A Futurist's Guide to Emergency Management

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INTRODUCTION

> As always, new technologies hold the promise of doing great good, supplying new sources of clean energy, curing disease, and otherwise enhancing our lives. From experience, however, we also know that new technologies can be used to diminish humanity and destroy societies. We can manage our technology or become victims of it. The choice is ours, and the Clock is ticking.
>
> ~Science and Security Board of the Bulletin of Atomic Scientists [1]

WHY THE FUTURE IS IMPORTANT NOW

The future is impossible to know, particularly when it comes to the dynamic situations faced by communities as they prepare to respond to the various dynamic events that can disrupt the local quality of life. However, that does not mean the future can or should be ignored. Community leaders and their designated emergency managers must use subjective and objective analyses to trend, forecast, predict, and project the various conditions that directly or indirectly create risk and increased vulnerability within a given community. These conditions include the various psychological, physical, economic, social, and sociodemographic characteristics of the people, environment, and culture of every community.

Interestingly, the foundation of these futuristic projections is in the present. Numerous studies, anecdotal observations, and various lessons over the past decades have set forth patterns and collections of information that have begun to build trends toward the next few years or even decades from now. Much like a threat assessment, which helps provide focus to planning and resource priorities in the future, evaluating future trends can help provide these same types of clarity and perspective to emergency managers at all levels.

Unfortunately, when most people think about the future they think about far-flung and outlandish developments out of science fiction stories like *Star Trek* or *The Jetsons*. Certainly there are stories in the news every day about seemingly impossible items like a team of scientists from Japan's Osaka University developing technologies to attach fuel cells to the backs of roaches to create so-called "cybugs" [2]. Conversely, others may envision

a future similar to the dystopian societies (and often disasters) in movies like *Mad Max, The Matrix,* or *The Day After Tomorrow*. For example, in 2007, former vice president and environmental "guru" Al Gore predicted that the North Pole would be ice free by 2013, with sea levels rising by 20 feet (which ultimately did not come to pass) [3]. Obviously those "futures" are possible, but are solely based on conjecture and wild guesses.

Clearly, there are challenges to projecting and forecasting not only the events of the future, but also how they may impact society at large. However, specific strategies were applied throughout this book to minimize these challenges as much as possible. These strategies include a focus on emerging technologies, consideration of technological applications, and identification of all market forces, by focusing on realistic rather than imaginative directions. This systematic approach was applied across all three sections of this book, whose themes are citizens, technology, and the future (Section 1), preparedness, response, and recovery (Section 2), and emerging global threats (Section 3).

UNDERSTANDING FORECASTING AND PREDICTION

This futurist guide, as well as all assessments of the future, must be based on as much science as possible. Without grounding future direction in analysis that is as objective as possible, there is a significant risk that subjective views and superstition can make any assessment no better than the science fiction and fantasy that fill books and movie theaters. This distinction is a fine line when looking toward the future, but is most effectively delineated by utilizing tools such as current statistics, predictive modeling and forecasting, process analysis, and organizational intelligence.

The simplest of these approaches is the use of statistics and patterns of current activities. This will serve as the foundational evidence for all of the future trends that will be considered in this book. These statistics will be based on well-crafted empirical research and anecdotal behaviors that have widespread acceptance or defendable stances within academic, research, and practical programming. As the breadth of these foundational statistics widens, the possible futurist projects also increase, which helps create clarity in a projected and interconnected future.

Once the statistics for a given issue are established, predictive modeling and forecasting must be initiated to begin a reasonable and fair approach to futuristic projections. Predictive modeling typically identifies

underlying relationships in statistics and historical data that can then be mathematically represented. This mathematical representation can then be utilized for forecasting or classification for future events [4]. The most commonly recognized form of predictive modeling is related to day-to-day and severe weather patterns that are produced by the National Weather Service, media meterologists, and commercial weather forecasting companies. These groups use scientific observations, tests, and data to project future activities and trends. Without fail, the accuracy of these predictions decreases the farther out they are projected. One National Weather Service official was quoted in a 2013 *Washington Post* article saying, "We sustain higher accuracy out to two to three days in advance; then it starts dropping off faster at days six through eight" [5]. Conversely, the National Weather Service recognizes that specific forecasts can only happen in the short term while more extreme events such as hurricanes receive longer term predictions that are often extremely vague.

Predictive modeling is frequently utilized for mission-critical operational decisions to help prioritize decision making in both near-time and long-term planning efforts. This application is often used by emergency managers and homeland security officials in day-to-day intelligence and operational decisions like the weather forecasting mentioned earlier, as well as in long-term planning and resource allocations related to community-based threat and risk assessments. This type of predictive modeling will also be highly valuable as emergency managers attempt to address the trending and future challenges that are discussed in this book. From topics like the rise of smart devices (Chapter 1), predictive behavior (Chapter 3), the "Internet of Things" (Chapter 4), "Black Swan" events (Chapter 9), climate change (Chapter 11), and cyberthreats (Chapter 13), these predictive models will be used as often as possible to project planning and resource needs for professional emergency managers.

The next component of forecasting is predictive analytics and optimization. Instead of trying to forecast or predict how technology or environmental cues change in the near and far future, this concept helps identify patterns in the ways or methods that such technologies are utilized. These patterns are often predicted through complex mathematical systems or equations called algorithms. These types of algorithms are commonly utilized by commercial products like Netflix or Match.com to predict viewer choices or likely romantic matches [4]. They leverage past choices and the choices of others to forecast or predict future choices. These types of programs are critical to customer service for these companies to improve the success and positive engagement for the client base.

The challenge to predictive analysis in its most common form is that it is dependent on highly technical math processes, which are unavoidable for most government and public safety agencies. However, there is a growing class of technologies that can be leveraged to help these smaller organizations apply it for use to predict the behavior of citizens and constituents before, during, and after a disaster. This phenomenon is discussed in Chapters 2 (communications) and 3 (data mining and predictive behavior).

The last two types of predictive analysis and forecasting are analysis and organizational intelligence. These are the most abstract features and thus are farthest from the raw data, but potentially most applicable to organizations seeking to identify issues in the future. One approach to analysis is the use of data or behavioral modeling. One of the best examples of predictive modeling is the Google search engine. Over the years, Google has shifted its modeling and predictions to ultimately create a search engine that "understands exactly what you mean and gives you back exactly what you want" [5]. Although no emergency management or public safety agency has the processing or modeling power of Google, it is an ideal (perhaps utopian) goal to give disaster survivors exactly what they need when they need it. This is particularly important given the limited resources available before, during, and after a disaster. This type of modeling is of particular importance in Chapters 8, 9, 10, and 11 as the impact of recovery, perception of risk, disaster economies, and so-called Black Swan events are considered.

By utilizing forecasting, predictive analytics, and modeling, an organization of any type or size increases its organizational intelligence. The concept of organizational intelligence is focused on the ability to identify and cultivate knowledge and apply it in strategic and targeted ways to meet organizational goals. The concept of organizational intelligence is a shift from traditional organizational models (and most professional emergency management and homeland security programs), which were often viewed simply as a collection of people and resources applied to tasks and products. The need for organizational intelligence is particularly important during emergency and disaster preparedness, which involves the interaction of a multitude of individuals, systems, and organizations within a local or broader organization [6].

Leveraging these prediction tools and understanding the future is the focus of this book. It is critical for emergency management and homeland security managers and organizations to understand these tools so they can more accurately look to the future and begin to more definitively

predict the issues and community challenges that will present themselves in the near future. Each chapter considers the current trends, applies various models, and identifies ways to improve the reader's personal and organizational intelligence.

RELEVANCE TO DISASTER MANAGEMENT

Emergency management and disaster response professionals do not often take the time to look to the future to understand the impact on personal and/or organizational success. In many ways this is a fundamental flaw of an industry that is often burdened by limited personnel, resources, equipment, and political sway to move beyond the most imminent and pressing threat or issue. While a realistic challenge, it often leads to short-sighted decisions about planning, preparedness, response, and risk reduction in a given community. This issue is commonplace throughout the history of managing the impacts of emergencies and disasters.

Starting with the rise of the Cold War, the profession of emergency management almost solely focused on the threat of nuclear war. This threat was addressed through comprehensive civil defense programming and planning. As the threat of nuclear war diminished in the 1970s and early 1980s, there was an industry shift to encourage a broader range of issues (mostly natural hazards) that most commonly was called emergency preparedness. Unfortunately, this shift was not based on sound analysis or research. While there were a few noteworthy social science researchers, like E. L. Quarantelli, Russell R. Dynes, and Gilbert White, the practical application and acceptance by emergency managers lagged by many years (and some would argue continue to lag even today) [7].

This type of divergence between academic research and practical application was repeated in the early 2000s after the September 11 terrorist attacks. Specifically, many organizations shifted philosophical models away from all-hazards or natural disaster models of planning toward homeland security and the prevention of terrorism. After a decade of this model and a massive reduction in homeland security funding, many emergency managers have been left in the lurch with many still lacking a natural and practical connection to academic studies and no financial incentives to direct philosophical approaches. This dynamic creates a phenomenal opportunity to look to the future and evaluate where the profession is going and what choices can be made to adequately address the circumstances and issues that rise from it.

The need for disaster managers to look to the future is critical to the practice of professional emergency management in countries throughout the world. Countries including the United States, Canada, Australia, New Zealand, and other areas in Asia and Europe have strong or developing emergency management programs. While there are some differences in the application of modern emergency management principles in these areas, there are two facts on which professional emergency managers and researchers can agree: (1) There are fewer deaths from disasters and (2) the costs of disasters are increasing. For example, Swiss Re (the world's second largest reinsurer) estimated that economic losses from global disasters in 2013 reached $130 billion, of which only 34% was covered by insurance [8]. According to the International Disaster Database from the Center for the Research on the Epidemiology of Disasters (CRED), the number of reported disasters has exponentially risen from a negligible number at the turn of the twentieth century to more than 350 events per year by 2011 with the growth curve started after World War II [8]. Likewise, CRED found that the total global cost of disasters rose exponentially in the 1940s to a figure exceeding $100 billion by 2011. Moreover, during that same period of review, CRED discovered that the number of people killed from global disasters fell from close to 500,000 in 1900 to only several thousand in 2011 [9].

In addition to these trends, the rise of social media (and related technologies) has had a profound impact on the management of emergencies and disasters throughout the world. In many ways, the communication and operational impacts of social media on all phases of emergency management have been revolutionary and are still not fully understood or accepted by all professional organizations. According to some professionals, this impact is on par with previous communication revolutions like the printing press, radio, television, and cable news [10]. These impacts have left the industry slightly off balance as it has sought ways to understand and apply social media principles in step with its growth and application. This concept as well as a variety of other digital considerations is expanded upon in Chapter 1.

One characteristic that has driven and will continue to drive some of the challenges related to adoption of social media and other technologies is the changing social and demographic factors within domestic and international communities. Specifically, additional generations are included in workforces and the community at large as younger citizens adopt technologies earlier and older citizens stay engaged in community leadership and decision making longer as health issues and life expectancy continue to improve. These sociodemographic issues are further

compounded by changing cultural standards, which ultimately impact disaster preparedness and identification of needs before, during, and after an emergency or disaster. These issues are further expanded upon in Chapter 5.

This book is about why the future is important today. Inherently, some of the modeling and projection ultimately presented within the chapters will be wrong. In truth, they may even be laughable upon reflection 10, 20, or 50 years from now. At the same time, the forecasting utilized in this book is based on the best available data and knowledge about the dynamics of the evaluated event. Consequently, like all good preparedness strategies, the efforts of considering the potential impacts and adjusting resources and planning strategies to meet those impacts will always improve an organization's readiness to respond to any emergency or disaster.

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Adam Crowe is a certified emergency manager (CEM), associate business continuity professional (ABCP), and master exercise practitioner (MEP). He is a nationally recognized leader in social media and emergency management and routinely engages in cutting-edge planning, training, and exercise opportunities that improve the readiness of communities, organizations, and businesses to respond to and recover from emergencies and disasters.

He has spoken at over 50 regional, statewide, or national conferences on how social media impacts emergency management and has been published more than a dozen times in professional journals. In addition to *A Futurist's Guide to Emergency Management,* he is also the author of *Disasters 2.0: The Application of Social Media in Modern Emergency Management (2012)* and *Leadership in the Open: A New Paradigm in Emergency Management (2013).*

He currently serves as the director of emergency preparedness at Virginia Commonwealth University and lives with his wife and children in Richmond, Virginia.

Section I

Citizens, Technology, and the Future

1

The Super Digital Age

> We are constantly adding new gadgets. Even as they have gotten simpler individually, the cumulative complexity of all of them is increasing.
>
> ~Clive Thompson [1]

HISTORY OF TECHNOLOGY IN DISASTER MANAGEMENT

Since the earliest foundations of professional emergency and disaster management in the 1950s, technology has played a role in preparedness, response, and recovery from disasters as well as the reduction of risk in a given community. Some of these technologies have long been replaced, while others have remained with minimal change of approach or capabilities. However, with the exponential rise in digital technologies and the institution of social media systems since the turn of the twenty-first century, technological systems and public expectations related to those systems have drastically changed.

One of the most traditional of these technologies is the outdoor warning siren. Because of the limited other notification systems available, outdoor warning sirens ultimately became one of the symbols of the Cold War. This historical connection primarily rose from the passage of President Harry Truman's Civil Defense Act in 1950 (see Figure 1.1), which called for the establishment of large outdoor sirens [2]. The first deployed outdoor siren was utilized in Detroit, Michigan, and was a Chrysler product [2]. While the sirens were initially utilized solely to warn communities of

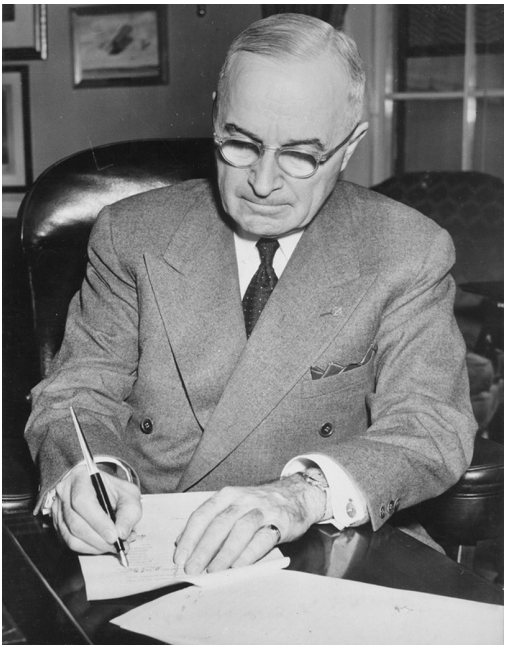

Figure 1.1 The national use of outdoor warning sirens was first established by President Harry S. Truman when he signed the Civil Defense Act in 1950. (Source: National Archives and Records Administration.)

nuclear threats, by the 1970s the purpose was expanded to include severe weather events and tornadoes [2]. However, by the end of the Cold War in the 1980s, these sirens became solely utilized for tornadoes and other imminent threats to life and safety.

Interestingly, these civil defense sirens not only served as the primary historical public notification system for a variety of communities, but they also became the visual standard of emergency preparedness and later the sign of antique strategies for public notification and warning. This is particularly true in light of the social media and digital technologies that will be evaluated in this chapter. This juxtaposition is no more evident than in the city of Los Angeles, which is littered with hundreds of outdoor warning sirens that have long been disconnected due to repeated reliability issues and measured deterioration even though the outdoor warning siren system was state of the art in production and capability when it was installed [3].

From an emergency management perspective, outdoor warning sirens served as the primary, but not the only communication systems. For example, printed materials, television, and radio represent the three foundational elements that have always been utilized to communicate issues to a public constituency. These types of communication systems were solely utilized until the advent of the Internet and its widespread application in the 1990s and early 2000s. At that point in time, many preparedness organizations adopted websites and other Internet-based protocols for the distribution of information. While the growth in the Internet and related browser-based information was in its own way revolutionary, it still ultimately followed the same model of distribution as the foundational systems. Primarily, information was only available to be disseminated or pushed to an intended audience or community. This one-way limitation was addressed with the astronomical growth of social media systems like Facebook and Twitter that allowed for a give-and-take, two-way communication system for anyone to use. These social media systems did not change the pre-existing technology available for communications and warning, but rather changed the dynamics of how communities expected to receive and engage in disaster-related information [4].

SOCIAL MEDIA, TEXTING, AND SMARTPHONES

Likewise, in 1984, a full two decades before the rise of social media systems, a Franco-German global mobile communications company developed a short message system that ultimately became known as texting. It took nearly 6 more years before an actual text message (specifically, "Merry Christmas") was sent between two telecommunication officials. It was not until 1993 that a handset manufacturer actually developed a cell phone device capable of sending and receiving text messages, as most of the initial network technology was merely to support the notification of voice mail messages. By 1997, Nokia released the first device with a full keyboard that was able not only to send text messages, but also to encourage their creation and distribution [5].

Public use of text messaging was slow in developing even after the devices contained the technological capability. For example, in 1995 the average American user sent 0.4 texts per month. By 2000, the average number of text messages increased to 35 per month per user [5]. This slow progression continued into 2006 where Americans sent and received approximately 65 messages per month. However, over the next 2 years

there was an exponential growth in the use of text messages. Specifically, by the second quarter of 2008, American mobile subscribers sent and received an average of 357 text messages per month. This figure is even more impactful when considering that those same mobile phone users only made or received 204 phone calls per month—clearly indicating a paradigm shift in how people communicate and how they use their mobile phones [6] (see Figure 1.2).

This trend does not appear to be slowing down. According to the CTIA (the wireless industry trade association) American cell phone subscribers send more than 75 billion text messages per month and average approximately 2.5 billion messages per day [5]. Likewise, of the 90% of all Americans who owned cell phones in 2014, nearly 81% of those owners utilized text messaging on a regular basis [7]. Additionally, this trend does not appear to be slowing down as younger generations maintain cell phones and utilize text messaging at a higher rate than older generations.

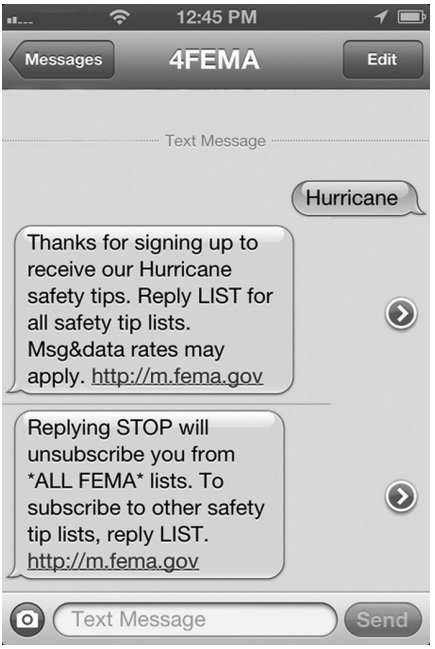

Figure 1.2 FEMA and other emergency management agencies have begun to utilize text messages to distribute information before, during, and after events. (Source: FEMA.)

For example, an average American teenager sends nearly 2,000 text messages per month [5]. This high-level adoption has significantly changed how the public expects to receive information not only from friends and family, but also from government officials before, during, and after emergencies and disasters.

Not surprisingly, the exponential rise in the use of text messaging coincides with the establishment of social media as a primary and ubiquitous tool of modern communication. As a form of two-way communication that exceeds the capabilities of broadcast systems available through traditional media forms (e.g., television and radio), social media systems have radically changed how people send and receive information on a day-to-day basis. Earlier social media systems like Friendster and MySpace started in the early 2000s and quickly grew in popularity and usage with Google attempting to buy Friendster for $30 million [8]. Unfortunately, these particular systems faded before the decade was over as more flexible and dynamic systems like Facebook and Twitter grew.

With the slight delay in development, Twitter and Facebook quickly and firmly replaced the earlier systems as the primary social media systems for the United States and then the majority of the world (see Figure 1.3). For example, according to Facebook there were 945 million monthly mobile users, 757 million daily active users, and 1.23 billion monthly active users by the end of 2013 with approximately 81% of all users

Figure 1.3 Social media systems like Facebook and Twitter have become increasingly valuable before, during, and after emergencies and disasters. (Source: FEMA/Patsy Lynch.)

located outside North America [9]. Likewise, Twitter maintains more than 645 million registered users who send 58 million tweets per day on average of which 43% originate from mobile devices [10]. These statistics are particularly impressive considering Facebook reached one million users at the end of 2004 and one billion users by September 2012 [11]. Similarly, Twitter grew from 30 million to 68 million to 138 million to 204 million active users between 2010 and 2013 [12].

In the case of Facebook, Twitter, and short-message texting, the peak in usage and users seen toward the end of the first decade of the 2000s was in conjunction with the rise in the availability and use of mobile devices. Mobile phones have come a long way since their invention over 40 years ago. The first cell phones weighed approximately 2.5 pounds and cost nearly $4,000 ($9,000 with inflation), while the most recent Apple iPhone weighed less than 4 ounces (about the weight of two eggs) and was provided for free by many mobile phone service providers [13]. While the physical changes are impressive, mobile devices have also increased in prevalence in day-to-day life. According to the Pew Research Internet Project, over 90% of Americans owned a cell phone with more than 62% of those devices being "smart" [14]. These smartphones (or other similar devices) can operate interactively and autonomously with other devices or networks through technological protocols like Bluetooth, NFC (near field communication), Wi-Fi, and LTE (long-term evolution). This connectivity allows for a push and pull of information via e-mail, social media, text messaging, operational applications, and other browser-based information. While that number dips slightly for older generations and some rural areas, it remains high in all sociodemographic categories.

Availability of these systems is merely a component of the impact of mobile devices. Because of the high portability of these devices, the widespread capability to access the Internet (or web-based sources), and simultaneous rise in communication systems like text messaging and social media, Americans use their smart devices for a variety of productivity functions including messages, Internet, using applications, listening to music, associating themselves geographically, using maps, and otherwise searching for more mundane information like weather and news. For example, according to Pew Internet, 74% of adult smartphone owners over the age of 18 regularly use their mobile phones to get directions or other information (e.g., locating restaurants) based on their current geographic location [14]. Additionally, 80% of mobile phone owners reported that they utilized their devices while watching television while another 40% reported sleeping with their phones near them to ensure they

did not miss a notification [15]. While not universal, the presence of these devices and their influence on an average person are extremely impactful with the presence of mobile phones nearly as ubiquitous as other forms of communication like television, radio, and print media.

Given the widespread use and availability, mobile phones have served to unyoke the social media and traditional communication systems from the stationary desktop computers or semiportable laptop computers to which they were previously limited. In fact, Twitter and Facebook are accessed via mobile devices by their users 60% and 78% of the time, respectively [15,16].

In Other Words...Impact of Smartphones

Over the past few years, one of the most important shifts in the digital world has been the move from the wide-open Web to semi-closed platforms that use the Internet for transport [of information] but not the browser for display. It's driven primarily by the rise of the iPhone model of mobile computing and it's a world where Google can't crawl, one where HTML [code] doesn't rule. And it's the world that consumers are increasingly choosing, not because they're rejecting the idea of the Web but because these [mobile] dedicated platforms often just work better or fit better into their lives (the screen comes to them, they don't have to go to the screen). The fact that it is easier for companies to make money on these platforms only cements the trend.

~Chris Anderson, *Wired* Cofounder [17]

ELIMINATING THE DIGITAL DIVIDE

The changes in technology have also helped create a clear and definitive bridge across the so-called "digital divide." The concept of a digital divide was first identified by the *New York Times* in January 1996 in an article called "A New Gulf in American Education, the Digital Divide," which compared the availability of computers and Internet access at two California primary schools [18]. Specifically, the article and later the broader concept of a digital divide looked at social, economic, and demographic considerations that limited certain individuals from having access to Internet-based information. To put this in perspective, the original *New York Times*

article quoted Reverend Jesse Jackson and the NAACP's Kweisi Mfume, who called the digital divide "classic apartheid" and "technological segregation," respectively [18] (see Figure 1.4). Likewise, another report from the state of Georgia entitled "A Nation Ponders Its Growing Digital Divide" reported that only 9% of American classrooms had access to the Internet [18].

The public and political attention given to the digital divide shifted significantly by the turn of the century as the concept fell out of political favor. This shift coincided with increased political support for marketplace solutions and a general acceptance of any digital divide being part of the "American Way" [19]. As the political outlook and philosophy changed, funding and support for programs founded in the late 1990s by the federal government like the National Telecommunications and Information Administration (NTIA)'s Technology Opportunity Program and HUD's Neighborhood Networks Program were suspended or allowed to fade away due to lack of funding [18,19]. This change was so definitive that the phrase "digital divide" was replaced by "digital opportunity" by the federal government in an attempt to frame the challenge and present a "blandly positive spin on all things computer related" [19].

Like many of the issues discussed throughout this book, the presence and availability of technology do not exist in a vacuum. There is little argument that since the Internet became available to the general public there is a divide between those who utilize technology and those who do not. Unfortunately, it is not necessarily limited to the sociodemographic

Figure 1.4 Civil rights leaders like the NAACP's Kweisi Mfume have referred to the technological challenge of the digital divide as "technological segregation." (Source: US National Oceanic and Atmospheric Administration [NOAA].)

issues that politicians would like to present. For example, a digital life columnist for the *Seattle Times* named Monica Guzman suggests that the digital divide is actually made up of four types of divisions based on the technological access, willingness to exchange information, digital identity, and technological creation [20].

Therefore, the first and most straightforward component of the digital divide is simply the availability of technology to the general population. As established earlier in this chapter, the presence of mobile phones in America is nearly ubiquitous with only minimal decreases based on gender, ethnicity, or geographic area (see Figure 1.5). This trend is no different when access to devices is looked at globally. For example, one study indicates that there are currently 4.3 billion people worldwide using mobile devices with that number rising to 5.1 billion by 2017 [21]. Unfortunately, the mere access to mobile devices is an inferior analysis as Guzman points out, "When it comes to prosperity under technology access is not the finish line, but [rather] the starting point" [20].

For example, a University of Washington professor named Ricardo Gomez has identified a growing trend he calls "pushback," which represents a growing tendency of some individuals with access to technology that intentionally resists or reduces their own access [21]. This pushback is not related to technological frustration or high costs as one might predict, but rather is predominantly due to emotional dissatisfaction with the needs being met by the technology. Likewise, Gomez found that other

Figure 1.5 The use of cell phones differs based on age, gender, and other socioeconomic factors. (Source: FEMA/Sharon Karr.)

reasons for this pushback were related to political, religious, or moral concerns, but not necessarily related to concerns about privacy [21].

Interestingly, the US federal government has also made a significant push at eliminating economic barriers to the ownership and availability of mobile devices. Specifically, since 2005, the US Federal Communications Commission (FCC) has applied an adjusted definition of a 20-year-old "Lifeline" program that allowed qualified low-income (no higher than 135% of federal poverty guidelines) consumers access to telephone equipment and service to support finding a job, connecting with family, and accessing emergency services [22]. By 2014, nearly 92% of all qualifying households utilized the Lifeline program to acquire a phone service [22]. Specifically, this program supports devices and services including phone calls, text messages, and data exchange, which support the full integration of mobile devices into all economic strata [23].

In addition to the availability of technology, an additional component of digital divide is the willingness to exchange information. Given the widespread use of social media and mobile devices, willingness to share information is a critical element to the future of these devices and the continued development or eventual erosion of the super digital age that currently intertwines life and society. Because of the interconnectedness of social systems like Facebook and Twitter, there is inherently an openness of information when these systems are used actively. For example, Facebook's proclaimed mission is to "give people the power to share and make the world more open and connected" [9]. This openness is intrinsically available as an exchange for personal, family, and systematic privacy. This balance of openness and privacy is not just limited to engagement in social media systems, but also often pervades third-party commerce systems like online retailers who collect data and interact with pre-existing social media networks of their customers and clients.

In Other Words…The Impact on Personal Privacy

Our unbridled love affair with all things technological has an evil twin: a seemingly unstoppable encroachment on our personal privacy. The same streaming video technology that allows grandma and grandpa to chat with their grandchildren is being used to spy on employees in the workplace or capture unsuspecting lovers stealing a kiss.

~MSNBC Op-Ed, December 2000 [24]

To put this level of sharing in perspective, more than 60 hours of videos are uploaded to YouTube every minute, which is approximately more video in 1 month than the ABC, CBS, and NBC television networks created in their first 60 years combined. Likewise, 500 years of YouTube videos are watched every day on Facebook and over 700 YouTube videos are shared on Twitter each minute [25]. This level of information sharing is also prevalent on Facebook. For example, at the beginning of 2014 the average Facebook user maintained 130 friends, and 80 connected events. Moreover, there are more than one million links, two million friend requests, and three million internal messages sent on Facebook every 20 minutes [26].

The final component of the individual's willingness to share is looking at not only the quantity, but also the type of information shared. Sharing on social media systems can include a variety of documentary information (e.g., photos), but also very specific and personal types of information. This shift toward less privacy and more openness is no more evident than looking at how teenagers are utilizing these systems. For example, Pew Internet found that 71% of teenagers post their school name and city or town where they live, 53% post their personal e-mail address, and 20% post their cell phone number, which are all significant increases over the last 5 years. Additionally, 82% of teenagers posted their real birth date and name, 62% reported their relationship status, 24% posted personal videos of themselves, and 16% automatically post geolocations for individual messages or activities [27].

Interestingly, this collective shift toward increasing openness and corresponding transparency is not limited to information about an individual and/or his or her friends. Specifically, there is a growing desire for ad hoc transparency—particularly in government—for all types of information including financial, governance, and public safety data. When this expectation is not fully addressed, it puts secured information and data at risk. For example, former National Security Agency (NSA) analyst Edward Snowden and Private Bradley Manning (see Figure 1.6) both illegally released classified files from various government agencies including the NSA. While Manning was convicted of crimes under the Espionage Act and Snowden has been granted international asylum from extradition to the United States, both of these individuals have received significant support from the broader online and social system community. In particular, Snowden's philosophy is the most enlightening to understand the broader philosophical shifts in regard to the prevalence of share information, its impact on those engaged in an open community, and what

Figure 1.6 Some individuals, like former US Private Bradley Manning, have illegally released classified files from various governmental agencies. (Source: US Army.)

responses have begun to be normalized within society. Specifically, Snowden claimed during a series of interviews, "I'm willing to sacrifice [my former life] because I can't in good conscience allow the US government to destroy privacy, Internet freedom, and basic liberties for people around the world with this massive surveillance machine" [28].

In Other Words…Privacy in the Big Data Era

It isn't just privacy that is at risk in this new era of Big Data collection. Secrecy is a casualty too. It used to be classified documents were kept in a safe and seen by a select view. Now a top secret document can be accessed by hundreds, if not thousands, all with the click of a mouse.

~NPR's All Things Considered, June 2013 [29]

DIGITAL IDENTIFICATION

The third leg of the digital divide is the growth and development of a digital identification that is unique and special to each individual user. Identity is the collection of characteristics which are inherent to a respective component or intentionally or arbitrarily assigned by collective groups [30]. In the real word, names, gender, race, and ethnicity are examples of common identification strategies applied to and understood by large groups of people. This collection of characteristics impacts interactions due to natural and inherent associations which are created during exchanges—whether organic or commercial. However, digital information and related digital transactions lack those physical characteristics and associations as fundamentally the data are simply bundled packets of information [30].

That is not to say that social media users do not maintain systematic identification in digital environments. In the early days of social media, this identification was limited to the individual systems that created personal information (e.g., name and passwords) to allow specific and targeted use of that particular system. While this approach is still widely utilized as new or modified systems are added to the multitude of social media and digital systems, there are the beginnings of a unification of these system identifications. Specifically, Facebook's Open Graph system allows for a personalization that is socially based, but also connected to other sites and/or third-party digital information providers to provide personalized and interconnected experiences. For example, individuals reading news stories, shopping online, or listening to music are now connected, which allows instantaneous feedback from trusted sources, immediate conversation, and crowdsourcing of related or tangential information [31]. While many other single sign-on systems are leveraged within enterprise approaches, the socially based versions are mostly based on the Facebook system or through Google's similar connectivity.

The digital identification necessary to bridge the so-called digital divide is not limited to the technological pieces of identification. It also relates to how individuals perceive themselves in a world filled with social media systems, mobile and portable technological devices, and a growing trend toward increasingly more information sharing. However, if the availability of information and devices is not convincing, the presence of these systems and devices during situations where information is not critical clearly indicates that people identify their existence with the ability to access and process information this way. For example, a 2013 Jumio survey found that 72% of Americans say they

are within 5 feet of their smartphones the majority of the time, which allows them to regularly use their devices in movie theaters (35% of the time), during a dinner date (33% of the time), at a child's school function (32% of the time), in the shower (12% of the time), and even during sexual activities (9% of the time) [32]. There are no other technologies over the history of time that have had the level of integration and prevalence not only throughout society, but also in the day-to-day lives of their users.

The final component of the modern digital divide is related to ability of an individual to create and manipulate data within these social media and digital systems. Pew Internet refers to those who actively and routinely engage in social media systems as creators, curators, and power users. Specifically, 46% of adult Internet users are creators who post original photos or videos on social media systems. This contrasts to the 41% of adult Internet users who repost photos that were found online or shared with them on social media systems. Overall, 56% of all users were either a creator or curator and 32% of users engaged in both creating and curating activities [33]. Likewise, most Facebook users get more from their friends on Facebook than they give. This phenomenon occurs because of so-called power users who contribute much more than an average user. According to a recent study, between 20% and 30% of Facebook users (depending on activity) were designated as power users due to their much higher daily or weekly engagement. Moreover, these power users are often specialized in a particular activity like sending friend requests, pressing "like" buttons, and tagging friends in photos [34].

This manipulation of data is certainly not limited to Facebook. Similar scenarios occur on Twitter, YouTube, Instagram, and many other social media systems. Likewise, there are many early adopters of digital devices who are willing to wait in long lines and pay premium prices to purchase cutting-edge technologies (e.g., new iPhones). These early adopters of technology are often described as forward-leaning and adventurous consumers; however, they do play a vital role in the growth, implementation, and later integration of technology into broader society. Specifically, they test systems as individuals and crowd collectives to identify strengths and weaknesses and begin to create interest and energy in later adopters. To technology adopters, this process is established through a higher competency of system interaction, acceptance and use of new systematic language, and the creation of so-called cultural capital where people embrace the early knowledge and understanding that comes from early adoptions [35].

Even though traditional research has indicated that only 13.5% of technological consumers are actual early adopters, a recent Harris Interactive poll found that nearly 56% of surveyed adults identified themselves as an early user and adopter of technologies [35,36]. This phenomenon is related to the fact that "the Internet has democratized the culture of early adoption…[so that] being first is no longer reserved for diehard fan boys" [36]. What previously was a relatively steady distribution between early and late adopters has now been flattened with the increase of early adopters of emerging technologies. This shift toward early or first implementers is contributing to addressing this component of the digital divide.

IMPACTS TO EMERGENCY MANAGEMENT AND RESPONSE

Widespread access to the Internet and nearly ubiquitous exchange of information via social media systems and mobile devices have clearly changed when, where, and how people access information. However, this change in the access and exchange of information does not necessarily change any cultural, ethical, or societal norms within given communities. Understanding this dynamic is important to understand how social media and other emerging digital technologies have impacted previous disasters and how they may progress in the future.

In Other Words…Changing Human Nature

While the internet may be changing the way we organize our thinking, and while it is changing the way we organize our relationship with one another, it certainly does not change basic human nature… [but] good and evil…will play out in new ways.

~Former Vice President Al Gore, *The Future: Six Drivers of Global Change* [37]

The influence of social media on disasters and emergency management has a short history. With the establishment of most active social media systems in the mid-2000s (e.g., Facebook in 2004) and the

meteoric rise in popularity and growth, the impact of social media and digital systems can be broken down into three phases: public usage, nongovernmental organization (NGO) usage, and governmental usage. While there is some overlap in these phases, these roughly represent the states of consideration, use, adoption, and eventual acceptance of social media systems within disaster preparedness, response, recovery, and mitigation.

The first phase of how social media systems impacted disaster was simply the public usage. Starting as early as the London bombings (2005) and continuing up to and including the Mumbai terrorist attacks (2008), early adopters of social media systems like blogs, Facebook, and Twitter began to post timely and poignant messages and content (e.g., photos) to share disaster-related information. For example, in 2005 during the bombings of the London underground system, active bloggers posted pictures and first-hand accounts that quickly undermined official government reports that the explosions were not acts of terrorism, but instead were caused by a utility system failure. Likewise, in 2007, students utilized social networking sites to confirm the names of all 32 victims of the Virginia Tech campus shooting before any confirmation from the university was provided to the general public. The last major event in this phase was the 2008 terrorist attack in the financial district of Mumbai, India. This event represented the first time documentation about an emergent event was first reported on Twitter rather than on traditional or cable news networks [38]. In all three cases and in similar events, the use of social media systems was solely by citizens. Formal volunteer groups and government entities more often than not ignored these complications or merely reacted retroactively to the implications presenting themselves.

While this level of public involvement in social media systems has only continued to increase, the next phase of utilization was the application of social media and related digital systems by organized and spontaneous groups of volunteers. For example, events such as the Haiti earthquake (2010), the EF-5 Joplin, Missouri, tornado (2011) (see Figure 1.7), and the response to the widespread Alabama tornadoes (2011) were groundbreaking in presence of social media within volunteer systems. For example, groups like CrisisCommons, Mission 4636, and Ushahidi (among others) brought together volunteers from around the globe through digital systems. This rise of crowdsourcing happened again in Joplin and Alabama and has become a common occurrence in most significant emergent events [38]. The significance of this change is that emergency management has traditionally depended on geographically dependent volunteers

Figure 1.7 In response to widespread damage like this from the 2011 Joplin, Missouri, tornado, there was widespread use of social media to provide supplementary support to formalized systems. (Source: FEMA/Jace Anderson.)

that have a natural and organic connection to the impacted community. However, with the rise of social media, this dependency on local resources and all related challenges are now altered.

Unfortunately, government's use and acceptance of social media usage before, during, and after disaster were the last to develop. However, this began to change as early as the earthquake and tsunami in Japan that lead to the Fukushima nuclear facility meltdown in 2011. During this event, social media was utilized by citizens and volunteer groups, representing one of the first major events that governmental operations specifically promoted and utilized social media as a primary communication system. Specifically, within 24 hours of the earthquake striking off the coast of Japan, the US Embassy in Tokyo released a message encouraging Americans in the impacted area to use social media, Google Person Finder, and cell phones to access and share critical information with friends and family in the impacted area and throughout the world [39]. This type of application was repeated during Superstorm Sandy in 2012 when nearly all impacted local, state, and federal emergency management agencies utilized social media to send, receive, and process information during the event.

This short history of social media and disasters is moving at a quick, but predictable pace especially considering that individuals throughout

the world have utilized systems for personal use and have leveraged them during a disaster. This includes the systems that impact them personally or the broader community they are engaged with. However, the simple exchange of formal and informal information on social media systems is not the limit of their impact to professional emergency management and response professionals. These additional issue impacts are broad in scope, but mostly relate to operational support, intelligence gathering, and resource availability and management.

OPERATIONAL SUPPORT AND INTELLIGENCE GATHERING

The first emerging characteristic is the impact of social media and digital technologies on operational support systems. In most historical examples, social media monitoring and support have been assigned to public information groups to monitor and distribute official information. Unfortunately, traditional and national incident management systems like the Incident Command System (ICS) and National Incident Management System (NIMS) have difficulty integrating social media (and all of its implications) into best-practice management systems that were developed well before social media became functional to use before, during, or after a disaster. Consequently, review and approval of information is often a time-consuming or organic process that may or may not be effectively utilized for social media. Likewise, it is rare for operational specialists to effectively aggregate, analyze, and apply information or intelligence provided via social media channels. As established earlier in the chapter, nearly every emergent event will generate social media information critical to all phases of response including injuries, fatalities, damage assessment, infrastructure damage, and many others, and it is certainly not limited to public information.

However, these challenges also present unique opportunities to improve response systems if social media information can be leveraged appropriately. For example, many regional, state, and international emergency management organizations are adopting a model developed in 2011 called the virtual operations support team (VOST). Much like the emergent volunteers that rose in prominence after the earthquake in Haiti, the VOST uses non-geographic-specific volunteers in an organized and controlled fashion to supplement local operational resources. This group is then dedicated to the monitoring, aggregation, and application of social

media information. These VOST groups integrate into operations centers or command groups at the will and direction of the impacted area. This is a potentially tremendous benefit to the resource-challenged impacted community and should significantly improve the information and intelligence available during disasters. While VOST is not the only model, the future clearly dictates that social media must be harvested for information just like any other source of information to ensure the efficient and effective application of resources during events.

In addition to the significant potential for operational readiness and intelligence improvements, digital technology systems also improve the resource redundancy to local response agencies. For example, cloud-based systems allow for a significant increase in the reliability and restoration of essential functions within the organization or community. For example, in the past critical computer files would have been maintained locally or at best in a locally maintained data center. While these systems can maintain duplicate records or files, the recovery sites are often localized and device based (e.g., tapes or drives), which leads to increased vulnerability to localized events and hazards as well as delayed recovery processes. In contrast, cloud-based solutions inherently address some of these issues through multiple off-site nonlocalized data recovery sites that can quickly be accessed via online systems and mobile devices and are not impacted by local events.

While cloud-based solutions are underutilized by most professional emergency management organizations, they are widely leveraged by businesses and emergent volunteerism groups as the threshold to utilize is much lower and the benefits are significant. As cloud-based solutions continue to increase in use and prevalence, the financial and operational efficiency will be too much not to apply before, during, and after disasters. For example, it is highly likely that all operational computer systems (e.g., incident management systems, emergency notification systems, etc.) will shift away from software or server-based protocols toward off-site cloud-based management options. Likewise, some organizations, like the VOST groups discussed earlier, actively utilize cloud-based document generators (e.g., Google Docs) to conduct simultaneous and real-time editing by multiple users. This type of functionality is not often utilized by emergency public information or operational functions in emergency operations centers (EOCs), but will quickly become commonplace as comfort levels with these tools increase within response communities.

Although unlikely to occur as quickly as data management, fundamental office tools such as word processing, spreadsheets, and basic data