternative energies. The government also established goals to meet the country's entire energy needs through alternative sources by 2025, particularly concentrating on replacing fossil fuels in electricity production by 2015. Subsequently, in 2011, it released its Policies for Renewable Energy in the Electric Sector and, later, the 2014 Decree 2048 to introduce regulatory and pricing mechanisms to govern new energy production. The progress that has been made on electricity production, particularly the conversion of electricity production from fossil fuels to alternative sources, has been remarkable. In 2005, Bolivia had the lowest electricity access rate in Latin America. It is now on track to meet most, if not all, its growing demand for electricity by 2025.

To make the switch to renewable energy, the government has reorganized to address the needs of different energies and fuels. In 2017, Bolivia split its Ministry of Hydrocarbons and Energy into the Ministry of Hydrocarbons and the Ministry of Energy. The new Ministry of Energy's focus is on electricity and alternative energies, with plans to initiate new alternative and renewable energy resource projects across the country.

In late 2018, the government made a number of announcements that realize its commitment to renewable energy and planned to devote US$1.5 billion to renewable energy projects. It announced plans to increase its wind energy production, aiming to quadruple its wind power. The project, supported by the Danish and Bolivian governments, includes the construction of three wind farms. It also opened its largest solar-powered electricity plant near Potosi. Run by the National Electricity Company, the plant can generate enough power to sustain 880,000 residents and is considering selling some energy to Argentina (teleSUR 2018). Potosi

was also selected as the site of a new geothermal plant, tapping a relatively new source of energy for the country.

Hydroelectric energy sources have also received attention. There are several efforts underway to construct dams for these plants. One project on the border with Brazil has stalled due to some unforeseen setbacks. Two of the dams are slated to be built in protected areas, such as a biosphere reserve, which has led to complications. Other projects require referendums. Bolivia's indigenous peoples are also often against hydroelectric plants because they inhabit the areas most suitable for those plants, meaning they would be forced off their lands in the event that many of those proposals received approval. Critics also add that most of these projects would cause irreversible environmental damage. Other researchers estimate that none of these efforts will produce sufficient power to make it saleable.

There is also rising interest in nuclear power as another alternative energy source. In late 2018, Bolivia agreed to a Country Program Framework with the International Atomic Energy Agency to explore how nuclear energy could help Bolivia achieve its development goals. In 2019, Bolivia signed several agreements with Russia to allow Russia to start a nuclear program in the country. The project includes building a reactor outside of La Paz, along with a Nuclear Research and Development Center. The agreement is a culmination of ongoing discussions and cooperation that started in 2015.

Many Bolivians are just as committed to renewable energy as the government. In 2017, the school Unidad Educativa Sagrado Corazon 4 in rural Bolivia won the Zayed Future Energy Prize, sponsored by the United Arab Emirates, for its proposal to use renewable energy to make the school entirely self-sustainable. With the prize money, school administrators constructed a solar energy grid and rainwater capture system. Although there were some setbacks, the school's system eventually worked and inspired students and teachers to seek other ways to make their communities greener (Field 2018). Many residents believe this program has, and will continue to, inspired students to improve society.

International programs offer the people different types of energy alternatives. Etta Projects works with rural women in Bolivia. In 2019, the group won a grant to teach village women how to use bicycle-powered appliances, allowing them to convert energy from riding a bike into electrical energy to run small electrical appliances. Other international efforts teach villagers to construct and use solar cooking ovens, which introduce clean energy, rather than traditional wood-burning stoves, which can introduce health hazards.

Bolivia may also support renewable energy in a different way. As the owner of some of the world's largest lithium supplies (estimated as the second-largest supply in the world), Bolivia could play a future role in the manufacture of lithium batteries, used in all kinds of technological devices, such as electric car batteries. As of 2018, Bolivia operates a pilot plant in Uyani, where it produces 250 tons of lithium carbonate. If the government can meet its projected goals, it will increase production over the next five years to the point that it would support about 20 percent of the world's lithium consumption (Millan Lombrana 2018).

Miners work the salt flats in Salar de Uyuni, Bolivia. Salar de Uyuni contains the world's largest lithium deposit, though due to austere conditions and recent developments in technology, it is only now being explored for mining purposes. Lithium is one of the components used in batteries to power modern-day technologies, such as smartphones, and Salar de Uyuni may be a lucrative source of the mineral for continued global high-powered, long-lasting battery consumption. (P7edch/Dreamstime.com)

The biggest challenge is how to mine it. The mines are extremely remote, and the processes to extract lithium require specialized equipment. Experts predict that it will be years before Bolivia can mine enough lithium to be competitive globally. The potential difficulties have not stopped the planning, however. The government currently has fourteen plants scheduled to start production by 2024, with a total of forty-one planned by the year 2030; many of these involve international partnerships with other governments and corporations (BNamericas 2019). The results of these efforts are entirely dependent on whether the lithium can be mined large scale, which includes transporting the required mining technologies and personnel to the remote areas.

Bolivia's progress in achieving its renewable energy goals has been commendable. The country seems poised to meet its objective to supply the entire country with electricity produced by renewable sources by 2025. While it continues to establish renewable energy projects, there are potential drawbacks, some of which could permanently alter the country's landscape. Some, such as the nuclear program and the lithium mining, are more nascent and experimental; it is not yet clear how they will develop. In addition to the government's efforts, many people and nongovernmental organizations work to provide more accessible, affordable, immediate alternative energy sources. Bolivia is unusual in that it is one of the only countries to declare access to energy a fundamental human right. However, while

it may achieve universal accessibility, it also needs to consider the impact of its renewable energy projects and how they affect the country, and its people.

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Further Reading

BNamericas. 2019. "Bolivia Plans 14 Lithium Industry Plants by 2024." Accessed August 25, 2019. https://www.bnamericas.com/en/news/bolivia-plans-14-lithium-industry-plants-by-2024

Field, Kyle. 2018. "A Small School in Bolivia Is a Model for Sustainable Living Using Solar & Rainwater Capture." CleanTechnica. Accessed May 30, 2020. https://cleantechnica.com/2018/04/29/a-small-school-in-bolivia-is-a-model-for-sustainable-living-using-solar-rainwater-capture/.

Millan Lombrana, Laura. 2018. "Bolivia's Almost Impossible Lithium Dream." Bloomberg. Accessed August 25, 2019. https://www.bloomberg.com/news/features/2018-12-03/bolivia-s-almost-impossible-lithium-dream.

teleSUR. 2018. "Bolivia Opens Country's Biggest Solar Panel Station." Accessed August 25, 2019. https://www.telesurenglish.net/news/Bolivia-Opens-Countrys-Biggest-Solar-Panel-Station-201809090008.html.

ICELAND

Iceland has used alternative energy sources, such as hydro and geothermal energy, to transform itself from fossil-fuel dependence and low economic standing in the early twentieth century to a high standard of living and, with some exceptions from market swings, economic development. In fact, almost 89 percent of Iceland's energy supply and 100 percent of Iceland's energy come from exploiting the island's abundant natural, renewable resources, which is significant because Iceland uses more electricity per person than any other nation (OECD 2019). The island is also privileged with the ability to experiment with new forms of alternative energy to determine what will best address its future energy needs. Despite the country's success with alternative energy, some researchers have exposed a downside to the push for renewable energy sources; it has, at times, resulted in damage to the environment and the population's health.

Iceland uses hydroelectric and geothermal power as its primary alternative energy sources. Although the country relied on fossil fuels until the 1970s global oil crisis, the first hydroelectric plant started operations in 1904. As of 2019, Iceland produced 100 percent of its electrical energy through renewable sources, with hydroelectric power contributing around 71 percent, geothermal 29 percent, and other renewable sources the remaining 0.1 percent (Iceland Magazine 2019).

These energies meet Iceland's current needs. However, there is interest in moving Iceland toward clean energy. While renewable, geothermal energy is not an entirely clean energy because of the gases and chemicals that it vents into the environment. These gases and chemicals are linked to climate change, which poses a special danger for an island nation mostly covered with ice and glaciers. As the

The construction of the Kárahnjúkar hydropower project, part of the 71 percent of hydropower network used across the island to produce renewable electricity. Iceland adeptly relies on its natural resources and terrain to produce alternative energies. While these help to reduce reliance on fossil fuels, they are not entirely risk free; studies and reports from Kárahnjúkar show that there is a trade-off for clean energy, as the hydropower project irreparably damaged local ecosystems. (Larysa Uhryn/Dreamstime.com)

country expects its energy needs to grow in the future, not only for its population but also for industry and its large tourism sector, additional energy sources may prove more sustainable long term.

In other countries, wind and solar are often reliable sources for renewable energy. In Iceland, wind energy is only now receiving more attention as the country seeks to expand its alternative energy usage. Wind energy has the potential to augment the country's alternative energy supply and is attractive because it is a greener source of energy than some currently being generated. Icewind, a collaborative project between multiple universities including the University of Iceland, has developed a wind atlas for Iceland to predict wind energy potential and the success of wind farms at different locations (Nawri et al. 2014). After conducting numerous studies, Icewind has recommended more extensive construction of wind power projects, as the return on investment for wind power makes it an attractive addition to Iceland's renewable energy portfolio.

Iceland is also examining the viability of ocean-based power. Tidal, wave, and osmotic power may prove important future sources of renewable energy. Iceland's Innovation Center has studied the feasibility of these types of projects and has designed several small prototype projects to explore the feasibility of ocean-borne energy sources. Tidal energy harnesses the power of the changing tides by either

Wind turbines are complex pieces of machinery. Each turbine has more than 8,000 parts to allow it to collect and convert wind energy into electricity (Global Wind Energy Council n.d.). The electrical system alone requires a power control, generator, special electronics, and connectors. These parts can be customized to the wind turbine's environment; a turbine located in the ocean can require additional components to anchor it to the seafloor, where it may require a horizontal orientation as opposed to the vertical axis found in land-based turbines. Many countries pioneering in sea-based wind energy technologies include the United Kingdom, Norway, China, Japan, Germany, and the United States. European nations, in particular, anticipate benefiting from future power produced by oceanic winds.

using the rise and fall of the tides to produce energy through specialized technologies or treating them similarly to wind farms, where the tides push turbines to create power. Wave energy relies on the power built up by waves traveling over distances, which only lose small amount of power during transit. Osmotic power would require placing underwater turbines in areas where river water mixes with seawater. When the fresh water flows through the membrane, or semipermeable barrier that separates it from the seawater, it produces energy to turn a turbine. All of these energy types require further research before determining how well they will perform for Iceland. Other parts of the world have achieved some success with ocean-based power production.

The government wants to make the entire country carbon neutral by 2040, which means that Iceland will not have a net release of carbon dioxide into the atmosphere, either by not producing carbon dioxide as a byproduct or by using offsets like planting trees to cancel out emissions. Its major incentive is to reduce the effects of climate change, insofar as it can do so unilaterally, because global warming is already threatening to melt the country's glaciers. Iceland has already taken steps to realize this goal. The country imposes a carbon tax, which adds costs to oils, such as diesel, motor, and heavy fuel oils, in addition to other taxes that stack to increase fuel prices. The tax rose by 50 percent in 2018. After 2019, this tax increases 10 percent annually to disincentivize fossil fuel usage, at least through 2020, and most likely through 2023.

Due to Iceland's terrain, it is experimenting with several forms of clean energy that are specific to the island's composition. For example, the Iceland Deep Drilling Project (IDDP), founded in the early 2000s, has been using a special rig known as Thor, after the Nordic god, to dig more than three miles into the Earth's crust, into a volcano. Engineers have designed a way to use the pressure and steam coming off the volcanic magma to create steam that will power a turbine and produce electricity. This effort is called IDDP-2, as it is the second major attempt to tap a volcano to produce energy.

IDDP-2 has faced some setbacks, such as the equipment being unable to withstand the pressure and temperatures at great depth. However, after a workshop

in 2018 that brought representatives from industry, academia, and government together, the group decided to push forward, as a successful outcome could not only be a breakthrough for Iceland's energy production but could also reshape the geothermal energy industry (IDDP 2018). Volcanically produced electricity would not technically be entirely clean energy, though it would be renewable; as a type of geothermal energy, drilling and the subsequent carbon dioxide emissions affect the environment. Estimations place these effects significantly lower than those of oil or gas, but they can nonetheless cause harm, as the carbon dioxide is vented into the atmosphere.

One Icelandic company, Carbon Recycling International, has invented a technology that could scrub some of the carbon dioxide emissions from geothermal energy and convert it into usable—and salable—methanol fuel. The process also reduces the carbon dioxide in the atmosphere, which could contribute to slowing the effects of gas buildup linked to rising temperatures. The company and its technologies have been successful. It received the 2019 Icelandic Growth Consortium Award for being the fastest-growing innovation company in Iceland over the year. It has also signed some international agreements for expansion, such as a deal with China, where it will incorporate its technologies into a new methanol-producing plant (CRI 2019). There are other corporate initiatives underway that may produce similar innovations. For example, another effort wants to use hydrogen fuel cells to power electric cars. Although this technology is still new, it promises to deliver electric cars that produce no pollutants, which would surpass the electric car models available today.

Despite the apparent success of renewable energies, Iceland had to make compromises in some cases that ultimately damaged the environment in order to develop some alternative energy projects. Henner Busch (c. 1983–), a professor in Sweden, examined two major projects that created additional problems. First, Busch (2018) looked at the Kárahnjúkar hydropower project and found that the project permanently damaged ecosystems surrounding the Hafrahvammagljúfur canyon, which had serious effects on the fish and deer populations. He also noted that the immense subsidies the government offered meant that it has not received any tax revenue or other profits from the international firm running the project. Thus, apart from the energy production, the project has provided little benefit. Busch also looked at a second case, the Hellisheiði geothermal project. Contaminants traced to this project have been definitively linked to environmental and health problems.

Additional research on these cases has indicated that industrial energy production and consumption, along with the government's desire to attract industry, have complicated the questions surrounding alternative energies and sometimes created additional social and political detriment (Guðmundsdóttir, Carton, Busch, and Ramasar 2018). Through case studies and alternative energy experiments, Iceland will be able to apply the lessons learned and make responsible choices about its future energy program.

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Further Reading

Busch, Henner. 2018. "The Hidden Price of Iceland's Green Energy." Phys.org. Accessed August 28, 2019. https://phys.org/news/2018-11-hidden-price-iceland-green-energy.html.

Carbon Recycling International (CRI). 2019. "Home Page." Accessed August 28, 2019. https://www.carbonrecycling.is/.

Guðmundsdóttir, H., W. Carton, H. Busch, and V. Ramasar. 2018. "Modernist Dreams and Green Sagas: The Neoliberal Politics of Iceland's Renewable Energy Economy." *Environment and Planning E: Nature and Space* 1 (4): 579–601.

Iceland Magazine. 2019. "Does Iceland Really Produce All of Its Electricity from Renewables?" Accessed August 28, 2019. https://icelandmag.is/article/does-iceland-really-produce-all-its-electricity-renewables.

IDDP. 2018. "IDDP-2 Way Forward Workshop: SAGA Report No. 11." Accessed May 30, 2020. http://iddp.is/wp-content/uploads/2018/04/Way-Forward-Workshop-20-21-March-2018-SAGA-REPORT-No-11.pdf.

Nawri, N., G. N. Petersen, H. Björnsson, A. N. Hahmann, K. Jónasson, C. B. Hasager, and N.-E. Clausen. 2014. "The Wind Energy Potential of Iceland." *Renewable Energy* 69: 290–299.

Organisation for Economic Co-operation and Development (OECD). 2019. "Fossil Fuel Support Country Note: Iceland." Accessed May 30, 2020. http://stats.oecd.org/wbos/fileview2.aspx?IDFile=95c30c34-7d82-4a3d-b5db-bdef2c504a1a%2.

INDIA

India boasts the second-largest population in the world, which translates into large demands for energy. These demands continue to increase; the country faces rising poverty levels as the population grows and urbanization intensifies. Urbanization draws people to cities for economic opportunity, which then increases the energy demands for those cities to support massive, continually increasing populations; in turn, urbanization can feed the growing urban-rural divide, causing less developed areas to receive fewer resources. In addition, India is experiencing the negative effects of climate change, with the effects expected to worsen as temperatures rise by at least four degrees.

To maintain an efficient and operational economy through the changes wrought by climate, renewable energies will be crucial for sustainable development and divestment from the fuels that have contributed to the increased temperatures. Historically, India has relied on fossil fuels, although in 2018 the country's investments in renewable energy surpassed traditional fuels. These investments represent India's aspiration to lead the world in renewable energy. The country has already starting making major progress toward this goal, through products in standard types of alternative energy, such as solar and wind, as well as through research to develop new, or better, forms of clean energy. It currently ranks fourth for regional renewable-energy production behind China, the United States, and Europe, although it also ranks third for carbon emissions, and these levels continue to rise with population growth and urbanization.

India took an early interest in the potential of alternative energies. It inscribed protecting the environment into its constitution and issued policies to develop renewable energies in the 1970s. By the late 1980s, it had a Renewable Energy Department and later formed a government ministry to focus on alternative energy, which came to be the Ministry of New and Renewable Energy in the early 2000s. In 2003, it passed the Electricity Act, which made multiple mentions of using renewable sources for electricity production and sale (Ministry of Law and Justice 2003). The Act also called for the creation of a national policy, released in 2005 as the National Energy Policy. The policy emphasized the importance of renewable energy sources for environmental preservation and reduction of effects related to climate changes. The National Energy Policy culminated in decades of interest in renewable energy sources and growing knowledge that traditional fossil fuels would not promote a sustainable environment, economic growth, or future.

Climate change and the danger it poses encouraged further interest in alternative energy sources. In 2008, the National Action Plan on Climate Change launched eight national missions, most of which revolved around sustainable resources. For example, the National Solar Mission focused on increasing utilization of solar power while acknowledging the need to explore nuclear, biomass, and wind energy options (Government of India 2008). Further, to encourage alternative energy development, India ordered taxes on coal and carbon, which increase costs of fossil fuel-powered energies and make alternative, cleaner sources financially competitive. It also cut state subsidies to traditional fuel sources.

As part of the process of promoting renewable energies, India pulled all major stakeholders together to discuss the country's future with renewable energies. In 2015, they produced a Renewable Energy Roadmap to help India fully develop to its potential. The report made four major recommendations: a comprehensive policy framework, support mechanisms, grid integration, and off-grid access considerations to reach more remote populations. Each of these recommendations included specific programming required for the successful implementation of the framework, ranging from developing critical metrics and targets to updating grid technologies and assuring financial support (NITI Aayog 2015). The government has made progress toward many of these recommendations and related programming. However, progress has not occurred overnight; more work is needed to realize all these recommendations, with additional reforms and support required to continue to modernize the energy sector with an eye toward alternative energy.

The momentum of investments into India's renewable energy sector is growing. Between 2015 and 2018, investments into the energy sector increased on average 7 percent annually, with 2018 showing a 12 percent expansion (Dash 2019). Through 2024, there is an anticipated increase of eighty gigawatts in capacity through investments into large- and small-scale solar projects and wind farms, which will help the country close the gap to reaching its goal of 175 gigawatts new renewable energy production by 2022, for a total of 225 gigawatts in capacity that same year (Economic Times 2019). As there has been a recent decline in investment, most experts state that this goal in not achievable on this timeline, although the government continues to work toward fulfillment.

As of 2019, total renewable energy capacity is calculated around seventy-eight gigawatts. Some experts predict that northern India may have the potential to produce over 300 gigawatts of renewable energy if it reaches its full production capacity. Current investments have yielded the Shakti Sthala, the world's largest solar park, and several multi-billion dollar partnerships with private companies. Investment may lead to an additional economic boost, as new energy infrastructure translates into job creation for individuals who possess the needed skills or can acquire appropriate training. Increased employment is a potential benefit from investments into the sector.

India is also advancing research into new kinds of renewable energy. In a remarkable breakthrough, Pune's National Chemical Laboratory developed an improved way to convert industrial biomass into biofuel. Through the use of an enzyme, the team can hasten the conversion process, reduce production costs, and deliver these savings to consumers. Some companies located in India are also working with wastewater. When microorganisms break down the contents of the water, they produce methane gas, which then can be converted into heat and electricity. The result is that researchers are finding new ways to convert waste into more efficient fuels. These alternative sources, along with others under investigation, could provide a boost, albeit a small one initially, to the country's renewable energy efforts.

Despite India's progress with renewable energy capacity and production, the country faces some barriers to achieving its energy goals with alternative sources. Tongia and Gross (2018) describe barriers that the energy sector must address regarding renewable energy: it is not yet competitive with existing coal-generated power, and it does not yet have a sufficient power infrastructure to integrate it into local energy grids. Thus, while the government pushes for renewable energy development, it must also consider policies that allow local governments to prepare for these energies and devise effective ways to lower reliance on coal and other fossil fuels. Without incentives, the support behind alternative energy is not enough to supplant the current power system.

Consideration is also needed with regard to cost reduction; despite increased availability, until costs come down, local people and governments will prefer the cheapest option, even when it is less environmentally friendly. These challenges

Algae is a small plant, often a single-cell organism, that can grow very quickly in salt or freshwater. When it is processed correctly, it produces more energy than most other plant sources grown on comparable acreage. Algae can also combine with diesel to create biodiesel energy, a process being explored in countries like India. The question is whether algal energy can be produced at scale. Many researchers believe that it can, which should help reduce reliance on fossil fuels. The U.S. Department of Energy and large oil companies, such as Exxon Mobil, are investing to develop cost-effective algal fuel. They are experimenting with natural and genetically altered forms of algae to determine which has the most potential as a renewable energy source (Barth 2017).

make India's renewable energy targets for 2022 more daunting. Some economists report that that India's growth momentum is slowing, which will also create obstacles to the 2022 targets. These barriers, while significant, are not the only ones that challenge India's clean energy movement.

India's size and geography are a major advantage as the country works toward higher rates of renewable energy consumption. It identified the need for renewable energy decades before many other regions to meet its populations' demands and to stave off the effects of climate change. While India has made progress and has high ambitions for achieving renewable energy targets in the coming years, progress has not been easy. Through significant investments, solar and wind energies have increased in capacity. However, despite the promise and progress toward a sustainable alternative energy solution, there are local and national challenges to widespread adoption of renewable energies. In spite of these obstacles, the government continues to pursue its goal to become the world's leader in renewable energy. If it meets these goals, the country has amazing potential to increase its targeted production capacity between three and ten times with continued investment.

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Further Reading

Dash, Jayajit. 2019. "India Leads World in Growth of Energy Sector Investments between 2015–18." *Business Standard*. Accessed August 27, 2019. https://www.business-standard.com/article/economy-policy/india-leads-world-ingrowth-of-energy-sector-investments-between-2015-18-119081700853_1.html.

Economic Times. 2019. "India Likely to Add 80 GW of Renewable Energy Capacity in Next 5 Yrs: Survey." Accessed August 27, 2019. https://economictimes.indiatimes.com/industry/energy/power/india-likely-to-add-80-gw-of-renewableenergy-capacity-in-next-5-yrs-survey/articleshow/69307811.cms?from=mdr.

Government of India. 2008. "National Action Plan on Climate Change." Accessed August 26, 2019. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1320.pdf.

Ministry of Law and Justice. 2003. "The Electricity Act, 2003 [No. 36 of 2003]." Accessed August 26, 2019. http://www.cercind.gov.in/Act-with-amendment.pdf.

NITI Aayog. 2015. "Report on India's Renewable Electricity Roadmap 2030: Towards Accelerated Renewable Electricity Deployment." Accessed May 30, 2020. https://www.niti.gov.in/niti/writereaddata/files/document_publication/RE_Roadmap_ExecutiveSummary.pdf.

Tongia, Rahul, and Samantha Gross. 2018. "Working to Turn Ambition into Reality: The Politics and Economics of India's Turn to Renewable Power." Brookings. Accessed May 30, 2020. https://www.brookings.edu/research/working-to-turn-ambition-into-reality/.

MEXICO

Mexico's ability to capitalize on its renewable energy capacity will only grow over time, aided largely by its size and geographic location. In 2015, Mexico was one of the top ten destinations in the world to make new investments in clean energy

(Graham and Viscidi 2018). In that same year, Mexico generated 28.3 percent of its electricity through clean energy, an increase of nearly 7 percent over the previous year (Energy Secretary of Mexico 2016). By 2021, Mexico may rank fifth in the world for production of energy from photovoltaic sources, behind China, India, the United States and Japan (Arias 2018).

To optimize its capacity for clean energy, Mexico must first surmount some of the obstacles to renewable energy production. Mexico's electricity infrastructure is decrepit. Transmission lines are old, and more electricity is lost during transportation and distribution than in high-income countries. Along with technical challenges, developers often face resistance from local communities. Since a large portion of Mexican territory is collective property, developers need to consult with tens, or even hundreds, of people before starting a project. This process is often carried out inadequately and with insufficient supervision, which generates long and costly legal battles (Graham and Viscidi 2018). Infrastructure and sociocultural challenges will continue to impede progress for the foreseeable future.

In general, the country supports clean energy. Political support, both internal and external, contributes to Mexico's success in renewable energy generation. By 2030, Mexico is expected to generate nineteen gigawatts of solar energy nationwide. NAFTA, the bilateral trade agreement between Mexico and the United States, should contribute to this growth by allowing the importation of solar power at a lower cost (Arias 2018). Domestically, the political movement toward renewable energy strengthened after the July 2018 elections.

At the time of President Andrés Manuel López Obrador's (1953–) election, renewable energy represented less than one-quarter of the energy production in Mexico. In an effort to reduce natural gas imports from the United States, President López Obrador announced plans to increase energy production from renewable sources both large and small, including the installation of new hydroelectric dams as well as solar roof panels on homes and businesses. The government approved tax incentives and easier access to bank credit to aid in building renewable energy plants (Graham and Viscidi 2018). These programs were successful; by late 2018, Mexico had thirty large-scale solar power plants after an investment of US$5.2 billion. 80,000 private homes had solar panels installed on rooftops for self-sufficient energy needs, and the number was expected to grow to 100,000 by the end of the year (Arias 2018). Exact statistics on homes adding solar panels are not available, but the market saw a 62 percent growth between 2018 and 2019.

Mexico's adoption of renewable energy sources is possible because of its large size and geographic location near the equator and its varied terrain. The country hosts and invests in wind, solar, biomass, geothermal, and hydroelectric power. According to data from the Mexican Wind Energy Association, there are 1,935 wind turbines distributed in forty-two wind farms, located in the Baja California region, and the states of Nuevo Leon, Tamaulipas, Jalisco, Oaxaca, and Chiapas, the strategic areas where there are strong wind currents. Strong winds, such as La Ventosa in Oaxaca and the winds of Santa Ana in Baja California, provide ideal

conditions for wind farms. In fact, the Santa Ana blows along the entire coast of California and reaches over one hundred kilometers per hour (Capilla Vilchis 2017).

Solar energy production is an important and growing segment of Mexico's renewable energy sector. The states of Durango, Baja California Sur, Chihuahua, Sonora, Nuevo Leon, Yucatan, and Coahuila have the best conditions to exploit solar energy (Lara 2018). As of 2016, solar energy comprised only 1 percent of Mexico's total energy production. Through private auctions, this number is expected to have risen to 13 percent by 2019 (Forbes Mexico 2017). Because of the growth in solar energy, some forecasters predict Mexico will become the solar energy leader in Latin America within the next five years.

Biomass energy is another prominent renewable energy source, with thirty-two Mexican states having the potential to provide biomass energy generation. Biomass-produced energy can be derived from crops grown for producing fuel, such as sugarcane, palm oil, and other forestry-related products. Residual biomass can be sourced from forestry or agricultural waste, livestock, and urban/industrial waste (Energy Secretary of Mexico 2018a). One biomass project is the Bordo Poniente Plant (Stage IV), which will use 70 million tons of garbage per year to generate 508 gigawatts of power for 1,700 public buildings in Mexico City.

The country also has a small industry for converting cactus waste to biogas (Mellino 2016). As of 2017, Mexico had nineteen energy plants that produced electricity from biogas in eleven different states (Aldaz 2017). Nestlé, a Swiss company known for its chocolates, has instituted a local biomass project. The company's largest Nescafé factory in the world is located in Toluca, State of Mexico. Its manufacturing process generates organic waste, called *coffee bagasse*. At the site, a boiler fed by the bagasse, rather than natural gas, generates heat for steam in the production process (Nestlé México n.d.). Nestlé offers one example of how industry can contribute to promoting biomass energies.

Geothermal energy generation provides another source of renewable energy. In fact, it has such huge potential for energy creation in Mexico that the country has founded an innovation center specifically to invent safe, new ways to explore the potential of geothermal energies and has developed a regulatory framework to govern its use and study. The energy has a decades-long history in the country; production began in Mexico in 1959 in Pathe, Hidalgo. As of 2010, four separate geothermal installations generate 965 megawatts of electricity, placing Mexico in fourth place worldwide for geothermal energy production, which relies on the earth's heat to produce energy.

Finally, Mexico relies on hydroelectric energy sources to provide the backbone for the renewable energy on which the country depends. Hydroelectricity continues to be the main source of clean energy generation with 30,891.54 gigawatt hours, followed by wind energy, at 8,745.15 gigawatt hours (Energy Secretary of Mexico 2016). Much of this is due to the eighty-six hydroelectric plants installed throughout the country. A hydroelectric plant generates electricity from the energy released through the movement of water, but this often requires dams and gravity

Similar to Mexico, Uruguay has become a leader in renewable energy in South America. As of 2014, the country derived 90 percent of its electricity from renewable energy sources. Oil, a nonrenewable energy source that is not typically drilled or refined in the country, only comprised 9 percent of the energy used to produce electricity. By 2015, the amount of electricity created by clean energy in the country increased to over 95 percent (Zhu 2017). Uruguay's investment in clean energy is good not only for the environment but also for the economy. Reducing reliance on imported oil and gas allows the country to reprioritize its spending. The focus on renewable energy also creates jobs in the energy sector, which increases the prosperity of a larger number of citizens.

to increase the speed and force of water passing through pipes. Even though hydroelectric plants are emission-free, the impact on the marine environment can be significant (Martinez 2018). Nonetheless, hydroelectric power provides a significant amount of energy domestically.

Overall, Mexico's renewable energy infrastructure continues to benefit from positive political support, investment from the private sector, and the country's geographic characteristics. While local laws and aging infrastructure serve as hurdles to continued growth of clean energy, the private and public sectors lend the support and investment necessary to sustain it. Few countries can benefit from the same size and location that contribute to Mexico's ability to generate renewable energy, especially from wind, solar, and hydroelectric sources. It is quite possible that in the future, Mexico may rival and surpass the world's current clean energy leaders: China, India, the United States, and Japan.

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Further Reading

Aldaz, Phenelope. 2017. "Biogas Plant Proceeds at CDMX Landfill Site." *El Universal*. Accessed February 3, 2019. http://www.eluniversal.com.mx/articulo/metropoli/cdmx/2017/04/25/reviven-proyectodel-bordo-para-generar-electricidad.

Arias, Adrian. 2018. "How Will NAFTA Open up a Market for the Mexican Solar Energy Industry?" *El Heraldo*. Accessed February 3, 2019. https://heraldodemexico.com.mx/mer-k-2/como-el-tlcan-abriramercado-para-la-industria-mexicana-de-energia-solar/.

Capilla Vilchis, Ricardo. 2017. "What Is Wind Energy?" Contact y Prensa. Accessed February 3, 2019. http://conacytprensa.mx/index.php/tecnologia/energia/18940-que-es-la-energia-eolica.

Energy Secretary of Mexico. 2016. "En 2015 México alcanzó un 28.31% de capacidad instalada para generar electricidad mediante energías limpias." Blog of the Energy Secretary of Mexico. Accessed May 31, 2020. https://www.altos.co/single-post/2016/08/11/En-2015-M%C3%A9xico-alcanz%C3%B3-un-2831-de-capacidad-instalada-para-generar-electricidad-mediante-energ%C3%ADas-limpias.

Energy Secretary of Mexico. 2018a. "National Atlas of Biomass." Blog of the Energy Secretary of Mexico. Accessed February 3, 2019. https://www.gob.mx/sener/articulos/atlas-nacional-de-biomasa?idiom=es.

Energy Secretary of Mexico. 2018b. "Wind Infrastructure in Mexico Grew 300 Percent: PJC." Blog of the Energy Secretary of Mexico. Accessed May 31, 2020. https://www.gob.mx/sener/prensa/infraestructura-eolica-en-mexico-crecio-300-por-ciento-pjc.

Factor Energia. 2019. "Alternative Energies: What Are They and What Types Exist." Accessed January 30, 2019. https://www.factorenergia.com/es/blog/eficiencia-energetica/que-son-energiasalternativas/.

Forbes Mexico. 2016. "The States with the Greatest Potential in Wind Power." Accessed January 30, 2019. https://www.forbes.com.mx/los-estados-con-mayor-potencial-en-energia-eolica/.

Forbes Mexico. 2017. "Photovoltaic Solar Energy." Accessed February 3, 2019. https://www.forbes.com.mx/energiasolar-fotovoltaica/.

Forbes Mexico. 2018. "Mexico, Fertile Ground for Renewable Energies. What Is It Doing Well?" Accessed January 30, 2019. https://www.forbes.com.mx/mexico-terreno-fertil-para-las-energias-renovables/.

Graham, Nate, and Lisa Viscidi. 2018. "AMLO Can Turn Mexico into the World Leader of Clean Energy." *New York Times*. Accessed February 3, 2019. https://www.nytimes.com/es/2018/07/23/opinionviscidi-amlo-energia-limpia-mexico/.

Lara, Frida. 2018. "In Five Years, Mexico Will Be the Leader in Solar Energy." *Milenio*. Accessed February 3, 2019. https://www.milenio.com/negocios/5-anos-mexico-lider-energia-solar-trina.

Martinez, Izchel. 2018. "Hydroelectric Energy in Mexico." *El Seminario*. Accessed February 3, 2019. https://elsemanario.com/negocios/283295/energia-hidroelectrica-en-mexico/.

Mellino, Cole. 2016. "World's First Cactus Biogas Plant Opens in Mexico." EcoWatch. Accessed February 3, 2019. https://www.ecowatch.com/worlds-first-cactus-biogas-plant-opens-in-mexico1882170111.html.

Nestlé México. n.d. "Green Biomass Energy to Reduce the Use of Fossil Fuels in the Toluca Factory." Accessed May 31, 2020. https://www.nestle.com.mx/historias/energa-verde-de-biomasa-para-reducir-el-uso-de-combustibles-fsiles-en-la-fbrica-de-toluca.

MOROCCO

Since 2001, King Muhammad VI (1963–) has ushered in a new era of environmental reform. Under his governance, there are multiple initiatives and programs to encourage sustainable development and environmental awareness in Morocco. With the establishment of the Muhammad VI Foundation for the Protection of the Environment in 2001, the government has implemented several environmental programs. The National Sustainable Development Strategy, National Municipal Solid Waste Management, the National Program of Sanitation and Wastewater Treatment, the National Program for Collection and Disposal of Plastic Bags, and the National Program for Prevention of and Fight against Industrial Pollution are among these environmental reform programs. The multiple initiatives introduced by the establishment of these programs have moved Morocco to the forefront of environmental policy.

Notably, in response to Morocco's reputation as the second-leading producer of plastic waste in the world, the Moroccan Parliament signed a bill into law on July

1, 2016. This law bans the use, production, or import of plastic bags throughout the country. On July 15, 2016, an additional law was passed, partially due to citizen engagement. As a result, the Moroccan Parliament suspended the import of foreign waste for disposal.

Morocco showcased these accomplishments in 2016, when it hosted 196 countries for the Twenty-Second Conference of Parties (COP22). COP22 was the successor to COP21's Paris Agreement, and its main purpose was to lay the foundation for future projects. As a result, the conference worked toward creating a standards and implementation plan, or rule book. This plan outlines the technical details that will make the Paris Agreement operational. The rule book addressed a variety of topics including "how parties will communicate their efforts on mitigation, adaptation, climate finance, transfer of technology and capacity building; how efforts will be ambitiously reviewed and scaled up in time; and how a process to facilitate implementation and promote compliance will be designed" in a five-year work plan (Carraro 2016).

This international, multilateral collaboration helped establish multiple international initiatives for Morocco including the Marrakech Investment Committee for Adaptation Fund, the Marrakech Partnership for Global Climate Action, and the Marrakech Action Proclamation for Climate and Sustainable Development. In addition, several start-up funding initiatives for small- and medium-sized enterprises focused on innovative technology and sustainable development have emerged, such as the Moroccan Innov Invest Fund. In the scope of capacity building, there have been programs across the country focused on educating the public and mobilizing youth on issues pertaining to the United Nation's Sustainable Development Goals and Agenda 2030 and the African Union's Agenda 2063.

Even though these programs and policies are still new, the wide variety and success of them has ranked Morocco as the fifth most climatically conscious country in the world, and it placed number one in the developing world for 2019. This ranking is based on criteria set forth by GermanWatch's Climate Change Performance Index, which includes carbon dioxide emissions, renewable energy development, efficiency, and climate policy. The report states, "the country has significantly increased the share of renewables over the past five years and has increased new renewable energy capacity. With the connection of the world's largest solar plant and multiple new wind farms to the grid, the country is well on track for achieving its target of 42 percent installed renewable energy capacities by 2020 and 52 percent by 2030" (GermanWatch 2019).

The organization that is leading the way for Morocco to achieve energy independency is the Moroccan Agency for Solar Energy (MASEN), a public-private partnership that designs and creates wind, water, and solar projects across the country. Notably, the Ourzazate Solar Complex, or Noor CSP, is the largest solar farm in the world. The complex currently has a total capacity of 580 megawatts and produces an estimated output of 1.2 terawatts a year to meet the power demand of more than 1 million people (Zafar 2019). In addition, its wind power projects produce at

total of approximately 1,215 megawatts, while the hydropower generated is about 1,770 megawatts (MASEN 2019).

Multiple successful projects have been implemented in Morocco in recent years. These efforts encourage sustainable growth through supporting larger municipalities, government entities, and private organizations. They adhere to the policies, programs, and initiatives that the government implemented. However, long-term sustainable projects for smaller towns are not the norm; these towns still lack basic public services and infrastructure and may have additional environmental issues that are unique unto themselves. This gap between national priorities and municipal operations may be due to smaller municipalities not having the means to create these projects or simply not knowing where to begin. Luckily, local associations serve as mobilizers of citizen participation and engagement to unite public initiatives and government involvement. The most concerning areas are the rapidly growing towns outlying larger metropolitan areas, which are experiencing an increase of population and a strain on resources.

Local Initiative—Waste-Powered Pottery Kiln—Tameslouht, Morocco

Tameslouht is a growing town of about 11,000 people located seventeen kilometers southwest of Marrakech, a large tourist city. Between 2004 and 2014, Tameslouht grew from 6,346 to 9,093 people, a 43.4 percent growth (City Population 2019). The most alarming statistic to consider for future development is that 47 percent of Tameslouht's population is under the age of twenty-four years, in comparison to 46.2 percent throughout Morocco (High Commission for Planning 2014). The reason for this population growth in Tameslouht is from the influx of people migrating from Marrakech and other rural areas in search of affordable housing in close proximity to Marrakech. This migration has increased the demand for housing and proper waste management services, which has placed a bigger spotlight on Tameslouht's other environmental issues.

The current waste management situation is simple. Tameslouht has three garbage trucks that gather the trash and throw it in the nearest landfill. There are about eight landfills of various sizes located around the town. A common method of disposing trash is to burn it, releasing dioxins and harmful carcinogens that can be absorbed through the skin, inhaled, or ingested. Even though the burning method is still the preferred way to dispose of waste locally, the municipality has recently built a temporary walled-in landfill to relocate the 2.6 acres of garbage strewn across the neighboring land. Plans are underway to design a permanent landfill and recycling facility with a local association.

The town also produces a significant amount of olive oil. Olive oil trees surround the northern edge of the town, offering the only vegetation visible in Tameslouht. The traditional olive oil mills that are currently used create four times more waste by volume than actual product. The three main byproducts are olive press cake (OPC), semisolid residue (SOR), and olive oil mill wastewater (OOMW). The OPC is often combusted to heat public baths or in the potter kilns, but after the final

separation process, there is 30 percent SOR, 50 percent OOMW, and only 20 percent olive oil (Dimitrios 2012). Without stringent environmental regulations, the untreated OOMW is placed into man-made basins or discharged into water bodies, which is problematic because the wastes cause environmental degradation and pollute groundwater sources.

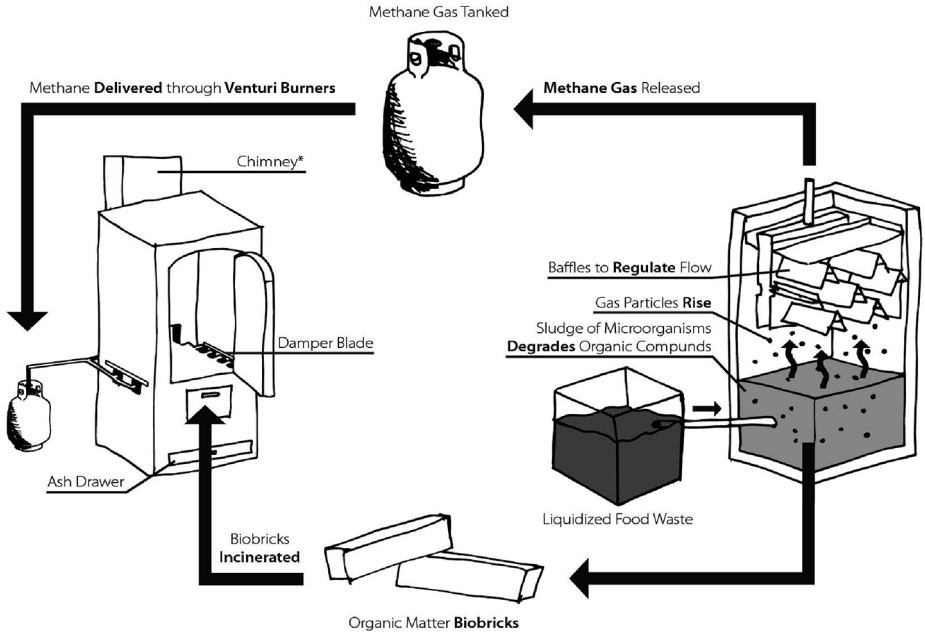
Tameslouht is known for its traditional artisanal crafts including clothing, baskets, metal work, carpentry, and especially pottery. Tameslouht has a potter sector of approximately seventeen traditional beehive-design pottery kilns, a majority of them located on the southeastern edge of the town. The area's arid climate provides no wood for the pottery kilns to be fired, so tires are brought in from Marrakech to provide combusted energy. Approximately 120 tires are burned each workday (nine hours). The burning releases thirty-four different toxic chemicals and wastes 31.2 million British thermal units of energy for one kiln. In a modern pottery kiln, the earthenware would only require 12,000 British thermal units per hour.

Based in Cincinnati, Ohio, and in Tameslouht, Resilient Communities is an international nongovernmental organization that has been developing ways to address these issues in a way that can benefit the community economically, environmentally, and socioculturally. The NGO has designed a pottery kiln that can potentially be powered by the combustion of organic solid waste and also from methane gas produced by the local wastewater treatment facility (WWTF), using small amounts of OOMW as a substrate to the pretreatment system. The organic matter naturally produced by the WWTF can also be dredged and made into biobricks that can be incinerated in the kilns. Therefore, the kilns will rely on alternative energy, as the larger project seeks to use existing waste materials in the area and turn them into new energy source, which will keep the project cost lower and provide the people with potential economic and health benefits.

For the design process, Resilient Communities partnered with the University of Cincinnati and created a capstone project for mechanical engineering students. It also consulted with two environmental engineering students, one environmental engineering professor, and one ceramics professor. To ensure sustainability of the project, the organization partnered with the University of Cadi Ayyad's engineering department in Marrakech to help analyze the OOMW in the wastewater pretreatment system. Contracts have been signed with the local government of Tameslouht and with the National Office of Electricity and Potable Water to provide access to the WWTF in Tameslouht. For local application of the prototype designs, Resilient Communities has partnered with the Alibdaa Cooperative for Pottery and Ceramics in Tameslouht to provide their expertise.

It is helpful to find proper resources that can be adapted to fit the context of a region's particular environmental issues. This can be achieved with the encouragement of the sustainable development and the formation of local, regional, national, and international partnerships. It takes citizen participation as well as the right partnerships to utilize local resources that will create a project that can genuinely and effectively address an area's most pressing issues.

Eastman Johnson



Schematic Diagram of Prototype Pottery Kiln System. (Courtesy of Eastman Johnson)

Tameslouht traditional pottery kiln. (Courtesy of Eastman Johnson)

Further Reading

Carraro, C. 2016. "COP22 in Marrakech: An Assessment of Its Achievements." Accessed May 31, 2020. https://www.cmcc.it/article/cop22-in-marrakech-an-assessment-of-its-achievements.

City Population. 2019. "Tameslouht." Accessed September 15, 2019. https://www.citypopulation.de/en/morocco/marrakechsafi/al_haouz/04109113__tameslouht/.

Dimitrios, Boskou. 2012. *Olive Oil: Constituents, Quality, Health Properties and Bioconversions*. London: InTech.

GermanWatch. 2019. "Morocco 2019." Climate Change Performance Index. Accessed August 19, 2019. https://www.climatechange-performance-index.org/country/morocco-2019.

High Commission for Planning. 2014. "Indicators RGPH2014." Accessed August 19, 2019. http://rgphentableaux.hcp.ma/Default1/.

Moroccan Agency for Solar Energy (MASEN). 2019. "Projects." Accessed August 19, 2019. http://www.masen.ma/en/projects.

Zafar, S. 2019. "Renewable Energy in Morocco." EcoMENA. Accessed May 31, 2020. https://www.ecomena.org/renewable-energy-in-morocco/.

PAKISTAN

Pakistan has been slow in its uptake of alternative energy technologies. While hydropower has been used for decades, there has been little growth in the use of other alternative energy sources. Pakistan also continues to be in the midst of its own energy crisis as its demand greatly supersedes its own internal supply. However, a number of current studies show that Pakistan has a great capacity for multiple forms of alternative energy. Pakistan's national government has taken some recent efforts to increase alternative energy production.

Pakistan has an ongoing energy crisis, in that it cannot meet the energy needs of the country. Because of this imbalance, it relies on purchasing energy resources from other countries. It imports almost one-third of its oil, and in 2016, the government signed a fifteen-year agreement with Qatar for the purchase of natural gas annually. Access to electricity has been on the rise; however, the Ministry of Energy estimated in 2019 that 25 percent of the country's population still had no access to energy. Access generally is significantly lower in rural areas than urban centers (APP 2019). Even in area where electricity is available, there are often massive blackouts or brownouts, which are intentional or unintentional drops in the power supply, that last several hours per day, affecting private homes, as well as the industrial and commercial sectors. To address its energy needs, the country is pursuing strategies to harness renewable energy sources, which may also reduce costs, as some renewable energy sources cost less than traditional, nonrenewable sources (Nicholas and Buckley 2018).

Pakistan's national electric grid receives 5–6 percent of its energy from renewable resources (Mukhtar 2019). Hydropower is the only alternative energy source in Pakistan with significant usage across the country. It accounted for 60 percent of Pakistan's energy production in 1978; however, that number has continued to

decline. It dipped as low as 25 percent in 2000 and now hovers around 30 percent of total energy production in the country (IRENA 2018). Currently, operating hydropower plants exist primarily in the northern provinces and along the Indus River. The primary governing authority for the development of large-scale hydropower resources is WAPDA, the Pakistan Water and Power Development Authority. Smaller-scale development of hydropower plants also continues under regional governments and within the private sector, with significant potential for further development. Additionally, there are numerous micro–hydropower plants in the north and northwest regions of the country that are off of the national grid.

In addition to hydropower, other alternative energy efforts in Pakistan fall under the purview of the Alternative Energy Development Board (AEDB), a group under the Ministry of Energy. The AEDB's goal is to facilitate and promote alternative energy development in the country. More specifically, it has been tasked with increasing the use of alternative energies in remote villages in the Sindh and Balochistan provinces and more broadly with increasing Pakistan's alternative energy power generation to 5 percent by 2030, although a 2019 policy proposal may increase this goal. The AEDB also coordinated with the International Renewable Energy Agency to produce a renewables readiness assessment for Pakistan in 2018.

In addition to WAPDA and the AEDB, the Ministry of Science and Technology also has a Pakistan Council of Renewable Energy Technologies (PCRET). PCRET's primary responsibilities include the research and development of alternative energy technologies and particularly the promotion of current alternative energy technologies to the public. A separate entity, the National Electric Power Regulatory Authority (NEPRA), has regulatory oversight and, as part of its work, reviews tariffs for proposed renewable energy projects (NEPRA 2017).

The national government developed the Policy for Development of Renewable Energy for Power Generation in 2006. This was the first federal policy in Pakistan with the sole goal of increasing alternative energy production. The Power Generation Policy of 2015 also impacts alternative energy with a focus specifically on thermal and large hydropower plant development. Some provincial level governments in Pakistan have either adopted the federal alternative energy policy or developed their own local policies regarding alternative energies.

A lack of implementation strategies and assigned federal dollars, however, has prevented many of the country's alternative energy goals from being realized. A proposed 2019 federal budget bill, if approved, will grant a five-year exemption from taxes for the manufacture and assembly of solar and wind energy equipment. In 2019, the Cabinet Committee on Energy initially approved a new Renewable Energy Policy 2019, but this policy has remained under review by other stakeholders before it can receive formal approval. In connection with this potential policy, the newly appointed minister of power stated a new goal of reaching 30 percent renewable energy usage by 2030 (Jorgic 2019).

There is a high capacity for solar energy in Pakistan, particularly in the south and southwestern parts of the country. The first on-grid solar power station was

installed in Pakistan in 2012. This was the result of an aid project with the Japan International Cooperation Agency (JICA 2012). The plant was built at the Planning Commission and Pakistan Engineering Council building in Islamabad, and it allowed for excess energy to feed into the national electric grid. Another plant, the Quaid-e-Azam Solar Park, located in Punjab, came into operation in 2015; however, goals to increase the power production from 100 megawatts to 1,000 megawatts have not yet been met.

Pakistan was able to double its installed capacity for solar energy production between 2017 and 2018, going from 742 megawatts to 1.5 gigawatts (Martin 2019). In early 2019, the World Bank awarded a grant of a US$100 million to the government of Pakistan to construct the Sindh Solar Energy Project. This project, located within the Sindh province, is intended to develop solar parks for public utilities, private investment, and private households. The private sector in Pakistan is also served by a number of providers for smaller solar energy systems, such as solar lighting and water heaters.

Pakistan has a large capacity for wind power, particularly in the southern parts of the Sindh and Baluchistan provinces. Much of this territory falls within what is called the Gharo-Jhimpir Wind Corridor. Zorlu Energy, a Pakistani subsidiary of a Turkish private firm, established the first wind power plant, the Jhimpir Wind Power Plant, in the country (Khan 2017). The plant first began producing energy in 2009, with an increased capacity to over fifty megawatts beginning in 2013, which it then began selling to the government of Pakistan via an electric distribution company.

The China-Pakistan Economic Corridor, a collection of projects agreed upon by China and Pakistan in 2015 (Zehra 2015), also includes Chinese investment in wind power. The Chinese built another wind farm in the Gharo-Jhimpir Wind Corridor in 2017, with a capacity of about fifty megawatts, while others are still being planned in the region. Overall, a total of twelve wind power plants were operational as of the end of 2016 (IRENA 2018), with others still undergoing construction. The Sindh and Punjab regions in particular have also approved wind projects under their regional governments.

Biomass energy is primarily used by sugar mills in Pakistan. Eight companies are currently listed by AEDB as operational for biomass energy production. In 2013, an addendum to the 2006 Renewable Energy policy, called the Framework for Power Cogeneration (Bagasse/Biomass), added biomass and waste to energy to the renewable energy mix. In rural areas of Pakistan, there is both widespread availability and use of biomass fuels at the local and private levels. However, these methods are not always sustainable, and sugar mills in remote regions are unable to be connected to the national grid.

Pakistan has identified the need for growth in expansion of alternative energy technologies to meet its energy consumption needs. Hydropower, which has a long history within the country, combined with solar, wind, and biomass energy offer promising alternative solutions to meet these needs. Investments and research into these technologies have increased energy production, and although more effort

will be required to realize their potential, the country is taking steps to grow and adapt these new technologies to resolve the country's energy crisis.

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Further Reading

APP. 2019. "Renewable Energy Policy 2019 Due out Next Month." *Express Tribune*. Accessed April 13, 2019. https://tribune.com.pk/story/1928133/2-renewable-energy-policy-2019-due-next-month/.

IRENA. 2018. "Renewables Readiness Assessment: Pakistan." Accessed May 31, 2020. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_RRA_Pakistan_2018.pdf.

Japan International Cooperation Agency (JICA). 2012. "Pakistan Gets First On-Grid Solar Power Station." Accessed April 12, 2019. https://www.jica.go.jp/pakistan/english/office/topics/press120529.html.

Jorgic, Drazen. 2019. "Pakistan Says Curbing Power Sector Debt, Seeks Energy Investors." Reuters. Accessed April 15, 2019. https://www.reuters.com/article/pakistan-power-minister/pakistan-says-curbing-power-sectordebt-seeks-energy-investors-idUSL5N1ZU0IK.

Khan, Rina Saeed. 2017. "In Coal-Focused Pakistan, a Wind Power Breeze Is Blowing." Reuters. Accessed April 17, 2019. https://uk.reuters.com/article/pakistan-energy-windpower-idUKL8N1K82U0.

Martin, José Rojo. 2019. "IRENA: PV Dominates in 171GW Global Renewable Push in 2019." PV Tech. Accessed April 15, 2019. https://www.pv-tech.org/news/irena-pv-dominates-in-171gw-global-renewable-push-in-2018.

Mukhtar, Imran. 2019. "Energy-Short Pakistan Moves to Power up Solar Manufacturing." Reuters. Accessed April 12, 2019. https://uk.reuters.com/article/pakistan-renewables-taxes/energy-short-pakistan-moves-to-powerup-solar-manufacturing-idUKL5N1ZS699.

National Electric Power Regulatory Authority (NEPRA). 2017. "State of Industry Report 2017." Accessed April, 16, 2019. https://nepra.org.pk/Publications/State%20of%20Industry%20Reports/State%20of%20industry%20report%202017.pdf.

Nicholas, Simon, and Tim Buckley. 2018. "Pakistan's Power Future: Renewable Energy Provides a More Diverse, Secure, and Cost-Effective Alternative." Institute for Energy Economics and Financial Analysis. Accessed April 10, 2019. http://ieefa.org/wp-content/uploads/2018/11/Pakistans-PowerFuture_December-2018.pdf.

Zehra, Anam. 2015. "Pakistan Opens First Solar Power Plant, Built with Chinese Investment." Reuters. Accessed April 12, 2019. https://www.reuters.com/article/pakistan-solar/pakistan-opens-first-solar-power-plant-built-withchinese-investment-idUSL4N0XW2VP20150505.

UGANDA

Uganda has the necessary alternative energy potential to be energy independent. With adoption of on- and off-grid solar energy, continued use of hydropower, and use of geothermal energy, Uganda can separate itself from its current dependence on fossil fuels. Making this transition is needed for the country's growing population, and to accomplish it, Uganda must diversify its resource base and

strive to optimize all aspects of how those resources are converted, used, and stored as energy sources. Researchers have identified five potential alternative energy sources that enable Uganda to achieve these goals and be energy independent: biomass, geothermal, hydro, solar, and wind. The following sections describe these five alternative energy sources and existing large-scale and small-scale technology processes to use them for energy (Gustavsson, Broad, Hankins, and Sosis 2015).

Biomass

Uganda relies primarily on biomass energy; it represents around 94 percent of the country's energy consumption and is the primary energy resource for rural industries. Charcoal, rather than biomass, is the preferred energy source in urban areas, whereas rural areas rely on firewood, agro-residues (the organic byproducts remaining after an agricultural harvest), crop residues, and wood waste as the primary sources of biomass fuels.

For agro-residue, sugar companies have been relying on sugarcane residue for electricity and heat production. Other potential sources of biomass energy, such as coffee and rice husks, remain to be explored within the country. On a small scale, biogas technologies have proven cost-effective means to provide electricity to poor communities. Presently, five districts across Uganda have implemented biogas technologies: Iganga, Kabarole, Mbale, Mpigi, and Tororo. Between them, there are fifty biogas plants, or approximately ten per district. Due to their success, the Ugandan government should consider implementing this technology in the remaining 116 districts (Fashina et al. 2018).

The Ministry of Energy and Mineral Development has made efforts to promote the use of rocket stoves among households and institutions, which reduce deforestation and the use of wood fuel. The rocket stove burns biomass cleanly and almost completely, promoting more efficient cooking that also minimizes losses that may negatively impact the increasing biomass energy demand. The rocket stoves are constructed from no- or low-cost local materials that correspond to what is available for people living in rural areas, allowing them to produce affordable, efficient energy for cooking and heating (Scott 2003; Rocket Stoves 2019).

> In Uganda, the Sesame Girls Secondary School is experimenting with an unusual type of fuel. With the help of scientists from the Bristol Bioenergy Centre in the United Kingdom, the school now uses the bacteria produced naturally by human urine to power the lights in the toilets, as well as to illuminate the path to the toilets to improve safety because they are not connected to the main building. The technology, also known as Pee Power by its creators, is being considered for implementation in other parts of Africa where gaining access to electricity has proven challenging (Cole 2017).

Since 2005, over 500,000 rocket stoves have been successfully distributed in the Rakai and Bushenyi districts, both located in the southwestern part of the country. Although about 10 percent of all households in Uganda have benefited from the expansion of the rocket stove program, more households could benefit from increased awareness of the effectiveness of biomass stoves to reduce less effective, less clean fuelwood consumption in other areas (Fashina et al. 2018).

Another government project has Uganda's largest slaughterhouse turning organic waste from the processing of agricultural products into energy. The project puts biomass waste, such as animal blood, wastewater, and other organic waste, through a process that allows it to ferment and then harnesses the methane it releases to produce electricity. In addition to using biogas, the project uses solar panels to heat water and raise the temperature to allow it to produce the most burnable methane. Besides helping the slaughterhouse avoid being affected by the city's frequent blackouts, using biogas for energy has cut the plant's monthly diesel bill by 90 percent. There are environmental benefits for nearby Lake Victoria as well, since these byproducts are also no long drained directly into Murchison Bay. The project is in the process of being scaled to treat all of the slaughterhouse waste; presently it can only accommodate around 40 percent.

Uganda's government monitors biogas energy programs, such as the harnessing of slaughterhouse and other organic wastes, to evaluate whether they offer promising solutions to Uganda's energy needs. Biogas energy has the potential to resolve energy deficiencies for populations residing in rural areas away from established power grids. The long-term effects of switching to biogas power generated from waste and wastewater would not only promote cleaner, alternative energy usage but could also aid the country to prevent deforestation and the destruction of other lands containing traditional fuel sources (Mbugua 2015). The effort would also allow Uganda to achieve the United Nation's post-2015 agenda for the Millennium Goals, one of which is to provide its population access to affordable and clean energy.

Geothermal

Geothermal energy is still in the exploration stage in Uganda. Current estimates show potential resources for development to be 1,500 megawatts in twenty-four known geothermal areas. At present, there has yet to be reported technology to develop the country's geothermal resources. According to Godfrey Bahati, Commissioner of the Geothermal Resources Department, the aim of geothermal energy is to develop more energy and complement other sources of power to meet the energy demand.

The Kibiro, Panyimur, Buranga, and Katwe regions in western Uganda have a high potential for the development of geothermal power generation, with an estimated geothermal energy potential of 450 megawatts. Results from studies indicate a suitable temperature range in these locations, between 150 degrees Celsius and

200 degrees Celsius, for electricity generation and direct use in industry and agriculture (Fashina et al. 2018; Richter 2018).

Hydro

Hydropower in Uganda uses two approaches: large scale and small scale. *Small-scale hydropower* generally refers to production less than ten megawatts, with large-scale producing more than ten megawatts. *Large-scale hydropower* includes three power stations—in the Nalubaale, Kiira, and Bujagli regions—with a combined capacity of 630 megawatts. Three additional large-scale stations are under development for future use in Isimba, Karuma, and Ayago, with a capacity of 1,383 megawatts.

While the Nile is ideal for large hydropower projects, smaller hydropower sites are more suitable in the mountainous western and the eastern regions of the country. Local rivers flowing through these areas hold promise for small hydropower; more than fifty potential sites have been identified as potential future hydropower sites. Three of these small hydropower stations, in Kuluva, Kagando, and Kisiizi, supply electricity to isolated hospital grids, and other sites can be used for energy supply to the national grid (Fashina et al. 2018).

Wind

Preliminary research has shown that wind power has potential in some parts of the country, albeit not for large-scale production. The first step in determining how to harness wind power for electricity is the Ministry of Energy and Mineral Development's wind mapping program, which has led to installing wind measurement equipment at high-altitude sites in the Napak and Kotido districts. The project aims to increase understanding of wind strength and patterns in these areas and will use this data to determine how to implement wind power technologies.

Current efforts to experiment with wind power have had some success. A joint project between the Karamoja Development Authority, the Roman Catholic Mission, and the Church of Uganda has begun in Karamoja and other parts of the northeast through the installation of wind pumps. One of the barriers to harnessing wind energy, however, is the high start-up cost; installation can be prohibitively expensive, and the technologies generally have increased costs because they are not created locally, meaning they must be imported (Fashina et al. 2018).

Solar

In 2018, Uganda had more than 30,000 installed solar photovoltaic systems with enough capacity to increase energy distribution to some rural areas. Because these systems have had success generating energy, there have been increased efforts to promote awareness of solar power technologies in country. For example, the Denmark-based Joint Energy and Environment Projects Uganda Nordic Folk

Center for Renewable Energy has been a major player in promoting awareness surrounding solar photovoltaic systems and the benefits of solar power, particularly in the Tororo, Luwero, and Arua districts (Fashina et al. 2018). Other nongovernmental organizations and joint projects could be critical for increasing the awareness and adoption of solar power technologies countrywide.

In 2016, Uganda built its first grid-connected solar plant with the goal of increasing its net output capacity of solar energy. The government has long regarded solar energy as a viable option for renewable energy generation, and according to the renewable energy policy, the country has a solar electricity potential of about 200 megawatts. The grid also gives Uganda the opportunity to further develop alternative energy sources to diversify away from its hydropower plants, which are currently beset by unstable water levels as a result of dry spells and changing weather patterns (African Business Magazine 2016).

In order for the government of Uganda to meet its commitment to achieving the energy needs of its people and promoting alternative energy, a number of barriers should be addressed, including lack of information and public awareness; huge initial investment cost; high operation and maintenance cost; inadequate attention to research and development; lack of human capacity, training, and education; grid unreliability; ineffectual quality control of products; and institutional barriers (Fashina et al. 2018). The country's best approach to address these challenges is to strengthen an environment that attracts innovative approaches to the production of alternative energy in order to include the invention and adoption of emerging technologies.

Anthony Ortiz

Further Reading

African Business Magazine. 2016. "Uganda: Renewable Energy Project." Accessed March 22, 2019. https://africanbusinessmagazine.com/sectors/energy/uganda-renewable-energy-project/.

Fashina, Adebayo, Mustafa Mundu, Oluwole Akiyode, Lookman Abdullah, Dahiru Sanni, and Living Ounyesiga. 2018. "The Drivers and Barriers of Renewable Energy Applications and Development in Uganda: A Review." *Clean Technologies 1*(1), 9–39. https://doi.org/10.3390/cleantechnol1010003.

Gustavsson, Mathias, Oliver Broad, Mark Hankins, and Karin Sosis. 2015. "Energy Report for Uganda. A 100% Renewable Energy Future by 2050." World Wide Fund for Nature. Accessed March 22, 2019. https://www.researchgate.net/publication/285766191_Energy_Report_for_Uganda_A_100_Rene wable_Energy_Future_by_2050.

Mbugua, Sophie. 2015. "How Uganda Is Turning Waste into Power." World Economic Forum. Accessed March 22, 2019. https://www.weforum.org/agenda/2015/02/how-uganda-is-turning-waste-into-power/.

Richter, Alexander. 2018. "Three Private Groups with Geothermal Licenses in Uganda." Think Geoenergy. Accessed March 22, 2019. http://www.thinkgeoenergy.com/three-private-groups-with-geothermal-licenses-in-uganda/.

Rocket Stoves. 2019. "Home Page." Accessed March 22, 2019. https://www.rocketstoves.com/.

Scott, Peter. 2003. "Introduction of Rocket Stove Cooking Devices in Uganda." Ministry of Energy and Mineral Development Energy Advisory Project. Accessed March 22, 2019. aprovecho.org/?paybox_id=91.

UNITED STATES

The United States, one of the highest consumers of energy worldwide, has continued to increase its usage of alternative energies since the 1970s. It primarily relies on hydropower, biomass, wind, and solar energies, and it devotes resources to continued research and development to increase efficiency and lower costs associated with them. The country is, however, not one of the world's renewable energy leaders.

Instead, it continues to rely on fossil fuels, and most recently, its federal government has demonstrated a desire to refocus on energy produced by coal and gas over renewable energy sources. This shift is in contrast to some state, and even city-level, efforts to promote alternative energies. In fact, there are no comprehensive legal frameworks, guaranteed incentives, or targets for renewable energy adoption. Thus, policy and economic challenges create the largest barriers to renewable energy production.

The United States relies heavily on fossil fuels, such as coal, petroleum, and natural gas, and only uses a small percentage of renewable energy sources. As of 2015, fossil fuels powered 81.5 percent of the country's energy needs, with only 9.7 percent made from alternative sources. Compared with the 1990s, when fossil fuels accounted for 85.6 percent of the country's energy supply and renewable sources 7.1 percent, progress has been slow in harnessing alternative energy sources (Procon 2018).

Reasons for relying on fossil fuels include their abundance and the relatively low monetary cost of continuing to use them rather than newer, more expensive energy types. The renewable energy that is used is primarily, though not exclusively, used for electricity production. Projections over the next decade show demand for renewable energy sources rising. The federal government itself is slated to be part of the growing demand, as Executive Order 13693 requires all federal agencies to use renewable energies for a minimum of 30 percent of their energy consumption by 2025.

Interest in renewable and alternative energies exists, with research to develop more efficient, cost-saving technologies underway. As of 2018, alternative energy contributed to 11 percent of U.S. energy consumption. Preliminary data shows that 11 percent breaks further down into hydroelectric (25 percent), wind (21 percent), solar (6 percent), geothermal (2 percent), and biomass (45 percent), which includes energy produced from wood, biofuels, and biomass waste (EIA 2019).

The U.S. Department of Energy's National Renewable Energy Laboratory released a study showing that with proper preparation and guidance, the United States could produce at least 80 percent of its electricity through alternative energy sources by 2050 (NREL 2012). More than one hundred experts contributed to

the study. It does not explain, however, to what degree the Department of Energy will choose to support the policy changes needed to make this switch a reality and whether it has additional political backing. High-level governmental support, as well as funding and financing, will be required to realize the 80 percent objective. To date, there has been limited public progress toward advancing this goal.

Alternative energies are most often applied to electrical works. The American Public Power Association notes that 3,304 providers comprise the electric industry, including 2,012 publicly owned utilities, 876 cooperatives, 187 investor-owned utilities, 218 marketers (often counted as public utilities), and 9 federal utilities (APPA 2018). From these sources, around 20 percent of the generating capacity for electricity, meaning the maximum amount potentially producible, comes from renewable energy sources. Hydroelectric power is the top producing source for electricity, followed closely by wind energy, with solar trailing behind. In fact, the United States is the world's third top hydropower producer. Wind and solar power energies have the potential to surpass hydroelectric power production in the future. With 80 percent of electricity still generated by fossil fuels, renewable energies currently comprise a small portion of the fuel production. Theoretically, assuming they become better regulated and more cost-efficient, renewable energies have space to expand within the context of electricity generation.

Tax credits have allowed companies and the government to pursue alternative energy sources. At the federal level, the production tax credit of 1992, established under the Energy Policy Act of that same year, credits companies a small amount for each kilowatt of electricity produced by renewable energy over a ten-year period. The volume produced translates directly into the amount of the credit, which encourages the use of alternative power generation. There is also an investment tax credit that reduces the installation costs and makes the new technologies profitable faster. This tax credit is set to expire in 2020, however, so its ability to encourage the switch to alternative energy technologies may be limited unless it receives an extension.

One way for energy developers to benefit without the investment tax credit is through the 2009 American Recovery and Reinvestment Act, which can provide a cash grant of up to 30 percent of a project's eligible costs to implement renewable energy projects. The Act is one of the mechanisms through which the government extended the production tax credit. It, along with the Bipartisan Budget Act 2018, now places regulations on the start dates needed to qualify as well as different regulations on the various energy types, specifically on wind and solar energies. Congress has discussed implementing laws or, at minimum, a comprehensive legal framework with alternative energy standards, but the attempts to do so have never made it out of committee. With the U.S. withdrawal from the Paris Agreement on climate change mitigation in 2017, the future for renewable energy in the country became more uncertain.

Tax credits continue to exist at the state level; in some areas, they are increasing along with policy to regulate renewable energy companies. State governments have the option of offering additional credits and incentives to promote alternative

energy technologies. Many states already have a renewable portfolio standard that requires a certain percentage of electricity production occur through renewable resources; the percentage varies by state where these portfolios exist. In some cases, the states also specify which energy type must satisfy the standard, although this choice is often left with the utility companies.

Iowa, for example, has reaped great benefit for its policies surrounding wind energy. The industry has created thousands of jobs, has brought more than $11.8 billion in investments, and accounts for a $17 million lease for lands supporting wind energy technologies (Hickey 2017). At least twenty-one other states have renewable energy standards, and additional states have voluntary standards and targets (NCSL 2019). Some cities have also started to establish renewable energy standards. However, the country lacks a comprehensive renewable portfolio standard at the federal level, which creates challenges for renewable energies at the national level. Without a national standard, the tax credits provide some incentive to move away from fossil fuel dependencies, but after 2020, there are questions as to whether the remaining state-level tax credits will be sufficient to sustain the momentum of alternative energy development.

Additional laws have supported the growth of the renewable energy sector. The Energy Independence and Security Act of 2007 set targets and standards for renewable fuel for 2020. The Energy Improvement and Extension Act of 2008 added to the tax credit regulation and provided some tax exemptions surrounding fuel-efficient technologies. In addition, several laws either instated or extended tax credits for renewable energy. These included the Tax Relief, Unemployment Reauthorization, and Job Creation Act of 2010; the American Taxpayer Relief Act of 2012; the Tax Increase Prevention Act of 2014; and the Consolidated Appropriations Act of 2016. All of these laws have contributed to growing the supply of renewable energies and associated generation capacity. However, even together they do not equate to a comprehensive, national-level framework to regulate alternative energy.

The transportation sector plays a large role in energy consumption and usage. While electric power comprises around 37 percent of the United States' total energy consumption, the transportation sector is not far behind at 28 percent, followed by industry at 22 percent and residential/commercial properties at 10 percent (AGI 2017). The transportation sector also has policy that affects renewable energy. Initially, the Energy Policy Act of 2005 set the minimum standard for renewable fuels in gasoline at a little under 3 percent. In 2007, the Energy Independence and Security Act increased the amount of renewable fuel to around 7 percent, with a target date of 2022. Some of the energy used in the transportation sector is electricity, and the rest is the fuel required to run a vehicle engine whether or land, in the air, or in the water. Petroleum is the most common fuel used in the industry, although there is a growing potential to apply biofuels to engines adapted to consume them.

The U.S. nuclear policy allows for the use of nuclear power as an alternative energy source. The first reactor went online in 1951 to produce electricity. Since that time, the use of nuclear power has increased, as well as the number of power

plants. In mid-2008, the Department of Energy created a loan guarantee program for the construction of approved plants and uranium enrichment facilities. After 2010, however, the loan program had difficulty granting loans, as one of the funded project's parent companies applied for bankruptcy in 2011.

In recent years, nuclear power has not been a competitive energy source. Many nuclear plants have shut down or have applied to close. New plants are unlikely to undergo construction, assuming they pass the three-to-five-year approval and permitting process, because they are cost-prohibitive compared to costs accrued by traditional fossil fuel plants. Since it appears to be a source that can cut carbon dioxide releases into the atmosphere and has fewer fatalities associated than other fuels, there may be a future for nuclear energy as an alternative to fossil fuels. However, nuclear energy production is not entirely clean; it produces waste that must be stored properly (Wilkerson 2016). For these reasons, there is an ongoing debate about the future of nuclear energy in the United States, with its proponents emphasizing that it is a continuous power source versus the intermittency of other alternative energies.

More recently, U.S. policies have increased the challenges of bringing renewable energy to market. The withdrawal from the Paris Agreement has allowed the U.S. government to implement policies that support its fossil fuel industries, such as coal and natural gas. By applying resources to these industries, there are fewer resources for alternative energy technologies, which makes it more difficult to develop and implement them. In addition, the government has scaled back, or in some cases removed entirely, protections for clean air and water that have helped to maintain cleaner environments and promote better health. Because these protections are at odds with the production of coal, gas, and oil—fuel that is not clean energy and produces pollutants and other byproducts that can affect the environment and health quality in surrounding areas—they were removed to support those industries.

Despite the reduction of these protections, the United States could do more to promote clean air and water. For example, the United States currently has few regulations to promote carbon capture, the idea of trapping carbon dioxide produced as a byproduct at several types of plants, including those that process fossil fuels, to prevent its release into the atmosphere. Carbon dioxide has been linked to rising

In 1958, the U.S. Navy launched *Vanguard 1*, the fourth man-made orbital satellite to circle the planet. At the beginning of the space race, the Soviet Union launched the world's first satellites, *Sputnik 1* and *2*. Two months later, the United States sent up the *Explorer 1*. *Vanguard 1* was the second U.S. satellite. It was also the first Earth satellite to use solar energy as its power source. Part of its mission including measuring the Earth from multiple dimensions; it even discovered that the planet is not truly a circular sphere but rather has a slight pear shape (Oberg 2008). As of 2018, it remains the oldest satellite in orbit and has travelled more than six billion miles.

climate temperatures, so preventing its reintroduction into the atmosphere could have national, as well as global, benefits. With the federal government expressed decreased interest in renewable energy, the brunt of these efforts will fall to state governments.

The United States is one of the world's highest power consumers. With its large population and varied terrain, alternative energies show great promise, although there is a divide in level of interest between federal and state efforts to develop and incorporate them. The current renewal in federal interest in fossil fuels demonstrates their cost-effectiveness and perhaps less concern over some of their drawbacks, such as their environmental and human health impacts. Meanwhile, many states are either pursuing or researching how to harness natural renewable resources to meet growing energy demands—at least for electricity, as opposed to the other sectors that rely heavily on fossil fuel power. The future of alternative energies remains in question for the United States; should the country choose to meet targets such as 80 percent renewable-energy-powered electricity by 2050, there remains a significant amount of work required to develop goals and milestones intended to achieve that target on time.

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Further Reading

American Geosciences Institute (AGI). 2017. "What Are the Major Sources and Users of Energy in the United States?" Accessed September 1, 2019. https://www.americangeosciences.org/critical-issues/faq/what-are-major-sources-andusers-energy-united-states.

American Public Power Association (APPA). 2018. "Public Power: 2018 Statistical Report." Accessed September 1, 2019. https://www.publicpower.org/system/files/documents/2018-Public-Power-Statistical-ReportUpdated.pdf.

Hickey, David. 2017. "United States of Renewables: Energy Revolution Continues Despite Hurdles." Trade & Industry Development. Accessed May 31, 2020. https://www.tradeandindustrydev.com/industry/alternative-energy-fuels/united-stat.

National Conference of State Legislatures (NCSL). 2019. "State Renewable Portfolio Standards and Goals." Accessed September 1, 2019. http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx.

National Renewable Energy Laboratory (NREL). 2012. "Renewable Electricity Futures Study." Accessed September 1, 2019. https://www.nrel.gov/analysis/re-futures.html.

Procon. 2018. "United States Energy Use by Source, 1950–2015." Accessed August 31, 2019. https://alternativeenergy.procon.org/view.resource.php?resourceID=004341.

U.S. Energy Information Administration (EIA). 2019. "Renewable Energy Explained." Accessed September 1, 2019. https://www.eia.gov/energyexplained/renewable-sources/.

Wilkerson, Jordan. 2016. "Reconsidering the Risks of Nuclear Power." SITN Boston. Accessed September 1, 2019. http://sitn.hms.harvard.edu/flash/2016/reconsidering-risks-nuclear-power/.

Chapter 7: Artificial Intelligence (AI)

OVERVIEW

Artificial intelligence, or AI, describes the technologies that teach machines how to simulate intelligent human behavior. In reality, *AI* is an umbrella term that encompasses multiple approaches to developing these technologies, because AI itself is a branch of computer science that focuses on creating machines that simulate how humans think, work, and react; using available data inputs, they learn to make decisions like people. AI technologies are able to perceive and respond to their environments in order to achieve the objectives defined in their programming, almost as if they were autonomous beings with the ability to think and act independently.

AI technologies demonstrate promise for accomplishing tasks at record speeds that humans would take years to complete. Yet, at the same time that AI offers so much potential, such as its ability to process big data at scale, there are limits to what it currently can do. Questions remain as to how well people will want to integrate AI into their lives, and there could be real positive and negative economic impacts for implementing the technology. There are also doubts about relying too heavily on AI, as it still requires testing to see how well it performs across multiple real-life contexts.

Many people view AI as the next major technological innovation. They anticipate that it will revolutionize many industries, including making entertainment more realistic and improving the way that businesses provide services. Some of the biggest changes may occur in medicine, marketing, and the financial sector. AI, however, is not a new concept. Ancient Greeks, Egyptians, and the Norse dreamed through their mythologies that objects could come alive with human qualities. In 1956, a group of scientists attending a conference in New Hampshire invented the term *artificial intelligence* and placed great optimism on what it could eventually do for humanity (Lewis 2014).

Interest in AI waxed and waned for decades, until 1997 when Deep Blue, an IBM supercomputer, beat world chess champion Garry Kasparov (1963–), using both programmed chess skills and lessons it had learned from IBM about human behavior. For example, Deep Blue's programming included waiting as if it were trying to figure out its next move even when it had determined the next move within seconds (Levy 2017). This humanlike behavior may have caused Kasparov to react as he would to a human player rather than respond to the calculations of mathematically derived algorithms. From 1997, AI matured, due to the increase

in computer processing power and the amount of data available for analysis. Many researchers and governments view it as a possible solution to many of the world's problems.

There are three types of AI: narrow AI, artificial general intelligence, and superintelligence. *Narrow AI* focuses on a specific task that does not require sentient intelligence. Voice recognition is an example of narrow AI that functions on a mobile phone; a phone itself consists of multiple narrow AI technologies that work either in harmony or in unison to make it fully capable. *Artificial general intelligence* (AGI) is more versatile than narrow AI. AGI does not need to solve a specific problem, but it would have the ability to apply intelligence to any problem. Technically, true AGI does not yet exist, although advances in AI bring it closer to realization every day. When it exists, it may be classified as a sentient, humanlike being.

Superintelligence is a purely hypothetical construct that, should research actualize it, may lead to great controversy. Superintelligence would outperform the most intelligent people on the planet. It would create ethical and moral questions about how it fits into society and how it should be treated. It might also play into fears that it would try to overthrow humanity or choose to perform outrageous acts. The CBS television series *Person of Interest* (2011–2016) featured two machines with superintelligence—one that tried to save the world, while the other tried to rule through surveillance and immoral actions. Although both represent fictional depictions of superintelligent AI, they demonstrate the power that some people believe AI-enabled machines will have the more human, or even godlike, they become.

Another type of computing, called *cognitive computing*, is often equated with AI. While they are similar in some ways, cognitive computing has some significant differences. For example, it often focuses on incorporating the five human senses (i.e., sight, touch, sound, smell, and taste) into computer programming. Another difference is that AI has greater autonomy. After processing data, the machine returns an answer or decision. In cognitive computing, the system is part of a human-machine team where the computer advises the human or even engages in two-way communications. Elements of cognitive computing, like the senses, could be added to an AI machine if its task required those skills. There could also be future overlap between the two that has not yet developed. In general, cognitive computing is discussed with AI, but many computer scientists would disagree that it is another type of AI.

In addition to the different types of AI, there are also different methodological approaches within the field of AI. *Machine learning* (ML) is one of the most important methods that fall under the AI umbrella. It is essentially a form a data analysis that starts with a set of algorithms. Through training on large sets of data, the machine learns what is important and starts to see connections within the data that might not be otherwise detectable. Many companies experiment with the application of ML to improve usability and functionality. For example, Google applies ML to its email service, Gmail. Initially, the ML filters suspected spam messages into a junk mail box. As a person continues to use Gmail and marks email as spam, the

ML algorithm learns how to filter those messages into the junk folder and then continues to apply them. Over time, Gmail will filter 99.9 percent of spam mail from its users inboxes (Narula 2018).

Deep Learning (DL) is a subset of ML. DL uses a technology called *neural networks*, designed to be similar to the connections of neurons in the human brain, to solve complex problems. Because it incorporates approaches from neural and neurological science, it is quickly becoming the preferred technique for training computers to solve challenging issues. For example, to solve the issue of having too few radiologists to view over a billion CAT scans to diagnose illnesses in the body annually in China, DL examines the scans to increase the accuracy of identifying cancer and decreases the errors that doctors can make due to fatigue (Marr 2018). As the neural networks learn from historical data, they continue to build on that learning by using the neural networks to process information. It is even possible for them to detect cells that are likely cancerous that a trained doctor might miss because it has extracted correlations and patterns from more people than a doctor could see in multiple lifetimes.

Countries interested in developing and applying AI technologies must consider their specific cultural and political contexts when addressing these opportunities and challenges. The United States and China lead the world in AI research, while the rest of the world accepts that AI has opportunities and challenges. According to the World Wide Web Foundation (2017), the opportunities for AI in middle- and low-income countries are employment, economic growth, and redistribution of wealth; delivery of public goods and services; and strengthening democracy. The major challenges fall into the same categories. However, the report also identifies that, instead of strengthening democracy, which has anticipated benefit from emerging digital technologies, AI could undermine some democratic principles.

Most of the benefits associated with AI are economic. One of the more controversial economic opportunities relates to employment. As a discipline, AI requires advanced training in computer science. It is not a field that is typically offered in elementary and secondary schools, although some schools around the world have begun to offer related classes. To have sufficient workers for the industries impacted by AI technologies, new training programs must emerge. Education is important because experts anticipate that AI will create 2.3 million new jobs by 2020; they also predict that one in five people will need to rely on AI at work by 2022 (Gartner 2017). These figures only look at the United States.

The numbers would be larger for the rest of the world, with the biggest losses for Mexico, Vietnam, and Indonesia and a total world job loss of 800 million when considering AI and automation (Koetsier 2018). At the same time, American companies will cut 1.8 million jobs because they will become redundant (Gartner 2017). These numbers point to a positive overall economic outlook, assuming that the needed training opportunities exist. They also suggest that many people working today will need to upgrade their skills in order to shift to work involving AI technologies. The transition period may not be smooth, as people take time to learn, especially when the skills and techniques are new.

The negative consequences are typically more political or ideological than economic, although in many ways they include a portion of all three. AI technologies can weaken democracy. EthioTelecom holds a monopoly on internet and phone connectivity and can shut them down as it chooses or as the government demands. In addition, ML techniques might be able to identify dissidents or activists based on their mobile internet usage (World Wide Web Foundation 2017). AI also has the potential to spread misinformation or propaganda over the internet, which could affect the stability of nations worldwide. Misinformation could also provide governments with the desire to strip people of their civil rights in countries where people enjoy them. These actions demonstrate how technology can weaken democracy and increase authoritarian tendencies. Thus, AI is generally not a one-size-fits-all solution to the world's most challenging problems. In some cases, its application could worsen an emerging situation.

Another, lesser known consideration in AI is the cultural bias of algorithms. Algorithms often contain hidden biases because human beings create them. All humans have biases, and while people can address them if they choose, algorithms work as programmed. If biases exist in the coding, algorithms will continue to perpetuate them. The consequences can be devastating to certain populations, not to mention the economic and political consequences they can have when algorithms make decisions with imperfect knowledge.

In the United States, for example, some cities are considering predictive policing to prevent crime. PredPol, a company hired to create algorithms to predict where crimes will take place and therefore inform local police where to apply resources, used a biased algorithm, according to a 2017 study. Researchers found that it focused heavily on police arrest reports as the main indicator of where to station the police. Because the program only received reports from areas where it sent police, it kept sending police to those same areas (Reynolds 2018). In other words, PredPol did not predict crime but rather suggested that an area that had prior arrests will have more. Without sending the police to other areas, it did not make valid predictions about criminal activity. It may also have inadvertently targeted some socioeconomic classes or racial groups because of this algorithmic bias.

Google Translate has suffered from criticism that it contains gender biases regarding jobs; in some languages, it makes doctors male and nurses female due to historical biases that certain genders perform specific jobs (Zhou 2018). Algorithms that contain biases can harm segments of the population. When they are used in AI, machines start making decisions based on these biases. Training data sets can further emphasize, or even create, additional biases. These issues have resulted in calls for algorithmic accountability to ensure that algorithms do not contain biases that can cause harm or lead to discrimination.

Despite the challenges inherent in adopting emerging technologies like AI, governments around the world are either embracing it or seeking to balance potential benefits against the people's needs. Ideally, these countries will develop policies to address the use of AI in advance of future incidents or problems with the technologies. No one nation has the answer, although many have plans under development

or are prepared to experiment with AI. The following section depicts countries in various states of AI adoption, from the more advanced to the nations that are just starting to examine AI-based solutions.

Further Reading

Gartner. 2017. "Gartner Says by 2020, Artificial Intelligence Will Create More Jobs Than It Eliminates." Accessed July 6, 2018. https://www.gartner.com/newsroom/id/3837763.

Koetsier, John. 2018. "Jobs and Robots: 25 Countries Ranked on Job Loss Potential from Automation, Robotics, and AI." *Forbes*. Accessed July 6, 2018. https://www.forbes.com/sites/johnkoetsier/2018/04/23/usa-ranks-9th-inglobal-robotics-automation-job-loss-report-after-korea-germany-japan-canada/.

Levy, Steven. 2017. "What Deep Blue Tells Us about AI in 2017." *Wired*. Accessed July 6, 2018. https://www.wired.com/2017/05/what-deep-blue-tells-us-about-ai-in-2017/.

Lewis, Tanya. 2014. "A Brief History of Artificial Intelligence." Live Science. Accessed July 6, 2018. https://www.livescience.com/49007-history-of-artificial-intelligence.html.

Marr, Bernard. 2018. "27 Incredible Examples of AI and Machine Learning in Practice." *Forbes*. Accessed May 31, 2020. https://www.forbes.com/sites/bernardmarr/2018/04/30/27-incredible-examples-of-ai-and-machine-learning-in-practice/#4348a6424a36.

Narula, Gautam. 2018. "Everyday Examples of Artificial Intelligence and Machine Learning." Tech Emergence. Accessed July 6, 2018. https://www.techemergence.com/everyday-examples-of-ai/.

Reynolds, Matt. 2018. "Biased Policing Is Made Worse by Errors in Pre-Crime Algorithms." New Scientist. Accessed July 6, 2018. https://www.newscientist.com/article/mg23631464-300-biased-policing-is-made-worse-by-errors-inpre-crime-algorithms/.

World Wide Web Foundation. 2017. "Artificial Intelligence: The Road Ahead in Low and Middle-Income Countries Foreword." Accessed May 31, 2020. https://webfoundation.org/docs/2017/07/AI_Report_WF.pdf.

Zhou, Li. 2018. "Is Your Software Racist?" Politico. Accessed July 6, 2018. https://www.politico.com/agenda/story/2018/02/07/algorithmic-bias-software-recommendations000631.

ARGENTINA

Argentina is one of South America's leaders in technology start-ups, working to foster innovation to promote economic growth and modernization. Artificial Intelligence and in particular machine learning and deep learning are technologies the country currently focuses on to increase efficiency and transform the economy, although actual application has been limited. Argentina aspires to become the regional leader in AI, drawing upon a public sector ripe for AI-enabled solutions and a private sector that is already exploring opportunities to employ digitally advanced solutions to reach consumers. To achieve its goals, Argentina must overcome some challenges that it currently faces. These include the lack of sufficient governance frameworks, the slow adoption of emerging technologies, limited support to research and development, and difficulties for start-ups to obtain the capital and resources necessary for technological advancement.

In acknowledging the advancements that AI and other emerging technologies might bring to Argentina, the government considered how to increase investments

in them. In 2017, the government passed the Ley de Emprendadores, or Entrepreneurs Law. Part of President Mauricio Macri's (1959–) efforts to open the economy to greater opportunities and make the country more competitive regionally, the Entrepreneurs Law eases the bureaucracy surrounding starting a new business, which allows start-ups to form quickly, increases access to loans and capital, and incentivizes new businesses with tax breaks. The government has also started accelerator programs to realize innovative developments and get them to market quickly.

Most countries intending to emphasize AI solutions start by implementing a national AI strategy. Argentina has paved the way for such a strategy, although it has not yet adopted one. There is a national AI strategy in draft that multiple government ministries are creating together. The effort is part of the Innovative Argentina 2030 Plan and is further supported by the 2030 Digital Agenda. A piece of the strategy includes building a National AI Innovation Hub, which will concentrate on well-designed projects and metrics to measure progress. The plan will enable AI development and adoption in the public and private sectors, covering the 2020–2030 decade.

The 2030 Digital Agenda aligns Argentina with other countries and organizations that promote AI and modernization efforts. Argentina signed the Organization for Economic Cooperation and Development's Principles on Artificial Intelligence in May 2019 along with forty-one other nations. These principles promote transparency, safety, and prosocial applications of AI, while further recommending international cooperation and development of digital and human infrastructures to support AI. Along the lines of international cooperation, Argentina had previously hosted the conference the First Artificial Intelligence Forum and Internet of Things in Smart, Sustainable Cities in Latin America, bringing together AI experts to discuss AI's potential to transform the public sector.

The economy is one of the main drivers behind Argentina's AI push. Ovanessoff and Plastino (2017) predict that AI will add US$59 billion in gross value to the Argentina's economy by 2035. Its agriculture, manufacturing, and public sectors could benefit greatly from enhancement with AI; in fact, a group of U.S. researchers used AI to predict soybean yields in Argentina with some success based on limited data.

Argentina has several AI success stories, though they are fewer than in other parts of the region. Prometea is an AI program designed to streamline the judicial system inspired by Apple's Siri. Users tell the system what they need, and the program then uses machine learning and other algorithms to create documents and return information from search requests (Gillespie 2018). The program can also offer solutions with a predicted success rate, although its predictions are limited to situations and issues for which it has been trained. The automation of processes allows judicial employees and lawyers to work faster and make more informed decisions (Bederman 2019). Emi Labs offers an AI-enabled virtual assistant to human resource departments. It automates mechanical tasks, such as résumé screening and scheduling appointments. S4, an Argentina-based company, developed a technique that draws on satellite and weather information to predict

climate risks to farmers and crops. Banco Marco has been working with IBM to develop AI techniques to detect banking fraud and improve outcomes for account holders.

Building local AI solutions is important for Argentina, as for Latin America as a whole, because some of the issues society faces may not be replicated in other parts of the world. One localized AI solution comes from Chazki, a Peruvian company that built a robot to remap the entire postal system through learning coordinates. In many parts of Latin America, including the outskirts of Buenos Aires, formal addresses do not exist, but rather descriptive locations are used, which challenge nonlocals unfamiliar with the area. Some locations have no official addresses. This new solution allows the post office to deliver mail correctly to recipients, regardless of whether they have an official or descriptive address. In an Argentine example, Buenos Aires has started using dashboards reliant on algorithms to determine where to provide direct investments to improve the city. These dashboards are for investor use rather than the government itself, allowing investors to make informed decisions about the best locations to open businesses or start other projects.

While promising much for the country, Argentina's AI use is still prone to challenges and even public debate. The Province of Salta, for example, has implemented AI to determine when someone is prone to teenage pregnancy or will drop out of school in order to coordinate resources for high-risk cases. In an external, expert review of this solution, experts have determined that it is error-prone and potentially even ineffective due to biases in the training data (LIAA 2018).

Moreover, the project has received criticism from advocates who believe it violates privacy rights, especially since it looks at data on underage populations, and only reactively identifies people at risk rather than provide a proactive solution to social problems. Data storage is also a question; because the data contains personally identifying information, its protection and security must be held at high standards. Whether Salta has been able to secure the data appropriately is a serious matter. There remains little information on how the program translates into support for school dropouts or in preventing teenage pregnancies, meaning that the effectiveness of this technology, in addition to the potential privacy and discriminatory risks to teenagers, is unknown.

Argentina has already started to address its challenges to AI development and adoption. The National AI strategy will lay out what needs to be done to create a sufficient governance framework. It should lead to improvements in digital infrastructure and create spaces for increased engagement and cooperation. Additional prioritization will be needed to increase support to research and development, and changes may be necessary in the financial sector to allow innovators and entrepreneurs access to loans and other capital required for AI investment. The 2017 Entrepreneurship Law completed another step in this direction.

With the initial steps already taken, Argentina may be well on the path to using AI to improve economic growth and, ultimately, to achieve its goal to be a regional leader in AI and AI-enabled technologies. With new policies that address the issues

that have historically constrained investors, Argentina will reduce investment risks, creating a more stable, supported environment for new businesses. While this is occurring, the government will also need to establish standards and best practices for AI developers that require privacy protections that align with data protection laws, risk mitigation, transparency, and, at least to some degree, explainability. The government will also have to consider other areas, such as increased cybersecurity, where improvement is required to sustain technical innovation.

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Further Reading

Bederman, Uriel. 2019. "Prometea, una inteligencia artificial hecha en la Argentina que sacude la burocracia judicial." *TN Techno*. Accessed August 25, 2019. https://tn.com.ar/tecno/f5/prometea-una-inteligencia-artificial-hechaen-la-argentina-que-sacude-la-burocracia-judicial_983174.

Gillespie, Patrick. 2018. "This AI Startup Generates Legal Papers Without Lawyers, and Suggests a Ruling." Bloomberg. Accessed August 25, 2019. https://www.bloomberg.com/news/articles/2018-10-26/this-aistartup-generates-legal-papers-without-lawyers-and-suggests-a-ruling.

Laboratorio de Inteligencia Artificial Aplicada (LIAA). 2018. "Sobre la predicción automática de embarazos adolescentes." Accessed May 31, 2020. https://liaa.dc.uba.ar/es/sobre-la-prediccion-automatica-de-embarazos-adolescentes/.

Ovanessoff, Armen, and Eduardo Plastino. 2017. "How Artificial Intelligence Can Drive South America's Growth." Accenture. Accessed August 24, 2019. https://www.accenture.com/_acnmedia/pdf-48/accenture-ai-southamerica.pdfla=es-la.

CHINA

As with other key aspects of the information technology sector in China, research into artificial intelligence began later and at a slower pace than in Europe and the United States. In the West, the field of AI dates back to the 1940s as an extension of mathematical logic. Although progress has not been consistent—the failure of early programming to meet greatly hyped expectations led to an "AI winter" in the 1980s, when research funds were drastically cut—universities and corporations in Europe and North America have maintained robust IT departments focused on fundamental research. China, however, is a relative newcomer to the field and has only recently begun to spend an enormous amount of capital in efforts to become a leader in AI technology.

China experienced its own Sputnik moment in 2016 when AlphaGo, an AI system developed by the Google-owned company DeepMind, began to topple world masters in the game of Go. Go, an ancient game with deep roots in Chinese history, philosophy, and even military strategy, is not particularly popular in the West, and the idea that an American-owned corporation could design a program to beat the world's best players caught many in Beijing off guard. Within months, Chinese Communist Party (CCP) leaders and government-associated think tanks issued edicts and published white papers for IT companies to begin investing heavily in AI research and development.

AI researchers have historically focused on programming through if/then statements and symbolic logic. Only recently, with the introduction of massive data sets coupled with fast, cheap processors, has AI begun to approach the type of applications that were initially promised (Calo 2017). Researchers have focused less on trying to recreate the human mind completely and instead are exploring new subfields like machine learning and computer vision, areas where computers have the potential to far surpass human abilities. Following the spectacular success of AlphaGo, Chinese leaders were quick to embrace the idea of AI as a powerful tool capable of reshaping their economy and closing critical gaps with strategic competitors like Japan and the United States.

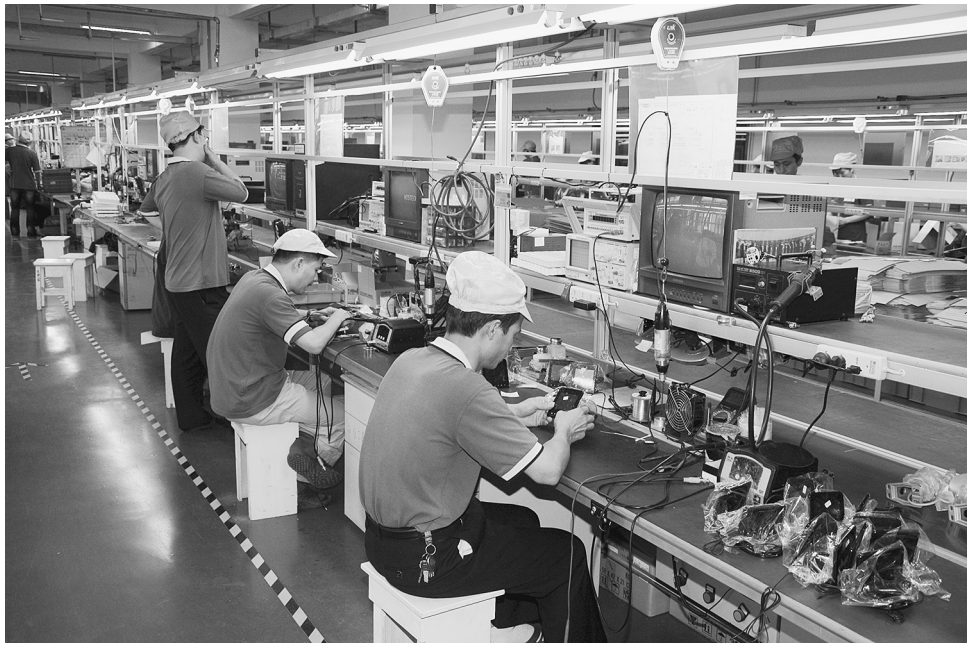
Starting in 2017, the CCP issued a series of industrial policy papers highlighting the importance of using AI to shift China's economy to advanced manufacturing. Key among these papers was the fifteen-year New Generation Artificial Intelligence Development Plan, which called for goalposts like homegrown AI systems to match those developed in the West by 2020, new technologies by 2025, and solidification of China's role as a global leader in AI by 2030. Although these nebulous goals are unlikely to be established purely through political decrees, private corporations have already started investing heavily in research and development to meet them.

The ability to corral private firms into following government priorities is one of several key factors that potentially provide China with an advantage over other countries. In the United States, free market capitalism has allowed a handful of homegrown innovators to dominate; companies like Google and Facebook have used their vast troves of data and hefty coffers to crowd out or purchase potential competitors. In China, on the other hand, CCP leadership is willing to bet that a more disciplined, regimented approach will help its own burgeoning firms leapfrog over their Western counterparts. This top-down approach, with the Chinese government essentially choosing the winners in its own domestic AI competition, provides its local champions with access not only to generous state subsidies but also to the CCP's massive data sets on its own citizens.

The massive amount of data in turn leads to another key advantage for China's AI industry: a general lack of privacy concerns among the Chinese public. Even as democratic societies struggle with how to protect personal information in an age of omnipresent social media and constant security breaches, Chinese society has appeared to accept, begrudgingly, the fact that the government engages in mass surveillance and compiles reams of information on its citizenry. These data sets are exactly what modern AI requires. A common adage among software engineers is that the software is only as good as the data behind it, and this is particularly true for modern applications like evolutionary computing, artificial networks, and transfer learning (Zhu, Huang, Chen, and Gao 2018).

Facial Recognition

This uninhibited access to reams of data has already led China to become a leader in certain technologies, most notably computer or machine vision. Machine vision plays a role in a myriad of functions, such as automated manufacturing, 3-D



Chinese workers assemble CCTV surveillance cameras at a factory in Shenzhen. CCTV cameras that use artificial intelligence and facial recognition connect the entire country for law enforcement and the social credit score system. More than 200 million cameras cover the nation's public spaces, and surveillance technologies are growing as some of the country's major technological exports abroad. (Bartlomiej Magierowski/Dreamstime.com)

printing, and self-driving vehicles, but China has made the greatest progress in applying it to facial recognition programs. The government maintains a vast surveillance network to monitor its citizens for any signs of unrest that may undermine the authority of the CCP. Key to this effort are the 200 million security cameras that surveil all public spaces; the government hopes to connect this sprawling network to various databases that track internet connections, hotel stays, and car travel. Some local governments have already demonstrated computer programs that can scan crowds for wanted criminals, debtors, or even jaywalkers.

The Chinese companies behind these programs are developing globally competitive applications, due in no small part to the fact that they have been able to fine-tune their algorithms on biometrics contained in the obligatory resident identity cards and the associated household registration databases. However, many elements are still being fine-tuned, and companies are taking advantage of cheap labor by having thousands of employees manually filter and classify images. The resulting resource and computing intensity mean that these programs have yet to be rolled out in every city but are mainly limited to areas where the CCP has security concerns, like the western province of Xinjiang.

Xinjiang's Muslim population, the Uighurs, are seen by many of China's ruling elite as a threat, either in form of separatists or religious extremists. As a result,

cities in Xinjiang have the highest penetration rates of surveillance equipment, with several cities even having facial recognition checkpoints established at gas stations, shopping centers, mosques, and other public locations (Larson 2018). Domestic firms are advertising that the programs used at these checkpoints are more than 97 percent accurate; while this might be an exaggeration, such claims have drawn the attention of foreign governments wanting to bulk up their own security programs. China has shown itself willing to sell or, in some cases, donate such equipment to police states, cornering a market that Western democracies have traditionally been unwilling to engage.

Social Credit System

Even as Uighurs deal with an intrusive set of surveillance programs, most Chinese citizens' direct experience with AI is in the form of the nation's Social Credit System (SCS). Whereas Xinjiang represents a draconian vision of the CCP's efforts to crack down on dissent, the SCS is seen as a way to make life more convenient for ordinary citizens and a new method for rooting out fraud and corruption. Officially launched in 2014 but based upon a number of earlier initiatives, the SCS was initially part of a larger move to modernize China's legal system by introducing cutting-edge technologies. In planning documents, the SCS is described as a mechanism to enhance trustworthiness and promote the traditional values being undermined by the shift to a more capitalist society (Creemers 2018).

In essence, this means that the SCS inflicts a series of punishments and rewards based upon behavioral patterns culled from both government and commercial databases. Citizens with a high SCS score—those who have paid their bills on time, have property, and maintain stable incomes—are eligible for perks like discounts when renting vehicles or easier access to bank loans through reduced paperwork or waived application fees. While these perks are not very different than financial credit systems in countries like the United States, the system's punitive components are unique and potentially problematic. Not only are finances taken into account

China announced in 2014 that it would develop a social credit system for its citizens. The system uses big data, or essentially all the information it can gather from electronic and nonelectronic means, to rate a person's trustworthiness, which is often equated with loyalty to the Chinese state (Rollet 2018). People who earn and maintain higher scores receive special benefits, such as not waiting in lines for coveted services, gaining better status on dating sites, earning scholarships, taking out bank loans, and many other privileges. Behavior that can legally lower credit scores include playing video games for long periods of time during the day. Penalties for low scores include limiting where one can shop and preventing the purchase of a bus or plane ticket for travel. The pilot system launched in 2018, and the government plans to extend it to every citizen and corporation operating in the country by 2020.

by the SCS but also minor transgressions like petty theft and traffic violations can weigh heavily against an individual's score. Nightmare scenarios of being denied credit cards or even access into a university are beginning to bubble up online. More troubling is the potential to be added to the government's List of Dishonest Persons Subject to Enforcement due to particularly low scores, where citizens are essentially banned from being able to purchase property, take out loans, or even travel abroad.

Much like facial recognition programs, the SCS is still under development, and the rollout of pilot programs is still patchy. Contrary to the breathless reporting in Western media, many of the more ominous, Orwellian-sounding elements like tracking behavior on online dating apps or monitoring purchase habits are largely optional on behalf of consumers at this point. But the very idea that the Chinese government works so closely with the private sector to share information and develop security programs is something of an anathema in more privacy-minded countries. This cooperation, coupled with the sheer amount of data created by an estimated 751 million internet users, is propelling China to the forefront of the AI race. The West may have a leg up in developing cutting-edge technology, but the CCP is willing to bet that it can use its structural advantages to quickly catch up.

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Further Reading

Allen, Gregory C. 2019. "Understanding China's AI Strategy." Center for a New American Security. Accessed June 18, 2019. https://www.cnas.org/publications/reports/understanding-chinas-ai-strategy.

Calo, Ryan. 2017. "Artificial Intelligence Policy: A Primer and a Roadmap." SSRN. Accessed June 18, 2019. https://doi.org/10.2139/ssrn.3015350.

Creemers, Rogier. 2018. "China's Social Credit System: An Evolving Practice of Control." Accessed June 18, 2019. http://www.iberchina.org/files/2018/social_credit_china.pdf.

Larson, Christina. 2018. "China's AI Imperative." *Science*. Accessed June 18, 2019. http://science.sciencemag.org/content/359/6376/628.

Zhu, Jun, Tiejun Huang, Wenguang Chen, and Wen Gao. 2018. "The Future of Artificial Intelligence in China." *Communications of the ACM* 61 (11). Accessed June 18, 2019. http://delivery.acm.org/10.1145/3240000/3239540/p44-zhu.pdf.

ESTONIA

Estonia prides itself on technological innovation. It has been at the forefront of technological development and deployment of digital solutions; it is the first nation to codify internet access as an inviolable human right and the first to implement an e-residency program. Part of the reason the country can support high innovation levels is because it contains a small population when compared to other nations. Another reason is that the country values creative, long-term thinking to address current and future challenges. Along these lines, Estonia views Artificial Intelligence as a cutting-edge modernization tool that, when applied appropriately, can reduce society's workload, increase leisure time, and heighten productivity.

Estonians use a unique method to explain complex technical ideas such as AI. They draw upon centuries of local mythology to explain the concept using local cultural analogies that citizens have understood since birth. For AI, Estonians draw upon a character named Kratt, a creature that traditionally comes to life from hay. When a potential master, often depicted as the devil, wants to own Kratt, the master gives it a soul. Once Kratt has received its soul, it becomes a slave to its master. When the analogy is applied in context, Kratt represents the AI. The soul is the algorithm used in AI. Once the algorithm functions, the AI can serve its creator (Kaevats 2017). Analogies such as these make difficult concepts like AI more accessible to laypeople.

Because of the interest in applying AI-based solutions to real world issues, and doing so well ahead of many other nations, Estonia is one of the first nations to struggle with advanced legal and philosophical questions surrounding AI. The government and the public must grapple with both the rewards and the challenges of implementing AI, especially in respect to the policy, legal, and ethical issues that such technologies create.

Estonia is one of the world leaders in e-governance, which is essentially a type of governance that relies on information and communication technologies to interact with citizens, businesses, and other entities to perform a wide range of government functions. Despite the success of e-governance in the country, officials believe that AI will provide better services for Estonian residents. To explore the issue further, the government's digital innovation office has initiated conversations across the government and with the public on how to deploy AI to improve citizen's lives. Specifically, officials have an interest in understanding the legal and technical frameworks required to implement government services and perform other functions through applied AI technologies. The issue has increased in importance since the successful test drive of a driverless car in 2017. Since this time, Estonia's desire to develop fully autonomous robots and vehicles has risen alongside the public's demands for proactive state services.

AI has been successful in improving government response times for citizen's questions on e-residency, a program that allows people from anywhere in the world who meet the country's qualifications to become residents regardless of their home country. In early 2018, the government launched an AI-enabled chatbot technology to respond to e-residency inquiries faster without requiring the government to add employees. The other advantage is that chatbots are available to anyone, anywhere, who has internet access. Therefore, chatbot services are persistent; they are always accessible at any time of the day or night, as opposed to employees who, by law, have restrictions on the number of hours worked before special benefits, such as overtime, must be paid. To date, Estonia's e-residency chatbots have around a 45 percent success rate for solving customer issues before they are elevated to a human (Kaarma 2018). Chatbots have the potential to serve other government institutions and businesses in a similar manner, saving time and cutting costs.

The legal issues surrounding AI in Estonia are related to its rights and responsibilities. To perform functions of governance and daily life, the rights of AI must be clearly delineated. For example, if a mobile phone user wanted a service like Alexa or Siri to do something on their behalf, such as purchase songs or videos online, the AI component must have the legal right to enter into the transaction. From another angle, AI also makes decisions based on available data and the algorithms it contains. In an instance where the data was incomplete or the algorithms biased, AI might make poor decisions. One solution under consideration is the establishment of rights for robot agents, a category that would fall between the rights of people and those of property (Tashea 2017). The decisions in e-governance affect people's lives, and without clearly defined rights and responsibilities, restitution for damages might be impossible, leaving people in a worse position.

Estonia has an advantage over some nations when it comes to AI. Instead of speaking of AI in hypotheticals, such as superintelligent AI, Estonians understand that they are referencing fully autonomous information systems. These are a type of narrow AI that, either individually or bundled with other autonomous information systems, perform a specific function. They are designed to complete specific, focused tasks rather than attempt to solve multiple problems at the same time. By focusing on discrete tasks, the government can focus on the issues and services the public considers the most important.

Recognizing the need to address the present and future challenges of AI, the Government Office and the Ministry of Economic Affairs and Communications created a specialized experts group. Their earlier tasks included developing a bill to utilize autonomous information systems, and their largest assignment was to develop a national AI strategy (Government of Estonia 2018). The strategy and roadmap were released in 2019. While Estonia was not be the first to develop an AI strategy, it joined the ranks of nations like Canada, Japan, Singapore, China, France, and Italy as some of the earliest adopters of AI for governance and improved social welfare (Dutton 2018). Estonia may still be, however, the first country to consider granting rights to the AI-enabled technologies that carry out people's requests.

An additional reason the country needs to develop a coherent strategy involves the desire to augment humans with AI. In February 2018, the Estonian government joined representatives from other nations and some of the world's largest technology firms to discuss AI in the future. Of the topics discussed, augmenting humans with AI received a great deal of attention. The idea would be to use AI for practical purposes, such as creating contact lenses with the ability to monitor glucose levels in diabetic or at-risk patients. Using AI or other technologies to enhance the body could complement the AI that is speeding up services. However, it comes with its own moral, ethical, and legal questions that remain unresolved at present.

As part of its strategy to develop AI, as well as to protect against cyber threats, Estonia seeks international partnerships. In May 2018, Estonia and Canada signed an agreement on digital cooperation. The agreement allows for exchange of ideas and technologies including AI that the Estonian government wanted. Meanwhile,

the Canadians look to learn lessons about Estonia's experience with e-residency (Vahtla 2018). Estonia also houses the North Atlantic Treaty Organization Cooperative Cyber Defence Centre of Excellence, which allows NATO member states and invited guests to pool their expertise on cyberthreats posed by neighboring states, such as Russia. Researchers at the center have considered both the offensive and defensive use of AI and automated intelligent agents (Guarino 2013; Tyugu 2011). They continue to explore the advantages and disadvantages of adopting AI-enabled technologies to operate in cyberspace.

The government is not alone in the country's quest to develop advanced AI applications. The country currently hosts a number of groups for interested persons, such as informal Meet Up groups that attract local internet users through forum discussions and in-person meetings. Estonian researchers apply AI to solving challenging problems. Mait Müntel (1977–), a former particle physicist at CERN, started a company that uses AI algorithms to enhance language learning. His company's app, Lingvist, is highly acclaimed across Europe. Universities have started enhancing their computer science programs to allow for more training related to AI and robotics. These examples demonstrate the growing interest and successes in the hobbyist, academic, and business worlds within the country.

However, there are risks embedded in highly technological innovations, especially as they involve the internet or other computer networks, which pose challenges for Estonia. The country was the first cyberattack victim in history, when hackers invaded its computer systems in 2007. While the government works diligently to protect its cyber capabilities and the data associated with them, such as Estonia's genetics database, more connected or interconnected systems can lead to greater vulnerabilities from cyberactors. Hacking is not the only area in which technology may enable cyber, or even lethal, attacks. In the era of AI, President Kersti Kaljulaid (1969–) has expressed her belief that there is a 50 percent chance that by midcentury, AI-enabled technologies will have developed to the point that they can launch lethal attacks (Aitoro 2018). To mitigate cyberthreats, the Estonian government must be vigilant. It also has help from its citizens, the Cyber Defence Unit, a group of volunteers with deep expertise in technology, cybersecurity, and other fields who wish to protect the country.

Estonia's innovation and push to harness AI is characteristic of the country. Along with countries such as the United Arab Emirates, Estonia demonstrates that a country's technical capability has nothing to do with its size, but rather with drive and investments. There is also a cultural component that accepts innovations and the associated risks. Estonians understand how technology such as AI can improve their lives and are moving toward a plan that addresses the benefits and reduces the inherent risks.

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Further Reading

Aitoro, Jill. 2018. "AI Warfare Is Coming, and Some Global Leaders Say NATO Isn't Ready." *Defense News*. Accessed May 31, 2020. https://www.defensenews.com/smr/munich

-security-forum/2018/02/16/ai-warfare-is-coming-and-some-global-leaders-say-nato-isnt-ready/.

Dutton, Tim. 2018. "An Overview of National AI Strategies." Medium. Accessed July 19, 2018. https://medium.com/politicsai/an-overview-of-national-ai-strategies-2a70ec6edfd.

Government of Estonia. 2018. "Estonia Will Have an Artificial Intelligence Strategy." Accessed March 18, 2020. https://riigikantselei.ee/en/news/estonia-will-have-artificial-intelligence-strategy.

Guarino, Alessandro. 2013. "Autonomous Intelligent Agents in Cyber Offence." In *5th International Conference on Cyber Conflict*. Tallinn: CCD COE Publications. Accessed July 19, 2018. http://www.ccdcoe.org/cycon/2013/proceedings/d1r1s9_guarino.pdf.

Kaarma, Juhan. 2018. "How E-Residency of Estonia Uses AI to Help Users Get Answers Instantly and Increase Customer Satisfaction." *Chatbots Magazine*. Accessed May 31, 2020. https://chatbotsmagazine.com/how-e-residency-of-estonia-uses-ai-to-help-users-get-answers-instantly-and-increase-customer-e07e052beb4f?gi=80aa48434353.

Tashea, Jason. 2017. "Estonia Considering New Legal Status for Artificial Intelligence." *ABA Journal*. Accessed July 19, 2018. http://www.abajournal.com/news/article/estonia_considering_new_legal_status_for_ai.

Tyugu, Enn. 2011. "Artificial Intelligence in Cyber Defense." In *3rd International Conference on Cyber Conflict*. Tallinn: CCD COE Publications, 95–105. Accessed May 31, 2020. https://www.ccdcoe.org/uploads/2018/10/ArtificialIntelligenceInCyberDefense-Tyugu.pdf.

Vahtla, Aili. 2018. "Estonia, Canada Sign Digital Cooperation Agreement." EER News. Accessed July 19, 2018. https://news.err.ee/836025/estonia-canada-sign-digital-cooperation-agreement.

NIGERIA

Across Africa, there are several countries that have built technology hubs, and Nigeria has seen great success with its efforts. As the most populous country in Africa with a population of 197 million (World Bank 2019), most of whom are under age twenty-five (Nigeria Data Portal 2006), Nigeria's fast-growing technology sector is developing solutions in artificial intelligence from grassroots projects. Developers with an entrepreneurial eye have emphasized language diversity and the nascent internet infrastructure to their advantage. The country has over 500 living languages, and nineteen are institutional, which means that most online services have not been created for these languages, data from these languages used in the development of other technologies does not exist, and the infrastructure to collect the data may also not have been built yet. All of this represents opportunities where Nigerians have gotten creative. Many young Nigerians are seeking training and education in AI to meet these needs and satisfy local demands for technology. As Nigeria's AI grows, it will be applied to health, transportation, food production, and public services by developers who want to bring the emerging technology to bear on their experience and see the future as one with technology-enabled services.

One such entrepreneur, the founder of Yorubanames, Kọ́lá Túbọ̀sún (1981–), says,

> One thing I'd tell anyone about the emerging technology scene is that it is dynamic and fecund. People are approaching many of the problems peculiar to the Nigerian environment and trying to solve them, to varying degrees—financial, language, health, food, etc. There are startups that help people save money, like PiggyBank.ng. There are those like mine that help improve inclusion through language and technology by creating speech synthesis, voice recognition etc. There are those like LifeBank.ng which focuses on logistics and helping patients get access to blood during emergencies. There is Paystack which help people pay for services more efficiently. There's Andela which trains people in software development and gets them remote jobs. There is Hotels.ng which helps people book hotels easily. There are other logistics and transport services like Max.ng and Gokada, etc. Just think of any local problem and you'll find people creating startups to fix the problem (Túbọ̀sún 2019).

Each example Mr. Túbọ̀sún shared has either addressed a need specific to the Nigerian context or provided a Nigerian perspective on a conventional product so that user requirements are met with a tailored design approach. For example, LifeBank.ng was developed by Temie Giwa-Tubosun (1985–) to respond to the extreme shortage of basic medical supplies. Her personal experience with receiving quality medical attention during a difficult childbirth drove her to develop LifeBank to ensure that her experience could reach others and improve care outcomes. The online app links medical professionals with blood banks and logistics that can transport the blood in locked, cooled containers to the recipients. The app filters requests by location and basic triage. Lifebanks' success quickly allowed it to expand its radius of service and staff and to add oxygen and vaccines to its deliveries. By contrast, Hotels.ng adapted traditional online hospitality services to a platform specific to Nigerian needs and offers support and reviews around the priorities of its customers.

Young Nigerians are seeking the skills to become AI developers. The thirst for this capability outpaces many universities' degree offerings, so students turn to online and local community courses where they can quickly gain practical experience. AI Saturdays, located in several major cities across Nigeria, were launched to fill this need. A founding member, Tejumade Afonja (c. 1995–), describes the boot camp's education mission as a community service that aims to "democratize AI." The sixteen-week boot camp offers newcomers to AI programming a project-based team setting to learn. The group is focused on continually improving their approach to education. Already, their courses are booked to capacity (Afonja 2019; Snow 2019).

Among the areas where Nigeria has led in technology development is language. First, advanced technologies for natural language processing (NLP) and automatic speech recognition (ASR) are crucial components in the field of AI. These technologies transform human language or speech into something a computer can understand and process. They allow us to communicate with computers. NLP and ASR technologies increase not only accessibility to current applications for millions of users but also the localized data these users can contribute to which machine learning techniques rely on.

For AI to represent users and requirements of any group, it needs representative data and programmers who know how to put that data into context. Moreover, language is how we think, imagine, make decisions, and problem solve to create new technology solutions. We don't initially think in code; we do our best thinking in our first language. As the creators of the YorubaNames suite of applications describe, language plays a critical role in technology: "First, we have always believed that development comes from innovation and that innovation cannot happen when one cannot think properly in their mother tongue" (Túbọ̀sún 2018).

Additionally, the data we produce as language in applications online and in mobile apps such as social media, even simple image tagging, becomes the data sources for training in machine learning techniques. This is one of the most common types of AI. Examples of ML include the famous AlphaGo and its successor, AlphaZero, that were "trained" from playing and "learned" the complex game of Go well enough to beat the best human players (DeepMind 2019).

One of the limiting factors for ML has been insufficient amounts of training data, particularly in African languages. In Nigeria, even with the rise in mobile phone use, individuals have been more likely to call than to text. This happens for many reasons. First, people prefer to talk as a mode of communication. Also, many languages are tonal, and this attribute comes across more clearly when speaking than texting, as the keyboards and scripts were not developed to support tonal languages. Nigeria has been at the forefront of developing keyboards and text-to-speech products for Yoruba and Igbo, languages which require tonal markings.

The platforms YorubaName.com and IgboName.com were built to bridge the gap for speakers of unsupported languages and facilitate a more natural use of text-based communication in their native language. The associated products include online crowdsourced dictionaries and speech-to-text applications to aid pronunciation for language learners. The site describes a specific problem their work addresses that can be expanded to other populations: "Many languages on the continent are tonal yet most of the software and hardware tools we have were not developed with tone-marking capabilities or users like you in mind. The little we find are either not easy to use due to complicated keystrokes, not easy to access because of where they are produced, or not affordable to the common man who just wants to write an email or a text in his native language" (blog.yorubaname n.d.). Additionally, there is an assumption in NLP/ASR training data that humans speak one language at a time, because the preponderance of projects has been initiated by monolinguals. However, in Nigeria, switching between languages, even in the course of one sentence, is quite common. Training AI to consider this type of communication is sparse, but emerging.

Another AI innovation happening in Nigeria is looking at how to perform ML with small data sets with an emerging technology called *edge computing*. Because there isn't enough data yet and access to cloud computing via internet infrastructure isn't consistent, finding efficient new computing methods are a priority for developers in Nigeria. Data from devices can be processed without going to cloud

farms far away over the internet. This saves time because of the shorter distance and because some computing tasks will not need to fight the increasing internet traffic to use cloud services. "Proof-of concept in evidence from pilot projects demonstrates that a variety of applications benefit from using the edge including online games, health care apps, military applications and autonomous cars," wrote Blesson Varghese (2018).

For objects, satellites have accrued an enormous amount of geospatial imagery that can show patterns in ecology and food production. These data sets have been used for training ML techniques to improve crop yields and learn about the factors that affect food production from precipitation levels to the influence of insects as well as nutrition value. These efforts can improve food security by spotting problems before they become crises. Another food-related project, Chownet, looks at African foods in order to develop an image classification system that recognizes dishes that are commonly made in Nigeria and the region (Afonja 2018). Love of food and cooking is a mainstay of the culture, so it is important to be able to share images across various platforms with easy tagging and aggregation for users to build a repository of data that can be leveraged for rating system platforms and business marketing and can be extended to other topics and user bases. This type of ML combines algorithms that could be trained to find patterns in images as objects with text-based learning for naming categories.

Nigeria will certainly remain at the forefront of AI innovation because of the energy and creativity of the developers using their own experiences with language, health, commerce, education, and more to evolve technologies in new and interesting directions that bring real solutions to their communities and beyond.

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Further Reading

Afonja, Tejumade. 2018. "AISaturdaysLagos: #LagosAIHack." Medium. Accessed September 22, 2019. https://medium.com/ai-saturdays/aisaturdaylagoslagosaihack-8479b3f53169.

Afonja, Tejumade. 2019. Personal Communication with the Author. May 10.

blog.yorubaname. n.d. "Yorùbá + Igbo Keyboard." Accessed September 22, 2019. http://blog.yorubaname.com/keyboards/.

DeepMind. 2019. "The Story of AlphaGo So Far." Accessed September 22, 2019. https://deepmind.com/research/alphago/.

Eberhard, D.M., G. F. Simons, and C.D. Fennig. 2019. *Ethnologue: Languages of the World*. 22nd ed. Dallas, TX: SIL International.

Nigeria Data Portal. 2019. "Nigeria Census." Accessed September 22, 2019. http://nigeria.opendataforafrica.org/xspplpb/nigeria-census.

Snow, Jackie. 2019. "How Africa Is Seizing an AI Opportunity." *Fast Company*. Accessed September 22, 2019. https://www.fastcompany.com/90308114/how-africa-is-seizing-an-ai-opportunity.

Túbọ̀sún, Kọ̀lá. 2018. "It's Time for an Online Yoruba Dictionary." Yoruba Name. Accessed September 22, 2019. http://blog.yorubaname.com/.

Túbọ̀sún, Kọ̀lá. 2019. Personal Communication with the Author. May 14.

Varghese, Blesson. 2018. "Forget the Cloud, Soon We'll Be on the 'Edge' When It Comes to Smart Tech." Phys.org. Accessed September 22, 2019. https://phys.org/news/2018-11-cloud-edge-smart-tech.html.
World Bank. 2019. "The World Bank in Nigeria: Overview." Accessed September 22, 2019. https://www.worldbank.org/en/country/nigeria/overview.

RUSSIA

Russian technology does not grab the world's attention as it once did during the twentieth century. At that time, Soviet nuclear missiles and biological weapons formed the centerpiece of an aggressive attempt to close the technology gaps between the more advanced Western world and its communist enemies. That technological battle, like the larger Cold War in which it was fought, was won by the United States and its allies. Today's Russian leaders remember the humiliation of that defeat after the glories of the Great Patriotic War fifty years earlier. The Soviets fielded some of the most effective tanks, aircraft, and short-range rockets in World War II (1939–1945), but transferring those advantages to the Cold War and beyond proved more than Russia could endure. The situation is changing, however.

With the return of Russian imperialism following the rise of Vladimir Putin (1952–), Russian technology, in particular *military cybernetics* as they were called in the last century, has taken advantage of Russia's asymmetric position relative to the United States. By leapfrogging data transfer and storage infrastructure to wireless and cloud-based systems, Russian has received large dividends from small investments. Therefore, unlike the massive military-industrial complex that consumed the Soviet Union's budget in the 1980s, early twenty-first-century cyberdevelopment looks more like a lean and mean venture capitalist start-up within traditional military procurements.

At the heart of the new approach lies machine learning and its more advanced variant, artificial intelligence. In early September 2017, President Putin declared that "AI is the future . . . whoever becomes the leader in this sphere will become ruler of the world" (Vincent 2017). Why did he emphasize an unproven, potentially disastrous technology as the sole definition of global power? Part of the answer lies in the nature of Russia, part in historical great power competition, and part in the technology itself.

Not a Normal State, but a Normal Empire

Conquest defines Russian history. Despite being on the receiving end of overwhelming violence by the Mongols, Napoleon, and the Nazis, the Kremlin has spent centuries subjugating others to its will. The bitterness of suffering combines with a messianic view to bring stability to the motherland and beyond through sheer power and will, thereby enshrining Russia's exceptional place in history and the world. As the sole Eurasian great power, straddling nearly the same number of

time zones as the continental United States, Europe, and China combined, Russia's place in global geography speaks for itself. Abundant natural resources in oil, gas, timber, diamonds, and precious minerals—including uranium for nuclear weapons—have defined Russian strategy throughout its history. With such power resources at its disposal, the Kremlin has quite easily compared Russia to past empires as the "Third Rome," responsible for ensuring domestic control amid international dominance.

Yet the Kremlin today does not need past draconian measures to control a largely passive and poor population. Unlike the growing middle-class expectations for freedom and protection from state abuses within communist China, Russian economic woes and demographic decline signal less societal threat to overt Kremlin rule. In such context, imperial narratives supply the external enemy and a pathway to national glory, leaving domestic control squarely in the hands of the Kremlin and Putin's quest for greatness.

The Return of Great Power Competition

Greatness is hard to come by, though, because international politics is a rough business. Statecraft requires the use of all elements of national power to pursue national interests, often including the brutality of conflict in those pursuits. This defines how states, especially those with great power to affect others, approach the world around them. Such is the current global competition between the United States and its allies, Russia and its fellow dictatorships, and China and its dominated neighbors.

Foremost, great powers seek more power, and always at the expense of others seeking the same. That does not mean that cooperation is impossible; quite the contrary, as any and all means of international relations are viable tools in the pursuit of power. Power is substitutable in that sense; it can be used for many diverse things because it comes in so many different forms. Since definitions and applications of power are so diffuse, the primary method of great power competition is hybrid in nature.

As a form of full-spectrum conflict, hybrid warfare spans the political, psychological, financial, and, critically important for the future, technological means of power, as much as the geographic and resource-driven aspects of statehood. In that regard, hybrid warfare means everything can be operationalized, so everything must be accounted for in both defense and offense. Such a system poses grave risks for escalation, and until clear "red lines" and areas of compromise arise in the current competition space, adversaries will continue to pursue advantages as quickly as possible. Machine learning and AI promise to deliver much in those pursuits.

Rise of the Machines, Sort Of

Perhaps the single greatest analytical challenge in assessing current threats and future warnings results from an odd word: *heteroscedasticity.* Despite its convoluted

pronunciation, the word's meaning is actually quite simple: variations vary across the range of outcomes. More simply put, the things we see and analyze change in different ways. Chaos theory attempts to make sense of this by showing that an underlying order defines the observable mishmash of results. Social sciences break the universe of cases into smaller more manageable categories, and big data analytics assist by collecting and collating massive amounts of information in fractions of the time needed by human analysis. Whether based on projections that it would take 5 million years to watch all the videos transmitted globally each month in 2020 or the rapid rise of facial recognition uses by China's CloudWalk technology, set to monitor millions outside of China as well as hundreds of millions within it, there is simply too much information to process and too limited human cognition to prioritize it.

Machine learning, in particular deep learning based on artificial neural networks, has entered the national security construct with more than just bluster. Relying on both "human in the loop" and "human out of the loop" processing, AI raises the stakes for conflict even as its necessity becomes increasingly ubiquitous. As President Putin remarked, ruling the AI arms race gives tremendous advantage. Yet while the rise of the "cyber arms bazaar" has fostered state power, it also threatens to undermine governments' control over their populations (Walther-Puri, Boyle, Henry, and Madsen 2019). Communist China's headlong rush to build the Great Firewall attempts to counter the destabilizing trends of more actors with greater capabilities fostered by exponential growth in connectivity.

AI itself also comes with significant costs, which are not merely research and development expenses. Instead, AI has yet to overcome some of its most perplexing problems, namely unpredictable rule breaking and a lack of nuance. The former certainly falls in the humanlike aspects of AI, whereas the latter presents a more persistent problem. Designing algorithms to do more than find what is out there and into the more complex realm of why it is so exceeds current efforts. That is not to say that the blockage will remain indefinitely, since that is more of a philosophical and religious discussion of the soul and spirit of humanity. Instead, the current brittleness of AI combines with its untrained applications and the pell-mell rush to operationalize it to make the emerging cyberenvironment even more dangerous than worries about infrastructure, privacy, and political stability.

Russia's Place in the AI Race

Much has been made of Russian attempts to influence the 2016 U.S. presidential election. While the presence of Russian activity has been confirmed, the broader question of its impact remains debated, as do the implications for what Russia will do next with those tools. Traditional information warfare seeks to draw attention away from true facts to "good facts"—those that conform to the desired end state. Even in best cases, true facts are still subject to incomplete information, imperfect perceptions, and inaccurate recall, producing a fog of what is going on and what it all means. Russia excels in such an environment,

and with AI-enabled "soft power" influence, Russia looks to become an even more destabilizing foe in the future.

Standing in a long line of soft power expertise, Putin and his cadre use all the tools at their disposal. Bolshevism's "politics of division," democratic openness, and human-machine cyborgs present opportunities to maximize existing divisions within Russia's enemies, as well as create new ones opportunistically. As a form of *swarming*—lots of moving parts spread out in a coordinated effort that responds to the environment and adversary actions—this kind of influence operation blends AI and human analysis to get inside the adversary's thinking as much as behavior. Tied to Russian *reflexive control*—shaping another's perceptions so they act in ways according to one's interests—AI-fueled psychological warfare continues to be a key priority for the Kremlin. Coupling the brass ring of quantum computing with its exponential increase in processing power, Russia stands ready to exploit any and all technological advances available to it.

How realistic those desires are remains a subject of much consternation within Russia itself. The poverty of the countryside, weakness of state-society relationships, and overreliance on twentieth-century fossil fuels and heavy industry mean that Russia needs a game changer to stay atop its region, let alone challenge the other great powers in the global contest. Several promising areas of cybercapabilities offer the Kremlin hope for success.

First, utilizing subtle deep fakes and changes to data sets can cause abiding failures in AI processing as much as popular perception. Mouth synthesis technology that alters someone's speech can work as affectively on people as shifting pixels undetectable to humans can change machine learning. Both cause misdirection, and in the case of AI, they can lead to noncombatants being classified wrongly, or the reverse, enabling hostile forces to move unnoticed. Advances in hardware also coincide with software development, and the counter-Ukraine CyberBerkut virus presents a clear example of cost advantages Russia has over the vastly more expensive Stuxnet effort against Iran, even though some of the cost differential came from the intended effect—weakening perceptions of Ukrainian legitimacy in relation to Iran's advanced nuclear systems.

Second, Russia's 2019 US$460 million investment in AI research pales by orders of magnitude compared to $7.5 billion by the United States and China's $24 billion; it will not buy anywhere near the surveillance coverage or big data crunching of its rivals. However, cheaper social media manipulation remains an area of Russian expertise. Partly because its antagonisms focus on democratic societies penetrated by open social media platforms, Russia has the advantage of punching above its weight class with a dedicated clique of nationalist cyberexperts, despite large numbers of Russian expats working for non-Russian companies and capital flight for the past twenty years.

Third, drones have become a pillar of Russian hybrid warfare in Ukraine and Syria. Expanding on intelligence, surveillance, and reconnaissance capabilities, Russian programs are developing underwater vehicles that identify, retrieve, or destroy unexploded ordinance. Plans to expand those allegedly defensive AI

platforms to aircraft, missiles, and electronic warfare systems share similarities to past dual-use technologies. Similar to vaulting over 1990s internet infrastructures, Russian drone capabilities also reap the benefits of others' research and development with cheaper, faster production lines.

Finally, recent high-level dialogue between Presidents Putin and Xi has increased Russian-Chinese cooperative efforts, specifically within cybercurrency, science and technology centers, and academic collaboration (Bendett and Kania 2019). As part of the ongoing Eurasian Economic Union (Russia)–Belt and Road Initiative (China) economic integration, technology transfers and joint ventures have raised Russia's access and placement within communist China, while also aiding in the development of functional divisions of labor between the two great powers. With over US$1 billion already committed to the recently launched Sino-Russian Joint Innovation Investment Fund in July 2019, both countries look to gain from further advances in STEM (science, technology, engineering, and mathematics) and AI-driven robotics research.

In addition, Russia has gained greater capacity to leverage China's telecommunications networks, partnering with Huawei for its own 5G development. Given the fundamental and widespread concerns about espionage capabilities built into those systems, Russia's partnership with China will continue to increase the Kremlin's resources for offensive information warfare. Thus, despite inevitable disputes arising from their distinct and at times conflicting national interests, technology cooperation provides a critical force multiplier for Russian aggression worldwide. Combined with unparalleled drive to remain dominant geopolitically and few ethical restrictions on doing so, Russian military cybernetics will challenge the United States and its allies for the foreseeable future.

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*The author's views do not represent official National Defense University or U.S. government positions.

Further Reading

Bendett, Samuel, and Else Kania, 2019. "A New Sino-Russian High-Tech Partnership: Authoritarian Innovation in an Era of Great Power Rivalry." Australian Strategic Policy Institute, no. 22. Accessed March 18, 2020. https://www.aspi.org.au/report/new-sino-russian-high-tech-partnership.

Janczewski, Robert, and Grzegorz Pilarski. 2018. "Comprehending Gerasimov's Perception of a Contemporary Conflict—The Way to Prevent Cyber Conflict." *AARMS* 17 (3): 71–82.

Jensen, Benjamin. 2017. "The Cyber Character of Political Warfare." *Brown Journal of World Affairs* 24 (1): 159.

Johnson, James. 2019. "Artificial Intelligence and Future Warfare: Implications for International Security." *Defense and Security Analysis* 35 (2): 147–169.

Scharre, Paul. 2019. "Killer Apps: The Real Dangers of an AI Arms Race." *Foreign Affairs* 98 (3): 135–144.

Vincent, James. 2017. "Putin says the nation that leads in AI 'will be the ruler of the world.'" Accessed May 31, 2020. https://www.theverge.com/2017/9/4/16251226/russia-ai-putin-rule-the-world.

Walther-Puri, Munish, Clare Boyle, Aaron Henry, and Dana Madsen. 2019. "The Commodification of Cyber Capabilities: A Grand Cyber Arms Bazaar." Analytic Exchange Program. Accessed May 31, 2020. https://nsiteam.com/social/wp-content/uploads/2019/11/191119-AEP-Concluding-Summit_Geopolitical-Impact-on-Cyber-Threats-from-Nation-State-Actors-Slides.pdf.

UNITED ARAB EMIRATES

The United Arab Emirates (UAE) has created an ambition plan to be one of the world's technological leaders. It is currently at the forefront of artificial intelligence development and application. In fact, in 2014 the country ranked 36th out of 143 nations on the Global Innovation Index (UAE Ministry of Cabinet Affairs 2015). In its pursuit of innovation, the country has announced that it will build a colony of 600,000 people on Mars by 2117 and that it plans to mine space metals from asteroids (Government.ae 2017a). To meet this objective, the government has begun advancing artificial intelligence policy and plans to secure its position as a global leader in technology.

The United Arab Emirates' shift to technological advancement began in 2006, when Sheikh Mohammed bin Rashid Al Maktoum's (1949–) became the vice president, prime minister, and ruler of Dubai. At that time, he sought to decrease the UAE's dependence on oil, which constituted around 50 percent of the country's gross domestic product (Zillman 2018). Rashid Al Maktoum recognized the importance of economic diversification instead of dependency on one primary revenue source, namely oil production. He championed infrastructure development and attracted start-up companies from around the world. More than a decade in the future, these reforms have proven successful, with the United Arab Emirates' economy barely dependent on oil sales. The attraction of technology start-ups also led to an increasing interest in emerging and disruptive technologies, including AI.

While the UAE has a decades-long reputation for promoting innovation in the Middle East, AI is one of its newer pursuits. In 2015, the country released its National Innovation Strategy. The strategy stressed the government's commitment to innovation, promising to position the country as one of the forerunners in technological advancement. It documented the country's commitment to investing in human capital rather than urban development, naming education one of its top seven priority areas along with transportation, space, technology, health, water, and renewable energy (UAE Ministry of Cabinet Affairs 2015).

As part of the National Innovation Strategy, the UAE issued its Strategy for Artificial Intelligence in October 2017 (Government.ae 2017b). This strategy, the first of its kind to be announced, is an extension of the 2015 National Innovation Strategy and aligns with the country's strategic development plan for 2071. It focuses on creating a form of "smart government" that will use the technology to reduce expenditures and enhance performance across all of its sectors and services. In addition, AI is expected to boost the economy and lead to improved

education programs that produce some of the most highly qualified technologists in the world. The government expects the benefits to the country to be a key part of meeting its future objectives and expects to become a regional hub, if not a national center, for AI.

In another world first, the United Arab Emirates reshuffled its cabinet and created a new position its government, the minister of state for artificial intelligence, in October 2017. Omar bin Sultan Al Olama (c. 1991–) received the appointment after contributing to multiple government efforts to develop future domestic strategy and increase the UAE's reputation for technological advancement internationally. As part of his appointment, he has selected a ten person AI council that represents every emirate. The council will assess opportunities for incorporating AI into government, infrastructure, and education. The council will also create the legal framework dealing with AI and other new technologies. Sultan Al Olama and his council expect the integration of AI across the government could cut government spending up to an estimated 50 percent.

The implementation of AI solutions is gaining traction within the country. The Ministry of the Interior announced in early 2018 that it plans to use AI to replace all immigration officers at airports by 2020. Along with changes to airport security, the UAE is examining how AI can improve other security sectors and intends to establish a Smart City Control Center to address other safety and security-related issues. The technology will also be applied to criminal activity, such as bribery, corruption, and fraud. With the assistance of AI, the country projects to become resistant to financial crises. Auditors expect to analyze massive amounts of complex data to detect anomalies that suggest criminal activities. AI systems would be able to examine multiple data sources, from financial transactions to contracts and leases.

The UAE's banking industry has already started integrating AI to improve its customers' experience. For example, many banks have launched specialized AI-enabled chatbots that leverage social media platforms such as Facebook, Messenger, and WhatsApp to provide customer service tailored to each customer's needs (Al Ghurair 2018). Through interactions online and at their physical locations, the banks also collect data on customer habits, which they can use to personalize customers' banking experiences. They use the data to offer additional financial services that fit their customers' lifestyles. AI algorithms are also applied to stock market trading, aiming to increase the chances of buying and selling stocks at the best prices. The downside to improved services is that AI reduces the number of employees a bank needs to function; some banks plan to eliminate jobs due to the success of AI technologies in the sector.

One immediate challenge the UAE faces centers on the need for skilled AI professionals. To address this issue, the UAE's Higher Colleges of Technology signed an agreement with Oracle to start a training program to prepare the future workforce. In early 2018, the government selected 500 men and women for training in AI in Dubai. At other levels of education, such as elementary and secondary schools, the government wants to integrate AI and other emerging technologies

into the curriculum. Curriculum change, however, is not as simple as deciding to make changes. It requires developing level-appropriate materials and bringing in talented instructors. The government recognizes that lack of training is an immediate issue facing its youths. It acknowledges that education related to AI is critical for the UAE to grow a skilled workforce prepared for emerging technologies and seeks to remedy the need for quality training programs.

The UAE's increasing reliance on AI has challenges beyond that of education and training. In spite of economic increases, such as the 14 percent GDP growth anticipated by 2030, widespread use of AI and automation will eliminate an estimated 45 percent of jobs in the Middle East (Prakash 2018). These figures, however, do not include the number of jobs that AI is expected to create globally for people with technologically-oriented skills. Until those jobs exist, AI applications could increase unemployment rates.

Many people in the UAE and the rest of the Middle East have concerns about how AI may affect their lives. While they acknowledge the beneficial applications, they also recognize that AI technologies could have detrimental effects. Specifically, they have concerns about privacy rights, safety, and ethics due to private and public usage of AI. While these issues garner debate, the UAE announced at the end of 2017 that it was working with a local firm to allow the police to use AI to see what people are doing inside their cars. It planned to install cameras on all police cars and to mine that data to understand people's driving behaviors. When drivers perform reckless acts, or even eat or drink in their car, the AI machine will inform the police. The advantage is that police will be able to catch people who break traffic laws and even detect wanted vehicles. Ultimately, the ability to catch drivers who endanger other people leads to greater safety on the road. At the same time, the police will be informed of activities occurring inside the car, which will eliminate privacy for drivers following the rules. The public has expressed mixed reactions to the trade-off between safety and privacy.

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Further Reading

Al Ghurair, AbdulAziz. 2018. "Embracing Artificial Intelligence: Do UAE Banks Have a Choice?" *Khaleej Times*. Accessed May 31, 2020. https://www.khaleejtimes.com/business/banking-finance/embracing-artificial-intelligence-do-uae-banks-have-a-choice.

Government.ae. 2017a. "2030–2117." Accessed March 12, 2018. https://government.ae/en/more/uae-future/2030-2117.

Government.ae. 2017b. "UAE Strategy for Artificial Intelligence—The Official Portal of the UAE Government." Accessed May 31, 2020. https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-strategy-for-artificial-intelligence.

Prakash, Abishur. 2018. "Robotics & Geopolitics: AI Policy, Balancing Robots and Jobs a Global Challenge." *Robotics Business Review*. Accessed March 18, 2018. https://www.roboticsbusinessreview.com/ai/roboticsgeopolitics-ai-policy-balancing-robots-and-jobs-a-global-challenge/.

UAE Ministry of Cabinet Affairs. 2015. "UAE National Innovation Strategy." Accessed March 18, 2020. http://www.uaeinnovates.gov.ae/docs/default-source/pdfs/national-innovation-strategyen.pdf?sfvrsn=2.

Zillman, Claire. 2018. "Dubai Decrees Itself the A.I. City-State of the Future." *Time*. Accessed March 13, 2018. http://time.com/5195292/dubai-artificial-intelligence-derq-strategy/.

UNITED KINGDOM

The United Kingdom has identified artificial intelligence as a key priority for development and modernization. As part of that designation, the country has published a large volume of strategy, policy, and guidance related to AI. These documents will not only advance technology development in the country but also set the country on a path to become a world leader and hub for research, development, and eventual implementation. It is already a European leader in AI, as it has identified AI as a way to boost its economy. To support its vision to become an international leader in AI, the United Kingdom has made significant financial investments to develop the technology and ensure that it is applicable for all people and all social and economic sectors.

The United Kingdom has a long history of involvement in AI. Though it had funded research projects through monies given to universities and other institutions in the 1960s and 1970s, the government's first official program supporting AI began in 1983. The Alvey Programme built the United Kingdom's IT sector and allowed it to become an early player in IT globally. The "AI winter" from the late 1980s through the 1990s contributed to this dismantling of the program in 1987. A trade deficit surrounding IT contributed to ending the program; it was also unsuccessful in improving the United Kingdom's competitiveness in IT, one of the project's main objectives (Clery 1991). Afterwards, the country had no national plan for AI, although private companies continued working on it and instead chose to participate in regional and international collaborations. The recent advances in computer processing resparked the United Kingdom's national interest in AI. These advances have caused the country to reengage with national programming and partnerships with industry and academia.

In recent years, the United Kingdom has started pursuing AI at the national level with vigor. In 2017, the government released the document *Growing the Artificial Intelligence Industry in the UK*. It outlined how to progress the country's AI development, stressing the need to improve access to data, maximize the research within the country, improve training and skill sets, and support the integration of AI into the relevant sectors (Hall and Pesenti 2017). This report was a precursor to the country's Industrial Strategy (HM Government 2017), which identified AI as a technology that will "transform the way we live and work, from the way we diagnose cancer to the security of online transactions."

The strategy outlined how the government would sponsor Grand Challenges to drive innovation and transform the economy. It also committed funding to support

British Prime Minister Theresa May (in office 2016–2019) visits Copenhagen to speak with Danish Prime Minister Lars Loekke Rasmussen in Copenhagen, Denmark, April 2018. The United Kingdom has a long history of involvement with artificial intelligence (AI). Theresa May, in her capacity as the country's political leader, made public statements about the United Kingdom's commitment to and strategy for pursuing advancements in AI across the country's sectors. (Ojen/Dreamstime.com)

AI, as well as other initiatives with a similar transformative power to prepare and advance the United Kingdom for the future. In fact, Prime Minister Theresa May (1956–; Prime Minister 2016–2019) announced at the 2018 World Economic Forum that "we are establishing the UK as a world leader in Artificial Intelligence, building on the success of British companies like Deepmind" (May 2018). All of the country's efforts signal that pursuing AI remains a serious commitment.

Developed with the Industrial Strategy, the United Kingdom also has an AI Sector Deal, initially issued in early 2018 by two departments of the cabinet, which solidifies public-private cooperation to increase innovation, create jobs, and establish the nation as an international technical hub (United Kingdom 2019). Previous years of AI research had already led to the United Kingdom's high global ranking for scholarship. With public-private cooperation, the government anticipates that it will strengthen its reputation for AI development and scholarship. It eases the ability for new start-up initiatives to apply AI creatively.

The agreement also ensures that AI benefits everyone and every sector falling under the purview of the United Kingdom and does so while carefully following the law and upholding ethical standards. In support of public-private cooperation and universal societal beneficence, the government has issued multiple documents guiding and explaining how AI must be developed and used for the public sector,

such as the reports Planning and Preparing for Artificial Intelligence Implementation and Understanding Artificial Intelligence Ethics and Safety (GDS and OAI 2019). The amount of guidance demonstrates how proactively the government addresses AI and works to ensure that the technologies will not create, or at least minimally lead to, new social or economic problems.

The United Kingdom has made significant financial contributions to support AI development. The AI Sector Deal by itself allocated up to £1 billion through investment from multiple sources. The government plans to contribute the majority, with industry and academia also providing financial support in conjunction with the government's endeavors. However, the country has recognized that even with the need for spending, it cannot outspend other nations on technology development. For example, China is pouring more resources into AI development than any other country in the world and at unprecedented levels.

Neither the United Kingdom nor other countries can match this, so instead of trying to lead financially, the United Kingdom invests where it sees the most opportunity and potential for advancement. Its leadership will fall more along ethical and moral lines to uphold high standards to AI. To this end, the government drafted an AI Code for worldwide adoption; the code promotes prohuman benefits of AI implementation and the necessity to protect human rights while using the technologies responsibly.

AI has the potential to boost the United Kingdom's economy, which has had sluggish growth for more than the past decade; many economists call the early 2000s the "Lost Decade," although it has actually lasted more than ten years (BBC 2019). The slump started in 2007 with the financial crisis; since then, the country has faced very low growth rates, ranging around 2 percent annually, though this number is not consistent, as some months or quarters have fallen into negative growth (Giles 2018; CEIC 2019). Within the country, there are expectations that AI will push the United Kingdom out of the productivity lull, with the possibility that it will lead to extreme growth. The Industrial Strategy states that AI has the potential to grow the United Kingdom's economy by £232 billion by 2030 using AI-enabled technologies (HM Government 2017). If this prediction comes true, it will reinforce the importance of the Industrial Strategy and the financial investments into AI and other emerging technologies, such as autonomy.

The country has some structural weakness that it will need to address as it continues to develop and implement AI solutions. The McKinsey Global Institute (2019) summarized some of these challenges, concluding that some of the country's greatest assets contribute to the current and future difficulties that must be overcome for success. For example, the United Kingdom has an innovation culture that enhances its ability to make technological advances quickly, yet this culture is currently not scalable. Second, the country has a lot of talent to draw from, but most of this talent pool does not yet have the needed technical skills for advancing the United Kingdom quickly with AI-related technologies. Third, the country is well renowned for its world-class academic institutions, but it has been difficult to

commercialize their research successes, which means that there is a gap between development and making those developments available to the public (McKinsey Global Institute 2019). Addressing these three areas could be key to advancing the United Kingdom's AI development and, along with it, boost the economy as it desires.

The United Kingdom has started addressing these gaps. In line with the AI Sector Deal, which recognized the importance of human capital in AI research, the United Kingdom worked with more than sixty educational institutions and businesses to establish the Institute of Coding. Ensuring that people are trained or retrained to have the most advanced, up-to-date skill sets for AI is critical to AI advancement. The government, as well as the country's industries and academic organizations, plans to invest in education and training. This path demonstrates one way in which the United Kingdom plans to address some of the challenges that it must surmount to enjoy the full benefits that AI portends to offer. Moving forward with potential solutions to address, or mitigate, these challenges, the United Kingdom appears to have a bright future for developing and reaping the anticipated benefits surrounding AI.

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Further Reading

BBC. 2019. "UK Productivity Continues Lost Decade." Accessed September 14, 2019. https://www.bbc.com/news/business-47826195.

CEIC. 2019. "United Kingdom Labour Productivity Growth." Accessed September 14, 2019. https://www.ceicdata.com/en/indicator/united-kingdom/labour-productivity-growth.

Clery, Daniel. 1991. "Alvey: The Betrayal of a Research Programme." *New Scientist*. Accessed September 14, 2019. https://www.newscientist.com/article/mg13017682-400-alvey-the-betrayal-of-a-research-programme/.

Giles, Charles. 2018. "Britain's Productivity Crisis in Eight Charts." *Financial Times*. Accessed September 14, 2019. https://www.ft.com/content/6ada0002-9a57-11e8-9702-5946bae86e6d.

Government Digital Service (GDS) and Office for Artificial Intelligence (OAI). 2019. "A Guide to Using Artificial Intelligence in the Public Sector." Accessed May 31, 2020. https://www.gov.uk/government/collections/a-guide-to-using-artificial-intelligence-in-the-public-sector.

Hall, Wendy, and Jérôme Pesenti. 2017. "Growing the Artificial Intelligence Industry in the UK." Accessed May 31, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/652097/Growing_the_artificial_intelligence_industry_in_the_UK.pdf.

HM Government. 2017. "Industrial Strategy: Building a Britain Fit for the Future." Accessed September 6, 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf.

May, Theresa. 2018. "Theresa May's Davos Address in Full." World Economic Forum. Accessed September 14, 2019. https://www.weforum.org/agenda/2018/01/theresa-may-davos-address/.

McKinsey Global Institute. 2019. "Artificial Intelligence in the United Kingdom: Prospects and Challenges." Accessed May 31, 2020. https://www.mckinsey.com/featured-insights/artificial-intelligence/artificial-intelligence-in-the-united-kingdom-prospects-and-challenges.

United Kingdom, Department for Business Energy and Industrial Strategy and Department for Digital Culture, Media, and Sport. 2019. "AI Sector Deal." Accessed May 31, 2020. https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal.

UNITED STATES

The United States has been involved in artificial intelligence (AI) since the term was conceived in the 1950s. It joined the number of countries with a national AI strategy in 2019, later than many of the other nations competing for leadership in regard to the technologies, through the issuance of numerous documents that together suggest the national strategy; technically, however, it does not have a true national strategy. Through the alignment of documents released, the government had taken many steps to increase the importance of AI at the national level, and even state and local governments had started exploring the benefits of AI. In addition to government interest, the United States has many corporations and educational institutions that are driving AI development and training.

The origin of AI, or at least the coining of the term, occurred in the United States in the 1950s. The foundational thinking for what would eventually become AI can be traced to the year 1637, when the philosopher René Descartes (1596–1650) wondered to what extent machines might be able to think and act for themselves. Essentially, he envisioned what researchers today refer to as *specialized* and *general AI*. More than 300 years later, John McCarthy (1927–2011), a Dartmouth College professor, first used the term *AI* in a proposal to get funding for the Dartmouth Conference in 1956. The event brought experts together from many fields, such as computer science, to discuss what would eventually be known as the field of AI. It lasted for two months. Although McCarthy later expressed that the conference was a failure because it failed to create a project that could aid machines to think, the event did leave a mark on history (Moor 2006). More than fifty years later, *AI* is a household term; companies, universities, and the government are investing heavily to see how these technologies might improve society.

In addition to the "invention" of AI, the United States has been home to some of the biggest milestones in AI development. These include IBM's use of AI in the program Deep Blue, which defeated chess master champion Garry Kasparov in 1997. IBM helped AI hit another major milestone in 2011 when its Watson computing system won the television game show *Jeopardy*. In 2012, Stanford University and Google presented work on deep learning that showed how a computing system could simulate a human brain and use billions of connections to identify images of cats.

In 2015, the ImageNet challenge showed—at least according to some researchers—that computers could statistically outperform human in computer vision, or the recognition of objects in images more accurately than people. In 2017, AlphaGo, a product created by Deep Mind, beat a world-level player of the Chinese game Go, one of the most sophisticated games on the planet (Mozur 2017). There have also been great leaps in the development of chatbots, smart-home assistants like Alexa and Siri, and many others. For these reasons, some analysts dubbed 2018 the year that AI "exploded" in terms of interest and applicability. Tesla, SpaceX, Google, and Nvidia, among other companies, have expressed how AI will be critical for the future. In other words, many U.S. experts expect that AI-enabled technology will continue to grow and change how the world works and how we work with the world.

The government has also been involved in AI development and progress along with industry. AI first received high-level government attention under the Barack Obama (1961–) administration (2009–2017). Toward the end of the administration, the government released three major reports that would shape future U.S. interest in AI: Preparing for the Future of Artificial Intelligence, the National Artificial Intelligence Research and Development Strategic Plan, and Artificial Intelligence, Automation, and the Economy. These documents paved the foundation for future US government policy.

With the foundation for a national AI strategy already laid, in 2019, President Donald Trump (1946–; President 2017–) codified the American AI Initiative with an executive order. Five principles guide the initiative, including guiding innovation, creating appropriate standards, training, promoting American values and trust, and protecting the U.S. advantage in development of AI-enabled technologies (White House 2019). The document also provided guidance for government agencies, including advising them to allocate more funding to AI. This document spurred the publication of several important follow-on documents to continue building U.S. national AI strategy.

Publications that followed the American AI Initiative included the U.S. Department of Defense's Artificial Intelligence Strategy and the release of a joint National AI research and development strategic plan from the Select Committee on Artificial Intelligence and the National Science and Technology Council, which differed from the similarly named document issued by the Obama administration. All of these documents conformed to the administration's declaration that AI become a national investment priority. Technically, however, while these documents together support the same ideas and principles, they do not constitute a true national AI strategy.

Both branches of the U.S. Congress, the House and the Senate, have introduced numerous bills and resolutions related to AI. In 2018, Congress members introduced five different bills. Only one of these passed, the National Security Commission on Artificial Intelligence Act (H.R. 5356/S. 2806). The bill establishes the National Security Commission on Artificial Intelligence, a special independent commission within the executive branch designed to review research and advances

in AI-related technologies intended to support U.S. national interests (U.S. Congress 2018). In 2019, Congress saw eight separate AI-related bills. Many of those introduced have been referred for further review and discussion, but none have yet become law. The increasing energy related to AI in Congress, however, suggests that lawmakers have become more serious about promoting the responsible use of AI-enabled technologies to support the nation.

Interest in AI is not solely the interest of the U.S. federal government; many states and cities have begun to consider how AI could benefit them and their populations. California, for example, has the most advanced AI-related policies of any state. It has regulations regarding the safe and ethical use of AI, disclosure laws that require bots to be well labeled when used, and privacy laws that allow people greater control of their personal data, which include restricting third-party sales of that data (Matthews and Bowman 2018). Other states with AI-related policy are Vermont and Washington. Connecticut has proposed a study to examine the risks and benefits of AI adoption, such as the risks of workforce displacement as economic sectors adopt AI. At the municipal level, San Francisco and New York City have passed laws regulating technologies. New York has established a special algorithmic task force to study and enforce algorithmic responsibility in automated decision-making systems (New York City Council 2018).

Academia has also played a major role in shaping how AI becomes implemented. While universities also invest heavily in AI R & D to produce cutting-edge technologies, they also study the effects that AI will have on people and the various levels of government. In response to the emerging U.S. national AI strategies in 2019, the Open Philanthropy Project gifted over $55 million to Georgetown University to establish a research center aimed at studying the impact that AI will have on national and international security.

In addition to universities developing specialized centers, many private and nonprofit organizations in the United States focus specifically on AI. Their research mandates vary, including specialties in AI such as explainable AI, which focuses on creating AI-enabled technologies that can explain to people in plain language why they came to a conclusion; ethical AI; and AI standard making. This list of specialties is not exhaustive, and as AI becomes even more widespread, these organizations may need to add or fine-tune their focuses to encompass any changes to the field.

The United States has several universities offering world-class education in AI. Although the rankings fluctuate depending on who compiled the list and the criteria used, some universities that appear frequently on the list include the Massachusetts Institute of Technology, Stanford, Harvard, the University of California, Berkeley, and Carnegie Mellon. While they all have highly ranked programs, they offer different emphases for their programs because AI is not monolithic; it incorporates a number of fields and subfields. Other universities also have talented faculty that offer courses or programs in AI, as colleges are responding to the rising demand for AI research and training.

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Further Reading

Matthews, Kristen J., and Courtney M. Bowman. 2018. "The California Consumer Privacy Act of 2018." Proskauer. Accessed May 31, 2020. https://privacylaw.proskauer.com/2018/07/articles/data-privacy-laws/the-california-consumer-privacy-act-of-2018/.

Moor, James. 2006. "The Dartmouth College Artificial Intelligence Conference: The Next Fifty Years," *AI Magazine* 27 (4): 87–91.

Mozur, Paul. 2017. "Google's AlphaGo Defeats Chinese Go Master in Win for A.I." *New York Times*. Accessed September 14, 2019. https://www.nytimes.com/2017/05/23/business/google-deepmind-alphago-go-champion-defeat.html.

New York City Council. 2018. "Automated Decision Systems Used by Agencies Int. No. 1696–2017." Accessed September 14, 2019. https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=3137815&GUID=437A6A6D-62E1-47E2-9C42461253F9C6D0.

U.S. Congress. 2018. "H.R. 5356—National Security Commission Artificial Intelligence Act of 2018." Accessed September 14, 2019. https://www.congress.gov/bill/115th-congress/house-bill/5356/text.

White House. 2019. "Accelerating America's Leadership in Artificial Intelligence." Accessed September 14, 2019. https://www.whitehouse.gov/articles/accelerating-americas-leadership-in-artificial-intelligence/.

Chapter 8: Autonomous Robots

OVERVIEW

People have always been fascinated or awed by robots. They are a prolific topic in science fiction and popular culture. Inventors and researchers have studied them for many decades, taking the concept from a thought to actual robots that are in use in households and businesses around the world today. The term *robot* first appeared in 1921, when the playwright Karel Čapek (1890–1938) introduced it in his play *Rossum's Universal Robots*. The term itself comes from the word *slave* in Čapek's native Czech (Roberts n.d.). In the 1960s, Joseph Engelberger (1925–2015) introduced the first industrial robot, the Unimate, to General Motors.

The successful use of robots to complete tasks sparked people's imaginations. In 1962, a futuristic cartoon called *The Jetsons* introduced an entire generation to the idea of Rosey the Robot, a robotic maid that could speak, think, and act with little prompting from the family in which she lived (Novak 2012). Since the mid-1970s, the robots R2D2 and C-3PO have charmed audiences worldwide in the *Star Wars* movie franchise. Rosey represents an autonomous robot, while R2D2 and C-3PO are more than autonomous robots; they are practically sentient, or alive. These types of robots currently exist only in the imagination. However, around the world, there are many researchers developing robots that can perform automatically to help people complete tasks so that they divert energy to jobs that cannot be easily automated.

Autonomous robots do not need human input beyond their initial programming to carry out assigned tasks. More precisely, according to the company Waypoint Robotics (2018), an autonomous robot is "one that can perceive its environment, make decisions based on what it perceives and/or has been programmed to recognize and then accentuate a movement or manipulation within that environment." After programming, an autonomous robot needs very little human interaction unless its assigned function includes one- or two-way communication with a human operator. One-way communication can occur with a remote control, while two-way communication can involve voice commands and responses.

The European Union's Autonomous Vehicle Emergency Recovery Tool consists of a robotic deployment unit and four autonomous robots that assist law enforcement in disposing of car bombs. Because this situation is dangerous for police, the unit is able to scan a vehicle suspected of containing a bomb and then send its team to move the car to a safer location. The autonomous team can save lives by itself, or via remote control when an operator decides to

override the machines' decision making (Moren 2015). The goal of autonomous robots is to improve lives by allowing robots to work independently or through human-machine teaming.

Many robotics kits are available on the market today for beginners to explore the fundamental types and concepts behind autonomous robots. Three types of robots fall under the classification of *autonomous robot*. These are remote controlled robots, such as the remote-control toys available at online and offline toy or gift shops; manually controlled robots; and autonomous control robots. Underneath these classifications, there are three subclassifications: programmable, nonprogrammable, and those considered as adaptive, and intelligent robots (Rethinavelsubramanian 2015). The type of robot determines the amount of autonomy that a robot has, as well as constrains its ability to perform complex tasks.

The first robot subtype is a *programmable robot*. This type follows its instructions until it is turned off and will start over when powered up again, without the ability to decide that the task is completed or the circumstances have changed. Assuming that the robot is not physically designed to prevent certain work, external design may not inhibit these robots from being programmed and then reprogrammed to perform another task. Ideally, however, a robot's design facilitates its programming.

For the second type of robot, a *nonprogrammable robot*, physical design is critical because it is designed specifically to perform a certain task. A mechanical arm used at an assembly plant is a good example of a nonprogrammable robot. For most assembly lines, the arm must have the exact characteristics, such as length and size, to reach the assembly line and to perform its intended job. A nonprogrammable robot could, for example, be used to pitch balls for some sports. For tennis, the robot could pitch balls at the same speed while swiveling to change the direction of the pitch. This is different from a programmable robot that would offer multiple settings to allow the user to customize, or even randomize, the throw's speed, spin, and length, for example.

Adaptive robots can observe facets of their environments, such as temperature, and change their actions based on changes they sense; they can also have varying degrees of machine intelligence. An example of an adaptive robot is one that might choose between software programs based on environmental conditions when performing its tasks. Intelligent robots are those that use sophisticated means to sense and process data. A Roomba vacuum cleaner is an intelligent robot because newer models have the ability to sense and map a person's home and then plan the most efficient route based on those maps. A Roomba can also avoid obstacles, such as a book fallen from a bookshelf, instead of sensing the change to the floor plan and stopping all activity. More advanced intelligent robots can sense emotions; some also have the ability to see and hear.

Another example of an intelligent robot, which attempted to transform the fast-food industry, is Flippy, a robot designed to grill and flip burgers for the California restaurant chain CaliBurger. Flippy wears a spatula or grill scraper and applies artificial intelligence and thermal vision to determine when burgers or sandwich

meats are properly cooked. It was designed to work alongside its human counterparts to inform them when to prepare the rest of the sandwich. However, multiple news organizations reported that the restaurant chain retired Flippy after two days. Apparently, Flippy worked too efficiently for the human employees, who were not able to keep up with production (Weisberger 2018). The cooked meat must be served quickly after being cooked to avoid potential health and safety problems. It is currently unknown if CaliBurger will experiment further with Flippy or other robot solutions to improve service.

Autonomous robots are working in different types of locations all over the world. In cities, they work in sectors such as transportation, construction, waste management, entertainment, industrial production, and medicine. They assist in the hotel industry, in retail stores, and in many locations that have found their businesses enhanced through robotic labor. In more rural areas, they work on farms and in businesses that often require manual labor. These robots work in many different types of terrain, including wet, humid climates and arid desert regions. They can even function in space or under water.

A controversial development in the autonomous robot world is driverless cars. The cars are not quite autonomous robots, but they often fall into this category because they involve the notion of autonomy, the idea that a successful car can make decisions based on continuous sensor inputs without instruction from a human conductor. An autonomous vehicle requires a network of sensing and processing tools to inform its decision-making processes because, at minimum, a driverless car would need to navigate, steer, avoid obstacles, brake, and control itself by obeying speed limit signs and staying within the lane lines. Safety is a major concern for drivers, as being in or around autonomous vehicles could be dangerous in the event of a programming malfunction.

Another concern for autonomous vehicles is the economic impact many people believe they will have on employment. Driverless cars could reduce the amount of jobs in certain sectors. For example, some researchers predict that autonomous vehicles will put truck and delivery drivers, as well as taxi and other transportation service operators, out of jobs. According to a Harvard study, around 5 million Americans work full- or part-time as a driver; most or all of these jobs could be impacted with the adoption of driverless vehicles (Einstein 2017). Several companies, such as the ride-share company Uber, are testing autonomous vehicles. It is unknown, however, when these vehicles will be safely, legally, and socially permitted to operate on the road. In other countries, there are similar experiments with the use of autonomous vehicles. Few societies appear eager to be first adopters of the technology.

Safety is not the only concern with autonomous robots and technologies. Some people genuinely fear robots and other technologies like artificial intelligence (AI). In fact, some researchers have coined this the *fear of autonomous robots and artificial intelligence*, or FARAI, and are examining ways to measure and understand the phenomenon (Liang and Lee 2017). For people afflicted with fear of robots, they often believe that robots will either learn to hurt or kill people or that they will become

more intelligent than humans and take over the world. This is not a new fear; it has appeared as the subject of movies and books for decades.

In 2013, a group of concerned citizens launched an International Campaign to Stop Killer Robots. Militaries around the world are developing and testing autonomous weapons systems. Human rights activists and concerned citizens have dubbed these technologies with names such as *killer drones*, *killer robots*, and *slaughterbots*. The ethical and moral implications of these types of robots are potentially just as serious as they are unknown. International bodies such as the United Nations are discussing the reality of these emerging weapons. As a body, the United Nations considers how the world's governments should respond to these developments and develops policy for the world's nations to endorse. An international response to autonomous weapons systems should place standards and expectations on developers, though it is important to note that the United Nations does not have the ability to enforce policy should a country refuse to ratify one of the United Nations' resolutions.

There are risks to creating autonomous robots. No one can predict exactly what the implications will be but only that humans need to start thinking through the problem sooner rather than later. At the same time, many people acknowledge the potentially lifesaving uses for such robots. Autonomous robots can explore and work in areas where humans should not go. In Scotland, a company is experimenting with a newly developed autonomous robot that can work on an off-shore oil rig. The robot can withstand explosive conditions and still perform inspections and maintenance in instances where humans would risk their lives. In the entertainment industry, Disney has announced the creation of autonomous robots that will perform stunts or act as stunt doubles so that humans do not need to risk loss of life or limb. There are drones being created for market that can fly into small and dark spaces to map areas where people cannot go, such as mines, caves, or other unknown spaces.

The future of autonomous robots, and their application worldwide, is in the hands of their creators. If people are responsible for their creations, robots can improve, and even save, lives. There will be disruption to societies if people experience job loss due to these robots, which will create tension that societies must overcome. In the end, if robots are used responsibly, there will be no need to imagine the world overrun with intelligent, or even sentient robots, as seen in films such as *The Terminator*. However, the responsible employment of autonomous robots and vehicles is not a guarantee.

Across the world, researchers and developers are at different stages in the development of robots. This section explores nations that are advanced in robot development as well as those that are beginning to explore the potential impact that robots may have on their societies' needs.

Further Reading

Einstein, Paul A. 2017. "Millions of Professional Drivers Will Be Replaced by Self-Driving Vehicles." NBC News. Accessed July 2, 2018. https://www.nbcnews.com/business/autos/millions-professional-drivers-will-be-replaced-selfdriving-vehicles-n817356.

Liang, Yuhua, and Seungcheol Austin Lee. 2017. "Fear of Autonomous Robots and Artificial Intelligence: Evidence from National Representative Data with Probability Sampling." *International Journal of Social Robotics* 9 (3): 379–84.

Moren, Dan. 2015. "Autonomous Robots to Help Remove Car Bomb Threats." *Popular Science*. Accessed July 2, 2018. https://www.popsci.com/autonomous-robots-help-remove-car-bomb-threats.

Novak, Matt. 2012. "50 Years of the Jetsons: Why the Show Still Matters." *Smithsonian Magazine*. Accessed May 31, 2020. https://www.smithsonianmag.com/history/50-years-of-the-jetsons-why-the-show-still-matters-43459669/.

Rethinavelsubramanian, A. 2015. "Design and Analysis of Autonomous Robots." *International Journal of Engineering Research and General Science* 3 (1): 1394–1399.

Roberts, Eric. n.d. "Robotics: A Brief History." Accessed July 2, 2018. https://cs.stanford.edu/people/eroberts/courses/soco/projects/robotics/history.html.

Waypoint Robotics. 2018. "What Are Autonomous Robots?" Accessed July 2, 2018. https://waypointrobotics.com/blog/whatautonomous-robots/.

Weisberger, Mindy. 2018. "Humans Couldn't Keep Up with This Burger-Flipping Robot, So They Fired It." Live Science. Accessed July 2, 2018. https://www.livescience.com/61994-flippy-burger-flipping-robot-flops.html.

CHINA

The People's Republic of China (PRC) is actively pursuing the development of autonomous robots as part of its attempt to achieve its two centenary goals of building a moderately prosperous society by the centennial of the founding of the Chinese Community Party; the PRC plans to reach these goals by 2021 and achieve national rejuvenation by the centennial of the founding of the PRC in 2049. Roadmaps and programs for achieving these goals are sprinkled throughout guidance documents such as the Made in China 2025 initiative (May 2015), the Robot Industry Development Plan (2016–2020; published April 2016), and the Artificial Intelligence Development Plan (AIDP; July 2017). These documents suggest the development of autonomous robotics plays a key role in solving a diverse array of challenges as the party struggles to cope with a changing geostrategic and economic landscape.

Robotics offer potential solutions to a wide range of challenges currently confronting the PRC, including moving up the production value chain (State Council 2015), dealing with demographic changes, and rapidly overcoming military gaps with the West. To overcome these challenges, the Robot Industry Development Plan augments the thirteenth Five-Year Plan (March 2016) in setting an innovation and development agenda for the country. This plan identifies ten products that will guide the development of the PRC's "industrial robots to the mid-to-high-end development" (State Council 2016). These include arc welding robots, vacuum robots, fully self-programing intelligent industrial robots, human-machine collaboration robots, dual-arm robots, overloading autonomous guided vehicles, fire rescue robots, surgical robots, intelligent public service robots, and smart care robots (State Council 2016). However, the plan also identifies key shortfalls in the PRC's technical ability to lead the autonomous robot sector. These weaknesses align

Robots at Kunming Airport help airlines and passengers receive more efficient services. China is among the leading investors globally in technology, which includes autonomous robots. These robots are becoming more prevalent in airports and other high traffic areas to assist people and enhance the workforce. (Wuwei1970/Dreamstime.com)

around the ability of PRC firms to design and produce the most advanced components of robotics, such as high-precision reducers, special servo motors and drivers for high performance robots, high-speed high-performance controllers, sensors, and end effectors (State Council 2016).

The combination of conviction that robotics are necessary to advance the economy with the recognition of serious shortfalls in this sector have led the PRC to focus on the sector as a priority for state-directed economic development. In January 2016, Wan Gang (1952–), Minister for Science and Technology, listed "intelligent manufacturing and robots" as one of the Science and Technology Innovation 2030 Mega Projects, or 科技创新 2030—重大项目 (Ray et al. 2016), thus highlighting its centrality in the PRC's development program. However, the private sector has also identified autonomous robotics as an area for strategic growth. Given the heavy influence of the CCP and state leadership in the economy, this is unsurprising. In fact, investment in the PRC's autonomous robotics market has been assisted by a centralized regulatory environment that has standardized guidelines and expressed an openness to trials (Berret 2018).

Autonomous automobiles are an example of a sector that is benefiting from state and private enthusiasm. It has been specifically encouraged in the AIDP and is being pursued in the PRC by a range of domestic and foreign companies (Bloomberg 2018). Adding to this environment is the comparative willingness of

PRC consumers to adopt and use automated vehicles, which exceeds that found in many developed countries (Continental Corporate Media Relations 2018). However, the PRC's leadership in this section is challenged by its inability to domestically source key components, such as semiconductor chips, drivetrains, and cutting-edge battery technology (Muller 2018). In fact, the desire to overcome dependency on foreign suppliers has been a trend in robotics and manufacturing development plans and is highlighted in Made in China 2025 and Robot Industry Development Plan (State Council 2015, 2016).

Nevertheless, autonomous systems are being pursued vigorously. This is in part to overcome what official documents perceive as an artificial intelligence gap that still exists between the PRC and developed countries (State Council 2017). However, it is also based on an assumption—and hope— that integration of autonomous robotics will help the PRC move up the value chain from low-skill manufacturing focused on the assembly of components designed and built elsewhere to dictating its economic future. The AIDP envisions a future of automated production in smart factories with enhanced operational management (State Council 2017). This effort reaches across the PRC, beyond state-owned enterprises to large internet companies such as Baidu, Alibaba Group, JD.com, Lenovo, and LeEco, which are all pursuing projects across a range of service robot applications (Ray et al. 2016).

It would be myopic to see this development push as solely driven by competitive economic calculous. In fact, the PRC faces serious demographic issues that seem intractable in the absence of assistance by autonomous robots. These challenges center on the rapid aging of the PRC population, started by the infamous one child policy and now continued by changes in individual preferences and personal finances as the country develops. The PRC is now faced with an increasing number of elderly individuals supported by a shrinking working-age population.

Consequently, the PRC leadership, which has long had to worry about having enough jobs for its citizens, will soon be faced with not having enough workers to fill key economic functions. This is especially true with jobs that are considered hazardous or boring. Accordingly, autonomous service robot development in the PRC tends to focus on sectors such as aging social services, medical rehabilitation, disaster relief, public safety, education and entertainment, and major scientific research (State Council 2016). Of course, the advance of autonomous robots may also simply free laborers from jobs where they are no longer needed. For example, the PRC is beginning to heavily automate container port operations, with the Port of Caofeidian, Hebei Province, seeking to become the first fully autonomous harbor (Prosser 2018).

However, it is not only hard labor that companies are seeking to replace with robots. Multiple generations with only one child per couple have led to the situation in which four grandparents commonly share one, and only one, grandchild. Consequently, elderly individuals are worried that there will be no one to take care of them in their old age. This concern is especially acute in a Confucian culture, where old age care has traditionally been a familial responsibility carried out by sons. With a declining number of people to take care of the elderly, technology

companies—and PRC leadership—are hopeful that autonomous elderly care robots can assume part of this responsibility. At present, multiple PRC companies are developing elderly care robots for the commercial and healthcare markets (Xinhua 2018).

However, not all robotic developments are seen as benign. Some of the advances in AI-related technologies that enable autonomous robots are also enhancing surveillance. These systems are being used to rate the citizenship of individuals, potentially affecting education and employment, and have gained international condemnation for their use in monitoring and controlling ethnic Uighurs in the Xinjian Autonomous Region (Mitchell and Diamond 2018; Lehr 2018). Continued advances in AI will improve the speed of collection and analysis as the need for extensive human involvement is replaced by intelligent systems (Wright 2018).

Another sector where the development of autonomous robots is raising concern in the West is the increasing reliance of the military on autonomous systems. The PRC's struggle with demographics plays a role here, as the People's Liberation Army (PLA) could use autonomous systems to overcome persistent difficulties with human capital and training (Wright 2018). In fact, the PRC appears to be investing heavily, both in current systems and the future of autonomous systems. In late 2018, thirty-one students were selected straight from high school to participate in an experimental Beijing Institute of Technology program that aims to turn them into AI-weapons scientists (Kilbride 2018).

Meanwhile, the PRC has become a leading exporter of unmanned aerial vehicles (Baker 2015). While the level of autonomous operation varies, China's willingness to develop and export these systems has greatly expanded its presence on current and future battlefields. Meanwhile, the PRC may be leading the way in the development of unmanned underwater vehicles. The PRC has built the world's largest drone boat testing facility and is aiming to deploy autonomous robot submarines capable of completing missions without human intervention by the early 2020s (Chen 2018). Some argue that this effort, through a combination of technology and number of autonomous systems that can be placed in the water, is aimed at closing the gap with U.S. submarine systems (Ray et al. 2016).

Although the PLA is admittedly rushing to increase the quality and quantity of the autonomous robot systems it employs, both political and ethical questions remain regarding its willingness to embrace fully autonomous systems. Politically, the PLA remains an organ of the CCP, not the state, and retains a centralized command-and-control culture. It is uncertain whether an organization loath to give subordinate humans too much autonomy will be willing to cede control to autonomous machines (Kania 2018). Such machine agency also calls to mind ethical concerns about ceding life-and-death decisions to machines. The AIDP repeatedly calls attention to the need to address ethical issues with autonomous systems; however, it does not get more specific. In fact, though the PRC claims to be in favor of outlawing lethal autonomous weapons systems (LAWS), its delegation to the Convention on Conventional Weapons (CCW) stressed that it only opposed the use of them (Campaign to Stop Killer Robots 2018). This position is reinforced

by its April 11, 2018, position paper submitted to the CCW, which discusses in depth the need to define LAWS properly and warns against "pre-set premises or prejudged outcome which may impede the development of AI technology" (People's Republic of China 2018).

In the long run, political and ethical considerations could be rendered moot by the same demographic concerns that are seeing elderly care and dock workers replaced by machines. If the working-age population dips too low as a percentage of the population, the military may be one more hazardous job deemed better handled by autonomous machines. Ultimately, the party and the state see autonomous robots as the solution to economic and technological challenges, but their real strength may ultimately be born of the PRC's inability to produce enough humans.

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Further Reading

Baker, Benjamin D. 2015. "Drone Wars: China and US Compete on the Global UAV Market." Diplomat. Accessed March 4, 2019. https://thediplomat.com/2015/10/drone-wars-china-and-us-compete-on-the-global-uav-market/.

Berret, Marcus. 2018. "Who Will Win the Battle of New Mobility Services? Our Automotive Disruption Radar Provided New Insights." Roland Berger. Accessed May 31, 2020. https://www.rolandberger.com/en/Publications/New-mobility-trends-China-is-driving-away-from-the-competition.html#!#&gid=1&pid=2.

Bloomberg. 2018. "Chinese Startups Floor the Pedal in a Driverless Car Race." Accessed March 3, 2019. https://www.bloomberg.com/news/articles/2018-07-25/chinese-startups-floor-the-pedal-in-adriverless-car-race.

Campaign to Stop Killer Robots. 2018. "Convergence on Retaining Human Control of Weapons Systems." Accessed March 2, 2019. https://www.stopkillerrobots.org/2018/04/convergence/.

Chen, Stephen. 2018. "China Military Develops Robotic Submarines to Launch a New Era of Sea Power." *South China Morning Post*, September 29, 2018. Accessed May 31, 2020. https://www.scmp.com/news/china/society/article/2156361/china-developing-unmanned-ai-submarines-launch-new-era-sea-power.

Continental Corporate Media Relations. 2018. "Where Are We Heading? Paths to Mobility of Tomorrow: The 2018 Continental Mobility Study." Accessed February 24, 2019. https://www.continentalcorporation.com/resource/blob/155638/140cb8b1d1e8c6b32198a9894627cf97/mobistud2018-studiepdf--en--data.pdf.

Kania, Elsa. 2018. "China's Strategic Ambiguity and Shifting Approach to Lethal Autonomous Weapons Systems." Lawfare. Accessed May 31, 2020. https://www.lawfareblog.com/chinas-strategic-ambiguity-and-shifting-approach-lethal-a.

Kilbride, Jack. 2018. "Killer Robots: Chinese University Recruits Talented 'Patriotic' Teens to Help Develop AI Weapons." ABC. Accessed February 24, 2019. https://www.abc.net.au/news/2018-11-09/china-recruits-talented-teens-to-help-developai-weapons/10477098.

Lehr, Amy K. 2018. "Responding to the Xinjian Surveillance State—And Its Likely Progeny." Center for Strategic and International Studies. Accessed March 3, 2019. https://www.csis.org/analysis/responding-xinjiang-surveillance-state-and-its-likely-progeny.

Mitchell, Anna, and Larry Diamond. 2018. "China's Surveillance State Should Scare Everyone." *Atlantic*. Accessed March 3, 2019. https://www.theatlantic.com/international/archive/2018/02/china-surveillance/552203/.

Muller, Joann. 2018. "Why China Could Be First with Self-Driving Cars." Axios. Accessed February 23, 2019. https://www.axios.com/chinataking-lead-on-autonomous-vehicles-609dfc98-f671-4a66-a731-b62d8327bef4.html.

People's Republic of China. 2018. "Position Paper, Submitted to the Group of Governmental Experts of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects." Accessed May 31, 2020. https://unog.ch/80256EDD006B8954/(httpAssets)/E42AE83BDB3525D0C125826C0040B262/$file/CCW_GGE.1_2018_WP.7.pdf.

Prosser, Marc. 2018. "Chinese Port Goes Full Robot with Autonomous Trucks and Cranes." SingularityHub. Accessed January 20, 2019. https://singularityhub.com/2018/05/17/chinese-port-goes-full-robot-with-autonomous-trucks-andcranes/.

Ray, Jonathan, Katie Atha, Edward Francis, Caleb Dependahl, James Mulvenon, Daniel Alderman, and Leigh Ann Ragland-Luce. 2016. *China's Industrial and Military Robotics Development*. US-China Economic and Security Review Commission. Accessed May 31, 2020. https://www.uscc.gov/sites/default/files/Research/DGI_China's%20Industrial%20and%20Military%20Robotics%20Development.pdf.

State Council, People's Republic of China. 2015. "Made in China 2025, 7 July 2015." Accessed February 26, 2019. http://www.cittadellascienza.it/cina/wp-content/uploads/2017/02/IoT-ONE-Made-in-China-2025.pdf.

State Council, People's Republic of China. 2016. "Robot Industry Development Plan (2016–2020)." Accessed February 27, 2019. http://www.ndrc.gov.cn/zcfb/zcfbghwb/201604/t20160427_799898.html.

State Council, People's Republic of China. 2017. "A Next Generation Artificial Intelligence Development Plan." Accessed February 23, 2019. https://chinacopyrightandmedia.wordpress.com/2017/07/20/a-next-generation-artificial-intelligencedevelopment-plan/.

Wright, Nicholas D., ed., 2018. *AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*. Arlington, VA: Joint Staff, J39.

Xinhua. 2018. "Conference Promotes Robots for Elderly Care." *China Daily*. Accessed February 25, 2019. http://www.chinadaily.com.cn/a/201808/24/WS5b7f4553a310add14f3877df.html.

DEMOCRATIC REPUBLIC OF THE CONGO

The Democratic Republic of the Congo (DRC), a country in sub-Saharan Africa, is not a typical place where one might expect to find innovative, applied robotics. Nonetheless, it is a growing field within the country. Robots are a part of daily life in some places of the DRC; in Kinshasa, the capital, traffic robots direct traffic, relieve road congestion, and save people's lives by preventing accidents. They are also applied to other important sectors, such as the mining industry, from which the country derives the majority of its income. Education for robotics and other emerging technologies is available on a limited basis, with more advanced courses

available at the university level. Some student teams travel internationally to compete with other teams.

One of the key innovators in the country's robotics industry is Thérèse Izay Kirongozi (1973–), sometimes referred to as the "Mother of Congolese Robotics." An industrial electronics engineer graduated from the Higher Institute of Applied Techniques of Kinshasa and housewife, Kirongozi reentered the workforce to develop robots. Her first major invention is a larger-than-life robot that conducts traffic. Inspired by the tragic death of her brother after a vehicle crushed him, preventing traffic deaths was a driver for Kirongozi's efforts.

Her robot, sometimes called Tamoke, sits on major traffic intersection in the country's major cities. The first was implemented in 2013. According to reports, the robots have caused a measurable decrease in traffic accidents. The robot has cameras and radar equipment; it is sensitive enough to detect pedestrians. The robot itself is made out of at least 50 percent recycled materials and sports solar panels for power. In addition to its technical capability, many people prefer the robots to traffic cops because they are always on duty and never ask drivers for bribes (Qhotsokoane 2018). In saving lives from traffic deaths, the robots have also addressed—and created—additional social problems through the disruption the technology has caused.

As part of her passion for robots and to further the fledgling industry with the country, Kironzogi started the group Women's Technology, an association of Congolese female engineers who focus on robotics and other technologies. She also runs two other businesses, one called Planète J that has an entertainment and retail focus and another that supports start-up companies run by women. Kirongozi is a role model to many Congolese. She has received several international awards for her work in robotics and for their role in saving lives. She also has a vision to expand her robotics production, believing that it could create over 1,000 jobs just for expansion within the DRC. She is also in discussions to sell and export the traffic robots to the Ivory Coast and Nigeria (Balogun 2019). Because of Kirongozi's and her colleagues' work, innovation in the DRC's robotics industry is high; more robots will be made in Congo to improve people's lives.

Another area where autonomous robots could help the population is through the use of drones. In early 2019, We Robotics agreed to work with VillageReach in the DRC to test drones as delivery devices. In particular, they wanted to test the possibility of delivering medical supplies, such as vaccines, to parts of the DRC with few clinics and poor immunization rates. Successful drone flights and delivery could start to reduce the number of people, especially children, who die from life-threatening but preventable diseases. In 2017, reports indicated that in Equateur province, only 67 percent of children received complete vaccine series, making it the province with the lowest resistance to preventable diseases (We Robotics 2019). Successful testing of drone delivery through remote and rugged terrain may not only improve children's health but may also be used in other applications that similarly provide needed aid to underprivileged areas. These drones would not

necessarily be autonomous, but they would employ people to make and pilot them to designated locations.

The addition of robots into the DRC's workforce offers some promise, but it can also fuel controversy. One well-known AI-enhanced autonomous robot in the country is Fred. Employed in a shopping mall in Kinshasa, Fred goes around the shopping mall to sell cellular phone services to potential customers. Fred is, interestingly, not entirely indigenous to the Democratic Republic of the Congo; its parts and operating system come from Russia. The operating system gives Fred the ability to greet people and a limited ability to talk to them about the service as it moves around the mall, often to the amusement of potential customers. Vodacom Congo, the robot's owner, wants to use Fred and other robots to reduce the number of people working solely on customer service and sales. The move to reduce employees is controversial, however, and has sparked backlash on social media. The country's unemployment rate is extremely high, estimated at 43 percent in 2014, and the use of robots to replace human workers could raise the rate of unemployed people even higher (Bayiha 2019). As robots enter the workforce, the country will need to balance the need and desire to adopt new technologies with the needs of its human capital.

The main industry where robot employment can protect human workers is the mining industry. Mining is the DRC's main industry, producing cobalt, lithium, and other valuable minerals used in advanced and emerging technologies. In fact, without some of these minerals, technologies such as autonomous robots and mobile phones might not be possible without significant investment into alternatives for their power sources; some experts predict it would take at least a decade of solid research to develop an alternative battery (Nicholas 2018). However, while minerals are the DRC's greatest natural resources, they are often found in mines controlled by warlords, paramilitary groups, or other groups that use or support violence. For this reason, these minerals are often labeled "conflict minerals," as they often are used to earn the money to fight wars and are often mined by children or other workers whose lives may be endangered by both dangerous working conditions and the violence that surrounds some of the mines.

As a result, many companies, especially in the West, have strict policies to ensure that they source minerals from reputable sources. These types of policies make robots more attractive for some mining establishments because people are not placed into hazardous working conditions and the minerals mined are not banned in the international marketplace. Increased efforts to employ robots in the most dangerous positions are popping up across the country. In Kibali, for example, Randgold Resources has started using automated technologies to load and handle materials from the mine. This sector has a lot of space for experimentation, and eventual implementation, of autonomous robots. They could not only speed up production in some cases; they would also protect more people.

Despite rising interest in robots, one area where the DRC lags behind is in STEM education, or Science, Technology, Engineering, and Medicine. Because there are

so few schools, the data on what education does exist in the country is scarce. A few high schools have robotics clubs in Kinshasa. Of those that have clubs, the best and brightest students may be invited to participate on competitive robotics teams that travel to international competitions. For example, Lyna Boyoko Nkolobise (n.d.) started up a special robotics team after being inspired by Kirongozi in 2016. Along with Reyel Kahudi Ndjeka (n.d.), they brought together three students to teach and train them on emerging technologies. This team attended the FIRST Global Challenge, along with representative teams from over 150 nations. Other school teams compete at competitions designed for elementary, middle, and high school levels.

Although there are not many teams, the Democratic Republic of the Congo has typically competed in PARC, the Pan-African Robotics Challenge. In 2019, teams from the DRC did not make the competition in Accra, Ghana, however, due a problem booking tickets, so instead they posted their ideas over Twitter so that the concepts, such as a solar-powered autonomous bus, would reach the competition (Lukisa 2019). Detailed information on the country's STEM educational programming is currently unavailable; the majority of the information comes from news stories and social media. Individual schools may have more robust curricula that is not widely publicized.

Although not known for being technologically advanced, the DRC is harnessing emerging technologies like autonomous robots to improve society. They are applying robotics to their unique social and cultural context to solve some of their country's challenges that in the past have often endangered human lives. They are also, albeit slowly, starting to train more youth and women to contribute to the technological ecosphere, allowing them to bring in new ideas using designs based on the materials to which they already have access. Developing the country's autonomous robotics capabilities to function across the country will bring more challenges due to difficulties traveling in remote or distant areas. However, while they are being considered for more widespread domestic use, some of the DRC technologies are already spreading to new parts of the African continent. Over time, the Democratic Republic of the Congo's reputation for robotics is likely to grow, especially as the technologies apply to other nations in the region and on the continent with similar issues.

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Further Reading

Balogun, Temmy. 2019. "Innovative! Congo's Thérèse Izay Kirongozi Invents Circulation Regulating Robot." Espact. Accessed May 31, 2020. https://espact.com/innovative-congos-therese-izay-kirongozi-invents-circulation-regulating-robot/.

Bayiha, William. 2019. "RDC: Premier robot avec intelligence artificielle, chargé de clientele." Africa News. Accessed June 5, 2019. https://fr.africanews.com/2019/03/28/rdc-premier-robot-avec-intelligence-artificielle-charge-declientele/.

Lukisa, Jeslone. 2019. "DRC' Team GIC Couldn't Fly to Accra Due to a Delayed Booking." July 5. Twitter. Accessed September 27, 2019. https://twitter.com/Jeslone_/status/1147163741575884801.

Nicholas, Lorna. 2018. "Cobalt Supply Chain Needs Transparency as Human Rights Violations Continue in DRC." Small Caps. Accessed September 27, 2019. https://smallcaps.com.au/cobalt-supply-chain-transparency-human-rights-violations-drc/.

Qhotsokoane, Tebello. 2018. "Keeping Up with the Robots—Maintaining Human Agency in an Automated World." Medium. Accessed September 27, 2019. https://medium.com/oxford-university/keeping-up-with-the-robots-maintaininghuman-agency-in-an-automated-world-fbba1eb1a268.

We Robotics. 2019. "Seeking Cargo Drone Partners for the Democratic Republic of the Congo." Accessed September 27, 2019. https://blog.werobotics.org/2019/03/22/seeking-cargo-drone-drc/.

GERMANY

Germany is one of Europe's technology leaders in the field of autonomous robotics and artificial intelligence. According to the Autonomous Readiness Report, it is the world's second most prepared country for autonomy after South Korea (Economist 2018). It ranks third as the most automated country in the world, with approximately 309 robots per 10,000 employees, a number expected to increase by at least 5 percent annually (Crowe 2018). In Germany, autonomous robots encompass a variety of robots, although emphasis is often placed on autonomous vehicles, such as automobiles. To allow and encourage their development, Germany has established or amended several national policies that also require meeting strong ethical standards. Automobiles are not the only type of robots being researched; German engineers explore a variety of robots intended to replace the need for humans in challenging or dangerous places.

Germany has a long history in robotics, most recently in the field of autonomous vehicles. For example, Johann Friedrich Kaufman (1785–1865), a watchmaker and inventor from Dresden, created a robotic soldier that could play the trumpet in 1810. Some people believe this was the first humanoid robot ever created (History-Computer.com n.d.). Although a robotic soldier is difficult to compare to a self-driving car, the automated soldier demonstrates early interest in robotics. More than a century later, initial efforts in Germany to build an autonomous car began in the 1980s.

Ernst Dickmanns (1936–), a professor at the Bundeswehr University Munich, invented an early driverless car along with a team of engineers. In 1986, the team produced a driverless van and tested it at the university and even on the autobahn, the German national highway that moves at extremely high speeds. In 1994, he created another car that could drive in French traffic (Delcker 2018). The time delay between the initial prototype and the test in France was due to the limits of the technology in the 1980s, although the original success led to the EUREKA Prometheus Project, a European Commission–funded effort that invested heavily in driverless technologies from 1987 to 1995. Current autonomous vehicles far surpass those of Dickmanns, but he is nonetheless credited as the inventor of the autonomous car.

Starting in the mid-2010s, Germany started shifting its policies and laws to focus on digital technologies. In 2014, and with an update in 2016, the government

released a Digital Agenda 2014–2017 and the Digital Strategy 2025. Between these agreements, the country established two data centers to work on artificial intelligence and machine learning, along with deepening researchers' understandings of the full breadth of what big data is and how to analyze it. To complement the growing research agenda, Germany organized and hosted a Digital Summit in 2016. Due to its success bringing together a wide variety of representatives from across multiple industries and institutions, the summit became an annual event. In 2018, Germany released its first Artificial Intelligence Strategy (Strategie Künstliche Intelligenz) highlighting the importance of ethical and legal standards for digital technologies.

Germany is a world leader in crafting national-level policies to govern the use of autonomous robots, such as autonomous vehicles. A May 2017 policy created a law requiring that any autonomous vehicle have a human operator ready to take control at a moment's notice. This particular policy has a two-year expiration date because of advancements in technology; it will be reassessed in 2019. In August 2017, the government issued another policy that autonomous programming cannot program ethical decisions into the car's operating system. Cars must be programmed to cause the least amount of damage and must preserve human life over that of property; the programming cannot allow the computer to choose which kind or type of person is the least valuable in case of an accident (Germany 2017).

Germany also amended the Vienna Convention on Road Traffic in 2016 to enable vehicles to operate autonomously legally and made specifications regarding the requirements for the vehicles to do so. To continue enable development and testing of autonomous vehicles, it also amended the Road Traffic Act in 2017, to allow autonomous vehicles to use public roads. The driver must still be ready to take control in the event of an emergency. This amendment also increased the damages to victims of accidents due to automated cars. Along ethical lines, drivers of autonomous vehicles remain the sole owners of their data or data the car produces while they are operators; the car manufacturers or developers do not automatically receive the data and cannot analyze it without the data owner's permission. This development is indicative of Germany's preference toward strict data privacy laws.

Upholding high ethical standards is an important component of German law. In 2018, the government established a German Data Ethics Commission and filled it with experts with different scientific backgrounds to address the need for ethics surrounding data. Prior to this, it had already created an Ethics Commission on Automated and Connected Driving in 2017, which also pulled experts from a variety of backgrounds together. This commission focuses on safety, privacy, and data rights. It establishes guidelines for programming that protect human interests and delineate individual responsibilities when operating autonomous vehicles. In addition, ethics are important because cars can cross borders, making interoperability of the technology as it changes borders critical not only for safety and a seamless experience. Germany has entered into a partnership with France and Luxembourg

to establish a digital test bed across borders, ensuring interoperability for the technology within different European Union member states.

Of course, Germany's work on autonomous robotics is not limited to autonomous vehicles. It has researchers designing and experimenting with special robots to work in flooded or damaged mines, including underground mines. The purpose behind these autonomous robots is to work remotely where people cannot, or should not, go. Helmut Mischo (1969–), the chair of underground mining at Freiberg University of Mining and Technology, focuses on autonomous robots designed to operate in underground mines. Through a project called ARIDuA, or Autonomous Robots and the Internet of Things in Underground Mining, his work examines how to design platforms, sensors, and specifications for these robots to function underground. These robots may contribute in the future to other challenging endeavors, such as space exploration and in conjunction with space stations and shuttles.

Using autonomous robots in space is another area Germany is investigating. Frank Kirchner (1963–), professor and director of the DFKI Robotics Innovation Center, believes that the robots currently under design may provide solutions for operating in space, on the moon, or eventually on other planets because they can function without sustained human contact. They may also assist human astronauts working in space, such as during space station repair or in clearing space debris. In 2016, Kirchner joined forces with another team from the University of Bremen. Operating remotely from a mission control center in Germany, the team-controlled robots positioned in Utah, in a region with geography similar to that of the moon. They tested the SherpaTT and Coyote III models, which are essentially land rovers. The experiment worked, proving that remotely controlled robots could respond appropriately and function in difficult terrain.

While some space robots are still under development, Rollin' Justin, a robot from the DLR German Aerospace Center, appeared in a livestreamed broadcast from the International Space Center in late 2018. European Space Agency astronaut and geophysicist Alexander Gerst (1976–) directed Rollin' Justin's third test to determine how well it could function in a human-machine team. Gerst performed the test as part of the METERON (Multi-Purpose End-to-End Robotic Operations Network) project, an effort designed with four primary goals: validation of the technologies; telepresence; human-machine teaming in restrictive environments; and interoperability of robots and mission, or other, control centers or devices (ESA 2017). Astronauts from across Europe and the United States participate in the METERON project.

Germany's robotics industry is thriving. Between government and academic initiatives, engineers strive to develop advanced autonomous robots that function on crowded streets as well as in remote or constrained environments. Not only is Germany prepared to embrace autonomy, but it is also one of the world's leaders in the creation of autonomous robots.

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Further Reading

Crowe, Steve. 2018. "10 Most Automated Countries in the World." Robot Report. Accessed August 19, 2019. https://www.therobotreport.com/10-automated-countries-in-the-world/.

Delcker, Janosch. 2018. "The Man Who Invented the Self-Driving Car (in 1986)." Politico. Accessed August 19, 2019. https://www.politico.eu/article/delf-driving-car-born-1986-ernst-dickmanns-mercedes/.

Economist. 2018. "Who Is Ready for the Coming Wave of Autonomy?: Autonomous Readiness Index." Accessed August 19, 2019. http://www.automationreadiness.eiu.com.

European Space Agency (ESA). 2017. "METERON Project." Accessed August 19, 2019. https://www.esa.int/Our_Activities/Space_Engineering_Technology/Automation_and_Robotics/METER ON_Project/(print).

Germany, Federal Ministry of Transport and Digital Infrastructure. 2017. "Action plan automated and connected driving." Accessed May 31, 2020. https://www.bmvi.de/SharedDocs/EN/Documents/DG/action-plan-automated-and-connected-driving.pdf?__blob=publicationFile.

History-Computer.com. n.d. "Friedrich Kaufmann." Accessed August 19, 2019. https://historycomputer.com/Dreamers/Kaufmann.html.

ISRAEL

In recent years, Israel has invested in advanced robotics research and development. Through government, university, and corporate initiatives, the robotics industry has boomed, gaining interest and large investments from other countries worldwide. While many domestic and international companies present in the country focus on autonomous vehicles, other organizations working in the country are also developing autonomous robots to protect its population as well as ones that should improve, or enhance, multiple sectors of society. The major area where Israel needs emphasis is on that of policy and regulation.

Israel is often dubbed the "Start-Up Nation." It has had a long-running history of successful technology start-ups, and the technology innovation center of the country is sometimes referred to as Silicon Wadi, as it functions similarly to California's Silicon Valley. Israel's technology sector is primarily export based because the country and its consumer consumption rates are small, yet it produces high-quality technologies. For this reason, Israel receives large amounts of direct foreign investment for its technology development, although that also means that it is beholden to those investors. These relationships do not affect Israel's ability to innovate, but rather they mean that there is less domestic usage of some of its inventions. The most promising autonomy effort for domestic use is the autonomous vehicle, of which testing is underway. There are also more specialized efforts on autonomous social robots that will appeal to domestic consumers.

Israel has moved quickly to develop its robotics industry in a short period of time. In 2016, Israeli Prime Minister Benjamin Netanyahu (1949–) called for Israel to become a world leader in robotics. This call followed a massive, multi-million

U.S. dollar Chinese investment into Israel's robotic development. Following Netanyahu's direction, Peretz Vazan (n.d.), the Minister of Science, Technology, and Space, decided to direct his organization's research focus to the field of robotics. Along with the ministry, the National Council for Research and Development suggested the need for an innovation center to examine robotics and facilitate information sharing across the government. Other parts of the government invested in robotics education programs and sponsored robotics competitions among schools to foster robotics development.

On the academic side, several university programs have gained strong reputations for robotics. These include Ariel University; Technion, Israel's Institute of Technology; Hebrew University; and BenGurion University of the Negev. There is also a consortium called the Israeli Robotics Association, which brings researchers together to collaborate and exchange information. It works across multiple sectors, such as agriculture, transportation, medicine, defense, and security applications of robotics and autonomy (IROB 2019). The group host numerous events and encourages members to join from all over the world, with a preference for those who will promote Israeli robotics.

Foreign demand for Israel's robotics technologies has grown steadily. China, Japan, and South Korea are three of the top nations investing in Israeli robotics. China has made multi-million-dollar investments into the robotics industry. In addition, it has established the Sino-Israel Robotics Institute in Guangzhou. It is a small part of the US$2 billion industrial park that will develop around jointly produced Israeli-Chinese technologies. The purpose of the institute is to work with Israeli firms to automate menial, rote jobs, and to expand the economy to employ people more fully (Shamah 2015). Japan has subsidiaries of its robotics industry in Israel and also invests millions of U.S. dollars into Israeli robotics startups. Similarly, South Korea makes large investments and has multiple partnerships with Israeli universities and technology firms. In addition, other countries have noted interest in collaborating with Israel's robotics talent. Most researchers find foreign investment critical; without it, Israeli's economy would only allow for limited opportunities for advancing new technologies.

Israel prides itself on its progress toward realizing autonomous vehicles, believing that it will integrate them into society in the near future. Mass transportation, such as shuttles, buses, and even taxis, will be the center of these early efforts. Testing has been underway in cities and on major public highways, such as the stretch between Jerusalem and Tel Aviv. The testing in the city includes using road that have no lane markings and including pedestrians and other obstacles that erratically interrupt the vehicle's course. Mobileye, a company that has tested different aspects of autonomous vehicles since 2014, plans to launch an autonomous taxi business by 2022, with pilot programs starting at the end of 2019. Private companies, such as Hyundai and Porsche, have elected to place some of their research into the high-tech aspects of the automotive industry in and around Tel Aviv. There is even one company working on a robot driver that would make any car an autonomous vehicle instantly, potentially

Many countries embrace the trend of using autonomous robots as law enforcement officers. Robotic police perform the jobs that people often don't want because they are dangerous. They have the ability to note subtle changes that might people might miss. In the Middle East, humanoid robot officers patrol the streets in Dubai. Special robot police cars patrol the streets, which are equipped with the ability to deploy a drone to allow for aerial coverage (Page 2018). Other countries also experiment with robotic police. The Congo implemented robots as traffic cops on heavily trafficked roads to reduce the number of fatalities. South Korea has used robots as prison guards and has robot patrols on its northern border. India has riot-control drones. Israeli police have a rover named Dogo that allow them to apprehend suspects safely without placing police lives at risk.

even changing the definition of what an autonomous vehicle is if the vehicle itself is not self-driving.

One of Israel's setbacks to autonomous vehicles is its current lack of a comprehensive legal framework to regulate them. While the Ministry of Transportation does require licenses for testing autonomous technologies, in particular those related to self-driving vehicles, they do not quite translate into policy that addresses areas of concern like safety, insurance requirements, and the imperative that robots do no harm to humans. The country has also started to develop lethal autonomous weapons systems, or LAWS. The government has expressed the possibility of considering regulations surrounding these LAWS, which are very controversial all around the world, but has not clarified how it will review and regulate them.

Other forms of autonomy are under development to protect the country and its people. The government, specifically the Israeli Defense Force, describes its role in robotics as one of design and manufacturing for the nation's security. Percepto, a local technology company, developed the Sparrow I, an autonomous drone that relies on artificial intelligence to perform real-time analytics that inform decision makers. These drones are suited to security, such as safeguarding a location, and would alert police or other law enforcement personnel when they detect something threatening. One of 4M Analytics' offerings, an autonomous robot driven by artificial intelligence, can identify and clear landmines. Testing on Israeli landmines has demonstrated a high clearing rate, even identifying several landmines that were previously undiscovered on land open to the public. The company hopes to export its capability to other countries to prevent people from damage or death due to a landmine explosion (Halon 2019). RoboTiCan, another local firm, invented the Rooster, a search-and-rescue robot with the ability to walk, hover, or fly to surmount obstacles in dangerous terrain. The company envisioned the robot to find people after a natural disaster.

Israel's autonomous robots are also intended to improve people's lives. Efforts are underway to create an autonomous smart home with an autonomous robot that controls it. There are also advances in robots that provide some degree of

A de-mining robot clears a suspicious object from the streets of Be'er Sheva, Israel. Israeli companies, either directly or through international partnerships, seek to develop robots for a variety of purposes, including protection and defense. This line of investment encompasses robots that can autonomously, sometimes with the use of artificial intelligence enhancements, perform actions that safeguard human lives, such as safely defusing landmines or bombs. (Irina Opachevsky/Dreamstime.com)

caregiving to senior citizens and others in need of extra help or companionship. Researchers at Technion, Israel's equivalent to the Massachusetts Institute of Technology, have put forward multiple approaches to develop autonomous robots for the construction industry. They see robots as a solution to the long-standing difficulty of employing people in construction and aspire to create robots that can help with potential labor shortages (Rosenfeld 1996).

With the progress Israeli researchers have already made in robotics, many people believe that a developer's imagination, coupled with the limits of computing power and algorithmic constraints, is the only significant barrier to development. They are also aware that there may be future issues to address, such as questions about the human impact of these technologies, like those currently occurring in the construction industry: What happens if machines replace human labor? In some sectors, such as those involving the transport of passengers from one location to another, the loss of human jobs is becoming more possible with each new development in autonomous vehicles.

Israel is well positioned in the areas of autonomous robots and vehicles. Investors and researchers in the country's technology development have high expectations for technology design and testing within the country. With the exception of a strong legal framework, of which the country may find itself in need as autonomous technologies continue to be developed and tested, Israel has most of the

ingredients it needs to continue advanced work on autonomous robots of all shapes and sizes.

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Further Reading

Halon, Eytan. 2019. "4M Analytics Clears Minefields with Artificial Intelligence." *Jerusalem Post*. Accessed May 31, 2020. https://www.jpost.com/Israel-News/The-Israeli-start-up-clearing-minefields-with-artificial-intelligence-599755.

Israeli Robotics Association (IROB). 2019. "Home Page." Accessed August 29, 2019. http://www.ariel.ac.il/sites/shiller/irob/index.html.

Rosenfeld, Yehiel. 1996. "Current Status and Key Issues in the Future of Automation and Robotics in Construction in Israel." 13th ISARC. Accessed September 1, 2019. https://pdfs.semanticscholar.org/b21f/84364821f0cec7fccc9a0cdd50570153af03.pdf.

Shamah, David. 2015. "Israeli Tech to Power a Robot Revolution in China." *Times of Israel*. Accessed August 29, 2019. https://www.timesofisrael.com/israeli-tech-to-power-a-robot-revolution-in-china/.

MEXICO

Mexico has great potential for the development and adoption of autonomous robots. With its large manufacturing sector, it is also a prime location for installing automated systems. While there is growing interest in robotics, the country currently ranks low, albeit not the lowest, on most indices of national preparedness for autonomous robots, especially for autonomous vehicles. Despite the low rankings, the country's robotics industry has grown. Over the last three years, the importation of robots has been increasing. Much of the robotics work originates in academia and industry, with some backing from the government and direct foreign investments. Mexico views autonomous robots as the possibility for great technical advancement; it plans to test robots on the moon and aspires to use them in the future to advance its ability to conduct more wide-ranging space exploration.

Relatively little statistical information is available on Mexico's autonomous robot development. With the exception of news stories that stress the importance of automation for economic advancement, data on Mexico's work on autonomy is limited. Research on public perceptions of autonomy and automation are also difficult to find, likely reflecting that robots have not yet had a great effect on people; there is little discussion of the fear that robots will take away human jobs and upset the labor market, unlike in more industrialized nations, where more people have expressed such concern. The impact automation could have on the country is staggering; the McKinsey Global Institute estimates that 52 percent of Mexican jobs will be impacted, including a 64 percent job loss in the manufacturing sector (WEDC 2017). At the same time, Mexican farmers have not been able to find the necessary labor to tend and harvest crops, despite considering offering higher wages to field hands, and are considering how to use autonomous robots for farming to meet demand. Most experiments with agricultural robots currently rely on foreign-purchased or -leased technologies.

Mexico has few laws governing autonomy, and emerging technologies offer challenges even though some have proven beneficial to the economy. Autonomous vehicles, specifically, present challenges for development and usage in Mexico; there are many barriers that the country must surmount. While they do exist in the country, there are few policies or laws that address them. It's also unclear as to whether the public accepts autonomous vehicles, as only limited tests have taken place in public, and the country's road systems are not generally of very high quality. However, in terms of automation, such as using robots to more rapidly produce auto parts, Mexico has adopted some robots into its manufacturing.

Robots aid in vehicle assembly and also the production of parts like chassis and headlights. Some of these robots use programming that includes artificial intelligence to increase their effectiveness. According to some companies, automation is critical because it increases productivity, quality control, and agility, which often translates into reductions, or no increase, in costs to consumers. However, experts also state that 50 percent of automated manufacturing solutions fail because of increased risks to the company (IDC Online 2019). Despite potential risks, Mexico is eyeing automation and, increasingly, the development of autonomous robots to modernize many economic sectors. In turn, these efforts should advance its robotics capabilities and increase investments into these technologies.

Similar to other nations that wish to test autonomous robots in space, Mexico planned to launch eight small robots to explore the moon by the end of 2019; the plan, now called COLEMNA, has shifted to 2021 and expanded to nine lightweight robots. After exploring different terrain, the robots are programmed to come back together to form a solar panel. If the mission is successful, Mexico will be one of the first Latin American nations to operate in space. In addition, these robots are economical; they are inexpensive, run on minimal power, and together weigh less than half a kilogram, making them cost little to transport. They are part of a larger strategy to consider launching a mission to Mars to mark Mexico's accomplishments. Such an endeavor, however, would be years in the future, as Mexico would need to work on other technologies to prepare it for space. Gustavo Medina Tanco (n.d.), head of the National Autonomous University of Mexico's Space Instrumentation Laboratory, is one of the driving forces behind these robots. The effort is further supported and financed through public and private funding. One 2019 effort was a success; working with NASA, a group of university students built a satellite approximately the size of a breadbox that launched from the International Space Station in December.

Despite some of Mexico's obstacles in tackling the development of autonomous technologies, interest continues to grow. The international engineering company ATI Industrial Automation opened its first in-country plant in 2015 in Queretaro. Genesis Systems, another international company, opened a Mexican subsidiary; it is not the only company to envision Mexico's potential as a robotics hub for Latin America. Nonprofit organizations, such as the Association for Advancing Automation (A3) México (2019), have also started advocating for domestic robotics

engineering and manufacturing. Its website maintains updated lists of robotics news and related events across the country. In some cities, local interest groups participate in meetings to discuss the future of autonomy; many of these are advertised on websites such as Meet Ups.

Mexico hosts a number of robotics challenges, where teams compete to complete tasks using autonomous robots. These events include, for example, the Torneo Mexicano de Robótica and Robofest Latinoamérica. Robofest, created by Lawrence Technological University (LTU), attracts teams from across the globe. It rotates locations, with the 2019 competition held in Mexico. Competitors are fifth to twelfth graders, with university students allowed to compete in the most difficult rounds. The competition includes several events, including a parade, exhibition, games, and challenges, some of which are scheduled in advance with others announced during the competition to surprise the competitors. The primary goal is to encourage innovation and, ultimately, to create a showcase of international robotic talent (LTU 2019). In 2019, an all-girls team from Ghana won the top prize. Mexico hosted the First Global Challenge 2018 robotics competition, which brought 700 teams together to compete in Mexico City. Mexican teams have placed well in many of these competitions, showcasing the ingenuity of Mexican students and engineers. For example, in 2018, Mexican students performed well at the World Educational Robotics contest in Shanghai. The three teams, comprised of sixth graders and representing three cities, took the top three prizes after competing with over 500 teams (Mexico News Daily 2018). One school in Gutiérrez Zamora holds over 160 international robotics prizes. Robotics education, however, is generally only available in private schools.

Mexico's future with autonomous robots and automation appears bright, although many questions remain unanswered. The Mexican government will need to create policy, if not a national strategy, to determine how it wants to regulate and legislate autonomy. These policies will be important to ensure public safety as autonomous vehicles and other technologies overlap with its citizens' lives. As autonomy and robotics more generally upend the labor market, there will be social impacts to mitigate. The government will also need to consider an educational strategy or curriculum to ensure that its students remain competitive internationally. The success it has enjoyed relies heavily on private funding and limits robotics to the elite rather than prepare the entire population for autonomy. In addition, researchers may consider conducting surveys to understand public perceptions surrounding autonomy and automation. The current lack of information makes it difficult to assess how the population might respond to issues surrounding these robots.

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Further Reading

A3 Mexico. 2019. "A3 México Bienvenido." Accessed August 20, 2019. https://www.a3mexico.com.mx/.

IDC Online. 2019. "México está madurando en automatización robótica." Accessed August 20, 2019. https://idconline.mx/laboral/2019/04/25/mexico-esta-madurando-en-automatizacion-robotica.

LTU. 2019. "Robofest Latinoamerica 2019." Robofest Mexico. Accessed August 20, 2019. https://www.robofestmexico.org/.

Mexico News Daily. 2018. "Gold Medal for Mexican Team at Shanghai Robotics Competition." Accessed August 20, 2019. https://mexiconewsdaily.com/news/gold-medal-at-shanghai-robotics-competition/ .

Wisconsin Economic Development Corporation (WEDC). 2017. "Automation and Robotics Set to Transform Mexico's Manufacturing Sector." Accessed August 20, 2019. https://wedc.org/export/marketintelligence/posts/automation-robotics-set-transform-mexicos-manufacturing-sector/.

SOUTH KOREA

South Korea has historically excelled in robotics and today ranks among the top—and by some standards is the top—nation in terms of preparedness for autonomous robots and artificial intelligence. For example, the *Economist* (2018) created the Autonomous Readiness Index to rank countries based on indicators of how well national policies prepare the population for the invention and adoption of autonomous systems such as autonomous robots. This rating reflects the country's large investments in the public and private sectors that include allocating funding for innovative approaches in addition to educational and training programs.

In 2016, South Korea budgeted US$450 to invest in its robotics industry over a five-year period and US$1.9 billion to develop new technologies, followed by an announcement to spend an additional US$6.5 million to grow its robotics industries by 2022 (Prakash 2018). By 2017, South Korea employed the highest density of robot workers to employees in the world, with 631 industrial robots per 10,000 workers (Crowe 2018). The majority of these robots are found in the industrial sector, primarily in manufacturing and electronics, although the application of robots to the country's textile and food-related sectors lag behind. While South Korea generally focuses robotics development on improving society, there is a debate in the country over the growing role robotics may plan in future warfare.

Historically, South Korea has frequently experimented with the use of autonomous robots. Its efforts generally support robots that improve society and place value on human lives. In 2012, it began testing robotic prison guards to patrol prison facilities and alert corrections officers of any anomalies. These robots were not allowed to interact directly with prisoners by design in order to avert any fears or opposition to employing robots in the facility. However, the tests did not pass the pilot stage. The government started using drones for safety inspections in high, hard-to-reach places in 2017 to detect problems and monitor for areas prone to mudslides. In 2017, surgeons used the Korean robot Revo-i in a radical prostatectomy that prevents incontinence, the inability to control one's bladder or colon functions. In a role with a smaller social impact, one company has even tested using a robot to deliver pizza at a popular food court. Businesses across the

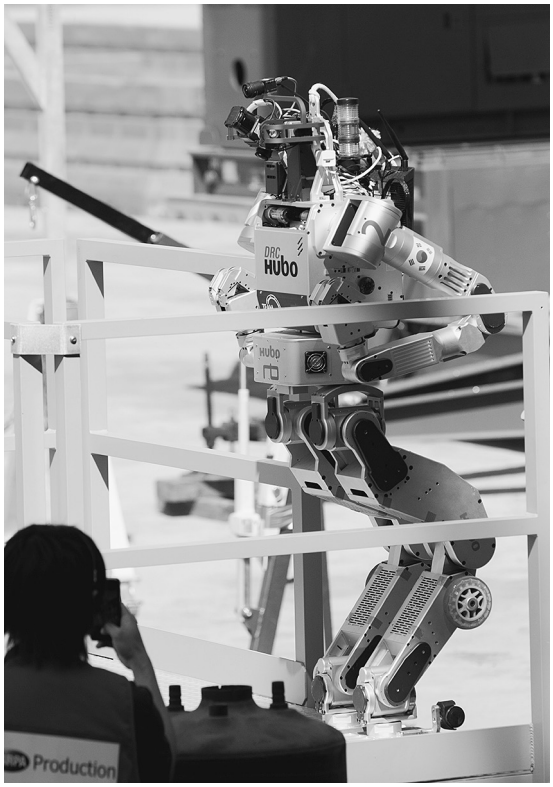
In the 2015 U.S. Defense Advanced Research Projects Agency Robotics Challenge, the South Korean-made robot HUBO won the US$2 million prize. HUBO is a walking robot with two legs that can transition between walking and kneeling. During the competition, it completed all of the required tasks in less than forty-five minutes (Asian Scientist Newsroom 2017). The university that created HUBO, the Korean Advanced Institute of Science and Technology, has continued to develop the robot. In the 2018 PyeongChang Olympics, HUBO joined the Olympic Torch Relay to carry the torch near KAIST in Daejon. As part of its relay leg, HUBO pulled out a drill to cut through a wooden wall in order to pass the torch to its creator for the next leg (Lee 2017).

nation view autonomy as an important next step in the country's development. It is also helpful that the population generally approves of integrating robots into social settings in most cases.

The robotics industry took off in the country in 2008, after the National Assembly implemented the Intelligent Robot Development and Promotion Act. Follow-on national plans in 2009 and 2014 built upon the foundation formulated in the act. Another strategy, enacted in 2018, included four action plans to expand the market for and development of intelligent robots. As part of its plans, the government developed a city called K-City for testing new technologies. An unpopulated city, it can be used to test autonomous cars and other technologies such as 5G mobile networks, including testing combinations of new technologies like autonomous vehicles that rely on 5G networks. The government continues to increase investments in robotics and artificial intelligence to support cutting-edge development.

The year 2018 was not just momentous for South Korea's technology testing and national action plans; but it also saw an increase in deploying autonomous robots to aid society and showcase the country's advancements in robotics with the world. In an international display of its robotics capabilities, South Korea employed multiple autonomous robots at the PyeongChang 2018 Olympics. Professor Oh Jun Ho (1954–), from the Korea Advanced Institute of Science and Technology (KAIST), led the team that selected which robots would feature at the airport and at the venues assigned to the major game events. Ho developed HUBO, the country's first humanoid robot in 2004, and it was an Olympic torchbearer (Gahui and Hana 2018). HUBO previously won the DARPA Robotics Challenge in 2015, receiving a US$2 million prize. Its original purpose was to work in places too dangerous for people, the focus of the competition inspired by the aftermath of the 2011 tsunami in Japan.

HUBO, like the other robots, impressed Olympic visitors, who also had the option to interact personally with multilingual robots designed to give directions and provide information about the games. Drones performed at the opening ceremony, with 1,218 drones flying simultaneously, setting a record in the *Guinness Book of World Records*. Ho spared no attention to detail, even placing robotic fish in the Olympic Plaza aquariums. He also organized a robot ski challenge, where



KAIST university's HUBO robot climbs stairs in the 2015 DARPA Robotics Challenge. HUBO won the competition by completing 8 major tasks in less than 45 minutes. HUBO also has the distinction of having been an Olympic torch bearer in the 2018 Pyeong-Chang Olympics and was among the 85 different robots that performed services or entertainment at the event, representing South Korea's advanced research in autonomous robotics and related technologies. (Jose Gil/Dreamstime.com)

Korean university teams competed in events to entertain and to test their programming (Gahui and Hana 2018). Other robots painted, cleaned, and entertained guests; in total, eighty-five different robots worked the Olympics.

Another notable robotics accomplishment from 2018 was the exploration underneath Antarctica's Dotson Ice Shelf. The Korean Polar Research Institute, in partnership with the University of Washington and Lamont-Doherty, carried out a year-long project to take measurements of the ice shelf. Previous efforts underneath the shelf had lasted a maximum of forty-eight hours. This effort marks the first time that sustained measurements of the ice shelf have been possible; the data derived from the expedition, though not yet analyzed, may provide great insight into the future of the planet.

South Korea continues to grow its vision for how robots can improve society. In fact, the country has decided to document the changes that robots will bring; to do so, it will host the future Robot Science Museum in Seoul. The project, carried out by the Turkish architecture firm Melike Altınışık Architects, will use robots and drones to construct the museum. The construction plan incorporates robots in almost every aspect, including using 3D printers to print concrete pieces and other required items. The drones, in particular, will not only map the construction site but will also provide security. Targeted for 2020, the building's first exhibit will feature the museum itself as well as the robots involved in its construction. After completion, the robots will carry out museum operations and educate visitors on robotics and other technologies either used by or featured in the museum, such as virtual reality, augmented reality, and holography. The final completion date is projected to be 2022. It will be ovoid shaped, meaning it will look like a three-dimensional egg.

South Korea also looks to robotics and artificial intelligence for its security. It uses robots developed by Samsung to patrol the demilitarized zone on the border between it and North Korea. These robot are controversial because they carry rifles. The country also announced plans in 2018 to build weaponized drones to attack North Korea in the event of a war (Perrigo 2018). While the South Koreans do not express distress at these robots, international researchers and observers fear that South Korea has started to weaponize robotics and artificial intelligence. Experts and scientists from more than thirty countries decided to boycott KAIST in 2018 because it partnered with a defense manufacturer to allegedly build robotic weapons. The boycott corresponded to a meeting of the United Nations to discuss South Korea's work on "combat robots," which many people fear will be like the Terminator from the Arnold Schwarzenegger (1947–) movies. Other developments related to national security include the country's announcements that by 2024, it will employ biobots with its soldiers. These biobots will have traits that mimic humans or insects, and in later years, other robots will mimic birds, reptiles, and marine animals.

One of the downsides to modernization with autonomous robots is whether their use will decrease jobs and how that would affect unemployment. South Korea's cities like Seoul might experience fewer effects due to the diversity of jobs available; displaced workers theoretically should be reabsorbed into the economy. However, cities that rely on manufacturing, such as Busan and Ulsan, could experience high unemployment rates if autonomous robots receive wide adoption because there are few alternative industries that could receive workers. Manufacturing typically involves manual, repetitive work and therefore would be ideal places to introduce automated or autonomous solutions. To allay fears of robots replacing human jobs, in South Korea introduced a robot tax in 2017; not truly a tax, it is a limit on tax incentives for companies choosing to invest in automation and autonomy. Despite concerns about the impact robots may have on society, the country remains robot friendly.

South Korea's goal to modernize with autonomous robots may lead to an overhaul of its many economic sectors and fundamentally change various aspects of society. The country has decided to devote significant resources to this endeavor and has attained a solid international reputation for its achievements.

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Further Readings

Crowe, Steve. 2018. "10 Most Automated Countries in the World." Robot Report. Accessed August 18, 2019. https://www.therobotreport.com/10-automated-countries-in-the-world/.

Economist. 2018. "Who Is Ready for the Coming Wave of Automation?" Autonomous Readiness Index. Accessed August 18, 2019. http://www.automationreadiness.eiu.com.

Gahui, Kang, and Lee Hana. 2018. "PyeongChang Olympics to Showcase Automated Robots." Korea.net. Accessed August 18, 2019. http://korea.net/NewsFocus/Sci-Tech/view?articleId=153149.

Perrigo, Billy. 2018. "A Global Arms Race for Killer Robots Is Transforming the Battlefield." *Time*. Accessed August 18, 2019. https://time.com/5230567/killer-robots/.

Prakash, Abishur. 2018. "South Korean AI Sees Continued Development, Investments." Robotics Business Review. Accessed August 18, 2019. https://www.roboticsbusinessreview.com/ai/south-korean-ai-sees-continueddevelopment/.

UNITED KINGDOM

The United Kingdom strives to be a world leader in autonomous robots, vehicles, and other technologies related with autonomy. It is investing heavily in technology development and research-based policy development to raise its global stature in these areas. The country is positioned well in terms of government and popular support for these technologies, and it stands to benefit economically from their adoption. While crafting policy and supporting research, the United Kingdom upholds high standards not only for the technology but also for the people who participate in every aspect of technology design, especially for ethics, best practices, and standards. Because the United Kingdom 's involvement is significant, the following summary touches on each of these areas, with the caveat that the country's history and experience with autonomy has greater breadth and depth.

Historically, the United Kingdom has excelled at researching concepts and components of new technologies like autonomous robots and vehicles, but the country has been slower to deploy them in comparison than many other nations. However, the United Kingdom has several advantages for moving toward autonomy and integrating autonomous robots into society that it plans to use to increase its footprint in robotics and autonomy. These advantages include a population that tends to accept and adopt new technologies faster than many other societies and a supportive, proactive government seeking to implement policy that enables faster technological development that reaches consumers faster. Trying to stay ahead of emerging technologies, the government issued a green paper in 2017 outlining its new industrial strategy incorporating these technologies. The paper included ten pillars of how it plans to prepare for fast-paced technological changes, including the need to develop, test, approve, and permit the distribution of technologies, such as those built to work autonomously (HM Government 2017).

As a sign of its commitment to autonomy and robotics, the government has supported various efforts to advance research and development. For example, in 2018, it committed to a £10 million fund to support policy research. As part of this fund, it invested in fifteen projects to investigate the needs surrounding the implementation of autonomous robots, such as the use of robolawyers to adjudicate legal issues and rules to govern flying cars (Elgot 2018). It also runs Innovate UK, a government agency that seeks to identify and grow technologies that will expand the country's economy. Since 2007, the organization has spent more than £1.5 billion for projects with positive economic potential and procured more than £1.5 billion in funding from the private sector (Innovate UK 2019). Some of this funding has gone to autonomous underwater vehicles and to other autonomous

robotics that work in dangerous or remote locations. In 2019, the Department of Defence announced multi-million-pound investments that would increase spending on robotics and autonomous systems for the military (Ministry of Defence 2019). These efforts represent a portion of investments being made into autonomy and robotics; the total amount of investment is likely much higher, demonstrating the country's commitment to these technologies.

The United Kingdom has developed many legal and policy positions focused on autonomy, robotics, and other emerging technologies. Currently, they are somewhat in question as the country breaks away from the European Union in a movement known as Brexit, or British Exit. The European Union's parliament, or European Parliament, has issued regional policy for autonomous robots and vehicles. Until the United Kingdom actually exits, it maintains representation on the European Parliament and, like other European Union bodies, must uphold that policy.

Involvement includes participating in debates, such as a recent debate over whether to grant autonomous robots the status of personhood (Pagallo 2018). Giving robots some degree of personhood would affect liability laws, making each robot hold liability and requiring personal insurance. However, granting any degree of personhood also conveys at least some human rights' status, which means that certain human laws would apply to the robot, leading to longer-term questions about robots having the same, or similar, rights as individual people. Although the United Kingdom has not taken an official stance on this issue, many experts argue against granting personhood to robots at this time.

The personhood debate, which could not have occurred until the past few years as the technology has reached greater maturity, is only one aspect of European Union law and guidelines that the United Kingdom has agreed to follow as a member state. It may choose not to adhere to all of them after departure, although the country has committed itself to upholding high ethical and legal standards for autonomy and artificial intelligence. It will continue to develop policy based on the United Kingdom's needs, and these regulations will safeguard the rights guaranteed in its Acts of Parliament, which, combined, form a national constitution, and other laws.

Regardless of how the United Kingdom continues to follow European Union policies and guidelines, it is likely to uphold at least some of the recommendations contained in the European Parliament's resolution 2015/2103(INL) from 2017 that provides recommendations to the Civil Law Rules on Robotics, which outline guidelines for liability and ethics (Olivi 2019). The United Kingdom follows a number of guidelines termed *roboethics* that outline ethical principles required in the development of robotics technologies. One of the founding principles states that human life is priority over that of a robot, as outlined in the European Union's 2000 Charter of Fundamental Rights. The Engineering Council and Royal Academy for Engineering (2017) produced a framework to govern engineering responsibilities for technology development, which outline engineering ethics, such as upholding the law and respecting human life. Specifically geared to robotics and autonomous systems, the UK-RAS Network (2019) issued a whitepaper to discuss

ethics as they relate to these new technologies, including bringing up the outstanding questions and challenges inherent to them. The government holds ethics highly and will strive to ensure these standards apply across industry, academia, and other parts of society so that any new technology adoption relies on machines that comply with its ethical standards.

Autonomous vehicles constitute an area where the United Kingdom anticipates becoming a world leader. The Department for Transportation (DfT) announced in early 2019 that it had ordered advanced trials for the automobiles to prepare them to be on the roads by 2021. These advanced trials follow several years of smaller, simpler trials to learn about risks associated with autonomous vehicle usage and questions about how to assure public safety. To address policy needs, in August 2018, the government issued the Automated and Electric Vehicles Act. This law placed insurance requirements on autonomous vehicles and drivers, similar to those already in place for other types of vehicles. Considering insurance rules early is one of the steps required to prepare the country for autonomous vehicles, though it is only an early step. The country will consider additional legislation if it wants to have autonomous vehicles on the roads by 2021. Some researchers, however, suspect that this goal is too ambitious and that the usage of autonomous vehicles will not receive full approval until a later year, once safety and risks are better known.

Due to its interest in autonomous vehicles, the government opened a special organization to consider the additional issues surrounding these vehicles. The DfT operates a center, the Centre for Connected and Autonomous Vehicles, established in 2015, where the government focuses specifically on autonomous vehicles, ranging from technology development to cybersecurity, infrastructure, data privacy, and other social and legal issues that could prevent adoption. As a government office, the center develops draft policies and invites the public to comment, ensuring more widespread acceptance of official policy (Gov.uk 2019). Public engagement is important; this process also allows the government advanced warning about areas of public controversy and concern so that it may focus on allaying them, which also aid in raising public trust and acceptance. This center ultimately aspires to position the United Kingdom as one of the world's vanguards for autonomous vehicles.

Autonomy, especially in the case of robots and vehicles, is an area where the United Kingdom plans to make quick progress and establish itself as a world leader. It has spent years preparing the legal framework and guidelines for sound and ethical technological development, and alongside the policy-level work, it has invested, funded, and otherwise supported the research to realize these technologies. The United Kingdom is also fortunate that its government's efforts are mostly supported by its people, with the population tending to adopt new technologies readily. It also engages with the public to gauge sentiment and address concerns early. The United Kingdom's efforts have positioned it well for the future with autonomous robots and vehicles.

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Further Reading

Elgot, Jessica. 2018. "'Robolawyers' among Futuristic Ideas Backed by £10m Innovation Fund." *Guardian*. Accessed June 1, 2020. https://www.theguardian.com/business/2018/oct/05/business-secretary-unveils-10m-fund-for-innovation.

Engineering Council and Royal Academy for Engineering. 2017. "Statement of Ethical Principles for the Engineering Professional." Accessed June 1, 2020. https://www.raeng.org.uk/publications/reports/statement-of-ethical-principles.

Gov.uk. 2019. "Centre for Connected and Autonomous Vehicles." Accessed August 24, 2019. https://www.gov.uk/government/organisations/centre-for-connected-and-autonomous-vehicles.

HM Government. 2017. "Building Our Industrial Strategy: Green Paper." Accessed June 1, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/611705/building-our-industrial-strategy-green-paper.pdf.

Innovate UK. 2019. "About Innovate UK." Accessed August 24, 2019. https://innovateuk.blog.gov.uk/about-innovate-uk/.

Ministry of Defence. 2019. "Desider, 130." Accessed June 1, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/799830/May-desider-online-v3.pdf.

Olivi, Giangiacomo. 2019. "European Union: Robots and Liability: Who Is to Blame?" Mondaq. Accessed August 24, 2019. http://www.mondaq.com/uk/x/767368/new+technology/Robots+And+Liability+Who+Is+To+Blame.

Pagallo, Ugo. 2018. "Vital, Sophia, and Co.: The Quest for the Legal Personhood of Robots." *Information* 9 (9): 230. https://doi.org/10.3390/info9090230.

UK-RAS Network. 2019. "Ethical Issues for Robots and Autonomous Systems." Accessed August 24, 2019. https://www.ukras.org/wpcontent/uploads/2019/07/UK_RAS_AI_ethics_web_72.pdf.

UNITED STATES

The United States has traditionally been a world leader in robotics. For example, the robot density of robots to workers in the United States in 189 to 10,000, as compared to the average across the world of 74 to 10,000 (Gutherie 2018). Robot adoption in the workplace is on the rise and continues to increase. However, at the same time, the United States has fallen in world rankings for robotics development, although the specific ranking differs depending on the scale. Some of the apparent decline can be attributed to the lack of a national vision for robotics and comprehensive framework for oversight as well as inconsistent investment in the technologies. Within the country, there are also legal questions that could affect developers, owners, and the robots themselves depending on how the courts decide. While the robotics industry continues to produce cutting-edge technologies and contains many outstanding robotics professionals, the industry has some hurdles to overcome. However, the industry is moving forward in a positive direction and continues to demonstrate high levels of creativity and ingenuity.

The United States ranks highly in the field of robotics. The United States has many of the world's top universities for studying robotics and autonomy. It houses many highly regarded corporations involved in producing robots and working on

autonomy, and the country provides the headquarters for multiple international organizations that seek to advance the profession. For the measure of robot density, the United States ranks seventh in the world, following South Korea, Singapore, and Germany in the top three (Crowe 2019). In terms of readiness for autonomous technologies, including autonomous vehicles and other robotics, most rankings place the United States within the top five places, although the lists often place it differently because they use different criteria. Overall, the United States scores well for robotics and work on autonomy.

Some U.S. robotics professionals have seen where U.S. robotics must improve in order to remain competitive with other nations. In 2016, 150 researchers from top U.S. universities and other national organizations, such as the National Science Foundation, produced the U.S. robotics roadmap. Primarily written to describe the state of the robotics field to the U.S. Congress, the document sought to guide the technological development of the robotics field, to ensure U.S. supremacy in robotics, and to create robots that benefit society; in addition, the document advocated for policy frameworks intended to support robot development and promote the responsible application of the technology (UCSD et al. 2016). The professionals involved in building the roadmap predicted that as robots become more integrated—and integral—to human lives, the roadmap would help developers start thinking about how to address some of the social concerns that might arise.

One of the outcomes of the roadmap, albeit indirectly, is increasing advocacy for a federal commission focused on regulating the robotics industry. Automation through the application of robots and autonomy through AI-enabled robots are poised to change the country, especially in terms of the workplace. Automation and autonomy will eventually lead to replacing human workers for robots; while in some cases the displacement will have minimal effects, in others, they will be disruptive, as people lose jobs en masse. Currently, there are many agencies and organizations in the federal administration with the ability to regulate very specific policies, which are often limited by the organization's mandate. With many agencies issuing limited regulations over the large field and application of robotics, there are often seams and gaps between them. Only a federal agency with the mandate to oversee robotics would have visibility over all these regulations and be able to bring them together in line with an overarching policy. The European Union and Japan already have national robotics commissions, meaning that the United States is behind on establishing a body that can both regulate these technologies and make decisions about some of the difficult issues surrounding them, such as when a technology is ready and safe for widespread implementation.

Although the United States is lacking a federal commission on robotics, it has created organizations to promote robotics as a field. The major organization promoting domestic robotics is the National Robotics Initiative (NRI), which formed in 2011 out of the White House's Office of Science and Technology Policy (Coldeway 2011). The NRI funds fundamental research in the robotics field using funding accumulated through federal bodies that identify projects aligned with their mission needs. The first five years of the program distributed several million

dollars to researchers. Because the government considered the NRI a great success, it was renewed in 2016 to continue funding robotics research and development. However, due to annual budget fluctuations, funding is not consistent. Without consistent, sustained funding, U.S. robotics could fall behind other nations that choose to invest more.

Robotics development moves faster than the law and courts can make decisions. The importance of creating a framework or policy, as underscored in the robotics roadmap, cannot be overstated because the United States lacks comprehensive guidelines or laws related to robotics and the development or application of related technologies. In fact, within the U.S. legal system, most legal questions surrounding robots remain at a fairly fundamental level. The major questions being addressed in the courts revolve around liability (i.e. questions about who or what takes responsibility in the case of a malfunction). They debate whether robots are objects, which would likely make the developer or owner liable for accidents, or the subjects of the law, meaning that the robot itself would be liable for mishaps. Answers to these questions, which will likely occur and evolve as the courts make decisions, are human-centric. They will likely be used to determine who can sue whom in the event of an event involving a robot as well as determine any monetary judgments.

On the other hand, there are already people considering the law from the robot-centric view. Questions such as whether robots have rights seem irrelevant to many people in the present, but as robots start to think independently through AI enhancements, at what point in time do they receive rights or be held to legal standards? The release of Microsoft's chatbot Tay in 2016 placed this question in front of the public, generating a large amount of media attention. Tay, a chatbot designed to learn from people who traded messages with it on Twitter, went from "naïve" to extremely offensive in less than a day.

While Twitter users fed it negative ideas and bad language, the answer to who or what was responsible for the chatbot disaster was never declared. Was it the Twittersphere? Microsoft? Tay? In this instance, no one was prosecuted, although Microsoft should have been able to predict the potential for online misuse (Scherer 2016). These questions will continue to arise as robots get smarter; some lawyers and scholars contend they need to be addressed now (Sherman 2018). In Europe, many nations are already considering the human rights surrounding robots. In Saudi Arabia, the government granted Sophia, a robot, citizenship—which implies a certain level of guaranteed rights. In the United States, robot rights, or robots' human rights, will need to be considered and probably codified.

There are, of course, issues that add complexity to the debate of a robot's status under the law. One of these involves the research and development of lethal autonomous weapons systems, or LAWS. These technologies are not new; what is new is that with the addition or artificial intelligence, the machines could be allowed to decide to act based on their programming. Questions about whether machines should be allowed to determine the use of lethal force are controversial worldwide and have caught the attention of the United Nations. Even as these questions arise,

many nations, including the United States, experiment with their development (Fryer-Biggs 2019).

In the United Nations, the Convention on Conventional Weapons has met over the years to discuss imposing restrictions and bans on LAWS. Twenty-eight nations have signed on to a complete ban, while hundreds of professionals from around the world have added their support to ban all autonomous weapons. However, organizations such as Human Rights Watch (2019) have pointed out that the United States, along with other nations like Russia, has been stalling negotiations, insinuating that in some cases, the United States is among the nations trying to prevent these negotiations all together. The United States currently does not have any policies preventing LAWS development. The U.S. Congress will likely need to discuss regulation of these technologies, including discussions on ethical considerations surrounding their future usage, should that appear to become a reality.

Despite questions and controversies surrounding some robotics and autonomy applications, autonomous robots have the potential to change the role of humans in the workplace, in some sectors. Manufacturing, agriculture, and other areas where robots can work more efficiently than humans are sectors ripe for adopting robotics in the labor force. As this happens, robots and humans will either work side by side or robots will replace humans, meaning that the number of people in a workplace may be limited, primarily including the technicians required to repair broken units.

In the United States, the Department of Labor regulates health and safety issues in the workplace under the Occupational Safety and Health Administration (OSHA), meaning it must have a growing role overseeing changing needs in a workplace combining human and machine labor. However, as of 2019, OSHA had no standards for the robotics industry. It did issue guidelines for robotics safety in 1987 with PUB 8-1.3, following the lead of the American National Standards Institute and the National Institute for Occupational Safety and Health (OSHA 1987). The 1987 guidelines are now outdated, as they focus on mechanical robots that work in a single, specific area on one task. While these robots continue to exist, such as in assembly plants, developers are now working on AI-enabled robots that can learn and make decisions and that are not glued to a static location, nor necessarily limited solely to one task. Therefore, standards and policy for safety, as well as for the other areas of life on which robots touch, must be updated to protect people and possibly even robots in the workplace.

There are questions and potential concerns surrounding how robots will change society. These answers will not come immediately; they will come with the robots and the changes they make to society. To a large extent, the robotics field itself is limited solely by imagination and the current state of the technology. For example, the National Aeronautics and Space Agency (NASA) builds robots to assist with exploring some of the most remote places in space where people cannot go. One of its projects is LEMUR, a robot that can scale rock and ice cliff walls. The project has spawned an entire family of robots for outer space, including Ice Worm to navigate the ice and RoboSimian to navigate over icy tundra and other terrain (JPL 2019).

Projects like the ones NASA has undertaken have the potential to shape the future. Much of the U.S. robotics and autonomy industries are focused similarly to NASA, trying to reshape society for the better.

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Further Reading

Coldeway, Devin. 2011. "Obama Announces National Robotics Initiative." Tech Crunch. Accessed September 21, 2019. https://techcrunch.com/2011/06/24/obama-announces-national-robotics-initiative/.

Crowe, Steve. 2019. "US Robot Density Ranks 7th in the World." Robot Report. Accessed September 22, 2019. https://www.therobotreport.com/usrobot-density-ranks-7th-in-the-world/.

Fryer-Biggs, Zachary. 2019. "Coming Soon to a Battlefield: Robots That Can Kill." *Atlantic*. Accessed September 22, 2019. https://www.theatlantic.com/technology/archive/2019/09/killer-robots-and-new-era-machine-drivenwarfare/597130/.

Gutherie, Ryan. 2018. "Is the U.S. Ready to Embrace Robotics?" Machine Design. Accessed September 21, 2019. https://www.machinedesign.com/motion-control/us-ready-embrace-robotics.

Human Rights Watch. 2019. "'Killer Robots': Russia, US Oppose Treaty Negotiations." Accessed September 22, 2019. https://www.hrw.org/news/2019/08/19/killer-robots-russia-us-oppose-treaty-negotiations.

Jet Propulsion Laboratory (JPL). 2019. "For Climbing Robots, the Sky's the Limit." Accessed September 21, 2019. https://www.jpl.nasa.gov/news/news.php?feature=7449.

Occupational Safety and Health Administration (OSHA). 1987. "Guidelines for Robotics Safety." Accessed September 21, 2019. https://www.osha.gov/enforcement/directives/std-01-12-002.

Scherer, Matt. 2016. "Tay the Racist Chatbot: Who Is Responsible When a Machine Learns to Be Evil?" Future of Life Institute. Accessed June 1, 2020. https://futureoflife.org/2016/03/27/tay-the-racist-chatbot-who-is-responsible-when-a-machine-learns-to-be-evil/.

Sherman, Andrew. 2018. "Now Is the Time to Figure Out the Ethical Rights of Robots in the Workplace." CNBC. Accessed September 21, 2019. https://www.cnbc.com/2018/12/27/now-is-the-time-to-figure-out-the-ethical-rights-of-robots-in-theworkplace-.html.

University of California San Diego (UCSD), et al. 2016. "A Roadmap for US Robotics: From Internet to Robotics, 2016 Edition." Accessed September 20, 2019. http://jacobsschool.ucsd.edu/uploads/docs/2016/roadmap3-final-2b.pdf.

Chapter 9: Genetically Modified Organisms

OVERVIEW

Genetic modification is a type of biotechnology. The most basic definition of a genetically modified organism, or GMO, is that it is a living organism (e.g., plants, animals, viruses) that has been altered through the process of genetic engineering. The end result is a product that either has a desired quality or no longer has an undesirable characteristic. The process of genetic modification can involve introducing new genes from one or more species; removing genes, such as those that make animals or plants susceptible to a specific disease; or making modifications to the organism's DNA, or deoxyribonucleic acid, the material that contains all of an organism's genes and chromosomes. For example, the Massachusetts Institute of Technology has modified watercress plants to give off light. Currently the plants produce dim light for four hours at a time, with the ultimate goal to create plants that are bright enough to replace desk lamps (Kwak et al. 2017). Most genetic modifications aspire to improve people's lives in some fashion.

The scientific advances making genetic modification and experimentation have grown rapidly in the twenty-first century. One of the more popular techniques is CRISPR, which stands for "clusters of regularly interspaced short palindromic repeats." First demonstrated experimentally in 2007, this approach is considerably different from traditional genetic modifications that combine genes from different organisms, including bacteria, thus creating a new organism. In contrast, CRISPR edits the DNA within the organism using a protein known as CAS9 to modify the existing genetic sequence. Using CRISPR techniques, scientists can turn on or off a single gene, allowing them to target specific parts of the genome with precision. For agriculture, this method allows for fine-tuning resistance against insects, fungi, and molds that decimate crops. For humans, it could lead to cures for debilitating genetic illnesses. While more research is still necessary, CRISPR offers potential future improvements for society. Not all people approve of CRISPR use for genetic modifications, or in some cases, agree whether it produced a genetically engineered organism.

The question of what constitutes a GMO is a complex and sometimes controversial debate. There is no one accepted definition. In fact, not only do different groups in the same country disagree on the definition, but there are also international variations in the definition. In the United States, the label *GMO* usually refers to the product. From a safety perspective, focusing on the product is often

simpler than examining the procedure because procedures can be complex and require ethical considerations. Even in examining only the product, there is no one American understanding of GMO. Europe has developed a standard definition for GMO. According to the European Food Safety Commission, a GMO is "an organism in which the genetic material has been altered in a way that does not occur naturally through fertilization and/or natural recombination" (Cnudde 2018).

There is additional controversy over whether gene modification in processes such as plant breeding truly produce a GMO product because officials may not view gene editing as gene modification (Nature Plants 2018). The definitional differences may mean that an American product may not be considered a GMO in the United States but would require package labeling for sale in Europe. The United States started requiring GMO food labels in late 2018; by 2022, manufacturers selling products that use ingredients, such as soy or corn that may be GMO, will indicate that possibility with an approved "bioengineered" label.

Food comprises the largest category of GMOs and receives the most media attention. Introduced into the world's food supply in the 1980s and 1990s, GMOs have become fairly common sources of food and food production; food and plant crops that can be GMO include cotton, corn, soybeans, apples, beets, papaya, alfalfa, squash, and potatoes. Many people believe that GMOs can have negative effects of their health. While the long-term effects of GMO consumption is not known, thousands of research studies have shown GMOs not to have a harmful effect on humans (Borel 2014).

Despite the current state of knowledge, GMOs remain controversial. In China, a 2018 study conducted in 193 cities surveyed 2,063 people about how they perceive GMO foods. The results showed that 11.9 percent viewed GMOs positively, 41.4 percent neutrally, and 46.7 percent negatively; further, 13.8 percent felt that the gene modification technology represented a bioterrorist attack aimed at the Chinese people (Cui and Shoemaker 2018). These neutral and negative sentiments exist across the world. No other society has vocalized concerns collectively about a connection between bioterrorism and GMOs, though some scientists have warned that every genetically engineered organism has the potential to severely damage the ecosystem.

The controversy surrounding GMOs began when the foods first came to store shelves. However, humans have a long history of interfering with the natural world. They encountered wild wolves and started to domesticate them thousands of years ago by picking those with desirable traits to breed. Later, people started interbreeding animals and plants to produce hybrids; estimates place the creation of plant hybrids around 2000 BCE and animals around 1400 BCE (Newton 2014). The hybridization process is a form of genetic manipulation, although it is not usually viewed to be the same as genetic modification because combining genes is not always equivalent to altering genes. The movie *Napoleon Dynamite* (2004), for example, contained a quote about the character's favorite animal: a liger. Ligers are a cross between a lion and a tiger. They actually exist as a product of hybridization.

While most of these experiments did not lead to protests, the increasing availability of GMOs, especially in foods, has led to rising vocal opposition.

Some people reject GMOs on philosophical, religious, or moral grounds, while others cite the potential dangers to health and the environment. The philosophical argument generally boils down to, we can create GMOs, but should we? While not the only possible line of argumentation, this argument draws on moral and ethical points to conclude that until more is known about unforeseen future health and environmental risks, scientists should refrain from developing GMOs and associated technologies. The religious objections to GMOs take the view that humankind has no right to disturb the natural law; that genetic engineering, when not performed with altruistic intentions, violates religious scripture; that support of GMOs is due to the work of lobbyists influencing the religious leadership; and that biotechnology must be explained through religious doctrine to ensure that its usage does not conflict with organizational beliefs. However, leaders from the world's three main religions, Judaism, Islam, and Christianity, disagree within their organizations as to the position the religion should take toward GMOs (Omobowale, Singer, and Daar 2009). For the foreseeable future, these anti-GMO positions will continue to keep GMOs as an object of controversy.

The next concern on the horizon is that scientists will start to genetically modify human beings. While animals have been genetically modified for decades, reports in 2017 that university researchers had genetically edited human embryos guaranteed that the debate surrounding GMOs will continue (Ma et al. 2017). Advances in CRISPR and new emerging technologies could also make modifications easier in theory. Questions already exist about whether it is right to create "designer babies" that have the characteristics parents prefer over those of natural selection. If the push to modify human genes continues, there will be subsequent questions about the ethics and implications of GMOs.

In the United States, the GMO controversy has led to public cries for their elimination. As the public has gained access to information about GMOs, it has demanded that stores and restaurants eliminate genetically modified foods from their menus. In 2015, Chipotle, the Mexicanized fast food restaurant chain, gave in to the public outcry, deciding to ban GMOs from its food. It received public praise for deciding to source its ingredients from non-GMO suppliers. It is unlikely that the ban entirely eliminated GMOs, as many of its sweetened beverages still contained high fructose corn syrup and it had little control over whether the livestock it purchased for meat ate genetically modified corn (Rupp 2015).

Studies about perceptions and attitudes toward GMOs have resulted in data about the GMO controversy in other nations. However, no study has examined attitudes about GMOs globally. Without such a study, it is difficult to compare the perceptions and resulting controversy in the United States to that of other nations. Studies that examine attitudes one country at a time, such as a 2016 study in Poland (Rzymski and Królczyk 2016), suggest that similar controversies exist in other parts of the world.

Apart from the ideological controversy surrounding GMOs, GMO creation and production is a big business in many parts of the world. Genetically modified seeds generate large annual profits for the seed creator and farmers benefit from larger crops to sell (PR Newswire 2017). GMO seeds increase crop yield and reduce the amount of pesticides needed per harvest. These traits are highly desirable. The downside is that there are restrictions on the sale of the seeds. Farmers cannot reuse the seeds annually. They are expected to return or destroy unused seeds every year. They often must contractually agree to binding arbitration, stripping them of the ability to file a lawsuit. The seed owner also indemnifies itself of all liability, meaning that if anything bad happens with, to, or because of the seeds, the planter takes full responsibility for the outcome.

Because of these legal restrictions, seed owners will seek action against farmers who violate the terms. The owners have also pursued legal action against neighboring farmers who accidentally grew the seeds when the wind had blown a small number of seeds from the other farmer's plot. The legal restrictions and degree of adherence depend on the country's legal system. In some countries, these restrictions are not enforceable. There are also locations where other political, economic, and cultural factors come into play regarding the use of GMO seeds.

Scientists believe that GMOs could revolutionize food production and health and could strengthen the economy in primarily agricultural areas. Gene modification technology has the ability to alter plants to resist disease and insects. It can also explore ways that plants can thrive on less water and under less than ideal planting conditions. It can also work to infuse more nutrients into the food, which can boost health and productivity and, potentially, even raise incomes for people involved in the food industry (Schumacher 2018).

Nigeria has experimented with the development of an insect-resistant cowpea since 2008. Cowpea is among the most consumed foods in the country and also one of the hardest to bring to market due to the pod borers that infest the crop. To test whether cowpeas can resist the borers, the genetically modified cowpea has been in field trials since 2010, and although it was expected to reach farmers on a larger scale in 2017, it faces additional delays. Researchers investigating the cost of the delay used models to estimate that a one-year delay will cost the country US$33–46 million and between 100 and 3,000 lives from deaths due to malnutrition (Wesseler, Smart, Thomson, and Zilberman 2017). Other countries may also receive both economic and welfare benefits from GMOs if the populations and governments choose to accept them.

Policy response to GMO cultivation varies widely across the world. Determining a government's stance toward GMOs is not always clear. While some governments ban GMO cultivation, they still permit GMO imports. Some governments have enacted a partial ban or special restrictions on GMO cultivation and/or import. Countries that set aside land for GMO crops in 2016 include the United States, Brazil, Argentina, Canada, India, Paraguay, Pakistan, China, South Africa, Uruguay, Bolivia, Australia, the Philippines, Myanmar, Spain, the Sudan, Mexico, and Colombia (Statista 2016), though many of these countries have tight restrictions on imported GMOs.

In addition to policy regarding cultivation and crop importation, many countries require GMO products to have labels identifying that the product is GMO. The European Union, Russia, China, Brazil, Australia, Turkey, and South Africa are among the sixty-four nations that require mandatory labeling (Center for Food Safety 2018). Countries that banned the cultivation and importation of GMOs include Algeria, Belize, Bhutan. Ecuador, Kyrgyzstan, Madagascar, Peru, Saudi Arabia, Turkey, Venezuela, and many European nations (Science Literacy Project 2018). National laws regarding GMOs can change over time based on new research and local consumer preferences.

This section examines select countries from different parts of the globe to illuminate the issues, trends, and challenges associated with GMO technologies. The countries vary in the degree to which they allow GMOs to be cultivated and imported. They demonstrate different perspectives toward the adoption of GMOs. Some of these countries are further advanced in their GMO-related experiences, while others strive to tackle the GMO issue to discover if it is a viable alternative to feed the population. There are also businesses watching, waiting to discover the next big market for GMO seeds. When philosophical, legal, business, and scientific needs mostly balance, there are many people who believe GMOs will advance the world in foods, medicines, and through other organisms that promote humankind's interests.

Further Reading

Borel, Brooke. 2014. "GMO Facts: 10 Common GMO Claims Debunked." *Popular Science*. Accessed July 4, 2018. https://www.popsci.com/article/science/core-truths-10-common-gmo-claims-debunked.

Center for Food Safety. 2018. "International Labeling Laws." Accessed July 4, 2018. http://www.centerforfoodsafety.org/issues/976/ge-food-labeling/international-labeling-laws.

Cnudde, Filip. 2018. "What Is a GMO? Different Definitions Create Confusion." Feed Nourish Thrive. Accessed July 4, 2018. https://www.feednourishthrive.com/gmo-different-definitions-create-confusion/.

Cui, Kai, and Sharon P. Shoemaker. 2018. "Public Perception of Genetically-Modified (GM) Food: A Nationwide Chinese Consumer Study." *npj Science of Food* 2(1): 10. Accessed July 4, 2018. http://www.nature.com/articles/s41538-018-0018-4.

Kwak, Seon-Yeong, et al. 2017. "A Nanobionic Light-Emitting Plant." *Nano Letters* 17 (1): 7951–7961. https://doi/10.1021/acs.nanolett.7b04369.

Ma, Hong, et al. 2017. "Correction of a Pathogenic Gene Mutation in Human Embryos." *Nature* 548 (7668): 413–419.

Nature Plants. 2018. "A CRISPR Definition of Genetic Modification." *Nature* 4: 233. Accessed July 4, 2018. https://www.nature.com/articles/s41477-018-0158-1.pdf.

Newton, David E. 2014. *GMO Food: A Reference Handbook*. Santa Barbara, CA: ABC-CLIO.

Omobowale, Emmanuel B., Peter A. Singer, and Abdallah S. Daar. 2009. "The Three Main Monotheistic Religions and GM Food Technology: An Overview of Perspectives." *BMC International Health and Human Rights* 9: 18. Accessed July 7, 2018. http://www.ncbi.nlm.nih.gov/pubmed/19698118.

PR Newswire. 2017. "Global GMO Crops and Seeds Market Driven by Leap in Agricultural Practices, Finds TMR." Markets Insider. Accessed July 7, 2018. http://markets

.businessinsider.com/news/stocks/global-gmo-crops-and-seedsmarket-driven-by-leap-in-agricultural-practices-finds-tmr-1002345590.

Rupp, Rebecca. 2015. "What Chipotle's Ban on GMOs Says about Us." *National Geographic*. Accessed July 7, 2018. https://www.nationalgeographic.com/people-and-culture/food/the-plate/2015/04/29/chipotle-gmo-ban/.

Rzymski, Piotr, and Aleksandra Królczyk. 2016. "Attitudes toward Genetically Modified Organisms in Poland: To GMO or Not to GMO?" *Food Security* 8 (3): 689–697.

Schumacher, Elizabeth. 2018. "Feeding East Africa—Locals Skeptical of GM Crops." Deutsche Welle. Accessed July 4, 2018. https://www.dw.com/en/feeding-east-africa-locals-skeptical-of-gm-crops/a-42385062.

Science Literacy Project. 2018. "Where Are GMOs Grown and Banned?" Accessed July 4, 2018. https://gmo.geneticliteracyproject.org/FAQ/where-are-gmos-grown-and-banned/.

Statista. 2016. "Area of Genetically Modified (GM) Crops Worldwide in 2016, by Country (in Million Hectares)." Accessed July 4, 2018. https://www.statista.com/statistics/271897/leading-countries-by-acreage-of-geneticallymodified-crops/.

Wesseler, Justus, Richard D. Smart, Jennifer Thomson, and David Zilberman. 2017. "Foregone Benefits of Important Food Crop Improvements in Sub-Saharan Africa." *PLOS ONE* 12 (7). https://doi.org/10.1371/journal.pone.0181353.

CHILE

Chile has made itself a significant player internationally for GMOs, especially GMO seeds. It is the top seed exporter in South America and the fifth-largest exporter worldwide. The country's seeds have proven useful for research, particularly in the development of seeds that grow in the off-season and that raise nutritional value. The country's approach to GMOs, and in particular GMO foods and seeds, is to place different standards on GMO crop production for domestic and international use. These policies are not universally accepted, as there are domestic groups that oppose GMO production and consumption. The internal debate is growing in the wake of multiple, natural weather disasters that have affected agricultural production nationwide.

Chile is one of the world's largest producers of GMO seeds; it is also a major food exporter, as its position in the Southern Hemisphere allows it to grow crops and export them to areas where those crops are in the off-season. The nation's GMO seed production has made it a key exporter to markets in North America, Asia, and Europe. In 2014, the GMO seed industry was valued at US$508 million, of which US$190.7 million corresponded with the country's seed exports (ChileBIO 2015). Chile's primary GMO crop production has focused on corn, canola, and soybeans, with low-level experimentation on a wide variety of fruits and vegetables. However, exports are primarily seeds; in 2017, around 13,143 hectares of land were devoted to growing the seeds, most of which were for research purposes (ISAAA 2017). The government is also considering expanding to GMO salmon and has made some progress in conjunction with researchers from Norway.

Chile's stance toward GMO seed use domestically, however, is almost ironic. GMO seeds can be exported or used in research, but local farmers cannot plant them, per policy. Government representatives submitted a bill in 2007 to allow local farmers the right to use GMO seeds, but policy on this matter remains undecided. In fact, seeds still technically cannot remain in the country once they are ready for use. Limited exceptions occur for controlled field research but do not extend to commercial use. One argument against the local use of GMO seeds is that Chile does not have the malnutrition problem that other nations have globally and therefore does not need to flood the market with GMO foods.

One disadvantage of the policy is that the inability for local farmers to utilize GMO technologies makes them less competitive with regional farmers who can use them. When farmers go against the rules, the punishment for planting GMO seeds is a fine. Carlos Crovetto (n.d.), a farmer in the Bio Bio region, experimented with GMO seeds in 2015. He rotated soybeans and corn, noting a 10–15 percent increase in yield. When he shared these results with the media, the police showed up, ordered the crops torn from the ground, and imposed a fine. The minimum fine is 3.5 million pesos, which at the time was more than US$5,000 (Bloomberg 2017). The total amount the farmer paid was never disclosed, other than to stipulate that it was an expensive venture.

The laws regarding GMO production have evolved in the country since the first field trials in 1987 through the early 1990s. In 1993, the first regulations for GMOs emerged, limiting them to the agricultural exports sector. Interest in GMOs increased around 2000 when commercial GM seed production started gaining in popularity. It has increased over time, making Chile a successful seed producer. In 2001, Chile legalized the production of transgenic seeds, or those that have been developed with artificially induced DNA from another organism, for export through Exempt Regulation No. 1523 (Gobierno de Chile 2010). In 2003, GMO products gained status as foodstuffs, which included additional regulations. Decree Law No. 3557/82, Exempt Resolution Co. 6966, and subsequent amendments permitted the Ministry of Agriculture's Agricultural and Livestock Service to regulate GMOs and created a technical committee comprised of experts to perform risk analysis on GMO field tests and production.

Chile allows GMO imports. It gets most of its soybean and corn from neighboring Brazil and Argentina, the majority of which become animal feed. There are few restrictions placed on GMO imports, and they generally do not require labels. As of 2015, Congress was considering two laws on the mandatory labeling of GMO products. It is unclear if either passed. Chile does, however, require food labels for nutrition, making it possible that a future law will require GMO information.

Public response to GMOs has not always been positive. The Coalition for a GM-Free Chile corresponded to a group of individuals, organizations, and other stakeholders that promoted a national anti-GM campaign around 2010. Other anti-GMO movements have developed, such as Chile sin Transgénicos (Chile without Transgenics), Chile Sustentable (Sustainable Chile), and Yo No Quiero Transgénicos en Chile (I Don't Want Transgenics in Chile). Most of the groups have, or

have had, active social media presences. They also publish information about the supposed dangers of transgenic seeds and food, even though they have not been substantiated over years of scientific testing. Examples of the arguments Chile sin Transgénicos use include the idea that transgenics adversely affect health, create risks for pregnant women, cause immune system reactions, produce toxins in the body, and build up over time, increasing health risks (Smith 2010). The groups also oppose toxic weed killer and solutions that are not environmentally friendly. The ultimate goal of these groups is to raise awareness and, when possible, convince people to join in protests.

Additional challenges to Chile's GMO policies have come from external forces, such as the transnational corporation Monsanto. People around the world protested the corporation and its policies that diminished the rights of local farmers. For example, the company-initiated lawsuits against farmers that neighbored those using Monsanto's seeds, claiming that even if the wind blew seeds onto their farms, they benefitted from Monsanto technology illegally and must pay the company compensation for losses. In 2014, both proponents of GMOs and their protestors agreed to prevent Monsanto and similar companies from using their standard business practices in the country. These companies develop seeds, apply for local patents, and then require all farmers to pay for the right to use those seeds.

The questions surrounding GMO production in Chile have had higher stakes since 2011. The country has experienced a long-term drought, which some scientists now refer to as a *megadrought*, that they believed began around 2010 and continues in many regions. To amplify the effects of the drought, the country has experienced unusual wildfires that damaged even more land and crops. Overall, the result of the drought is the need to import more food, including GMO and non-GMO products. It has also made researchers wonder if they can, or perhaps should, produce drought-resistant GMO seeds, especially as the drought shows no signs of abating.

Despite the seemingly contradictory policies surrounding GMOs, Chile continues to be at the forefront of research, along with its university counterparts in Argentina, Mexico, Colombia, and Brazil. In 2017, Chilean universities made several notable examples to improve GMOs. At the University of Chile, scientists developed transgenic wheat that increases yield and quality (ChileBIO 2017b). The company Favet-Inbiogen has found ways of using CRISPR technology, a biologically inspired and derived method used to alter gene sequences in DNA, to create disease-resistant salmon (Feest 2017). In addition, the minister of agriculture met with his counterparts from South America's Southern Cone to establish processes to examine new GMO technologies and third-country GMO markets cooperatively (ChileBIO 2017a). Because GMOs comprise a significant economic sector, Chile is poised to continue advancing GMO technologies.

Chile has been successful in its investments in GMO technologies, as demonstrated by its ascendance as a global power in the industry. While it has some uneven policies applied to its import-export and domestic-international GMO sectors, the country will continue to advance its approaches. One of the next areas

where it may reconsider policy is the restrictions that prohibit local farmers from utilizing the same technologies that the country's researchers are developing. Reconsideration, though not guaranteed to be an issue open to political discussion, might offer the potential to boost the country's economy by making it more competitive in trade.

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Further Reading

Bloomberg. 2017. "A Closer Look at Chile's GMO Paradox." Agweb.com. Accessed July 22, 2018. https://www.agweb.com/article/a-closer-look-at-chiles-gmo-paradox-blmg/.

ChileBIO. 2015. "Situación En Chile de Los Transgénicos." Accessed July 22, 2018. http://www.chilebio.cl/situacion-en-chile/.

ChileBIO. 2017a. "Ministros de Sudamérica Llaman a Agilizar Aprobación de Transgénicos en La Región y En Países Importadores." Accessed June 6, 2020. https://www.chilebio.cl/2017/09/08/ministros-de-sudamerica-llaman-a-agilizar-aprobacion-de-transgenicos-en-la-region-y-en-paises-importadores/.

ChileBIO. 2017b. "Universidad Chilena Desarrolla Trigo Transgénico Que Incrementa El Rendimiento y Peso Del Grano." Accessed June 6, 2020. https://www.chilebio.cl/2017/07/20/universidad-chilena-desarrolla-trigo-transgenico-que-incrementa-el-rendimiento-y-peso-del-grano/.

Feest, Patricio. 2017. "Chile: Los Primeros Pasos para El Uso de Crispr/Cas9 En Salmónidos." Salmon Expert. Accessed June 6, 2020. https://www.salmonexpert.cl/article/chile-los-primeros-pasos-para-el-uso-de-crispr-cas9-en-salmonidos.

Gobierno de Chile. 2010. "Establece Normas para la Internación e Introducción al Medio Ambiente de Organismos Vegetales Vivos Modificados de Propagación." Biblioteca del Congreso Nacional. Accessed July 22, 2018. https://www.leychile.cl/Navegar?idNorma=187630.

ISAAA. 2017. "Global Status of Commercialized Biotech/GM Crops in 2017: Biotech Crop Adoption Surges as Economic Benefits Accumulate in 22 Years." ISAAA Briefs 53. Accessed July 22, 2018. https://isaaa.org/resources/publications/briefs/53/download/isaaa-brief-53-2017.pdf.

Sánchez, Miguel A., and Gabriel León. 2016. "Status of Market, Regulation and Research of Genetically Modified Crops in Chile." *New Biotechnology* 33 (6): 815–823.

Smith, Jeffery M. 2010. "Médicos Advierten: Evite Los Alimentos Modificados Genéticamente." *Revista Mundo Nuevo* 12 (73): 32–35.

Tironi, M., M. Salazar, and D. Valenzuela. 2013. "Resisting and Accepting: Farmers' Hybrid Epistemologies in the GMO Controversy in Chile." *Technology in Society* 35 (2): 93–104.

GERMANY

Located in central Europe, Germany is a country teeming with 83 million people. Most of those people strongly support bans on all genetically modified organisms. This majority attitude contrasts with much of the world, where deep divisions exist between supporters and protestors of GMOs, making Germany an unusual case. While there are several benefits for GMOs, many believe there are many drawbacks that could potentially harm the consumers and the environment in the long run, though some countries in other parts of the world rely heavily on GMO

production and consumption. In many developing countries, like the Philippines, poorer populations face problems like malnutrition and vitamin deficiencies. With GMOs, food products can be modified to hold more vitamins and nutrients that would not otherwise be available.

Despite potential benefits, the German population consistently supports the GMO ban at high levels. Around 66 percent of the population rejects GMO food consumption, and 78 percent of the population do not believe that humans have the right to create or consume any genetically modified food, plants, or animals (Keine Gentechnik 2018). Since 2009, the German government has systematically removed GMO crops from cultivation in the country. However, although Germany maintains its stature as a leader in the anti-GMO campaign, the government has been involved in controversial decision making regarding GMO imports and label regulations.

In 2009, the German government banned the only genetically modified crop approved in Europe: Monsanto's insect-resistant maize, MON 810. This move occurred after France banned MON 810 in 2008 through the European Union's safeguard clause, which questions the safety of the genetically modified crop for public consumption. To address the GMO controversy, the European Union Commission convened to discuss a proposal that would allow individual European Union state members to make national-level, rather than union-wide, decisions on the GMO issue in 2010. In 2014, after much deliberation on the cultivation of GM crops in Europe, the European Union decided to allow countries the decision to opt out of planting any of their approved GM seeds (Euractiv 2014).

The following year, the German government notified the commission that the country was opting out of planting any GM seeds within in its borders, even if the European Union considered the GM strain to be safe for cultivation. Germany joined many other countries, such as France and Italy, as they shifted away from planting and harvesting GM crops. The following year in 2016, German Prime Minister Angela Merkel's (1954–) cabinet ratified a draft law, an amendment to the already existing Genetic Engineering Act of 1993, to ensure Germany's ability to enforce a ban on the cultivation of any GM seeds. Despite the ratified amendment, the German government still needed approval from the EU Commission to remove Germany from the list of European Union countries approved for growing GM crops (TRT World 2016).

The idea of allowing individual nations to make legislative decisions on GMO cultivation led to further European Union debate on GMO imports. In addition to the GMO cultivation opt-out, the EU Commission initially proposed allowing member states the option to impose bans on imported GMO products, even if approved by the commission. This proposal allowed the commission to strike a balance between its approval system and the member states' ability to choose products they deemed safe for their citizens. However, the proposal failed in October 2015 (Euractiv 2015).

Voting against the GMO import opt-out not only allowed the EU Commission to continue approving GMO imports for distribution within the European Union,

but it also allowed Germany to continue its heavy import of GMO products for the German market. Critics believe it is hypocritical of the German government to oppose GMO cultivation but allow public access to imported GMOs through the food industry. Germany imports genetically modified corn and soy for livestock feed and food products in the country. In fact, Germany imports up to 35 million tons of soy annually (Lange 2019). Since livestock requires a protein-rich diet to grow quickly and meet the demands of the food market, much of Germany's GM soy import is a protein supplement added to the livestock feed (Tost 2015). However, GMO imports for nonlivestock feed remain extremely limited.

Germany's anti-GMO stance and desire to ban GMO cultivation is unsurprising; the country's history of opposing GMOs predated discussions of the domestic legal ban. In fact, the country's Genetic Engineering Act, updated in 2004 as a response to EU Directive 1829/2003, which imposed regulations of GM foods, feed, and subsequent labeling, primarily creates a legal and regulatory framework surrounding environmental protections, human health risks, and GMO-related research and development. However, by 2003, locals had created GMO-free regions, following Munich, which had become Germany's first GMO-free town in 1999. By 2013, 211 regions, or approximately 10 percent of Germany's farmland, had declared themselves GMO-free (Stop the Crop 2013). Thus, popular sentiment from the farming community and the mass populace tends to be anti-GMO.

From the government perspective, Germany's anti-GMO policies for its agricultural sector continue to be very strict to ensure GMO-free crops for their consumers. At the beginning of 2019, German-owned company Bayer announced that farmers in Germany and France planted seeds that were mixed with a genetically modified rapeseed strain from Canada. While the GM seed is available for planting and harvest in Canada, it is not authorized for cultivation in Germany or France due to environmental risks that can affect local crops.

After detecting the GMO strain, Bayer notified all rapeseed farmers and offered compensation for the 2019 and 2020 harvests. Instead of preserving the harvest and destroying the crop at a later date, both Germany and France removed all traces of the GM rapeseed inadvertently transferred from Canada before the GM crop's flowering to prevent the spreading of the unauthorized GMO strain in the two countries. Germany destroyed at least 2,150 hectares, which is minimal compared to the 1 million hectares of rapeseed in the country (Trompiz 2019). The destruction demonstrated the agricultural community's commitment to GMO-free crops.

Complicating the GMO issue is not just the availability of GMOs in the market but also the existing GMO labeling regulations. Suppliers and producers can obtain labels indicating that food products are GMO-free. To receive the Ohne Gentechnik (Without Genetic Engineering) sticker, foods must meet European Union requirements. However, the sticker does not necessarily mean that the product is entirely GMO-free. The European Union allows at least 0.9 percent of GMOs in food products without a labeling requirement. While farms must follow a strict time frame in which animals must not be fed GMOs before being readied

for the food market, they cannot provide guarantees the animals will not encounter any GMOs or GMO supplements in their lifespan.

They also cannot guarantee that the final product, such as meat, milk, and eggs, will be subjected to the same labeling requirements (Lange 2019). To provide more GMO-free food products in the German market, German food retailers feed livestock with certified European soybeans. Through the Hofglück program, Edeka Südwest favors a regional feed that uses GMO-free soy grown in the Danube region. The program uses an independent inspection body to ensure that all products are certified and in a controlled environment (Byrne 2019). While this program shows how food retailers can assure consumers that food is GMO-free, these same processes may be improbable for all foods that reach stores and only address one avenue for adhering to GMO labeling requirements.

Germany has experienced further complications with the legal aspects of labeling GMO products due to emerging GM-related technologies. Specifically, new methods of genetic editing that result in GM foods are not covered by older GMO regulations (tg 2017). Since the introduction of CRISPR, geneticists have advocated the use of this method of gene editing. CRISPR changes an organism by editing its genetic sequence, which could mean altering a single gene, similar to mutagenesis. Instead of fusing different organisms together, genome editing is based on the premise of natural mutations (Schulz 2019). The process does not necessarily change the organism into something different or new. Laws and regulations were not written for processes such as CRISPR or to define the altered product and will need to be reconsidered as technologies continue to advance.

Since mutagenesis was not covered by older GMO regulations, the German government has proposed to review and decide on a case-by-case basis for individual products. The review process includes the decision to label or not label a product as a GMO. This proposal can be found in Merkel's ratified 2016 draft law within the Genetic Engineering Act, through which others questioned the relevancy to more recent bioengineering advances. Green Party genetic engineering spokesperson Harald Ebner (1964–) spoke against this proposal and demanded transparency from the German government. Relying on the European Union's definition of GMOs, Ebner argued that a GMO was a process and not a product. In 2018, the European Court of Justice determined that CRISPR was another method of genetic manipulation and must adhere to current GMO regulations (Schulz 2019).

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Further Reading

Byrne, Jane. 2019. "Germany: Edeka Sudwest to Roll Out GMO-Free Meat and Sausages." Feed Navigator. Accessed June 6, 2020. https://www.feednavigator.com/Article/2019/02/14/Edeka-Suedwest-to-roll-out-GMO-free-meat-and-sausages.

Euractiv. 2014. "GMO Cultivation in Europe: A Decade of Legal Battles." Accessed June 6, 2020. https://www.euractiv.com/section/agriculture-food/linksdossier/gmo-cultivation-in-europe-a-decade-of-legal-battles/.

Euractiv. 2015. "EU Lawmakers Reject National Bans on GM Food, Feed Imports." Accessed June 6, 2020. https://www.euractiv.com/section/science-policymaking/news/eu-lawmakers-reject-national-bans-on-gm-food-feed-imports/.

Keine Gentechnik. 2018. "Unverandert: Vier Funftel der Deutschen lehnen Agrogentechnik ab." Accessed April 1, 2019. https://www.keine-gentechnik.de/nachricht/33287/#gsc.tab=0.

Lange, Tobias. 2019. "Wunderpflanze oder unsichtbare Gefahr? Gentechnisch veraenderte Pflanzen in der Discussion." Accessed May 12, 2019. https://www.suedkuirer.de/region/bodenseekreis/bodenseekreis/Wunderpflanze-oderunsichtbare-Gefahr-Gentechnisch-veraenderte-Pflanzen-in-der-Diskussion;art410936,101400226.

Schulz, Florence. 2019. "Genetic Innovation: Nothing We Eat Is Natural." Euractiv. Accessed June 6, 2020. https://www.euractiv.com/section/agriculture-food/news/gentechnik-nichts-von-dem-was-wir-essen-ist-natuerlich/.

Stop the Crop. 2017. "German Fields Are GMO-Free in 2013." Accessed May 14, 2019. http://www.stopthecrop.org/news/german-fields-are-gmo-free-2013.

tg. 2017. "Germany to Allow GMOs without Labelling." European Biotechnology. Accessed June 6, 2020. https://european-biotechnology.com/up-to-date/latest-news/news/germany-to-allow-gmos-without-labelling.html.

Tost, Daniel. 2015. "Germany Skeptical of National Import Ban on GM Foods." Euractiv. Accessed June 6, 2020. https://www.euractiv.com/section/agriculture-food/news/germany-sceptical-of-national-import-ban-on-gm-foods/.

Trompiz, Gus. 2019. "French Rapeseed Farmers Destroyed 18,000 Hectares over GMO Risk: Bayer." Reuters. Accessed June 6, 2020. https://www.reuters.com/article/us-france-rapeseed-gmo-idUSKCN1RH218.

TRT World. 2016. "Germany Approves Draft Law Banning GMO Crops." TRTWorld. Accessed June 6, 2020. https://www.trtworld.com/europe/germany-approves-draft-law-banning-gmo-crops-219968.

INDIA

As of 2017, India had the fifth-largest acreage of GM crops in the world, although it differs from other high-ranking countries in that all of its GM crops come from a single product—cotton—known as *Bt cotton* (ISAAA 2017). Currently, Bt cotton is the only commercially approved GM crop in India. There have been some attempts at government approval to grow other GM crops; however, current government regulations have yet to permit additional GM crop cultivation. Additionally, GM plants have a history of controversy in the country, as they have been linked to a rise in farmer suicides. India also has a number of active anti-GMO groups and organizations. There has been recent litigation in India's Supreme Court surrounding patents and Bt cotton.

Bt cotton, produced and sold by Monsanto, an American agricultural biotechnology corporation acquired by Bayer in 2018, received approved for cultivation in India in 2002. An upgraded version received approval in 2006. The cotton is currently the only GM crop allowed by the Indian government. Bt cotton makes up over 90 percent of the total cotton cultivation in India, and India is the second-largest

producer of cotton in the world. Bt cotton was created to be resistant to a number of common pests for cotton crops, such as bollworms, and contains natural insecticides for specific pests, which is intended to reduce reliance on pesticides.

While Bt cotton usage among farmers remains consistently high, it has also become a focal point of multiple controversies surrounding GMOs. In 2012, the state of Maharashtra banned Bt cotton seeds distributed by Mahyco, an Indian partner of Monsanto, after assertions that the state was being sold inferior seeds. The government lifted that ban in 2013. Infestations of pink bollworm in Maharashtra during the 2017 and 2018 growing seasons created another point of controversy around Bt cotton. While it is clear that pink bollworms are developing resistance to the pesticides used in Bt cotton cultivation, this situation is complicated by other factors, including potential improper farming techniques such as leaving the crops to grow for longer than recommended periods and the sales of illegal, herbicide-tolerant Bt cotton seeds.

Approvals for GM products are overseen by the Genetic Engineering Appraisal Committee (GEAC), a committee under the Ministry of Environment, Forest, and Climate Change of the federal government of India. In 2009, the GEAC approved the production of Bt brinjal (eggplant); however, this central Indian government placed an indefinite moratorium on commercial GM eggplant use in 2010. Minister for Environment Jairam Ramesh (1954–) justified the ban by citing food security, a number of controversial safety tests, and the difficulty in regulating labeling, despite the fact that the conclusion does not align with several international agreements to which India has signed and is contradictory to findings from international experts. The moratorium remains in place today. As a result, there is also a rise in the number of illegal Bt brinjal cultivators within the country.

In May 2017, the GEAC gave an initial clearance to GM mustard, also known as DMH-11 mustard, which Indian researchers developed as a potential solution to the need for edible oil imports. The Centre for Genetic Manipulation of Crop Plants at the University of Delhi developed GM mustard, and the project received funding and support from the National Dairy Development Board and from the central government's Department of Biotechnology. However, after pressure from anti-GM and farmer organizations, GM mustard did not receive its final approval from the central ministry and remains in a limbo state. In October 2018, the GEAC approved field tests of the product on honeybees and other pollinators to determine any potential impact the crop may have on the ecosystem. However, these tests cannot be conducted until permitted by the local and state level governments.

The Food Safety and Standard Authority of India (FSSAI) oversees genetically modified foods and food imports. The organization began creating procedures around GM foods in 2018. This new effort originated after the Centre for Science and Environment, a think tank, released a study that year reporting that 46 percent of imported food products in India already test positive for GM. As the FSSAI had not approved import or sale of GM food products without a permit, these food imports have potentially entered the country illegally. Currently,

the FSSAI is looking at GMO labeling requirements for food products, although there has been no specific regulation made. One of the challenges is that the current government declared in 2014 that it would not allow GM food products within the country.

India's stated requirement to only import non-GMO foodstuffs has caused other difficulties for the country as well. Due to drought and increased demand in recent years, India has begun to import corn since 2016, after previously being a corn exporter. While the country has so far been successful in importing corn, the non-GMO requirement has made importation more difficult, as many countries now primarily export GMO corn, and the Indian government has had to explore allowing for lower tariff rates to facilitate importation.

GM crops are also controversial for many Indian citizens and have received attention from the nation's highest legal courts. Federal litigation is ongoing for GM mustard in India since an established anti-GMO activist, Aruna Rodrigues (n.d.), became the lead petitioner in a Supreme Court case to place a moratorium on GM crops. While the case remains open, the GEAC was allowed to give clearance to limited field trials on GM mustard. In early 2019, there was a Supreme Court ruling on GM cotton patents, which awarded Mahyco Monsanto Biotech (MMB) an undisclosed amount. The MMB is a joint venture of Monsanto and a Maharashtra-based seed company. In 2015, Monsanto filed a lawsuit against a local company when it discovered that they were selling genetically modified cotton seeds that they believed encroached on their patents.

There are many anti-GMO activist groups in India, as well as high-profile individuals such as Vandana Shiva (1952–). These organizations represent multiple parts of the political spectrum, from the Coalition for a GM Free India, which is an umbrella group comprising a number of smaller, left-leaning farmer organizations, to Swadeshi Jagran Manch, which is affiliated with a right-wing, Hindu nationalist political party. While all of these groups continue to work against the use of genetically modified organisms in India, the country reached worldwide notoriety in relation to an assertion that the rise in farmer suicides in the country was linked to Bt cotton. Specifically, speculation blamed Bt cotton for its higher costs, which in turn create more debt for farmers and a failure to increase crop productivity in a single planting season or over multiple years. The mass media picked up this specific claim, which became a major point of argument for Vandana Shiva and other anti-GM activists, and it eventually appeared in a multiple award-winning documentary titled *Bitter Seeds*, which premiered in 2013. However, multiple in-depth studies have proven this claim to be false, including a 2008 study from the International Food Policy Research Institute, which concluded that there was no evidence that Bt cotton contributed to increased farmer suicides.

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Further Reading

Bhushan, Chandra, Amit Khurana, Sonam Taneja, and Bhavya Khullar. 2018. "Genetically Modified Processed Foods in India—Need to Curb Illegal Sales in the Indian Market."

Centre for Science and Environment, New Delhi. Accessed April 20, 2019. https://www.cseindia.org/genetically-modified-processed-food-in-india8877.

Energy and Resources Institute. 2010. "Strengthening Agricultural Biotechnology Regulation in India." TERI Policy Brief. Accessed June 6, 2020. https://www.teriin.org/sites/default/files/2017-12/TERI_PolicyBrief_Sept2010.pdf.

Fernandes, Vivian. 2018. "The Truth behind Genetically Modified Food Imports in India." *Financial Express*. Accessed April 15, 2019. https://www.financialexpress.com/opinion/the-truth-behind-genetically-modified-foodimports-in-india/1307844/.

Gruère, Guillaume P., Purvi Mehta-Bhatt, and Debdatta Sengupta. 2008. "Bt Cotton and Farmer Suicides in India." IFPRI Discussion Paper (00808). Accessed April 30, 2019. http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/14501/filename/14502.pdf.

ISAAA. 2017. "Global Status of Commercialized Biotech/GM Crops in 2017: Biotech Crop Adoption Surges as Economic Benefits Accumulate in 22 Years." ISAAA Briefs 53. Accessed April 19, 2019. https://isaaa.org/resources/publications/briefs/53/download/isaaa-brief-53-2017.pdf.

Karnik, Madhura. 2016. "There Will Be 1.8 Billion Indians by 2050. GM Crops Are the Only Way to Feed Them All." Quartz India. Accessed April 15, 2019. https://qz.com/india/740532/there-will-be-1-8-billion-indians-by-2050gm-crops-are-the-only-way-to-feed-them-all/.

Kloor, Keith. 2014. "The GMO-Suicide Myth." *Issues in Science and Technology* 30 (2). Accessed April 26, 2019. https://issues.org/keith/.

Lynas, Mark. 2018. "The Complicated Truth behind GMO Cotton in India." Cornell Alliance for Science. Accessed April 19, 2019. https://allianceforscience.cornell.edu/blog/2018/08/complicated-truth-behind-gmo-cotton-india/.

Shankar, Uttara. "Status of Genetically Modified (GM) Crops in India." Energy and Resources Institute. Accessed April 19, 2019. https://www.teriin.org/library/files/GM-crops-in-India.pdf.

Sheelendra, M. Bhatt. 2015. "GMO Foods: Regulatory Mechanism and Challenges in India." *Journal of Bioremediation and Biodegredation* 6 (5). https://doi.org/10.4172/2155-6199.1000e165.

KENYA

As the third African country to develop a comprehensive framework for regulating GM crops, Kenya is often considered a model for the promotion of biotechnology, particularly in the East African region. While GM crops have yet to be approved for commercial growth in Kenya, they hold support from the lead regulatory agency, the National Biosafety Agency (NBA), as well as President Uhuru Kenyatta (1961–), who has challenged government agencies to explore the use of GM cotton to revitalize the country's struggling textile industry. GM cotton and maize are currently undergoing national performance trials, after which they will each be evaluated for commercial release. Their commercial release, however, faces strong opposition from Kenyan civil society, which has questioned their safety and benefits, as well as the capacity of the state to adequately test, monitor, and oversee their use. Kenya also has a ban on GM imports, which has been in place since 2012 for concerns related to public health.

One of the key points of contestation regarding the adoption of GM crops in Kenya concerns their appropriateness for the Kenyan agricultural sector. Simply put, Kenya is an agricultural country, with approximately 30 percent of the country's GDP and 65 percent of its export earnings derived from the agricultural sector (FAO 2019). Furthermore, 40 percent of Kenyans are directly employed in the agricultural sector. For proponents of biotechnology, the use of GM crops and seeds represent a clear opportunity to achieve significant gains. They believe that by adopting GM crops, Kenyan farmers will boost productivity, increase incomes, adapt to changing environmental pressures stemming from climate change, and compete more readily within global markets.

Kenyan civil society groups have questioned these benefits. In Kenya, farming is primarily the endeavor of smallholder farmers; some 75 percent of country's food production is household-level subsistence, and the average farm size is just 1.2 hectares (Rapsomanikis 2015). Within this context in which production is oriented toward subsistence, critics argue that it simply does not make sense for these farmers to adopt GM crops, which would require the annual purchase of GM seeds, leading to increased dependency and indebtedness. This viewpoint changes the question from what are the benefits are to who will benefit. Critics have also raised questions regarding the public health impacts of GM crops. Maize, in particular, is a staple crop within the Kenyan diet and is the foundation for ugali, a cornmeal dish made from maize flour that is eaten almost daily by Kenyans. Most GM maize, however, is accompanied by the use of glyphosate, a pesticide that the World Health Organization has labeled a probable carcinogen, a substance that may cause cancer. From this perspective, the use of glyphosate to grow GM maize creates clear concerns for public health.

The ongoing debate regarding GM crops in Kenya extends back to January 2000, when Kenya became the world's first country to sign the Cartagena Protocol on Biosafety. This treaty, designed to accompany the 1992 Convention on Biological Diversity, represents an attempt by the international community to ensure the

The world's bananas are at risk of extinction again. Most bananas around the world today are the Cavendish variety. The Cavendish became the only major banana option when a plague known as Panama disease decimated the Gros Michel, the more delicious variety that was sold in stores. The Panama disease has mutated to attack the Cavendish and is spreading rapidly. It is moving quickly across East Africa, where approximately one-third of the world's bananas grow. Kenya, Uganda, Tanzania, and Burundi have banana plants that are threatened, and researchers across the region are examining genetically engineered solutions. The disease is also prevalent in Asia, although there are no reports of it in Latin America. Today, genetic engineers are working to develop disease-resistant bananas. By modifying the banana's genetic structure, engineers anticipate having a farm-to-store solution in place by 2022 (Baggaley 2017).

safe use of modern biotechnology and to limit its potential risks to environmental safety and human health by requiring risk assessments for GMOs. By signing this treaty, Kenya committed itself to overhauling its domestic laws and regulations and developing a comprehensive framework for the responsible regulation of modern biotechnology.

In 2001, the Kenyan Parliament began the process of drafting a Biosafety Bill. However, with diverse stakeholders, competing interests, and cabinet changes, a final draft bill would not be ready until 2005, and its passage was delayed following contestation from civil society groups, particularly the Kenya GMO Concern Group and the Kenya Biodiversity Coalition. They argued that the proposed bill would promote the introduction of GMOs by multinational companies, increase the risk of contamination of traditional crops, undercut a public participation process, and ignore the precautionary principle of international environmental law. Despite significant nationwide protests, the bill was approved by the cabinet in 2007, then by the parliament in 2008, and signed into law by President Mwai Kibaki (1931–) in 2009. The bill became the first comprehensive biosafety legislation in East Africa (Karembu, Otunge, and Wafula 2010).

The 2009 Biosafety Act introduced three key innovations for the regulation of GMOs in Kenya. First, it created a new institution, the National Biosafety Agency, to regulate all GMO activities in Kenya, including handling, transfer, development, and use. Second, it promoted a multisectoral approach to regulation, in which the NBA adopted the lead role but received input from any of eight relevant regulatory agencies as part of its GM crop risk assessment and evaluation. Finally, it created a formal process for the commercialization of GM crops, in which applications must be accepted and then pass multiple National Performance Trials before being considered for commercialization.

Although the Biosafety Act seemed to prepare Kenya for the adoption of GM crops, this trajectory changed when, in 2012, the Minister of Public Health Beth Mugo (1959–) presented concerns regarding a controversial research paper, the Séralini Study, that linked GM maize to the development of tumors in rats (Séralini et al. 2012). As a response, the Kenyan cabinet, led by President Kibaki, implemented a ban on GMO imports (Snipes and Kamau 2012). This ban has remained in effect since 2012. At this time, the Kenyan government has created a task force to examine the issue of GMOs and food safety, leading to a special report, headed by Professor Kihumbu Thairu (c. 1941–) and presented to parliament in 2014. This report, known as the Thairu Report, was never made public. Civil society groups contend that it recommends rejection of GMOs and continue to demand its release. The controversies surrounding these studies serve as active grievances for both pro-GMO and anti-GMO groups.

Kenya has yet to approve any GM crops for commercial release. In 2017, the NBA received an application for GM gypsophilia, a white flower used as filler material in flower arrangements (also known as baby's breath), which was

expected to be cleared for commercial production. The genetically modified version was altered to include a new range of colors (shades of red) that would attract a premium price on international markets. The NBA, however, rejected the application on the basis of trade considerations; Kenya's flower industry is large, and its primary market is the European Union, which at times takes a strong stance against GMOs. Since GM gypsophilia would be accompanied by other flowers, it was perceived to put the entire flower bundle at risk of rejection, with potential damage to the reputation of Kenya's flower export market.

Kenyan President Uhuru Kenyatta speaks at the Milan Expo in 2015. In 2017, President Kenyatta announced that his Big Four agenda for the nation included manufacturing and food security, to which he assigned multiple ministers to further explore the cultivation of genetically modified cotton and other crops. Genetically modified crops are controversial in the country and none have been approved for commercial release; however, from a legal standpoint, the country is poised to explore the potential of genetically modified foods. (Thejaguar74/Dreamstime.com)

While GM crops have yet to be approved for commercial release, there appears to exist a strong political will for their use. In December 2017, President Uhuru Kenyatta (1961–) announced the four pillars of his Big Four Agenda: manufacturing, housing, affordable health care, and food security. As part of the drive to push manufacturing sector, President Kenyatta directed the Ministries of Health, Agriculture, and Industry to work together to revitalize Kenya's struggling cotton industry, including the exploration of using GM cotton. Under this revitalization plan, the government will attempt to create 680,000 new cotton farming jobs and meet the domestic annual demand for 200,000 bales of cotton (ISAAA 2018). Currently, Kenyan ginneries produce just 25,000 bales annually.

The potential introduction of GM cotton has faced strong criticism from civil society groups. They contend that the collapse of Kenya's cotton industry was never about seed. Instead, the collapse was related to the mismanagement of Kenya's cotton ginneries, which were privatized under the recommendation of World Bank and Internal Monetary Fund (IMF) structural adjustment programs and rendered

uncompetitive without the assistance of government support (Maina 2019). Civil society groups also point to the experience of Burkina Faso, formerly Africa's top cotton producer, which introduced a new strand of GM cotton, Bollgard II, in 2008. While this pest-resistant variety increased production, it was also found to decrease the quality of cotton, leading producers to lose their premium pricing (Bavier 2017). Ultimately, Burkina Faso returned to conventional cotton, eliminating GM cotton in 2016. Many civil society groups have used this experience to show that GM cotton benefits are unclear and may create more problems for Kenya's cotton industry.

Currently, both GM cotton and GM maize are undergoing National Performance Trials, after which they may be considered for commercial release. Confined field trials are being conducted for GM maize, cassava, sorghum, gypsophilia, sweet potato, and banana.

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Further Reading

Bavier, Joe. 2017. "How Monsanto's GM Cotton Sowed Trouble in Africa." Reuters Special Report. Accessed June 21, 2019. https://www.reuters.com/investigates/special-report/monsanto-burkina-cotton/.

Dowd-Uribe, Brian, and Matthew A. Schnurr. 2016. "Briefing: Burkina Faso's reversal on genetically modified cotton and the implications for Africa." *African Affairs* 115 (458): 161172.

FAO. 2019. "Kenya at a Glance." Accessed June 21, 2019. http://www.fao.org/kenya/fao-in-kenya/kenya-at-aglance/en/.

ISAAA. 2018. "Crop Biotech Update—Kenyan Government Banks on Bt Cotton to Revive Textile Industry." Accessed June 21, 2019. http://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=4/18/2018#16383.

Karembu, Margaret, D. Otunge, and D. Wafula. 2010. "Developing a Biosafety Law: Lessons from the Kenyan Experience." ISAAA AfriCenter. Accessed June 20, 2019. https://www.isaaa.org/resources/publications/developing_a_biosafety_law-lessons_from_the_kenyan_experience/download/Developing%20a%20Biosafety%20Law%20-%20Lessons%20from%20the%20Kenyan%20Experience.pdf.

Maina, Anne. 2019. "Bt Cotton No Aid to Textiles Sector but a Trapdoor for Unsafe Food." *Daily Nation*. Accessed June 6, 2020. https://www.nation.co.ke/oped/opinion/Bt-cotton-no-aid-to-textiles-buttrapdoor-for-unsafe-food/440808-4925068-jb67dvz/index.html.

Muraguri, Lois. 2010. "Unplugged!: An Analysis of Agricultural Biotechnology PPPs in Kenya." *Journal of International Development* 22 (3): 289–307.

Rapsomanikis, George. 2015. "The Economic Lives of Smallholder Farmers: An Analysis Based on Household Data from Nine Countries." Food and Agriculture Organization of the United Nations. Accessed June 6, 2020. http://www.fao.org/3/a-i5251e.pdf.

Schurman, Rachel. 2017. "Building an Alliance for Biotechnology in Africa." *Journal of Agrarian Change* 17 (3): 441–458.

Séralini, Gilles-Eric, et al. 2012. "RETRACTED: Long Term Toxicity of a Roundup Herbicide and a Roundup-Tolerant Genetically Modified Maize." *Food and Chemical Toxicology*. 50 (11): 4221–4231.

Snipes, Kate, and Carol Kamau. 2012 "Kenya Bans Genetically Modified Food Imports." USDA Foreign Agricultural Service–GAIN Report, Kenya. Accessed June 6, 2020. https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Kenya%20Bans%20Imports%20for%20Genetically%20Modified%20Foods_Nairobi_Kenya_12-4-2012.pdf.

MEXICO

Mexico represents a critical case for understanding the ways in which the state, civil society groups, and international markets interact to shape both adoption and rejection of genetically modified crops. In many ways, Mexico was primed for GM crops from the start; the signing of NAFTA in 1994 ushered in a new era of agriculture, displacing Mexican farmers and promoting a new model of dependency on agricultural exports from the United States. This challenge of trade liberalization created a new set of economic pressures for Mexico to adopt GM crops.

However, in Mexico the question has been about much more than competitiveness in agricultural markets; it is also intimately connected with questions about the role that certain crops, particularly maize, play within Mexican culture and heritage and the potential risks that genetic modification presents for these components of Mexican identity (Fitting 2011). These concerns are also compounded by the fact that Mexico is megadiverse; it is considered the fifth most biodiverse country in the world and a center of origin and diversity for many types of plants, including maize. These conditions make the story of GM crops in Mexico very complex; it is part of a dynamic mix of competing economic, cultural, and environmental pressures.

Mexico currently holds a mixed policy toward GMOs. The main regulatory framework is based on the 2005 National Biosafety Law, which created a formal process for the commercialization of GM crops and established requirements for conducting risk assessments of each crop prior to release. However, the only GM crop that Mexico produces commercially is cotton; the cultivation of GM soy and GM maize have been prohibited via court order.

A History of Genetically Modified Crops in Mexico

To understand this policy, it is necessary to review the history and development of GM crops in Mexico. This story begins in 1988, when Mexico offered the first permits for contained field trials of GM tomatoes. At this time, genetic modification of crops was new and poorly understood, and Mexico's embrace of field testing was very much at the vanguard of biotechnology policy around the world. The lack of scientific data regarding GMOs led Mexico to pursue a policy of ad hoc regulation.

The government put together a committee of experts across scientific fields to assess each application for GMO field testing on a case-by-case basis, guided by

the "precautionary principle" that a lack of scientific evidence of risk would not be considered the same an absence of risk (Serratos 2009). In practice, this process meant that the committee of experts would act cautiously in their decision making, considering all available scientific evidence as well as the potential risks for which complete scientific evidence was not yet available. Under this policy, Mexico pursued contained field testing for numerous crops including rice, zucchini, canola, tomato, maize, melon, potato, papaya, pineapple, papaya, banana, soy, tabasco pepper, and wheat.

In 1998, however, this group of experts became concerned with the growing interest in permits for experiments with GM maize. Of particular concern were two issues. First, most types of the maize grown in Mexico are open-pollinated varieties that are susceptible to cross-contamination, meaning that pollen from genetically modified varieties could potentially mix with native maize varieties. Second, Mexico is the "center of origin" of maize and home to over sixty different races of maize (as well as teosinte, the wild grass from which modern maize was developed beginning some 10,000 years ago). What might happen if GM traits were to spread within this area? Could this reservoir of genetic information be lost or permanently changed? Given these concerns, along with the limited information available regarding the risks of contamination, the committee endorsed a moratorium on the GM maize experiments, which Mexico would adopt beginning in 1998 (Sarukán 1999).

Despite its intentions, the moratorium had limited effectiveness. In 2001, researchers from the University of California, Berkeley published a study in the journal *Nature* showing that genes from GM maize had mixed with native varieties in the Sierra Norte region of Oaxaca, a finding that was later confirmed by Mexico's Ministry of Environment (Quist and Chapela 2001). This study sparked a tremendous public outcry and brought the question of GMOs firmly into the public discourse, where scientists, campesinos, agroindustry, indigenous groups, environmentalists, and other communities would make claims for how to regulate this technology appropriately. In this way, the contamination of maize made visible the issue of GMOs, transforming it from a technical issue to a social issue of concern to all of Mexican society.

After years of vigorous public debate, Mexico passed a National Biosafety Law in 2005. This law created a comprehensive regulatory system for GMOs in Mexico and can be thought of as having three main components. First, it established a process for commercializing GM crops, requiring plants to pass three phases: experimental, pilot, and commercial. Previously, under Mexico's ad hoc system, crops were grown primarily for research purposes; there was no system that could certify crops for commercial purposes. Second, the law established a formalized system across state agencies for evaluating the potential risks for each crop in terms of public health, environmental effects, and effects on biological diversity prior to its release. Finally, it established labeling requirements for the import and export of GM crops.

Mexican civil society groups widely decried the Biosafety Law, which was soon named the Monsanto Law, for its alleged benefits toward agroindustry (Ribeiro 2005). In particular, opponents criticized it for promoting biotechnology rather than biosafety, fast-tracking commercialization of GM crops, lifting the moratorium on GM maize, neglecting to include a public consultation process, and disregarding the issue of GM food labeling. These concerns remained present within civil society groups, and the two largest activist networks, Red en Defensa del Maíz and Sin Maíz No Hay País, have repeatedly made calls to overhaul the existing biosecurity legislation.

With a new regulatory system in place, biotechnology companies and research institutions began soliciting permits to grow GM crops at larger scales. Between 1988 and 2004, the Mexican government granted 317 permits to grow GM crops on 667,510 hectares of land. Between 2005 and 2017, it granted 595 permits to grow GM crops on 5.8 million hectares (CECCAM 2017). In 2010, Monsanto received a permit to grow GM cotton commercially in the northern states of Chihuahua, Coahuila, and Durango. This cotton was the first commercially grown GM crop in Mexico and is currently the only GM crop grown commercially in Mexico.

In 2012, the Mexican government granted Monsanto a permit to grow GM soy commercially in 253,500 hectares spread across the states of the Yucatan peninsula. This same year, five companies applied for permits to grow GM maize on a total of 2.5 million hectares (CIBIOGEM 2019). These events triggered a firestorm of legal activity. In the case of GM soy, the government had authorized the permits without having pursued or received the "free, prior and informed consent" of indigenous beekeeping communities, violating Mexico's international legal commitments under ILO Convention 169. Furthermore, the introduction of GM soy was demonstrated to imperil the economic livelihood of indigenous beekeeping communities; bees were transporting GM pollen to their honeycombs, causing honey exports be rejected by European Union markets. As Mexico is the world's fifth-largest exporter of honey,

Malaria is a mosquito-borne disease where a person contracts a parasite transferred from the biting insect. Without treatment, the disease can be deadly. The World Health Organization (2017) reported that 90 percent of the world's reported malaria cases occurred in sub-Saharan Africa in 2016. To combat the epidemic, researchers have developed a Target Malaria campaign that has genetically modified mosquitos to impair them from transmitting the parasite. The technique could also help to sterilize the species that carries the deadly disease. The modified mosquitos are tentatively scheduled for release in 2029, allowing researchers to consider and address the ethical and ecological ramifications of introducing the changed species into the environment (Regalado 2016).

rejected honey reflected a significant economic loss. In 2015, the case reached the Second Chamber of Mexico's Supreme Court, which revoked the GM soy permit and required the government to engage in a full consultation process for future permits. At present, no further permits for commercial GM soy have been issued.

In 2013, La Colectividad del Maíz, a claimant group of fifty-three individuals representing twenty organizations across Mexico, filed a class action lawsuit against Mexico's Ministry of Agriculture, the Ministry of Environment, and the five companies that had applied for commercial GM maize permits. In October 2013, a federal judge cited the threat of imminent harm to the environment as well as the need to respect the precautionary principle of international law and ordered the suspension of the commercial cultivation of GM maize in Mexico, a ruling which remains in effect.

The future of GM crops in Mexico, however, remains mixed. Public opposition to GMOs remains strong and has the support of President Andres Manuel Lopez Obrador (1953–), who declared on his first day on office, December 1, 2018, that Mexico will not produce GMOs. However, Mexico still imports approximately ten tons of GM maize from the United States each year and has approved 188 GM transactions for import and consumption. Furthermore, the forthcoming United States–Mexico-Canada Agreement, ratified by Mexico on June 19, 2019, contains requirements for Mexico to adopt the highly controversial UPOV 1991 treaty, which advances genetic modification through a system of intellectual property protections for plants. These scenarios present a conflicted and uncertain future for GMOs in Mexico.

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Further Reading

CECCAM. 2017. "Treinta Años de transgenicos en Mexico." Accessed June 17, 2019. http://ceccam.org/sites/default/files/30_años_transgenicos.pdf.

CIBIOGEM. 2019. "Solicitudes de Permisos de Liberación." Accessed June 6, 2020. https://www.conacyt.gob.mx/cibiogem/index.php/solicitudes/permisos-de-liberacion/solicitudes-de-permisos-de-liberacion-2011.

Fitting, Elizabeth. 2011. *The Struggle for Maize: Campesinos, Workers, and Transgenic Corn in the Mexican Countryside.* Durham, NC: Duke University Press.

Fitting, Elizabeth. 2014. "Cultures of Corn and Anti-GMO Activism in Mexico and Colombia." In *Food Activism: Agency, Democracy and Economy*, edited by Carole Counihan and Valeria Siniscalchi, 175–192. New York: Bloomsbury.

Quist, David, and Ignacio Chapela. 2001. "Transgenic DNA Introgressed into Traditional Maize Landraces in Oaxaca, Mexico." *Nature* 414 541–543.

Ribeiro, Silvia. 2005. "Ley Monsanto: Parece mal, pero es peor." *La Jornada*. Accessed June 17, 2019. https://www.jornada.com.mx/2005/01/22/023a2pol.php.

Rodríguez, Jose Carlos, César L. Navarro-Chávez, Mario Gómez, and Margarita Mier. 2015. "Science, Technology and Innovation Policy to Sustain Agricultural Biotechnology in Emerging Economies: Evidence from Mexico." *International Journal of Biotechnology* 13 (4): 198–229.

Sarukán, José. 1999. "Organismos vivos modificados en la agricultura mexicana: Desarrollo biotecnológico y conservación de la diversidad biológica." *Revista de la Sociedad Mexicana de Biotecnología y Bioingeniería* 4: 47–60.
Serratos, José. 2009. "Bioseguridad y dispersión de maíz transgénico en México." *Ciencias* 92: 130–141.

PHILIPPINES

The Philippines, a Southeast Asian country, is home to approximately 104.9 million people. Often referred to as the pioneer of adopting genetically modifying technology in developing countries, the Philippines has become a leader in Asia for genetically modified food. Due to the import of U.S. Monsanto's GM soybean crop in 1996, genetically modified organisms became an integral part of the Filipino food product and the country's food market, contributing significantly to the Philippines' daily diet (Grain 1997).

In 2002, the Philippine government approved the first planting of genetically modified seeds for commercial cultivation. With a total of 812,000 hectares of planted biotech crops, the International Service for the Acquisition of Agri-Biotech Applications ranked the Philippines thirteenth in the world for GMO cultivation (Cornish 2018). Biotech crops may revitalize the country's agricultural sector and fuel the rural economy (Roxas-Mendoza 2017). However, anti-GMO groups believe that the use of GMOs will be detrimental to public health and safety. These opponents support an organic solution to solve world hunger rather than what they perceive to be a scientifically engineered band-aid that could be more damaging to consumers and farmers.

Agriculture is important to the country's economy; however, the industry itself has not progressed in decades (De Guzman 2018). GM crops show promise for progressing the country's agricultural sector. With the use of GMOs, the Philippine government aims to cut farming costs for the average farmer and revitalize the agricultural sector. As most farmers are tenants and not actual owners of their farmland, they usually see little-to-no profits after each farming season because of accrued debt and high rent. With the use of biotech crops, more and more Filipino farmers turn a greater profit from higher crops yields and spend less on additional equipment and farming technologies (Cornish 2018).

Engineering plants to be heat tolerant ensures crop survival in the country's high temperatures. Seeds can not only be modified for heat tolerance, but they can also be pest and bacteria resistant. For example, since the initial planting of GM corn in 2002, the country has introduced thirty-six varieties of GM corn that are both heat tolerant and pest resistant. GM corn accounts for 70 percent of the country's corn output (Serapio and dela Cruz 2016). Producing pest-resistant GM seeds allows farmers to plant with confidence, ruling out worrying about pests, such as the corn borer, that can ruin an entire crop or require the use of toxic pest repellent on their fields. Engineered seeds can also repel certain kinds of bacteria and fungi that produce aflatoxin, a mold that researchers have linked to liver cancer. Other benefits

of GM seeds include annual increased yields and profits (Alunan 2017). With GM seeds, farmers do not risk losing their crops, and essentially their profits, nor do they need to invest more money into pesticide, fertilizer, and labor. Despite the high yields in biotech harvests, the Philippine government must address several problems the agricultural sector faces with the production of GM crops, such cultivation costs and labor. Only 25.96 percent of Filipino workers work in the agricultural sector.

The primary GMO incorporated into the national food supply is textured vegetable protein (TVP); as many as 2,000 types of foods, including hotdogs, corned beef, and cheese, have been genetically modified to incorporate TVP (Roxas-Mendoza 2017). While TVP has been incorporated into many processed foods, it is not the only biotech crop used in the Philippines to support the population's dietary requirements. GM corn production has already had success domestically. Current experimentation occurs on GM rice. Rice, as the country's dietary staple, plays an important role in the country's cuisines. For this reason, farmers are looking at Golden Rice, the latest biotech crop offering great promise. After being in development for about two decades, the second generation, GR2, is currently being tested in trial runs by the International Rice Research Institute and the Philippine Rice Research Institute (Simeon 2018). In addition to the typical GM seed features, Golden Rice drops seeds intended to produce similar high-yielding harvests for the next planting season, unlike other biotech crops that see a significant drop in yield with each subsequent harvest (Roxas-Mendoza 2017).

The most unique benefit of Golden Rice is that it is specifically developed to target vitamin A deficiencies in developing countries. Large parts of the population live in poverty and, consequently, register high in vitamin deficiencies because of malnutrition. With this deficiency, poorer populations require, yet often lack, access to medical assistance to help alleviate symptoms, which can be especially severe for children. Without vitamin A, children's bodies experience stunted growth and development, and they become more susceptible to illnesses, possibly developing blindness or other vision impairments. To correct the vitamin deficiency, Golden Rice was engineered to be rich with vitamin A. Because the Philippines relies on rice as its primary dietary staple for sustenance, the substitution of Golden Rice into the daily diet will ensure the population's regular consumption of vitamin A (Alunan 2017).

However, GM foods are not without controversy. While showing promise to meet national needs for sustenance, Golden Rice has also come under growing public scrutiny. Several anti-GMO groups, such as the Stop Golden Rice! Network and Greenpeace, have protested and criticized the use of GM foods in the Philippines. They argue that the sale of the more expensive GM seeds will hamper the Filipino farmers' ability to continue farming because they cannot afford the up-front and recurring costs. Since biotech crops do not drop high-yielding seeds, farmers must buy GM seeds every farming season rather than collect dropped seeds from organic crops. The costs are prohibitive; when farmers must buy a new batch of GM seeds to plant, they typically spend an average of PHP₱ 5,000 per hectare, or close to US$100, every planting season (Roxas-Mendoza 2017). Despite efforts to revitalize the country's agricultural sector with biotechnology,

anti-GMO groups believe the use of GMOs is making it more difficult for farmers to have a sustainable livelihood (Cornish 2018).

Anti-GMO groups state that the use of biotech crops cannot be used as a cure-all for world problems such as malnutrition. They argue that providing vitamin-rich foods produced from sustainable and organic farming is the answer for long-term solutions. They claim that organic farming is a better approach to malnutrition because organic crops ensure the safety and health of their consumers (Roxas 2018). Anti-GMO groups also believe that large biotech companies, such as Syngenta, one of the world's largest biotech companies and the creator of Golden Rice, are trying to humanize GMOs to improve marketability and sales while misleading the public. Despite studies supporting biotech crops such as the vitamin-rich Golden Rice, anti-GMO groups continue to challenge the legitimacy of GMO research because they believe that companies only sponsor and support research aligning with their claims; they also contend that close examination of this research demonstrates flaws that discredit the companies' sponsored study results (Yap 2013).

Many Filipino organic farmers rally with anti-GMO groups against the use of biotech crops in the Philippines. They argue that through cross-pollination with biotech crops, they cannot guarantee organic crops for export. The loss of the country's organic export position could cost its niche in the emerging specialty foods market. The results of cross-pollination can also be damaging to the plants' genetic makeup or even create a herbicide-resistant superweed. In 2013, Filipino farmers appealed to the agriculture secretary, Procesco Alcala (1955–), a huge supporter of organic farming, about restricting GMOs, citing loss of a lucrative position in the specialty foods market, possible irreversible damage to the country's biodiversity, and risk to food security and public health (Yap 2013).

In addition to protests from local organic farmers, the Philippines also face the rising illegal use and development of GM seeds available at a lower price. Despite the appeal of inexpensive GM seeds, they ultimately come at a great price. Because the illegal seeds were developed without the same materials and procedures used by large biotech companies, their usage does not guarantee the same results. Farmers may lose or produce poor yields because the illegally developed seeds are not as resilient as their legitimate counterparts (Icamina 2018). Planting substandard GM seeds can devastate farming communities and destabilize portions of the farming industry, ultimately boosting anti-GMO sentiment within the country.

After much criticism of the GMO approval process and a petition led by Greenpeace, the government took drastic steps to address the GM controversy. In December 2015, the Philippine Supreme Court stopped all testing and trials for the GM eggplant and suspended all biotech permits and regulations at that time (Cornish 2018). In May 2016, the Supreme Court introduced a new, strict regulatory system for biotech crops and its products. It takes ten to fourteen years for the Biotech Food Safety Review to study a new biotech crop, which includes extensive laboratory research, contained greenhouse and small-scale field trials, and precommercial testing, before the crop even reaches commercial release (Roxas-Mendoza 2017).

The stringent system also guarantees transparency into the approval process of permits to import, cultivate, and commercialize GM crops. To assuage concerns of local farmers, the new regulatory system enhances the current risk assessments with tighter regulations and more involvement with the local government (Serapio and dela Cruz 2016). Despite the drastic change in regulation, according to anti-GMO groups, there is still much to be done surrounding the regulation and restriction of GMOs in the Philippines.

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Further Reading

Alunan, Michael Makabenta. 2017. "Must We Fear GMOs or Start Listening to Science." Business Mirror. Accessed December 1, 2018. https://businessmirror.com.ph/must-we-fear-gmos-or-start-listening-to-science/.

Cornish, Lisa. 2018. "What Are the Political Drivers for GMOs in Developing Countries." Devex. Accessed November 29, 2018. https://www.devex.com/news/what-are-the-political-drivers-for-gmos-in-developing-countries-92091.

De Guzman, Sara Soliven. 2018. "Agriculture Is Dying in the Philippines." Philstar. Accessed December 6, 2018. https://www.philstar.com/opinion/2018/06/18/1825542/agriculture-dying-philippines.

Grain. 1997. "Soybean: The Hidden Commodity." Accessed May 17, 2019. https://www.grain.org/en/article/226-soybean-thehidden-commodity.

Icamina, Paul. 2018. "'Fake GM Corn' Eating into Filipino Farmers' Profits." Sci Dev Net. Accessed December 1, 2018. https://www.scidev.net/asiapacific/gm/news/fake-gm-corn-eating-into-filipino-farmers-profits.html.

Roxas, Pathricia Ann V. 2018. "Group Warns PH vs 'Golden Rice': It's Not the Solution to Malnutrition." Inquirer. Accessed December 5, 2018. https://newsinfo.inquirer.net/978209/group-warns-ph-vs-golden-rice-its-not-the-solution-tomalnutrition.

Roxas-Mendoza, Psyche. 2017. "The GMO in Your Food." Philippines Graphic. Accessed June 6, 2020. https://philippinesgraphic.net/2017/12/04/the-gmo-in-your-food/.

Serapio, Manolo, Jr., and Erik dela Cruz. 2016. "Philippines Sign New GMO Rules, Food Industry Relieved." Reuters. Accessed November 30, 2018. https://www.reuters.com/article/us-philippines-gmo/philippines-signs-new-gmo-rules-food-industryrelieved-idUSKCN0W90MK.

Simeon, Louse Maureen. 2018. "Golden Rice Moves Forward." Philstar. Accessed December 15, 2018. https://www.philstar.com/business/2018/07/08/1831505/golden-rice-moves-forward.

Yap, D. J. 2013. "Environmentalists, Farmers' Groups Raise Alarm on Genetically Modified 'Golden Rice.'" Inquirer. Accessed December 5, 2018. https://newsinfo.inquirer.net/480423/environmentalists-farmers-groups-raise-alarm-on-geneticallymodified-golden-rice.

SOUTH AFRICA

South Africa has led the way in Africa's GM crop development; in fact, it differs significantly from most African nations because it does allow GM crop cultivation and currently leads the continent in GM cultivation along with Sudan. South Africa has become the world's ninth-largest GM crop producer and is the first African nation to allow commercial cultivation of a GM crop. Many scientists and researchers

attribute South Africa's success with GM crops to a high level of political support that other African nations do not enjoy. At the same time, the entire population is not enthralled with GMOs; some people continue to hold critical and even opposing viewpoints on the country's GMO activities, and there are organizations whose primary purpose is to advocate for the reduction, or even elimination, of GM crops.

Agriculture in South Africa today relies heavily on genetically modified or engineered seeds. Approximately 94 percent of all corn plantings use these seeds, while 95 percent of soybeans and 100 percent of cotton follow suit (USDA 2019). In 2010, the government established the Agricultural Research Council's Biotechnology Platform to provide high-quality research to ensure high standards for the country's agricultural sector. It is one of several research institutions that seek to understand the development and impact of agricultural developments, such as the cultivation of GM crops, more fully. Many people view GM foods as a potential avenue to decreasing hunger in the country and support the positive economic impact that GM cultivation has had for many farmers.

South Africa's history with GM crop experimentation started in the late 1990s and continued gradually with the success of the crops. In 1996, the country first experimented with GM maize. In 1997, the government approved the cultivation of Bollgard, an insect-resistant GM cotton, and MON 810, a type of GM maize. In 2001, it approved a herbicide-resistant GM soybean. Since the first approval, the country has allowed at least 70 experiments with GM crop cultivation, including canola in addition to maize, cotton, and soybeans.

It also tightened the regulations by which companies and farmers could work with GMOs by adding the Guideline Document for Work with Genetically Modified Organisms in 2004 to update the Genetically Modified Organisms Act, Act No. 15 of 1997 (South Africa 2004). By 2017, South Africa had planted more than 2.73 hectares of GM crops and found that the levels of GM cultivation even allowed small-scale farmers to benefit from commercialization, mainly by increasing crop yields and revenue (Agaba 2019). The number of planted hectares continues to grow annually; the country's experimentation with GM crops and its progressive stance toward them, founded on solid research and policy, appear to have been successful to date.

Despite the government's relatively pro-GM food stance, it nonetheless takes its responsibility for GM food safety and societal benefit seriously. In 2018, the government rejected an application from Monsanto, one of the world's largest developers of GM seeds, to sell its drought-tolerant GM maize seeds in the country. After conducting small field trials and submitting results, the Executive Council for the GMO Act determined that the data was insufficient to claim that the crop would be drought or insect resistant and noted that the field trials suggested that some yields might be lower than those of traditional farming. With no added benefit to current crop growth and no ability to confirm claims about the drought tolerance or insect resistance of the seeds or the potential of subjecting farmers to a decline in revenue, the country had to reject the application.

In response to South Africa's initial approval to cultivate GM crops in the late 1990s, researchers and activists established the African Centre for Biodiversity

(ACB) to protest this development. The ACB has remained vocal in its criticism against GM crops and foods. In April 2019, the ACB launched an objection to an application for GM maize with resistance to chemical 2, 4-D, a component in the dangerous compound Agent Orange, based on the premise that the crops would increase health and environmental risks. With resistance to chemicals such as 2, 4-D, the ACB argued that companies will increase use of the chemical as a pesticide and noted that the chemical itself has been linked to several serious, life-threatening diseases. The argument also included that once in the environment, the pesticides would not be limited to the crops because they could spread on the wind or sink into the ground, leading to fears and speculation about unanticipated, long-term environmental consequences.

The ACB shared its objections over social media to raise public awareness about the objection, one of its strategies to inform the public about its activities and positions. The ACB, however, is not always adversarial to government decisions on GMOs; it used a similar social media strategy to approve the previously mentioned rejection of the Monsanto seeds in 2018, claiming the rejection as an anti-GMO victory. Generally, the ACB maintains a critical stance on GM production, ultimately contributing to the anti-GMO sentiment that some other South Africans share.

Public attitudes on GMOs are often split fairly equally, although for some aspects of GM cultivation, the majority opinion is positive or optimistic. Gastrow, Roberts, Reddy, and Ismail (2017) reported on a section of the South African Social Attitudes Survey in 2015 that focused on perceptions surrounding GMOs. It found that 49 percent of South Africans believe GM foods are safe to eat; 52 percent find the long-term health risks unknown, and 75 percent want all GM foods labeled. At the same time, 53 percent feel GM foods boost the economy, 56 percent find they benefit large-scale farmers, and 47 percent say GMOs increase the sense of food security. The overall finding was that 46 percent believed GM foods provide more benefits than risks, with 19 percent disagreeing and 36 percent undecided on the overall social effects of GMOs (Gastrow, Roberts, Reddy, and Ismail 2017). Unless public opinion shifts negatively, a significant part of the population supports GM cultivation to some degree.

Domestic perceptions offer only one potential challenge to South Africa's GMO production; international and regional policies also affect the GMO trade. Other African nation's anti-GM or conservative GMO stances, for example, have started to affect South Africa's ability to trade in GM crops. In late 2018, Namibia implemented stricter biosafety policies on GM crops entering the country. Crops crossing into Namibia must pass through new testing procedures, and all domestic companies accepting GM crops must be fully permitted to receive them. Food products containing GMOs must also be labeled to meet the country's guidelines, which could impact South Africa's agricultural trade in many grains, such as maize, rice, potatoes, and soybeans, as well as cotton and sugarcane, in addition to any other approved GM crops.

In other neighboring nations, debates have emerged on GM crops. In June 2019, Thamsanqa Silitshena (n.d.), state council for the Ministry of Agricultural

Development and Food Safety, spoke on Botswana's inability to regulate South Africa's GM crop exports, as Botswana has no biosafety or GMO-related law. He brought attention to a draft bill that would create the initial parameters for such a law and stressed the importance of enacting the bill. Zimbabwe's policy is conservative, allowing the importation of authorized GM foods, with the exception of GM grains. Other regional and more distant African nations all have different policies that may impact South Africa's GM food trade.

South Africa's progressive position on GM cultivation has allowed it to lead the continent in GM production, and its successful commercialization has provided the country with added benefits. The controversies and criticisms surrounding GM production, both domestic and international, do pose some challenges for the future of the industry. At present, the government has found the challenges surmountable and the population has, for the most part, accepted GM crops as beneficial for society and the agricultural sector. The future of GM cultivation in South Africa is predicated on maintaining the sector's previous successes and continuing to hold a high standard for the acceptance of new GM seeds for cultivation.

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Further Reading

Agaba, John. 2019. "Why South Africa and Sudan Lead the Continent in GMO Crops." Cornell Alliance for Science. Accessed August 18, 2019. https://allianceforscience.cornell.edu/blog/2019/01/south-africa-sudan-lead-continent-gmocrops/.

Gastrow, Michael, Ben Roberts, Vijay Reddy, and Shameelah Ismail. 2017. "Public Perceptions of Biotechnology in South Africa." *South African Journal of Science*, 114 (1/2). Accessed August 18, 2019. http://www.scielo.org.za/pdf/sajs/v114n1-2/16.pdf.

South Africa, Department of Agriculture. 2004. "Guideline Document for Work with Genetically Modified Organisms." Accessed August 18, 2019. https://www.nda.agric.za/docs/geneticresources/applicant%20-%20%20May%202004.pdf.

United States Department of Agriculture (USDA). 2019. "South Africa, Republic of: Agricultural Biotechnology Annual, Biotechnology in South Africa." Global Agricultural Information Network. Accessed June 6, 2020. https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Agricultural%20Biotechnology%20Annual_Pretoria_South%20Africa%20-%20Republic%20of_2-5-2019.pdf.

UNITED STATES

Labeling of Genetically Modified Foods in the United States

When asked whether they want genetically modified or genetically engineered (GE) foods to be labeled, the vast majority of Americans (more than 90 percent) have said yes since the introduction of the first GE food, the Flavr Savr tomato, in 1984. In general, "the unknown" and "dread" are two concepts that cause people to experience increased perceptions of risk that lead them to desire more information, such as product labels. GE foods fall into the category of unknown and dreaded, as opposed to known and acceptable (Slovic 1987). The United States

A couple reads and compares food labels while shopping at the grocery store. As of January 2020, some genetically modified and engineered foods in the United States are required by law to display labeling indicating they are bioengineered foods. Genetically engineered foods have faced some challenges to acceptance in the country, and due to controversies and questions about the safety and science behind them, the law is not a catch-all, but rather a step in the direction of meeting the general public's demand for product labeling. (Seventyfourimages/Dreamstime.com)

has historically taken a "science alone" approach to decision making about GE foods. Because science has not found GE foods to be harmful to humans nor substantially different than comparable foods produced without genetic engineering, there had not been mandatory labeling of GE foods in the United States. This changed in 2016, with the passage of the National Bioengineered Food Disclosure Law, passed by Congress in July 2016 (USDA n.d.).

Some foods produced using GE, also known as *genetic modification*, will carry required labels by January 1, 2020. However, the labels will not include the words *GE* or *GM*. Instead, a new word, *bioengineered* (BE), has been introduced into the genetically engineered organism lexicon. And even with the term *BE*, there are many products that will not be labeled. Even those that meet the federal standards for labels may not have an actual label on the product. As with any federally mandated initiative, the actual rules outlining what products must be labeled and how the BE characteristic is conveyed are complicated. A complicated labeling landscape was anticipated, given the complex and hotly debated history of the development of genetically modified foods. And with technology advancing at a rapid rate, which gene modifications will or should be designated as genetic modification and/or so labeled will continue to be deliberated among scientists, policymakers, activists, and citizens.

The history behind insulin shows that it has evolved as a genetically modified organism with lifesaving properties. In the early 1920s, Canadian researchers discovered insulin. After that discovery, medical professional relied on insulin to treat diabetes. Until the 1980s, the production of insulin typically involved the pancreas glands from pigs and cows, parts that constituted slaughterhouse waste. In fact, it took approximately two tons of pig glands to produce eight ounces of insulin (Gebel 2013). Advances in the biotech industry caused the switch from animal-based insulin. Researchers discovered that they could combine the human insulin gene with a sanitized strain of E. coli bacteria to produce insulin.

Confrontation, *controversy*, *irrational*, and *anxiety* are words neither consumer nor seller wants associated with their product. These tension-causing words erupted during the early introduction of GE products into the human food supply and continue today. The first product was a tomato called the Flavr Savr. The Flavr Savr tomato was voluntarily labeled as GE but was taken off the market by 1996. Since that time, there have been many GE crops developed and debates about how and whether to provide information about crop production methods to consumers (Kolodinsky 2018).

The National Bioengineered Food Disclosure Law (NBFDL) was passed in 2016, and by 2020, foods with more than 5 percent of certain GE foods must be labeled. Therefore, controversies over GE should end. Consumers now have tools that allow them to make their own decisions about GE through purchases in the marketplace. Consumer choice may ultimately decide the future of these technologies in the United States. Those who embrace GE technologies, those who do not embrace GE technologies, and those who do not care either way will be able to advance their own preferences as individuals, given their values. While greater tension may remain at the public level, facilitating consumer choice can buffer the debate.

But the NBFDL does not require labeling of all GE foods. The official list includes alfalfa, apple (Arctic varieties), canola, corn, cotton, eggplant (BARI Bt Begun varieties), papaya (ringspot virus resistant varieties), pineapple (pink flesh varieties), potato, salmon (AquAdvantage), soybean, summer squash, and sugar beet (USDA n.d.). The list will be updated annually. It exempts food served in restaurants or similar retail food establishments. Regulated entities have several disclosure options: text, symbol, electronic or digital link, and text message. Additional options such as a phone number or web address are available to small food manufacturers or for small and very small packages. Foods using technologies that were not developed as the law was being promulgated, such as CRISPR, or that have not yet been developed will be evaluated on a case-by-case basis.

Even before the labels will appear on products, a new initiative has been introduced that can limit the reach of the NBFDL. In June 2019, the Animal, Plant Health Inspection Service (APHIS) introduced a proposed rule, Movement of Certain Genetically Engineered Organisms (APHIS 2019), which proposed to

exempt certain categories of modified plants, including GE plants with plant-trait mechanism-of-action combinations that have already evaluated by a regulatory status review and found to be unlikely to pose a plant pest risk. Under the proposed new regulatory framework, a developer would have the option to make a self-determination as to whether their GE plant belongs to one of the categories on the GE list and will be exempt from the regulations. If passed, the exempted categories of plants would also be exempt from labeling, as there will be no list of these new technological advances, unless the developer chooses.

In March 2019, the Voluntary Labeling Indicating Whether Foods Have or Have Not Been Derived from Genetically Engineered Plants guidance was distributed (Office of Nutrition and Food Labeling 2019). This guidance is not only for future GE developments but also for food products derived from GE that are exempt under the current NBFLD, including incidental additives, meat and milk derived from animals fed GE feed, and foods so highly refined that current DNA tests may or may not show the GE content in the final product, despite the source of the ingredient(s) indisputably being GE. Nongovernmental organizations have also entered the marketplace of information. The NonGMO project, for example, uses third-party verification to certify that more than 3,000 brands and 50,000 products meet their non-GMO standards.

With the promise that GE technologies will have positive impact on society, difficulties about deciding what should be labeled and efforts to limit future labeling appear out of place. There have been three major contributions to these challenges. First, several years ago, it was asserted that GE labels would "scare" people away from these technologies, leading to them being abandoned. Second, focusing only on scientific advancement has served to bifurcate views on the promise versus villainy of GE. Third, recent exposure of less than ethical business practices continue to contribute to confrontation and controversy.

With regard to the first, a priori studies of consumer "dread" due to labeling in the United States showed mixed results. A study that used data from the only U.S. state to implement a mandatory GE labeling law, Vermont, concluded that compared to the rest of the United States, people in Vermont were more accepting of GE. Another study using data from the same mandatory labeling environment showed that an overwhelming majority of people who saw mandatory labels used the information to make decisions. The information did not contribute to their attitudes of support or opposition (Kolodinsky, Morris, and Pasuniak 2018). Each of these articles contains an extensive reference list for readers who desire more information.

With regard to the second, there are many criteria on which people base their food purchasing and consumption decisions. Scientific evidence is only one. Communication experts know that top-down approaches to teaching the public about the benefits of technological advances in agriculture, including genetic engineering, do not change consumer opinions about these technologies. Nevertheless, there remains a view that a focus on educating consumers about science will help gain public support for GE. When the science of GE ignores the science of

communication, it seems that science is at odds with itself. And when the science of GE ignores important ethical principles of communication, conflict and tensions will arise. A bioethics rubric of autonomy, nonmalfeasance, beneficence, and justice is helpful to understand the issue.

Ethical tensions about GE foods go beyond safety and include difficult-to-quantify issues, such as interference with the natural order of things, religion, freedom of choice, environmental concern, trust, risk, cultural identity, equity, fairness, consent, and self-determination (See Kolodinsky 2018 for a detailed discussion of the science alone approach to communicating about GE). And, while the National Academies (2016) report found that current scientific evidence reveals no adverse health effects related to foods produced using GE, they also wrote that GE technology has not had a significant impact on yield increase of maize, cotton, or soybean in the United States; there is evidence of pest and weed insect increases; there has been gene flow (drift); GE has not been found to have causal impact on no-till agricultural practices; and the economics of mandatory labeling are uncertain.

With regard to the third, commercial industry has contributed to challenges with society's acceptance of GE. For example, Monsanto (now owned by Bayer), knew that one of its first GE entrants into the market, rBST, designed to promote increased milk production by dairy herds, was not entirely safe to cows. Reports obtained in 2009 via the Freedom of Information Act showed that the company knew that the drug caused more health and mastitis incidents as well as reproductive problems in cows than in a control herd, that intramuscular injection was unacceptable, and that there was an increase in total cows affected and total days observed for hock abnormalities (FDA 1993).

A continuing challenge is with the product Dicamba. In 2017, Monsanto sold its Dicamba-resistant Extend soybeans to farmers before approval was obtained. It then sold Dicamba to farmers before the Environmental Protection Agency approved of a new way to spray it. Dicamba is toxic not only to nonresistant varieties of crops but also to woody plants and trees. It is reported to have damaged 5 million acres of nonresistant crops. Lastly, after a lawsuit awarded a California man $289 million in damages, German agrichemical Bayer faces 18,400 legal cases in the United States over glyphosate, which is linked to a form of cancer (see USRTK n.d. for details).

Clear, transparent, and truthful labeling of GE foods can both facilitate the potential of genetic engineering and limit undesirable outcomes related to its use. In a capitalist society, societal demand typically decides which products will succeed or fail in the marketplace. It is unlikely, however, that the National Bioengineered Food Disclosure Law will halt the tensions between scientists and the public. GE technology is moving ahead rapidly, stimulating increased perceptions of the unknown. Mishaps in commercial applications have caused unintended consequences to crops and animals. And even with a national labeling law, many products that consumers may perceive as GE may or may not be labeled.

Jane Kolodinsky

Further Reading

APHIS. 2019. "Movement of Certain Genetically Engineered Organisms Proposed Rule. Federal Register, 84 FR 26514." Federal Register. Accessed June 6, 2020. https://www.federalregister.gov/documents/2019/06/06/2019-11704/movement-of-certain-genetically-engineered-organisms.

Food and Drug Administration (FDA). 1993. "POSILAC: For Increasing Production of Marketable Milk in Lactating Dairy Cows." Accessed June 15, 2020. https://animaldrugsatfda.fda.gov/adafda/app/search/public/document/downloadFoi/512.

Kolodinsky, Jane. 2018. "Ethical Tensions from a 'Science Alone' Approach in Communicating GE Science to Consumers." In *Ethical Tensions from New Technology: The Case of Agricultural Biotechnology*, edited by James, Harvey, 12–25. Wallingford, UK: CABI.

Kolodinsky, Jane, and Jayson Lusk. 2018. "Mandatory Labels Can Improve Attitudes Toward Genetically Engineered Food." *Science Advances*. Accessed September 23, 2019. http://advances.sciencemag.org/content/4/6/eaaq1413.

Kolodinsky, Jane, Sean Morris, and Orest Pazuniak. 2018. "How Did Consumers Use Mandatory Genetic Engineering (GE) Labels? Evidence from Vermont." *Agriculture and Human Values*. https://doi.org/10.1007/s10460-018-9896-y.

National Academies of Sciences, Engineering, and Medicine. 2016. Genetically Engineered Crops: Experiences and Prospects. Washington, DC: The National Academies Press.

Office of Nutrition and Food Labeling. 2019. "Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Derived from Genetically Engineered Plants. Food and Drug Administration. FDA-2000-D-0075." FDA. Accessed June 6, 2020. https://www.fda.gov/media/120958/download.

Slovic, P. 1987. "Perception of Risk." *Science* 236 (4799): 236–285. https://doi.org/10.1126/science.3563507.

U.S. Department of Agriculture (USDA). n.d. "BE Disclosure." Accessed June 6, 2020. https://www.ams.usda.gov/rules-regulations/be.

USRTK. n.d. "Glyphosate." Accessed September 23, 2019. https://usrtk.org/our-investigations/#glyphosate.

Chapter 10: Virtual and Augmented Reality

OVERVIEW

Virtual Reality uses technology to provide an immersive experience that seems real; for the viewer, the experience will include sensations like sight, smell, sound, and touch through multimedia presentations using a 360-degree simulation. *Augmented reality* is the overlay of virtual images onto, or on top of, the physical environment. Ideally, AR provides a seamless transition between the augmented and actual realities. There is also *mixed reality*, MR, which is different than AR because it can anchor objects to the physical environment. An MR experience is an extension of an experience that either begins in the physical world and shifts to the virtual world or vice versa. The concepts of virtual, augmented, mixed, and sometimes hybrid realities are increasing referred to collectively as *immersive reality*. This term is appropriate because these technologies seek to engage people deeply in an environment, a concept that is known as *immersion.*

Ivan Sutherland (1938–) created virtual reality (VR) in 1965. His "Ultimate Display" described the technology conceptually; his ultimate vision was to have a computer display a "room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in" (Sutherland 1965). Scholars consider it the first VR device invented. Three years later, with the help of graduate students, he released the Sword of Damocles, the first VR headset. While VR showed potential for simulating different training environments, the price tag was prohibitive. An ultimate display or widely available headsets would not become a reality for another half century.

The game changer for making VR accessible and affordable allegedly originated in a garage. Palmer Luckey (1992–), a teenager with an active interest in VR technologies, sought support through Kickstarter, a site that crowdsources funding for innovative ideas, to create the Oculus Rift. In 2014, Facebook acquired Oculus for US$2 billion (Clark 2014). While still expensive at around $600 a unit when it launched, the headset was more affordable than the technology had ever been. There were also prohibitive additional costs, such as the price of the computer required to run the headset. Estimates place the cost of Oculus-recommended computer systems at around US$1,000 (Eadicicco 2016). Although the Oculus Rift did not become popular with the mainstream or even initially with the gaming community, VR continued to attract interest.

As prices have dropped, VR has gained popularity. It no longer requires an expensive computer to use, because some of the newer headsets can work in conjunction with a cell phone. Some models do not even require a phone connection. Prices have also fallen. The low-end models cost less than US$20, whereas some of the highest-end models, such as the Microsoft Hololens, can cost over US$4,000 at full price.

Augmented reality (AR) involves imposing virtual images on the actual physical environment. Essentially, the technology involves the creation of an illusion that appears real, or semireal, to the person wielding the device. AR requires one of two types of devices. It can be run through a smartphone app or eyeglasses that support AR, or it works through the use of a headset similar to those used for VR. AR is therefore overall less costly and more accessible to a wider audience in many applications. Pokémon Go is an example of an AR game. The app imposes virtual Pokémon characters into the player's surroundings, allowing the player to capture it. The game also establishes virtual gymnasiums where players can user their captured Pokémons to battle those of another player. Other examples include the yard lines projected onto a National Football League game for television viewers or picture filters that allow users to customize effects. Snapchat offers these features to its users.

Many companies see AR as adding value to their services. Some are also viewing opportunities to increase services or develop entirely new ones. AR is currently being explored on multiple fronts. Training, for example, is usually taken in person, online, or in a blended mix of the two. With AR, trainees can see instructions while they work, making it possible to involve them in applied, hands-on training rather than amplifying their knowledge and later asking them to translate that knowledge into their jobs. Transferability of learning is a huge commodity in the world of education. Other industries that may receive a boost from AR include foreign language translation, gaming, marketing, and tourism. Some unanticipated areas are also considering AR; for example, wildlife conservation and heritage preservation efforts can use AR to educate, gamify, and promote their causes by making them interesting and entertaining.

AR researchers have identified several critical features (University of Washington 2015). AR programs must be able to sense properties about the world surrounding the user. These programs must be able to know where people are, such as by reading GPS. Understanding location or other characteristics of the environment is critical because placing an object of interest in the middle of a river could create a health hazard. Medical programs with AR that assist medical professionals must be able to identify what the user is observing in order to have any utility. Presently, AR-enabled devices are not approved for mainstream medical services. If that changes, some doctors anticipate that they will improve patient outcomes.

The devices must also be able to process data in real time. Without the ability to work at the speed of real life, AR-enabled devices cannot aid in many professions. They must show the user the information needed on top of reality. With the wrong background, AR projections might not be visible, which is undesirable in

circumstances such as the previous medical example. The same is true of contextual information. AR devices must display sufficient information to provide utility to the user. Finally, the technology must have the ability to track objects. Without these characteristics, AR will have difficulties following the user and supplying needed information on demand.

Mixed reality sounds like a combination of VR and AR. While this is close to accurate, MR reflects the blending of the physical world with the virtual or augmented world. It has unmistakable similarities to the other immersive technologies. MR is like VR in that it requires hardware to run, such as a headset and a computer. Like AR, MR can project onto the physical environment. Distinguishing it from the two, however, is that physical and virtual objects do not only exist in the same time and space but also interact. An example of MR is the ability to design and project 3D objects on the physical world and then manipulate them. Some engineers use this technology to design and evaluate prototype models.

Scholars have high expectations for VR, AR, and MR. Archeologists see the ability to preserve natural heritage sites and to allow people to experience the sites and the associated traditional cultures from afar. They have even invented terminology for these technologies, *heritage virtual*. Doctors foresee the possibility that VR and AR could enhance surgery in the operating theater. Psychologists view the technologies as having the potential to promote mental health or even reduce physical pain, by providing distractions, introducing emotionally pleasing elements into the daily environment, or promoting positive motivation. The improvements these technologies might offer society seem limitless. Thus, they are surrounded by hype and enthusiasm.

At the same time, lawmakers and legal scholars foresee the challenges that VR and AR technologies introduce into society. They see the potential for the infliction of accidental or intentional harm as a result of people who dismiss the real world entirely when engaged in these technologies. While this concern has arisen for many emerging technologies over the past decades, VR and AR may create new legal dilemmas. In most, if not all, uses of the technologies, companies will collect data after having consumers agree to lengthy, jargon-filled terms of service and privacy policies that they do not understand. The possibility of a great reduction of privacy is very real; to function, VR and MR track eye movement and facial gestures. If this information is recorded and sent back to the company, it could provide them with significant personal biological information. The data becomes even more sensitive when combined with other personally identifying information that could connect preferences and habits with facial and iris scans. The data also increases the risk that third parties will obtain and exploit it.

The Pokémon Go app released in mid-2016 in limited countries and later expanded to a broader international audience raised many questions related to user privacy. Upon the app's launch, it required access to all a user's Google accounts, its camera, and GPS location. The app could therefore access all of a user's email, calendar activities, documents, and pictures stored in Google services, allowing the service to collect extremely personal data about a person's life, activities, and

contacts (Krishnamurthyprakash 2017). Large amounts of personal data often lead to major cybersecurity risks. They can become targets for hackers or other malign actors. Presently, most countries allow companies to keep this data and use it for their own purposes. The exception is the European Union's General Data Protection Regulation, which requires user consent and gives them the ability to control what happens with their data.

Another legal aspect that may present a problem is how real-world crimes will be policed in VR or AR. Some scholars predict that many of the crimes that may occur using immersive technologies will relate to sex, nudity, and violence (Lemley and Volokh 2018). Some of the crimes expected to occur in VR or with AR—such as indecent exposure, flashing, sexual harassment or abuse, voyeurism, and inappropriate sexual acts in public—fall to the police. These same acts in a public-private space have undefined jurisdictions. These activities may be difficult to control, especially when people use them for criminal misbehavior. Presently, there is no mechanism to report virtual crimes to the police and no legal guidance as to on whom the responsibility falls. There may also be complications obtaining data, such as chat logs, from private corporations that may be unwilling to share because the laws have not yet been set. Many questions will require answers to ensure that everyone is protected from criminals in a virtual reality environment.

Other dangers attached to AR exist. Pokémon Go provides some examples of the potential perils of AR and other immersive technologies. Lost in concentration and focused on the game, some players committed crimes accidentally. Police arrested them for trespassing or for disturbing the peace when they entered areas where they were not permitted. A small number of players died or were seriously injured in collisions with vehicles or other forms of transportation because they did not notice conditions in their environment. In Guatemala, one teenager died and another was injured during a suspected burglary attempt as they played the game (Moore and Couzens 2016). Some governments, like Bosnia, warned people not to search in areas with active landmines. Although no deaths were reported, landmines pose serious risks. Pokémon Go is not the only AR or VR technology to have dangers associated with it. Because of the global interest in the game and the widespread media coverage, it provides an example of the scope of the risks involved and the way that those risks differ by country.

VR and AR are set to add value to our lives in multiple ways. They also increase our risk of harm in terms of privacy and may have unknown, unforeseen consequences. Most nations have not yet thought ahead to how they will address these successes and challenges politically, economically, or socially. In countries at more advanced stages of VR and AR, some policymakers are already contemplating how to promote the positive aspects of the technology while mitigating the bad. In other countries that are developing the technology, many have not examined the potential implications that the technologies could have. The following section features multiple cases of countries at varied stages on their journey to explore and develop VR and AR. The solutions they each need rest upon their unique sociopolitical and cultural circumstances. As they develop these technologies and their populations

adapt them, most likely in ways that are similar and others that are distinct to meet their particular needs, there are many factors they will want to consider in terms of regulations and policy.

Further Reading

Clark, Taylor. 2014. "How Palmer Luckey Created Oculus Rift." *Smithsonian Magazine*. Accessed July 10, 2018. https://www.smithsonianmag.com/innovation/how-palmer-luckey-created-oculus-rift-180953049/.

Eadicicco, Lisa. 2016. "Oculus Rift VR Headset Release Date and Price Announced." *Time*. Accessed July 10, 2018. http://time.com/4169430/oculus-rift-price-release-date-2016/.

Krishnamurthyprakash, Pramitha. 2017. "Law Lessons: Real World Legal Issues in an Augmented Gaming World." Silicon. Accessed July 12, 2018. https://www.silicon.co.uk/e-regulation/law-lessons-ar-205627.

Lemley, Mark A., and Eugene Volokh. 2018. "Law, Virtual Reality, and Augmented Reality." *University of Pennsylvania Law Review* 166 (5): 1051–1138. Accessed July 12, 2018. http://www2.law.ucla.edu/volokh/vr.pdf.

Moore, Charlie, and Gerard Couzens. 2016. "Pokemon Go Player Killed in Guatemala and Cousin Injured While Playing Game." *Daily Mail Online*. Accessed July 12, 2018. http://www.dailymail.co.uk/news/article-3699722/Pokemonsees-death-Teenager-18-killed-cousin-injured-playing-game-Guatamala.html.

Sutherland, Ivan E. 1965. "The Ultimate Display." *Proceedings of the IFIP Congress* 2: 506–508.

University of Washington. 2015. "Augmented Reality: A Technology and Policy Primer." Tech Policy Lab. Accessed July 12, 2018. http://techpolicylab.org/wp-content/uploads/2016/02/Augmented_Reality_Primer-TechPolicyLab.pdf.

BRAZIL

In Brazil, when it comes to immersive audiovisual content, the high costs of equipment importation affect supply and increasing demand from buyers continue to challenge content producers, who must balance the two. In addition, inflation, currency, political, and economic restrictions place Brazil and some other countries in Latin America in a challenging position to produce content (Lauret 2017). Despite these challenges, experts predict that VR/AR in Brazil will have a strong future across multiple industries. The technologies have already piqued domestic consumer interest.

A study of 2,004 Brazilians found that 73 percent have an interest in shopping using VR—significantly higher than other countries surveyed such as Germany (59 percent) and Japan (57 percent). In the same study, 85 percent of those interviewed would consider purchasing a product in VR, and 84 percent would like to see physical stores using the technology. However, 56 percent say that the ability to visualize and experience a product or experience in VR or AR would not change their likelihood to impulse buy (Worldpay 2017). Another study forecasts a 2019 economic projection of VR/AR business in Brazil with the industry generating more than $53 million for the year (BIG Festival 2018).

Video game users also have a high interest in VR/AR, with events such as the Brasil Game Show and Brazil's Independent Games (BIG) Festival offering opportunities to explore a collection of VR/AR games. The Brasil Game Show and BIG Festival both claim to be Latin America's biggest gaming event, and both events have proven to maintain a large following (Be Brasil 2017). In 2018, the Brasil Game Show had 320 exhibitors, and that same year, the BIG Festival featured eighty-seven new VR/AR games. The expected turnout for Brasil Game Show was over 300,000 participants, and the BIG Festival had 36,000 visitors.

Organized by the Ministry of Culture of Brazil and the Municipal Secretariat of Culture of São Paulo and Spcine, the BIG Festival is also prominent a business hub for both local and international game developers. At the 2018 BIG Business Forum, there were more than 400 speakers and 880 professionals from 428 Brazilian and international companies. Regardless of which event is Latin American's biggest gaming forum, both events give Brazil an opportunity to develop VR/AR capabilities domestically and through other Latin American partnerships (BIG Festival 2018; Agencia EFE 2018).

The biggest virtual and augmented reality conference in Brazil is the Symposium on Virtual and Augmented Reality (SVR). It is distinguished from other VR/AR conferences in that it presents basic research; the main contribution is that is discusses new technology developments that improve VR/AR. Established in 1997, SVR aims to promote technology advancement and knowledge dissemination over all aspects of virtual and augmented reality, with the conference contributing to the history of the field in Brazil (Hounsell, Detroz, Jasinski, Bosse, and Berlim 2014).

The most recent SVR in November 2018 addressed the following topics: VR/AR/MR systems, frameworks, and toolkits; 3D interaction; input devices for VR/AR/MR; haptics, audio, and other nonvisual interfaces; user studies and evaluation; tracking and sensing; computer graphics techniques for VR/AR/MR; immersive gaming and serious games; virtual humans and avatars; advanced display technology; immersive projection technology; multiuser and distributed VR/AR/MR; perception, presence, and cognition in VR/AR/MR; teleoperation and telepresence; social, economic, and technical impacts of VR/AR/MR; and virtual environments evaluation (SVR 2018). The conference has established Brazil's reputation as a hub of virtual innovation and advancement, and its proceedings help shape the development of VR/AR worldwide.

VR and AR education in Brazil is also becoming more popular, and there is a growing interest in studying the applications of VR and AR for educational purposes, which has led to the formation of VR/AR research groups. A recent study examined the geographic use and subject matter of Brazilian VR and AR research groups. In their study, the highest number of research groups is in the Southeast region, and research is concentrated in the areas of computer sciences and engineering. The concentration of geographic region and subject-matter usage demonstrates the importance of expanding this research to other areas of knowledge and regions of Brazil. Other results of the study revealed that AR devices and content are currently more accessible to the general public in terms of cost and availability

than in the past and that the reproduction of AR environments requires less bandwidth consumption compared to VR environments. Educators and technology experts expect the application of these technologies to education to expand, especially in low-income communities and places with difficulties of access to internet of quality (Queiroz, Tori, Nascimento, and da Silva Leme 2018).

In the medical field, the VR Vaccine project in Brazil, launched by pharmacy chain Hermes Pardini, seeks to help kids cope with the fear of medical treatment. In their study, a nurse gave kids a VR headset where they watched a 3D-animated adventure story involving heroes in coats of armor defending their land against a villain. The immersive storytelling alleviated the children's fears and helped by relaxing their muscles, making it easier for the nurse to administer the shot. The results of the VR Vaccine project have been positive, and Hermes Pardini has installed headsets in all eighty of its pharmacies. Researchers believe that VR has the potential to help with a range of other medical scenarios to relieve patients' stress (Mulligan 2018).

Museums in Brazil have also contributed to developing virtual reality capabilities through the use of VR exhibitions. The Museum of Astronomy and Related Sciences in Rio de Janeiro, for example, recently hosted a special virtual reality exhibition that presented works, images, sounds, and movement that encouraged participant interaction to enhance observers' perceptions, allowing them to experience the world differently through digital technology. The museum's exhibits are diverse and include a VR experience that simulates symptoms of anxiety disorders, one that promotes citizen awareness of urban air pollution, one that allows participants to see new connections between our bodies and the digital universe, and another that shows how technology can be used to augment the traditional practice of reading by overlapping content that amplifies the original material (Arnhold 2018).

Horniman Museum in London offers a different type of VR experience: enabling visitors to experience the lives of the Kuikuro community in Central Brazil. Researchers from Queen Mary University helped to create a Xingu Village virtual reality experience. Visitors can go on a thirty-minute virtual journey to Ipatse village to see the day-to-day life, environment, and cultural practices of the Kuikuro's 800 people living in the Xingu protected area, which is home to sixteen indigenous tribes. The project director, Professor Paul Heritage (n.d.), said, "This international partnership project shows how immersive technologies create new connections between objects and people, revealing the stories we need to tell and to hear about the world around us" (Brooke 2018). According to researchers, the exhibit is the first of its kind; it provides indigenous peoples with a direct voice into a process that preserves and disseminates their histories and relies on noncontact technologies. The project raises awareness of remote and fragile indigenous peoples, whose way of life is beyond the reach of the world's general population, without putting them at risk (Brooke 2018).

Brazil's natural environment in the Amazon has been the setting for several VR/AR experiences; because of its remote location, the technologies allow people to

experience the region without traveling. One of the better known experiences occurred in 2018 when Australian artist Lynette Wallworth (1961–) released a virtual reality film that offers a realistic representation of imbibing a hallucinogenic tea called Ayahuasca believed by many Amazonians to have transcendental qualities. Using psychedelic virtual reality, users are able to explore the Amazon from the point of view of Brazil's Yawanawá people. Released in late 2018 in Sydney, Australia, the film was part of Create NSW's annual 360 Vision VR/AR event and was played at the Venice and Sundance film festivals and the World Economic Forum. The film, from the Yawanawá people's perspective, hopes to send a message to the world that human beings are part of nature and one day will come back to nature (Buckmaster 2018).

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Further Reading

Agencia EFE. 2018. "Virtual Reality Reigns Supreme in LatAm's Foremost Video Game Show." Accessed March 21, 2019. https://www.efe.com/efe/english/technology/virtual-reality-reigns-supreme-in-latam-s-foremostvideo-game-show/50000267-3778473.

Arnhold, Jack. 2018. "Rio's Museum of Astronomy Launches Virtual Reality Exhibition." *Rio Times*. Accessed June 6, 2020. https://riotimesonline.com/brazil-news/rio-entertainment/rios-museum-of-astronomy-launches-virtual-reality-exhibition/.

Be Brasil. 2017. "Brazil Becomes the Capital of Latin American Gaming." Accessed March 21, 2019. http://www.bebrasil.com.br/en/news/brazil-becomes-the-capital-of-latin-american-gaming.

BIG Festival 2019. 2019. "Home Page." Accessed March 5, 2019. http://www.bigfestival.com.br/.

Brooke, Mike. 2018. "People's Palace Goes on 'Virtual Reality' Journey to Amazon's Xingu People with Horniman Museum Installation." *Docklands & East London Advertiser*. Accessed June 6, 2020. https://www.eastlondonadvertiser.co.uk/news/heritage/queen-mary-university-of-london-runs-amazon-xingu-village-project-at-horniman-museum-1-5810351.

Buckmaster, Luke. 2018. "Welcome to the Jungle: Experiencing the Amazon in Psychedelic Virtual Reality." *Guardian*. Accessed June 6, 2020. https://www.theguardian.com/film/2018/nov/19/welcome-to-the-jungle-experiencing-the-amazon-in-psychedelic-virtual-reality.

Hounsell, Marcelo da Silva, Juliana Patrícia Detroz, Marcio Geovani Jasinski, Rafaela Bosse, and Thiago Luiz Berlim. 2014. "A Brief History of Virtual Reality in Brazil: A Survey over the Publications in the 'Symposium on Virtual and Augmented Reality.'" *SBC Journal on Interactive Systems*78–92. Accessed June 6, 2020. https://seer.ufrgs.br/index.php/jis/article/view/49935/32616.

Lauret, Maria Fernanda. 2017. "How Film Festivals Are Changing the VR Scene in South America." Medium. Accessed March 4, 2019. https://medium.com/contrastvr/how-film-festivals-are-changing-the-vr-scene-insouth-america-d26acdcc0065.

Mulligan, Gabriella. 2018. "Helping Kids Cope with the Fear of Medical Treatment." BBC. Accessed March 21, 2019.https://www.bbc.com/news/business-45978891.

Queiroz, Anna Carolina M., Romero Tori, Alexandre M. Nascimento, and Maria Isabel da Silva Leme. 2018. "Augmented and Virtual Reality in Education: The Role of Brazilian

Research Groups." *20th Symposium on Virtual and Augmented Reality (SVR)*, Foz do Iguaçu, Brazil, 2018, pp. 170–175. https://doi.org/10.1109/SVR.2018.00034.
SVR. 2018. "20th Symposium on Virtual and Augmented Reality." Accessed March 21, 2019. http://svr.net.br/index.html.
Worldpay. 2017. "Purchasing in Virtual Reality Is a Wish for 73% of Brazilians." Accessed March 4, 2019. https://www.worldpay.com/global/about/media-centre/2017-05/purchasing-in-virtual-reality-is-awish-for-73-of-brazilians.

CHINA

The virtual reality and augmented reality industries are booming in China. A major emphasis of the government's long-term technology, the country and its major corporations are pouring large amounts of money into training and development, with the ultimate goal of making China the world leader in immersive reality technologies. Many people in China view immersive reality technologies as game changers for the future across most social and economic sectors. Although these efforts require more time to test and implement, VR/AR is already popular as entertainment, especially for gaming, and is under development for education, tourism, and marketing. Investing into physical, digital, and human capital, China is working to reach its goal of becoming the world leader for immersive reality technologies.

In 2016, President Xi Jinping demonstrated his country's commitment to VR and related immersive technologies in an opening statement at the international business summit B20. In that speech, he stressed the importance of innovation and pointed at VR as a vital part of the future: "The new round of scientific and industrial revolution with Internet at its core is gathering momentum, and new technologies such as artificial intelligence and virtual reality are developing by leaps and bounds. The combination of the virtual economy and the real economy will bring revolutionary changes to our way of work and way of life" (Jinping 2016).

This statement aligns with the country's Made in China 2025 plan, released in 2015, to modernize Chinese industries and rank the country first internationally as an innovative, technological power. While the English translation of the plan does not mention VR or AR, it does point out smart manufacturing as one of the plan's key focuses, where smart manufacturing is the fourth revolution in industrialization through the use of digitization and automation to optimize production and organization (Wübbeke, Meissner, Zenglein, Ives, and Conrad 2016). Industries working in or to achieve smart manufacturing are applying immersive reality technologies to achieve this optimization, meaning that VR and AR are important technologies for industrial modernization. In fact, interest in the technologies is both vertical (from the president to the public, the national to the local) and horizontal (across the business sector) because the technologies promise needed economic growth.

President Jinping further demonstrated his and his country's commitment to VR by having government officials read his congratulatory statement at the 2018 World VR Conference. Held in Nanchang, the conference opening expressed the

president's view on the technology: "China is willing to strengthen international exchanges and cooperation in the fields of virtual reality, share development opportunities, share innovation achievements, and strive to create a smarter and better future for human society" (Jiangxi Political Headlines 2018). This statement not only reflects the president's view of the power of VR/AR and associated technologies but also mirrors the country's overall approach to advancing technological development, an approach that integrates domestic research and development efforts with strategic, often international, partnerships to hasten innovation and progress.

China's VR/AR craze did not start, however, solely with the president. Along with financial support, the government has also focused on creating policies and strategies that enable VR/AR development. One key policy is Internet Plus, a national-level industrial strategy to allow advanced development of the country's digital technologies. Internet Plus includes all internet-based technologies like e-commerce, cloud computing, and the Internet of Things, in addition to immersive reality technologies.

Launched in 2015, Internet Plus focuses on digital technologies with the potential to revolutionize government, manufacturing, agriculture, education, and healthcare, among other sectors. Policies associated with Internet Plus have also sought to increase internet access more broadly, such as through launching affordable, faster internet connections and opening platforms designed for the faster sharing of information. In addition, a complementary policy called Broadband China aims to bring high-speed internet to every administrative village in the country by 2020, along with an updated telecommunications and IT infrastructure. Together, these and other policies form the backbone of China's strategy to amass cyber power, gained through the internet and digital sphere, and position itself as one of the world's technical leaders.

The Chinese government today is investing heavily in VR and AR. It subsidizes training and education opportunities, provides office and laboratory space, purchases and distributes hardware, and even organizes conferences and competitions to encourage growth in immersive reality technology development. As of 2019, it has dedicated US$3.9 billion to investments in VR/AR, in comparison with the United States' $120 million. Along with these investments, China is now the destination for over 80 percent of all shipments worldwide for VR headsets (Baptista 2019). It is creating VR hubs in cities across the country, and the Ministry of Industry and Information Technology supports banks financing start-ups and projects that support public welfare. Following the government's drive to increase China's VR and AR development, major firms like Shanghai Media Group, Alibaba, Baidu, Xiaomi, and Tencent are pursing these technologies through specific investments and partnerships with international corporations and educational institutions.

To date, the investment in immersive reality technologies has received an incredible public response. People in China respond positively to VR/AR; the number of users jumped from half a million people in 2015 to 18.79 million in 2019 (Statista 2019). When Xiaomi, an electronics company in Beijing, launched Mi VR in 2016, the first batch sold out with a day. The second also sold out within twenty-four

hours. With VR and AR primarily applied to entertainment and training, the people patronize the more than 3,000 VR arcades across the nation. Scattered across shopping malls and other easily accessible locations, these arcades attract many customers who otherwise could not afford the hardware. By making these locations accessible and affordable, the technologies have become accessible to a large swath of the population.

Another large investment that has excited the public is the creation of the VR Star Theme Park in Guizhou province. Similar to the United Arab Emirates' VR theme park that advertises itself as the world's largest, China has opted to provide patrons with the ability to immerse themselves in VR/AR on every ride, unlike amusement parks in the North America and Europe that have chosen to enhance select existing rides. China's park cost US$1.5 billion and features more than forty VR experience rides (Staramba 2018). The park also has exhibits on the history of VR and China-specific VR/AR investment to appeal to visitors who are curious to learn more or who want to increase their understanding of the technologies.

China's gaming industry may also gain a huge boost from VR/AR. In fact, general interest in VR gaming has slowly built momentum since it entered the Chinese gaming marketplace in 2010. Over the past few years, the government has had to impose limits on the number of traditional, mobile video games launched in the country and place restrictions on youth playing times, due to the millions of people who have become addicted to or obsessed with mobile games. With the government push to advance the country's VR/AR industry, these technologies—even when applied to gaming—will probably escape the restrictions placed on video games. The reasons, in part, are that VR/AR content takes time to develop, meaning that fewer games will be released, and as they are, the companies can spread them out so as not to saturate the market. In addition, because most VR/AR hardware remains unaffordable to the majority of the population, it would be harder for people to experience addiction. Instead, they would need to venture to specific locations to enjoy gaming and other content until headset prices drop.

Until an unknown future point in time, VR/AR gaming will avoid the same limitations and restrictions that mobile video gaming has had placed around it. Therefore, VR/AR games have the potential to transform China's gaming industry in a way that aligns with the government's vision to develop immersive reality technologies while keeping the population from suffering some of the detrimental effects that it previously has with more traditional gaming. VR and AR provide exciting gaming experiences, and because of all the support thrown behind them, without some of the negative impact, they appear to have a strong future in China.

VR/AR in China is on the rise. It has the potential to be transformative for many social and industrial sectors and has already been accepted as a premiere form of entertainment. As long as immersive reality technologies continue to receive high-level government and corporate support, they will continue to grow in demand and application. China may be well on its way to reaching its goal of becoming a world leader for these types of technologies and experiences.

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Further Reading

Baptista, Eduardo. 2019. "China's Communist Party Is Making Its Own (Virtual) Reality." Foreign Policy. Accessed September 20, 2019. https://foreignpolicy.com/2019/06/21/chinas-communist-party-is-making-its-own-virtual-reality.

Hong, Yu. 2017. "Pivot to Internet Plus: Molding China's Digital Economy for Economic Restructuring?" *International Journal of Communication* 11: 1486–1506.

Jiangxi Political Headlines. 2018. "General Secretary Xi Jinping Sent a Congratulatory Letter to the 2018 World VR Industry Conference." Accessed September 23, 2019. https://mp.weixin.qq.com/s/hvx4uB4uEZS1CxymP0pr6g.

Jinping, Xi. 2016. "Keynote Speech by H. E. Xi Jinping, President of the People's Republic of China, at the Opening Ceremony of the B20 Summit." Accessed September 22, 2019. http://en.people.cn/n3/2016/0904/c90000-9110023.html.

Staramba. 2018. "China Opens Doors to $1.5 Billion Mega Virtual Reality Park." Medium. Accessed June 6, 2020. https://medium.com/@Staramba/china-opens-doors-to-1-5-billion-mega-virtual-reality-park-a6209ab96c39.

Statista. 2019. "Number of Virtual Reality Users in China from 2015 to 2020 (in Millions)." Accessed September 28, 2019. https://www.statista.com/statistics/948999/china-number-of-vr-users/.

Wübbeke, Jost, Mirjam Meissner, Max J. Zenglein, Jaqueline Ives, and Björn Conrad. 2016. "Made in China 2025: The Making of a High-Tech Superpower and Consequences for Industrial Countries." Mercator Institute for China Studies. Accessed September 23, 2019. https://www.merics.org/sites/default/files/2018-07/MPOC_No.2_MadeinChina2025_web.pdf.

GERMANY

For many reasons, the Germans are taking VR/AR development slowly. These reasons include the need to determine market value and growth potential as well as ethical standards for applications, the need for regulations on immersive technologies, and challenges with internet connectivity and speed. Despite these challenges, VR/AR technologies in Germany are being applied for practical and entertainment purposes. These technologies offer great promise for training and education, such as in Germany's Elbedome, the largest 3D lab in Europe, and for aiding law enforcement to solve crimes. They are also valuable technologies for entertainment. Germany has launched a number of world firsts for virtually-enhanced amusement park rides; with their successes, VR and AR enhancements have popped up at theme parks around the world.

The German marketplace for VR/AR technologies has experienced significant growth. Since 2016, the value of these technologies has grown, with the software seeing the largest growth rates, such as over 100 percent growth annually from 2016 to 2019. Hardware has seen a smaller increase in value over time. The 2020 projections for the market are €290 million for hardware, a dip from 2019, and €730 million for software, the first year since 2016 where the growth has not doubled (Statista 2019). The decrease in market value growth offers credence for taking the time to develop VR/AR solutions for problems the Germans want to

address or pointing them to entertainment areas where they could enhance current user or rider experiences.

With the growing demand for VR/AR, one major concern to come out of Germany is the ethics surrounding the technology. Scholars at the Johannes Gutenberg University in Mainz were the first to consider the need for regulating VR/AR technologies. In 2016, they produced a partial ethical code to guide fellow developers. Among the suggestions were content ratings, such as currently exist for the movie industry, and labeling for violent or pornographic content. A later paper from the university offered discussion and recommendations on how to address the potential psychological impact of immersive reality technologies, wherein people may come to feel differently about the world or develop a newfound sense of ownership over virtually inhabiting an avatar or another person's body. They also warned about privacy concerns, because VR will produce a lot of data, and potentially biometric data from the body itself, over which the user may have limited control. The entire VR/AR community will be grappling with these issues as the technologies mature.

Another potential issue is the lack of regulation over these technologies, especially with the impact they could have psychologically on users. No different than most other nations, Germany does not yet have a legal framework for VR/AR or other immersive reality technologies. One law that does stand on the books, however, is that it is prohibited to fly most drones using VR goggles. Drones or model aircraft weighing less than 0.25 kilograms flying under thirty feet and within line of sight can be viewed through goggles or video glasses; these are the only machines that do not require official registration (Gesley 2017). This law, of course, will not be sufficient by itself to regulate VR/AR development, and it was not intended to do so. It does suggest that if VR/AR or related equipment need to be regulated for specific cases, such as drone flying, they are likely to be needed more broadly and systematically.

Internet speed and connectivity have been a challenge in Germany, but this could change as the country upgrades its networks. While Europe generally has good 4G coverage, Germany has 4G covering about 66 percent of the country, often running at lower speeds than other nations (Center for the Promotion of Imports 2019). VR/AR requires fast network speeds, so lower bandwidths slow development of the technology in areas without higher speed connections. Current limitations on internet connectivity permit the development and employment of these technologies only in select locations. The introduction of 5G promises to change this situation by bringing higher speed internet to the country. Germany's first rollout of 5G occurred in July 2019. Deutsche Telekom launched the first 5G networks in Bonn and Berlin (Rahn 2019). They are only usable by expensive Samsung phones configured to handle the network. By 2020, over twenty cities should have accessible 5G networks, which will allow emerging digital technologies to be developed and utilized across the country.

Even though Germany has some challenges with VR/AR development and has decided to move more slowly than other nations as a result, it nonetheless houses

Thyssenkrupp offers trade show attendees the opportunity to participate in an interactive presentation, the Virtual Steel Experience, during an 2018 event in Berlin. Germany has become a hub for immersive reality technology research and trade shows. Despite moving forward with the technology purposefully, the country creates start-ups and attracts international partners due to its success in developing these technologies. (Cineberg Ug/Dreamstime.com)

a number of burgeoning VR/AR start-ups. Companies such as VR-Nerds, Gamelab. Berlin, Sehsucht, Vragments, Invr.space Gmbh, and the Fraunhofer Virtual Reality Solutions have already made an impact on the country with their innovative developments. In the media, journalist Julia Leeb (n.d.) and broadcasters WDR and ARTE use VR to improve how the news is reported.

In addition, Professor Egbert van Wyngaarden (1967–) uses VR to experiment with immersive storytelling, and Professor Frank Steinicke (1977–), who looks at VR/AR from a human-computer interaction perspective, holds the world record for being the first person to spend twenty-four hours in a VR simulation (Dauerer 2018). The country is also home to Europe's largest 3D lab, the Elbedome, where clients use the 360-degree projections for training simulations. Research and development is alive and well in the country.

A fun, entertaining application of VR/AR in Germany is the rise of VR/AR-enabled rides in the country's theme parks. In Germany, immersive reality rides have set a number of world firsts. In early 2019, the country introduced the world's first VR bumper cars. These came less than a year after the world's first VR waterslide, which provided a nice addition to the VR/AR technologies used on some of the theme parks' roller coasters. Germany introduced the world's first virtual roller

VR is changing visitors' experiences at amusement parks worldwide by offering special rides that include VR goggles for riders. These rides are designed together with the VR technology to allow riders to live the theme, such as escaping from flying dragons or evading supervillains, through the headset. Through precise synchronization of the VR programming and the ride, designers have improved the experience, reducing the nausea and dizziness that can occur when the programming and ride movements are not well calibrated (Janssen 2015). Germany's Europa Park opened the Alpenexpress, the world's first VR ride in 2015. As of mid-2018, amusement parks have added VR-enhanced rides in Canada, the United States, Japan, the United Kingdom, Belgium, Finland, Italy, Australia, Denmark, Spain, Norway, Finland, Mexico, and South Korea.

coaster in 2015 at its Europa-Park. Since these firsts, virtual and augmented rides have been added all over to theme parks all over the world. In Germany, these rides add a fresh twist to the same loops and turns by allowing riders to be chased by dragons and aliens and even to have encounters with superheroes. VR/AR will have other applications for the entertainment industry and may even change the face of entertainment and consumer experience as they become more engrained into the landscape.

Germany is using VR/AR in unprecedented ways. In 2014, the Bavarian state crime office used VR technologies to build the world's most accurate model of Auschwitz, the concentration camp where Nazis executed over a million Jewish people during World War II. The VR technology was part of a project to convict war criminals. Previously, several had said that although they worked the camp, they had no knowledge of the atrocities carried out there. At first, the claim was impossible to refute, but with VR, lawyers, judges, and jury members can explore the site and assess the validity of these claims.

The first major prosecution using VR occurred in 2016. Reinhold Hanning (1921–2017), a former SS guard at Auschwitz, had claimed he was not aware of executions in the camp. After judges and investigators used the VR, they determined that his post allowed him full view of movements around the camp, meaning that he could see people being forced into gas chambers. He was sentenced to serve five years in prison for facilitating 170,000 counts of murder, although he died from natural causes prior to serving his sentence (BBC 2017). Germany has over two dozen cases of alleged former Nazi guards under investigation, although with their ages, it is unknown how many might be prosecuted. Should those cases go to trial, the VR can provide additional evidence as to where the crimes happened and what that area looked like in the 1940s. This usage of VR has set a precedent as a future law enforcement tool.

Germany's VR/AR industry has shown that VR and AR have applications that few people have explored. While some instances may be uniquely German, others have high potential for international appeal, such as theme park rides and

entertainment more broadly. The country has shown that there is great potential for immersive technologies. At the same time, many questions will need to be addressed, such as ethical applications and implications, as well as the need for legal guidelines and frameworks that govern the technologies.

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Further Reading

BBC. 2017. "Reinhold Hanning: Convicted Nazi Guard Dies before Going to Prison." Accessed September 22, 2019. https://www.bbc.com/news/world-europe-40122610.

Center for the Promotion of Imports. 2019. "Virtual Reality and Augmented Reality in Europe." Netherlands Ministry of Foreign Affairs. Accessed June 6, 2020. https://www.cbi.eu/node/2665/pdf/.

Dauerer, Verena. 2018. "VR Projects 'Made in Germany.'" Goethe Institute. Accessed September 22, 2019. https://www.goethe.de/ins/us/en/kul/tec/21297250.html.

Gesley, Jenny. 2017. "Germany: New Rules for Operation of Drones and Model Aircraft." Library of Congress. Accessed June 6, 2020. https://www.loc.gov/law/foreign-news/article/germany-new-rules-for-operation-of-drones-and-model-aircraft/.

Rahn, Wesley. 2019. "Germany's First 5G Network Launched by Deutsche Telekom." Deutsche Welle. Accessed September 22, 2019. https://www.dw.com/en/germanys-first-5g-network-launched-by-deutsche-telekom/a-49467131.

Statista. 2019. "Revenue Forecast for Virtual Reality Products in Germany 2016–2020." Accessed September 22, 2019. https://www.statista.com/statistics/772794/virtual-reality-revenue-forecast-germany/.

NEW ZEALAND

New Zealand has embraced virtual reality, augmented reality, and other immersive reality technologies. Although the country is small, the population is known for being innovative, lives on land with thousands of years of history, and has a penchant for being good storytellers. Across the country, there has been an explosion of companies and universities working on VR/AR, and the market is poised to grow tremendously through corporate, academic, and government investments.

New Zealand inaugurated its VR/AR association, NZVRARA, in 2015 to promote extended reality technologies across the nation. The NZVRARA has four main goals: fostering community; promoting education; building a large user base that includes businesses, government, media, and educational institutions; and advocating for the application of these technologies to meet social and economic needs (NZVRARA 2018). The association attracted interest from corporations across the world and even spun off a student chapter in 2017 to capitalize on university interest in research and development in immersive reality technologies. As of 2017, approximately 112 organizations within New Zealand worked with NZVRARA, complementing the 3,800 businesses involved in VRARA, the international organization under which NZVRARA falls. With Auckland and Wellington being key centers for VR/AR production, training, and innovation, the NZVRARA helps build connections and collaborations.

Filmmaking is an area where New Zealand has successfully integrated VR/AR. In 2016, Alejandro Davila (n.d.) produced an immersive reality-based movie for his master's thesis. In a first for the country, the movie, *The Green Fairy*, combined VR and AR. The thesis focused on better understanding how stories must be told differently to be effective in VR. Traditional storytelling is not necessarily suited to VR because it can leave the viewer feeling unwell after scene changes and through some action sequences; storytelling simply and through narrators may be a better format (Davila 2017).

For the movie, Davila received a nomination for the Young NZ Innovator of the Year award. The movie turned into an interactive book in 2018. Since the first movie, World Vision, National Geographic, and other companies have started creating VR/AR films in the country. Presently, the country has high hopes for Minimum Mass, a movie-like experience expected to feature at the 2020 Sundance Festival (Dreaver 2018). To differentiate the VR experience, developers have explicitly stated that it is neither a game nor a film.

Gaming, particularly interactive gaming, has become important to New Zealand's economy. In 2019, interactive gaming, which includes VR/AR games, generated NZ$143 million; the majority of those earnings came from digital exports (NZGDA 2019). Most VR/AR companies are expected to have significant growth rates, and the market for start-ups and jobs is expanding. The games they develop are primarily entertainment, although other types of more serious games have been developed for marketing, education, and other training-related purposes. New Zealand already hosts a VR arcade for visitors to experience VR. The industry is expected to grow as the costs of VR/AR and other immersive reality equipment prices decline.

Universities have increased their emphasis on VR/AR. They not only offer degree and certificate programs for VR/AR but also use the technologies in the classroom. Massey University Wellington formed the first VR club, VRTX. It also has a VR room for training and educational purposes. In 2017, it added elective courses to its bachelor's degree program. Other universities working to advance the state of VR/AR through research include Auckland's University of Technology, Auckland University, and Victoria University.

In terms of research, these institutions have many programs seeking to apply VR/AR to the learning process, from fields such as tourism to architecture. For the classrooms of younger ages, ClassVR is a New Zealand technology offering that brings VR into the classroom through headsets. The teacher manages the headsets from a central computer, while students access preloaded content or school-specific content that aligns with their curriculum. There's a VR solution available to students at every level in New Zealand, from initial exposure to advanced, hands-on training.

Corporations and universities are not the only entities interested in VR/AR; the government is also a huge proponent and makes investments in the technologies. The Minister for Social Development, Carmel Sepuloni (1977–), for example, has started a training program to help people train for jobs that have labor shortages.

The pilot, planned for late 2019, targets employment in the construction industry. Participants will use VR goggles to practice building and testing skills. Employers can then use test results to select the best employees and quickly assign them to the job for which they have qualified. Future programs may focus on upskilling workers for emerging jobs to impact the economy positively.

The idea of using VR to train New Zealand's construction workers is not new; in 2017, Fulton Hogan VR won a finalist award for one of its VR training programs, the first in the construction industry, which allowed workers to experience a dangerous construction situation and go through the cleanup process step by step (Mack 2017). The Department of Internal Affairs has also hosted sessions on VR/AR. A 2018 session featured an official from the Wellington City Council who discussed using VR to include more people in city planning. The department's Service Integration Lab also spoke about harnessing VR to improve service delivery and explored the different ways VR might connect citizens with government through the technologies (Webster 2018).

Industry also sees value in teaming with the government to promote VR/AR technologies along with other emerging technologies expected to see growth in the future. In a report from the New Zealand Game Developers Association (2019), analysts recommended public-private partnerships to create a strategic plan for interactive media, provide sufficient investments, train and upskill workers, increase access to data, and develop policy in order to grow the technologies. Policy and regulation gaps are growing around the world; in this sense, New Zealand is no different. As the technologies continue to develop and they arrive at a point where they disrupt society in a meaningful or controversial way, regulations and frameworks may become more critical. With New Zealand's growing demand for VR/AR, it may experience the need for guidance and policy sooner than in other parts of the world where the technology is either nascent or people are unsure whether it has value.

Air New Zealand, the national airline, has already started investing heavily in VR/AR technologies. In one of its AR efforts, the company teamed with Magic Leap to create an experience that superimposes images onto reality. Using a special viewer, potential customers have the opportunity to explore products and interact with the environment. With these options, the program wants to lure travelers to use the airline. In another venture with Magic Leap, the airline has constructed an AR board game-like experience to allow multiple people to play against one another while learning more about New Zealand. The game does require an actual board, with the AR viewer enhancing reality. In exploring the country virtually, players interact with hobbits, as the movie series *Lord of the Rings* (2001–2003), based on the J. R. R. Tolkien literary trilogy, was filmed there. Players also interact with nature specific to the country. Overall, these efforts are intended to allow people to prepare for a trip to New Zealand and show them the benefits of using Air New Zealand on the journey.

The outlook for VR/AR and other immersive technologies is currently bright. Industries apart from the airlines are also exploring their potential. Online shopping

and retail sales have the possibility of benefiting. In fact, Heathcoate Appliances received the accolade as the first retailer to bring AR into the shopping experience. In its testing, shoppers use their phones to run an AR program that lets them place new appliances in their homes to envision how they would look. This type of technology could reshape how people shop and at the same time could reduce costs involved with returns and reshelving. The full range of where VR/AR can be applied and how they can improve people's lives or experiences is not yet known. However, New Zealand and its innovators are working on developing these technologies in ways that will directly and indirectly provide answers to the extent that VR/AR will change society.

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Further Reading

Davila, Alejandro. 2017. "Virtual Reality Storytelling." Master's thesis: Auckland University of Technology. Accessed September 21, 2019. https://openrepository.aut.ac.nz/bitstream/handle/10292/10984/GuarinDavilaA.pdf?sequence=4&isAll owed=y.

Dreaver, Charlie. 2018. "Behind the Scenes of NZ's VR Film for Sundance." Radio New Zealand. Accessed September 21, 2019. https://www.rnz.co.nz/news/national/376865/behind-the-scenes-of-nz-s-vr-film-for-sundance.

Mack, Ben. 2017. "The Very Real Uses of Virtual Reality in New Zealand Workplaces." Idealog. Accessed September 21, 2019. https://idealog.co.nz/tech/2017/11/very-real-uses-virtual-reality-new-zealand-workplaces.

New Zealand Game Developers Association (NZGDA). 2019. "Interactive Aotearoa: Driving Growth and Wellbeing through Interactive Media." NZ Tech. Accessed June 6, 2020. https://nztech.org.nz/wp-content/uploads/sites/8/2019/08/Interactive-Aotearoa-Report-2019_email.pdf.

New Zealand VR/AR Association (NZVRARA). 2018. "About Us." Accessed September 21, 2019. http://www.nzvrara.nz/about-us/.

Webster, Nadia. 2018. "Emerging Tech: Virtual and Augmented Reality." Digital.govt.nz. Accessed September 21, 2019. https://www.digital.govt.nz/blog/emerging-tech-virtual-and-augmented-reality/.

PAKISTAN

Virtual reality and augmented reality gained popularity in the West in the early twenty-first century, mainly with the gaming industry, and now have a strong foothold in a variety of industries. The developing world does not lag far behind. In the East, Pakistan is one of a handful of countries that is rapidly gaining momentum in both VR and AR technologies despite its still-fledgling economy. In the last five years alone, an impressive number of private companies has emerged on the forefront of this immersive technology. And aside from just the gaming industry, VR/AR in Pakistan is gaining popularity with real estate and architecture firms, the health and medical fields, and the education sector. Local incubators for funding along with government initiatives are increasing as the entrepreneurial leadership in Pakistan uses its networking and resources to tap into the talent of its population.

A Pakistani man uses virtual reality to select his national flag. Pakistan is a country that is among the growing number of countries experimenting with and investing in immersive reality technologies. (Aleem Zahid Khan/Dreamstime.com)

The most obvious use of VR/AR has been seen in the gaming industry. In the urban centers of Karachi, Islamabad, and Lahore, VR gaming centers are getting attention from the more elite masses who otherwise resort to restaurants and cinemas for entertainment. With headsets imported mainly from the United States along with handsome user fees, these new arcade centers have received great reviews from patrons despite the occasional electrical shortages and voltage fluctuations that increase costs. And to cater to the general public, there are a variety of online tech stores, such as Bytes.pk, which occasionally distribute free headsets to promote this technology and to inspire content creation.

As the population of Pakistan continues to expand, the major cities are continuing with rapid construction projects beyond their traditional borders. Virtual and augmented reality companies are assisting architectural firms by allowing potential clients to be completely immersed in an unbuilt space to tour their potential homes even before the purchasing and building phase. The interactive nature of VR even allows customers to design their living spaces through simple things such as changing the paint colors, the carpeting, and the lighting and thus creating lasting emotions that further help with a real estate firm's marketing strategies. Not only does VR make it easier to sell properties by attracting more customers, but it actually reduces costs because physical models can be replaced by virtual ones, leading to a significant cost reduction for large residential real estate projects in a developing country like Pakistan, where construction is an ongoing endeavor.

With more than 200 million inhabitants, it comes as no surprise that health and medicine are two of the most critical sectors in Pakistan (World Population Review

2019). In a university setting, many medical students are graduating and earning degrees without ever having touched a cadaver because of a lack of funding. To fill this gap, VR/AR companies are creating educational simulations that students can use to visualize human anatomy in an immersive three, rather than a two, dimensional environment. Concurrently, VR technology provides training for emergency personnel to learn lifesaving skills without risking themselves or their patients by creating realistic scenarios that place them in high-pressure situations so that they can respond effectively. Not only can this significantly reduce patient morbidity, but also it is a cost-cutting measure that can have lasting effects on the overall society. The challenge these VR firms face is to educate medical school faculty and staff to embrace the technology without feeling threatened by it; many professors feel that their jobs will be at risk if VR enters the classroom, when on the contrary, their jobs will be further enhanced and the students better prepared to enter their medical professions with greater confidence and training.

Promising VR applications for healthcare are already in the market, specifically by Renderlounge, a company that has developed a device for exposure therapy. This device is already being used in patients like burn victims, where an initial trial has helped induce sleep, leading to faster recovery and rehabilitation. It also shows promise for patients suffering from other medical conditions, including anxiety and depression, which affect 34 percent of Pakistan's overall population, with close to 50 percent of people affected in the major cities, far greater than the global average of 20 percent (Mansoor 2017). The noninvasive and safe nature of this therapy will lead to other VR-based devices that have the potential to reach patients on a larger scale.

Approximately 80 million Pakistani citizens are part of the education system, from the preprimary to the tertiary, or university, levels (UNESCO 2017). The introduction of VR/AR technology within the classroom is providing students with powerful tools that convert the conventional two dimensional (2D) syllabus to three dimensions (3D), helping not only to convey the concepts better but also to excite students to take more interest in their education. The use of these kinds of applications extends beyond the traditional classrooms as well, with companies focusing on children with special needs.

Games based on AR are used as therapy, creating cost-effective, efficient, and accessible solutions, and are designed to develop motor, coordination, cognitive, and functional skills. Some Pakistani students are also part of an international effort called PenPal Schools to educate students from other countries through the medium of VR. Using VR headsets, these students can take field trips through which they learn the history and culture of Pakistan. On a broader note, this VR education gives them a view of Pakistan that they would otherwise not be exposed to, dispelling misconceptions and building greater understanding.

With an unpredictable political climate and a fledgling economy, Pakistan certainly faces challenges, especially with respect to funding sources for a technology that is still considered relatively new even on the international stage. But despite these fairly insurmountable obstacles, the VR/AR start-ups are gaining

momentum. To tackle problems relatively unseen in the urban areas of the West, such as electricity shortages, internet connections, basic office space, mentors, and investment sources, the amount of incubators with impressive international support is on the rise. These incubators, backed by government initiatives, private organizations, and higher educational institutions, fill these gaps by linking potential VR/AR companies to training resources for development of their business plans, exposure to international markets, and financial and legal assistance. In the past five years, hundreds of companies have graduated from product idea to viable businesses.

Pakistan's entrepreneurial spirit and international influences play a strong role in maximizing the future of VR/AR initiatives. These tech-savvy companies are entering the global arena with an increased presence at international trade shows, harnessing the power of their national talent to gain more projects for the overall economic growth of Pakistan. Many Pakistanis are using their skills to network with big technology companies such as Google and Facebook, along with renowned universities in the West.

As with any new endeavor, much more has to be done to ensure that VR/AR is applied effectively and supports people's needs. Experts in the VR/AR field in Pakistan are optimistic that this technology will be as prevalent as mobile phones within the next ten years in combination with more sophisticated devices; some experts have made the prediction, though perhaps overly aggressive, that VR/AR and other emerging technologies will change the country's technological landscape. VR/AR is an open field with relatively few players right now; the ones who will come to the forefront will have not only the technology but also the skills to educate and expand it to the greater public at a cost that is results oriented, affordable, and reliable.

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Further Reading

Dawn. 2017. "Virtual Reality Headsets Now a Reality in Pakistan—and Some Come Free." Accessed June 12, 2019. https://www.dawn.com/news/1232464.

Ghafoor, Hammad. 2017. "When Virtual Gaming Hit Lahore." Dunya News. Accessed June 10, 2019. http://dunyanews.tv/en/Pakistan/397536-When-virtual-gaming-hit-Lahore.

In3D. "Home Page." Accessed May 15, 2019. www.in3d.pk.

Malik, Faysal. 2017. "AR, VR and Where We Are." Ignite. Accessed June 7, 2020. https://ignite.org.pk/blog/2017/01/18/ar-vr-and-where-we-are/.

Mansoor, Hasan. 2017. "Depression Rising Alarmingly in Pakistan's Urban Areas." Dawn. Accessed June 12, 2019. https://www.dawn.com/news/1325360.

The Nest, i/o. "Home Page." Accessed June 11, 2019. http://thenestio.com/.

Plan 9. "Where Ideas Take Flight." Accessed June 11, 2019. https://plan9.pitb.gov.pk/.

RenderLounge. "Home Page." Accessed May 29, 2019. https://renderlounge.com/.

Rowe, Cortney. 2017. "Virtual Reality Fieldtrips to Pakistan." Borgen Project. Accessed June 7, 2020. https://borgenproject.org/virtual-reality-field-trips-to-pakistan//.

Taylor, Paul, and Rich Morin. 2009. "Forty Years after Woodstock, a Gentler Generation Gap." Pew Research Center. Accessed June 7, 2020. https://www.pewsocialtrends.org/2009/08/12/forty-years-after-woodstockbra-gentler-generation-gap/.

UNESCO. 2017. "Pakistan." Accessed June 12, 2019. http://uis.unesco.org/en/country/pk?theme=education-and-literacy.
Virtual Reality Center (VRC). "Home Page." Accessed May 29, 2019. https://vrc.neduet.edu.pk/.
World Population Review. 2019. "Pakistan Population 2019." Accessed June 12, 2019. http://worldpopulationreview.com/countries/pakistan-population/.

SOUTH AFRICA

South Africa is home to a number of corporations, organizations, and universities pursuing the development of virtual reality and augmented reality technologies. The country has long considered the use of immersive technologies in sectors such as education since the early 2000s, although it is only now that these technologies are being explored to provide a digital boost to the economy and society. Some companies, as well as academia and the government, recognize that they may benefit greatly from the adoption of new technologies. Because the technologies are relatively new, there is no existing policy or regulation, although some grassroots and citizens movements have expressed the need to ensure the responsible development and deployment of them.

South Africa ranks the highest in Africa and fifty-eighth in the world for global innovation (Matebvu 2018). While it is investing in artificial intelligence and other technologies that corporations view as game changers, the potential for VR/AR is not as clear. According to an Accenture report (2018) on extended reality (XR), the larger field that includes all the subsets of immersive reality such as VR and AR, business executives are not in agreement on how important these technologies will be. In fact, it reports that only 54 percent of executives view XR as an important future tool to connect with customers and employees, especially when geographic distance exists between them.

Despite the disagreement, however, a growing number of corporate entities and educational institutions has focused at least some attention and resources on immersive technologies. This fact is evidenced by a growing number of local and

Internet of Elephants, an Africa-based social enterprise that promotes wildlife conservation, launched its augmented reality app Safari Central in late 2017. After its release, the organization ran a contest over #RewildYourWorld, asking people worldwide to add animals to their photos and selfies. The competition ultimately awarded Richard Gudz (n.d.) the title of the first-ever augmented reality wildlife photographer. Internet of Elephants uses technology to share data about animals to enhance public awareness and to protect endangered species. As of early 2018, more than 24,000 people actively use the app (Internet of Elephants 2018). The organization's next major project is to create a mobile AR game similar to Pokémon Go to allow players to track animal migrations, capitalizing on the growing interest in AR apps and games.

international conferences, events, and competitions in which South Africans have participated, including a large number of them hosted within the country. One example is South Africa's first-place team in an AR event at the multinational AR/VR Hackathon in 2018, sponsored by Imisi 3D and multiple industry partners.

Corporations drive the majority of virtual, augmented, and immersive reality technologies in the country, employing them in the healthcare, tourism, and real estate sectors. There is additional potential for filmmaking and video gaming. One specific economic sector where companies are investing heavily in VR technologies is the mining industry. Training in a working mine can be dangerous, especially for the inexperienced. Thus, mine operations are exploring how to apply immersive reality to training programs to reduce risk as employees master skills and learn to work with machinery prior to applying their training in a real-world mining experience. For example, Kumba Iron Ore has teamed with the University of Pretoria to create the continent's first Virtual Reality Center, which designs simulated training for industrial sectors with an emphasis on mining. On a similar note, in a world first in 2019, Forestry South Africa, Fibre Processing and Manufacturing Sector Education and Training Authority, and several industry partners developed a VR training simulation for chainsaw operators. These types of trainings keep costs low and promote safety for workers in high-risk situations.

Another sector receiving investment for VR support is healthcare. EON Reality, a global company with branches in Cape Town and Pretoria, offers a VR Innovation Academy for students. In its Tshwane, Pretoria, location, the academy partnered with the City of Tshwane Health Department to develop an HIV/AIDS awareness campaign using VR. Students worked with healthcare subject matter experts to develop the application, designing it to align with the city's 90-90 strategy to diagnose and treat all HIV/AIDS patients by 2020 (EON Reality 2018). Similarly, Makhulu Media, a film production company, has also created VR programming to allow medical staff and patients with HIV/AIDS to understand what a visit to the doctor's office is like from the other perspective. In theory, such an experience could lower anxiety and improve interactions from both sides of the experience. These examples are only two of a growing number of efforts attempting to apply immersive reality technologies to improve healthcare in a culturally sensitive and appropriate manner.

Immersive technologies have potential to deliver improved educational curricula to a wider student population in South Africa. The United Nations studied how VR might improve education in the early 2000s, though the country's telecommunications infrastructure was unable to support mass adoption of online learning at that point in time. The barriers to applying immersive technologies for educational use have not yet been overcome, however; due to some of the current challenges with VR/AR in the country, such as the cost of equipment, while the technologies offer future promise, for the moment they are most suitable as teaching aids (Buliva 2018). At the same time, the training efforts in the mining and forestry sectors have already demonstrated that virtual training can lower costs, reduce risks, and allow students to participate in experiential learning that differs greatly from book learning. As these training efforts are assessed for effectiveness, they may provide lessons to help usher in the adoption of digital learning more broadly, assuming the

costs of equipment continue to drop. Allowing students to use their own devices, such as mobile phones, to access instruction could help alleviate some of the cost burden when expanding VR and AR to education.

The year 2019 was pivotal for VR/AR in South Africa. It demonstrated that immersive reality technologies have started receiving attention and, at times acclaim, in the country. A brother-sister team from the country, Rick (1981–) and Ree (1978–) Treweek, screened a short, interactive adventure movie called *The Lost Botanist* at the 2019 Annecy animation festival. Selected as one of nine films to screen out of ninety submissions, this film represents a huge achievement for the Treweek siblings and a significant accomplishment for South Africa's VR filmmaking industry (Milligan 2019). As filmmaking and gaming are two areas that may benefit greatly from immersive and extended reality, this initial success may inspire new filmmakers to work with the technologies.

Paid VR entertainment experiences are becoming more common in South Africa. Like any consumer-driven market, many of the locations have been unable to stay in business. For example, Johannesburg has hosted the VRCade, which is essentially an arcade for virtual reality technologies that allows visitors to experience the promise that mixed reality has for South Africa and, more broadly, Africa. It is actually the second one to open in the country. The first location opened in Cape Town, although it has permanently closed, and it is unclear if the Johannesburg location remains open in 2019.

VirtualWorld opened in Cape Town in 2016. As of 2019, it offers more than fifty games to beginning and advanced gamers, using high-end equipment. Its games include surviving the zombie apocalypse, winning a snowball fight, and team-building exercises such as working with colleagues to diffuse a virtual bomb (Caboz 2019). In Johannesburg, Blue Ocean VR has great online reviews and specializes in room-scale entertainment. Across both cities, and in other areas such as Pretoria, there are development and entertainment companies specializing in immersive reality. As some researchers speculate that extended reality could change how people consume entertainment over the next five to ten years, South Africa has already provided the world a taste of what it has already started developing in this sector.

Success with immersive technologies will enable the country to move forward with them. However, one of the drawbacks of immersive technology is that the price point remains too high for the majority of South African consumers. If the population cannot afford access to the technology broadly, despite costs having dropped worldwide, they cannot benefit from them.

As the country develops and relies more and more on immersive technology, South Africa will face some of the same challenges as the rest of the world. The use of immersive technologies, as well as other digital innovations, leads to questions about data privacy, the nature of reality and the implications of experiencing something fake that can engage all the senses, cybersecurity, addiction, widening of the digital divide, and other psychosocial and behavioral changes that can occur when people engage with new technology. XR also has another potential implication if South Africa does not work on it competitively.

In other parts of the world, travel agencies have developed virtual tours to South Africa, ostensibly as a way of piquing people's interest in traveling there. Thomas Cook, an international travel agency that collapsed in 2019, was among the first companies to make VR trips to South Africa available to potential tourists. However, virtual tourism has the potential to cripple South Africa's tourism sector should tourists visit it virtually and spend their money in other physical locations. To compete, the Department of Tourism may want to develop its own immersive programming to entice tourists, which would allow the department to control what people see and promote some of the experiences of which only South Africans would have intimate knowledge rather than views controlled by foreign companies. The one exception to promoting virtual tourism vigorously has been due to the COVID-19 lockdown, where many agencies have used virtual tours to keep interest in the country's scenic locations high. Krueger National Park, for example, has offered virtual safari tours twice daily to promote interest in future travel, although in this case, it relies on regular video aired through its YouTube channel and has not sought to integrate VR/AR technologies.

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Further Reading

Accenture. 2018. "SA Businesses Lag Global Peers in Leveraging Technology to Integrate into Customers' Lives." Business Tech. Accessed September 15, 2019. https://businesstech.co.za/news/industry-news/225885/sa-businesses-lag-global-peers-inleveraging-technology-to-integrate-into-customers-lives/.

Buliva, Newton. 2018. "Virtual Reality and Knowledge Rediscovery in Sub-Saharan Africa: A Review of Literature." International Conference on Innovative Technologies and Learning, Conference Proceedings, Portoroz, Slovenia, August 27–30, 2018, Springer.

Caboz, Jay. 2019. "I Found a Virtual Reality Arcade Unlike Anything I've Seen in South Africa—You Can Shoot Zombies, Have Snowball Fights and Even Diffuse Bombs." Business Insider. Accessed June 7, 2020. https://www.businessinsider.co.za/i-found-a-modern-arcade-unlike-anything-ive-seen-in-sa-where-you-can-walk-on-a-plank-50-stories-up-or-shoot-hordes-of-zombies-2019-2.

EON Reality. 2018. "City of Tshwane Health Department Attends EON Reality VRIA Students' Presentation." Accessed September 15, 2019. https://www.eonreality.com/tshwane-health-department-eon-reality-vria-students/.

Matebvu, Farai. 2018. "African Countries Fare Poorly in Innovation Ranking." Sci Dev Net. Accessed June 7, 2020. https://www.scidev.net/global/innovation/news/african-countries-fare-poorly-in-innovation-ranking.html.

Milligan, Mercedes. 2019. "Treweek Siblings: First African VR Makers to Screen at Annecy." *Animation Magazine*. Accessed June 7, 2020. https://www.animationmagazine.net/immersive/treweek-siblings-first-african-vr-makers-to-screen-at-annecy/.

UNITED ARAB EMIRATES

The United Arab Emirates is well positioned to develop and employ virtual reality and augmented reality technologies. Many domestic businesses are exploring the viability of immersive reality technologies, with the public sector driving current

development and demand. The UAE government is also interested in involved in VR/AR; it has accepted that emerging technologies including VR/AR will play a larger role in the economy, especially with the introduction of 5G internet speeds. Through government support and industry's innovative approaches to immersive reality technologies, the UAE has become known as the one of the forerunners for these technologies, particularly in the Middle East.

The UAE is a multicultural nation, and Dubai is a metropolis known for its over-the-top style and out-of-this-realm concepts fusing futurism with a long ancient history. It is through this backdrop that the UAE has become a hub for domestic and international companies. Among these, many of the VR/AR companies are part of the Virtual Reality Augmented Reality Association (VRARA). Dubai's local chapter of the international VRARA is guiding the development of cutting-edge VR/AR applications in the country. The chapter seeks to inspire leading gamers in VR and AR to collaborate with new ventures, connect business owners with funding, and generate processes for the implementation of best practices and groundbreaking applications. The VRARA Dubai chapter brings together global and local talent to generate a community of VR and AR visionaries. It invigorates innovative suppliers and the content inventors through state-of-the-art hardware businesses and motivated researchers.

The market for VR and AR is growing in the Middle East and North Africa, including the UAE. Across the region, experts predict that the market will grow to US$6 billion by 2020 from around US$182 million in 2017 (Forrest 2018). In the UAE itself, forecasters have predicted that the VR/AR market value will reach US$1 billion by 2020, exhibiting high growth rates and market value. Analysts attribute this change to two key reasons: equipment pricing, such as the cost of viewers, is falling, making the hardware more accessible to a larger swath of the population, and the country expects to implement a 5G network that will enable VR/AR to run smoothly over high-speed connections. Some experts predict that VR/AR in the UAE could grow exponentially, reaching a possible value of US$1 billion in the year 2020 (Bussmat Alkayan 2019).

The government supports these efforts, as it understands that promoting better internet will allow the country to embrace and adopt emerging technologies, such as immersive reality technologies, leading to increased development efforts. In many of its recent strategies, the government has espoused support for technologies for the future of the nation. Domestically, the northern part of the country hosts the most significant share of the VR and AR marketplace, and projections suggest that it will continue to attract and maintain the largest portion of the domestic marketplace.

Government investment in VR and AR is widespread in the country. Immersive reality technologies have the potential to attract investment, improve manufacturing, reshape the entertainment industry, and provide new career opportunities. The UAE wants to realize every opportunity through applied VR/AR and actively experiments with these technologies. Examples include the Dubai Electricity and Water Authority, which has recruited the prominent AR solution and hardware

supplier DAQRI to formulate smart glasses and helmets for its engineers, utilizing AR software created by the Dubai-based corporation Takeleap. The Ministry of Health and Prevention has started a program to promote VR usage for physiotherapy, addressing treatment and rehabilitation for a wide variety of disorders (MOHAP 2018).

The Emirates Nuclear Energy Corporation has demystified its energy plant by allowing people to take virtual VR tours (ENEC 2018). Dubai itself has a training center that allows urban planners to perform their duties in VR in preparation for work in the real world. These organizations are bringing the most current technologies to their specific sectors to improve citizens' lives. With the emphasis on applying immersive reality technologies in innovative ways, the government has positioned itself to offer new or improved services; as these applications mature, they may spread to more sectors and further contribute to public welfare.

Businesses in the UAE see great potential in VR/AR for a wide variety of applications. In the country, location-based entertainment has created a buzz around VR in both the business and public sectors. There are countless business uses of VR, from remote surgery to car test drivers, real estate sectors in relationships of growth, gaming, and entertainment, as well as potential in the learning sector, tourism, and retail. Etihad, the national airline, has brought the SkyLights VR headset into its lounges with the goal of providing its customers with new, premium entertainment opportunities. Jumeirah Hotels, a luxury brand, allows potential travelers and business clients to explore some of its properties prior to booking.

For start-up companies and businesses aimed at the nonluxury market, there are also opportunities. The Dubai Future Accelerator, for example, brings together government, industry, expertise, and funding for new ventures to tackle difficult challenges. Every session starts with an application process, from which a consortium selects the best ideas and puts them through an intensive, nine-week program. Each nine-week session, or cohort, generally revolves around a particular topic or public sector. Cohort 6, a program that ran from May to July 2018, called for proposals to enhance the police force and reduce traffic congestion, among other areas of public interest. Cohort 7 focused on applying blockchain to improve the public sector in early 2019 (Smart Dubai 2019).

In mid-2019, the accelerator had a competition for "VR and Beyond," where two projects featuring VR experiences in and around Dubai promoting the country won. Game Cooks, a U.S.-based company, created the winning VR experience Dubai Rising Falcon (HTC Vive 2019). The program allows users to explore the famous Burj Khalifa from the top, transforming the user into a virtual falcon, the country's national symbol (HTC Corporation 2019). While primarily for entertainment, VR programs underscore how VR/AR can change perspectives and create more intimate experiences in a city like Dubai.

The "Dubai Rising Falcon" VR experience received another acclaim, as it has come to reside at another unique feature in Dubai, the VR Park. Located at the Dubai Mall, the park advertises itself as the world's largest VR park, although it incorporates more reality technologies than just VR. Spanning over 75,000 square

Dubai Mall's VR Park is one of the largest virtual and immersive reality entertainment centers in the world. Spanning more than 75,000 square feet, the park features more than 30 rides, accessible to the public for approximately $4 USD per hour. Immersive reality entertainment is one area where the United Arab Emirates excels with its high quality technology. (Ritu Jethani/Dreamstime.com)

feet, the park takes up multiple floors and offers more than thirty rides, some of which are single and others multiplayer experiences. Reviews of the park have been excellent online. Prices are also reasonable, with general admission free and the price of an experience starting at 15 AED, or approximately US$4. Overall, the park demonstrates the public demand for new entertainment experiences that VR/AR have the ability to meet. While VR theme park rides and experiences are not the only type of this potential application, they do represent a new wave in entertainment that other countries, such as Germany, Denmark, the United States, and China, are developing in different ways.

While entertainment in the UAE may become permanently transformed by VR/AR, it is not the only industry facing potential disruption. Another area under exploration is that of applying VR/AR to e-commerce. NDigitec, a UAE firm known for being at the frontier of VR/AR, has launched a concept for a VR mall. Not yet launched, the mall will connect consumers virtually with stores so that they can experience them and their products in real time. As the experience would simulate a physical experience in the store, it would allow consumers to feel like they were present without leaving their homes. Through the experience, consumers could select and purchase items just as they would in a store. Should this technology catch on, it is poised to transform the face of shopping fundamentally, as people

might never need to step foot in a mall or store, should they prefer the convenience of shopping using immersive technologies.

The UAE will continue as a strong developer of VR/AR. Along with other emerging technologies, government and industry support of VR/AR will allow the public sector to demand more immersive reality products and experiences. While some of these will be pure entertainment—though with the value add of allowing people the psychological and emotional experience without any physical danger—others will be transformative for how the country functions on a departmental and sector level.

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Further Reading

Bussmat Alkayan. 2019. "AR VR Industry in UAE." CanWe Global. Accessed September 25, 2019. https://canweglobal.com/index.php/ar-vr-in-uae/.

Emirates Nuclear Energy Corporation (ENEC). 2018. "App Intro." Accessed September 27, 2019. https://www.enec.gov.ae/360/.

Forrest, Emma. 2018. "UAE Well Set for Virtual Reality Revolution." The National. Accessed September 23, 2019. https://www.thenational.ae/business/uae-well-set-for-virtual-reality-revolution-1.744834.

HTC Corporation. 2019. "VR & Beyond Challenge Winners Announced." Vive. Accessed September 27, 2019. https://blog.vive.com/meaen/2019/06/27/gamecooks-emerge-winners-vr-beyond/.

HTC Vive. 2019. "VR and Beyond Challenge Winner Announced: Experience Burj Khalifa in VR Like a Falcon!" YouTube. Accessed September 27, 2019. https://www.youtube.com/watch?v=mTpBn-VQswA.

Ministry of Health and Prevention (MOHAP). 2018. "MOHAP to Use Artificial Intelligence (AI) Techniques to Rehabilitate Patients." Accessed September 27, 2019. https://www.mohap.gov.ae/en/AwarenessCenter/Pages/post.aspx?PostID=32.

Smart Dubai. 2019. "Smart Dubai Global Blockchain Challenge 2019." Dubai Future Accelerators. Accessed September 27, 2019. https://dubaifutureaccelerators.com/en/blockchainchallenge/.

UNITED STATES

The United States has contributed to virtual reality and augmented reality technologies since their official adoption as named concepts. It currently invests the most in VR/AR development, leading the world in research related to these areas, and for the foreseeable future, it expects to remain the world leader. As VR/AR technologies are expected to become profitable, more and more companies and universities and, to a lesser extent, the government are investing in them. In some sectors, such as healthcare and marketing, VR and AR are already in use to provide better services. Many other industries are experimenting with these technologies to lower costs and produce better products for the market faster than ever before.

Although the precursors to what would become VR can be linked to the late 1800s, Jaron Lanier (1960–), an American computer scientist, has received credit for officially coining the term in 1987.

Morton Heilig (1926–1997) invented the earliest working VR machine in the late 1950s. Called the Sensorama Simulator, it required the viewer to sit pedaling a stationary bicycle while watching 3D video and experiencing both an audio and olfactory, or smell, machine to make the experience more realistic. Because 3D films were uncommon in that era, Heilig invented a 3D camera and projector to make his own videos. Unable to find investors and create public interest, the Sensorama failed. Just prior to its invention, Heilig patented the Telesphere Mask, a 3D video headset that allowed an individual to be part of the viewing experience, also complete with sound and scent (Brockwell 2016). It, too, failed, but the inventions later earned Heilig the nickname the "Father of VR."

Lanier's story became, at least in part, immortalized in the movie the *Lawnmower Man* (1992) starring Pierce Brosnan (1953–). His company, the Visual Programming Lab, sold the first VR goggles for over $9,000. Throughout the 1990s, several games used them, and a small number of companies starting developing technologies for this market.

From this point in time, VR and AR have been gaining momentum not only in the entertainment industry but also as potential solutions to improve other social and economic challenges. Similarly, although precursors to the technology existed since the 1960s, Thomas Caudell (c. 1952–), an American Boeing employee, coined the term *AR* in the early 1990s. After that point, AR development hastened, with companies slowly rolling out their new developments. It is only more recently that *VR* and *AR* have become household terms.

Niantic, a U.S.-based firm in San Francisco, introduced the majority of the world to AR with the release of Pokémon Go in 2016. The game, based on the Pokémon franchise, allowed people to use their phones outdoors to capture virtual Pokémon and collect rewards. The app started in Australia and the United States and launched incrementally across the world. It became a worldwide phenomenon as people played in parks and on beaches and even caused problems when people playing the game ignored dangerous street crossings and trespassed into restricted areas in search of Pokémon and "gyms" where people could fight against one another in virtual battles. The company later released a Harry Potter AR game in mid-2019 that has not achieved the same popularity level as Pokémon Go. Regardless, the games have demonstrated worldwide interest in AR entertainment and, in a sense, spurred additional commercial and governmental attention in immersive technologies.

The United States currently has the most AR researchers at the largest number of universities, meaning that AR research is spread across institutions more than in any other nation; of these, the Massachusetts Institute of Technology publishes the most papers in ranked journals, although Blair MacIntyre (n.d.) at the Georgia Institute of Technology has the most papers in the United States when counted individually by researcher (Billinghurst 2018). Along similar lines, universities are not the only

organizations investing in VR/AR. Google and Microsoft, in particular, are projected to remain strong contenders in VR/AR development. Many start-up corporations are also playing in this space, vying to produce profitable immersive reality technologies. Many more are likely to join the competition as the market demand increases.

VR/AR and the other extended reality technologies are likely to become big business over the next few years. In 2017, Digi-Capital reviewed data on VR/AR and estimated that the market for the two would grow to be worth US$108 billion by 2021. The company further stated that of the two technologies, AR would grow to own over 75 percent of the market, with VR at under 25 percent; while those numbers generally held in an updated prediction, Digi-Capital did lower the overall projected market value at slightly lower by 2023, at around $100 billion, due to 2018 setbacks with the required equipment (Digi-Capital 2017, 2019).

In the United States alone, spending on VR/AR may reach $6.6 billion, the largest amount of any nation (IDC 2018). Even though the projections have dropped, the investments and potential profits from these technologies are large. As the technologies continue to mature, there is the possibility that these estimates will increase, and with higher numbers, production could increase and expand across additional economic and social sectors to which VR/AR has not yet been applied.

The U.S. government has shown interest in immersive technologies in various sectors. The Department of Education ran a challenge in 2016 to explore the potential of simulations for education and training. In 2017, it selected five finalists to go through an accelerator program to realize their ideas. This investment demonstrates interest in immersive technology applications to education. VR/AR technologies have also been applied to healthcare and safety. Examples of existing efforts include applications for preventing opioid misuse, aiding first responders, helping veterans with PTSD, providing virtual medical care, food safety, and reducing obesity.

Private and public investments in VR/AR are also growing. In the healthcare industry, over 200 hospitals already employ VR assistants to help people understand their treatment plans. The medical industry is also using VR/AR for a variety of other tasks. Specifically, it is developing technologies to assist with surgeries, radiotherapy, education and training, pain management approaches, rehabilitation, and behavioral therapy. The market value of these technologies in healthcare alone is projected to reach $5.1 billion by 2025, though the reality could be much higher if these technologies demonstrate greater benefit sooner (Kite-Powell 2018). With the current technologies already being used and the projected growth for them, VR/AR appears to have a very bright future in healthcare, and it is only one sector to which the technologies may apply.

Other industries have started experimenting with VR/AR. Car manufacturers like Ford have used immersive reality technologies to enhance business processes and address issues in safety and purchasing. The aerospace industry has found VR/AR applications successful for designing and testing new prototypes before any construction has begun. The result is that new aircraft should be readier sooner and at a lower price point when released. The same principles apply to architecture, where designs can be finalized before investing in construction materials. Prospective owners and investors can also visit these locations virtually to speed up investments.

Retailers can sell more products to consumers because they have the ability to visualize and interact with products sooner. For example, shoe companies like Nike and Adidas allow customers to try on apparel virtually, allowing customers to shop and make decisions comfortably without having to brave a crowded shopping mall. The technology can also prompt consumers to purchase directly online, which can save the cost of running a brick-and-mortar store. Other sectors that involve consumer interaction with a corporation or brand could benefit from some form of VR/AR technology, and in the United States, many see value and potential profit in enabling extended reality technologies. Exciting future advancements may come from VR/AR, such as Lockheed Martin's exploring its use in sending people to Mars.

As VR/AR advance, scholars already anticipate the rise of new issues associated with them. For some consumers, the top of the list includes data protection and privacy rights. The current state of the market in the United States is to give consumers very little control of their data and sell that data to places and parts unknown for profit. VR/AR may shine a brighter spotlight on these issues, as these virtual worlds will not be bound to geography. Along those same lines, VR/AR may bring new legal questions and challenges, especially as virtual spaces could become criminal hot spots and will certainly lead to jurisdictional questions. There's also the potential for VR/AR to change people's behavior. The movie *Ready Player One* (2018) suggests that people will live their lives primarily in VR/AR and that some people will be addicted to such a lifestyle. In the movie the *Matrix* (1995), most people live in a virtual reality simulation without ever questioning it. While no research yet exists on VR/AR and potential addiction, similar research has been produced on video gaming and smartphone usage, meaning that it is possible result but not guaranteed. If it, or any other behavior change, occurs, it could have ramifications for society whether positive or negative.

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Further Reading

Billinghurst, Mark. 2018. "Where in the World Is AR Research Happening?" Medium. Accessed September 15, 2019. https://medium.com/@marknb00/where-in-the-world-is-ar-vr-research-happening-ddebbdc6436b.

Digi-Capital. 2017. "After Mixed Year, Mobile AR to Drive $108 Billion VR/AR Market by 2021." Accessed June 7, 2020. https://www.digi-capital.com/news/2017/01/after-mixed-year-mobile-ar-to-drive-108-billion-vrar-market-by-2021/.

Digi-Capital. 2019. "For AR/VR 2.0 to Live, AR/VR 1.0 Must Die." Accessed September 15, 2019. https://www.digicapital.com/news/2019/01/for-ar-vr-2-0-to-live-ar-vr-1-0-must-die/.

IDC. 2018. "Worldwide Spending on Augmented and Virtual Reality Expected to Surpass $20 Billion in 2019, According to IDC." Accessed September 15, 2019. https://www.idc.com/getdoc.jsp?containerId=prUS44511118.

Kite-Powell, Jennifer. 2018. "See How This Company Uses Virtual Reality to Change Patient Healthcare." *Forbes*. Accessed June 7, 2020. https://www.forbes.com/sites/jenniferhicks/2018/09/30/see-how-this-company-uses-virtual-reality-to-change-patient-healthcare.

Selected Bibliography

Abdulaal, Mirna. 2018. "Bullying Killed His Best Friend, So He Launched an Organisation to Fight against It in Egypt." *Egyptian Streets*. Accessed June 6, 2020. https://egyptianstreets.com/2018/11/16/bullying-killed-his-best-friend-so-he-launches-an-organisation-to-fight-against-it-in-egypt/.

Arabian Business. 2017. "Dubai Ruler Launches Arabic E-Learning Initiative." Accessed July 22, 2018. https://www.arabianbusiness.com/industries/education/378975-dubai-ruler-launches-arabic-e-learning-initiative.

Asian Scientist Newsroom. 2017. "Hello, World! Meet 10 Made-in-Asia Robots." *Asian Scientist Magazine*. Accessed June 28, 2018. https://www.asianscientist.com/2017/01/print/hello-world-meet-10-made-in-asia-robots/9/.

Baggaley, Kate. 2017. "The World's Bananas Are under Attack." *Popular Science*. Accessed July 4, 2018. https://www.popsci.com/worlds-bananas-under-attack-disease.

Barth, Bradley. 2017. "Researchers Expose Russian Cyber Bank Robbers Who Stole over $10M." *SC Magazine*. Accessed July 22, 2018. https://www.scmagazine.com/researchers-expose-russian-cyber-bank-robbers-who-stole-over-10m/article/713775/.

Barth, Brian. 2017. "The Next Generation of Biofuels Could Come from These Five Crops." *Smithsonian Magazine*. Accessed June 30, 2018. https://www.smithsonianmag.com/innovation/next-generation-biofuels-could-come-from-these-five-crops-180965099/.

Brockwell, Holly. 2016. "Forgotten Genius: The Man Who Made a Working VR Machine in 1957." *TechRadar.* Accessed July 6, 2018. https://www.techradar.com/news/wearables/forgotten-genius-the-man-who-made-a-working-vr-machine-in-1957-1318253.

Cairo Scene. 2017. "This Egyptian Teenager Launched a National Anti-Bullying Campaign after His Friend Committed Suicide." Accessed July 8, 2018. http://www.cairoscene.com/LifeStyle/Egyptian-Teenage-National-Anti-Bullying-Campaign-Committed-Suicide.

Cole, Rob. 2017. "Ugandan School Successfully Lit in Urine-Powered Energy Trial." *Resource Magazine*. Accessed June 28, 2018. https://resource.co/article/ugandan-school-successfully-lit-urine-powered-energy-trial-12080.

Daftardar, Ishan. 2015. "5 Unusual Alternative Energy Sources You've Never Heard Of." *ScienceABC*. Accessed July 13, 2018. https://www.scienceabc.com/innovation/unusual-alternative-energy-sources-never-heard.html.

Gebel, Erika. 2013. "Making Insulin: A behind-the-Scenes Look at Producing a Lifesaving Medication." Diabetes Forecast. Accessed June 30, 2018. http://www.diabetesforecast.org/2013/jul/making-insulin.html.

Global Wind Energy Council. n.d. "Wind in Numbers." Accessed July 15, 2018. http://gwec.net/global-figures/wind-in-numbers/.

Huggins, Susan. 2018. "OEC Announces the 2018 Winners of OPEN RESOURCES, TOOLS & PRACTICES AWARDS for Open Education." Open Education Consortium.

Accessed July 22, 2018. http://www.oeconsortium.org/2018/03/oec-announces-the-2018-winners-of-open-resources-tools-practices-awards-for-open-education/.

Internet of Elephants. 2018. "Safari Central." Accessed June 27, 2018. https://www.internetofelephants.com/safari-central/#safari-central-1.

Janssen, Jan-Keno. 2015. "Ausprobiert: Mit VR-Brille Auf Dem Kopf Achterbahn Fahren." *c't Magazin*. Accessed June 27, 2018. https://www.heise.de/ct/artikel/Ausprobiert-Mit-VR-Brille-auf-dem-Kopf-Achterbahn-fahren-2821323.html.

Kaevats, Marten. 2017. "Estonia Considers a 'Kratt Law' to Legalise Artifical Intelligence (AI)." Medium. Accessed July 19, 2018. https://medium.com/e-residency-blog/estonia-starts-public-discussion-legalising-ai-166cb8e34596.

Lee, Dami. 2017. "A Robot Cut through a Wall to Pass on the Olympic Torch in South Korea." The Verge. Accessed June 28, 2018. https://www.theverge.com/2017/12/12/16767620/hubo-humanoid-robot-pyeongchang-olympics-south-korea.

Liberman, Anatoly. 2012. "A Lovable Bully." OUPblog. Accessed July 7, 2018. https://blog.oup.com/2012/11/bully-word-origin-etymology/.

Metro Magazine. 2018. "AI-Powered Tech Tracks Passengers' Response to Ads on Brazil Subway." Accessed July 8, 2018. http://www.metro-magazine.com/technology/news/729774/ai-powered-tech-tracks-passengers-response-to-ads-on-brazil-subway.

MiríadaX. 2018. "Conócenos: Nuestros Números." Accessed July 22, 2018. https://miriadax.net/web/guest/nuestros-numeros.

Oberg, James. 2008. "Satellite Turns 50 Years Old . . . in Orbit!" NBC News. Accessed July 13, 2018. http://www.nbcnews.com/id/23639980/ns/technology_and_science-space/t/satellite-turns-years-old-orbit/#.W0lHONJKjIU.

Page, Tom. 2018. "Self-Driving Police Patrol to Hit Dubai." CNN. Accessed July 9, 2018. https://www.cnn.com/style/article/dubai-police-self-driving-vehicle-o-r3/index.html.

Regalado, Antonio. 2016. "The Extinction Invention." *MIT Technology Review*. Accessed June 30, 2018. https://www.technologyreview.com/s/601213/the-extinction-invention/.

Rollet, Charles. 2018. "The Odd Reality of Life under China's All-Seeing Credit Score System." *Wired UK*. Accessed July 4, 2018. http://www.wired.co.uk/article/china-social-credit.

Shaw, Lucas, and Sharon Waxman. 2014. "Insider: China Censors Rejected Brad Pitt's 'World War Z' (Exclusive)." The Wrap. Accessed July 21, 2018. https://www.thewrap.com/brad-pitt-world-war-z-china-rejecting-zombie-apocalypse-95051/.

Stucky, Nathalie. 2018. "Five Nations Join Efforts to Punish Transnational Bitcoin Tax Crime." Bitcoin News. Accessed July 22, 2018. https://news.bitcoin.com/five-nations-join-efforts-to-punish-transnational-tax-crime/.

World Health Organization. 2017. "Key Points: World Malaria Report 2017." Accessed June 30, 2018. http://www.who.int/malaria/media/world-malaria-report-2017/en/.

Zhu, Ziyue. 2017. "Uruguay Will Make You Believe in a Clean Energy Future." Worldwatch. Accessed June 28, 2018. http://blogs.worldwatch.org/uruguay-believe-clean-energy-future/.

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