CHAPTER 12

TECHNOLOGY AND PUBLIC MANAGEMENT INFORMATION SYSTEMS

Where We Have Been and Where We Are Going

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Those who cannot remember the past are condemned to repeat it.
George Santayana, U.S. (Spanish-born) philosopher (1863–1952), in
The Life of Reason, vol. 1 (1905)

Over the past fifty years there have been huge changes in both information and telecommunication technology. With each major change, social scientists, management scholars, and public administration researchers have made a number of bold predictions about how each new technology would lead to sweeping changes in public organizations' structures and processes. Despite these claims, many of these predictions today remain unrealized. For example, in the 1950s many scholars suggested that new information technology (IT) would flatten organizational hierarchies and dramatically eliminate middle management (Leavitt and Whisler 1958). More than fifty years later, while we do see more diverse organizational structures, large hierarchical structures still persist and to some extent dominate, generally and particularly so in government.

In the 1980s scholars developed a more contingent perspective on the role of information technology in organizations. As one major textbook from the period notes, "Contemporary research also recognizes that organizations have a great deal of control over the impacts of systems on structure. Important groups in the organization determine, either consciously or unconsciously, what kinds of impacts on organizational structure will occur. Organizations can decide to centralize or decentralize power" (Loudon and Laudon 1988). This perspective suggested that technology does not ultimately drive the changes but rather enables new forms and approaches. Once enabled, these forms and processes are ultimately pushed into being through management action (King and Kraemer 1985; Stevens and LaPlante 1986; Kraemer, Dutton, and Northrup 1981).

Yet such lessons once learned are not always maintained. As the Internet began to dominate our experience, many again claimed that new technologies would lead us inevitably to new forms and processes. Terms such as *e-commerce* and *e-government* were coined along with claims that technology could enable direct democratic practices to replace representative institutions. Once again, ten years later we see change, but most large national governments still maintain large hierarchical structures, physical offices, and representative democratic institutions. We do not claim that new technology cannot lead to important changes but rather that the more reasoned models of management action, institutional forces, and the enacted-technology (Fountain 2001) perspective provide a better framework for prediction.

We proceed by first critically reviewing the various theories of how technology changes relate to institutional, organizational, and procedural change. This is followed by a historical review of changing technology over the past fifty years. This review identifies the major shifts and trends that have occurred with regard to both information and communication technology. The fourth section of the chapter provides a series of propositional predictions of how we see these trends working through preexisting government relationships based on preexisting institutions. We end the chapter by summarizing where we see the future potential of IT on both the structure of government organizations and management.

THEORETICAL FRAMEWORKS

As suggested in the introduction, there are a number of social science theories that attempt to explain the relationship between technological change and social, political, and economic institutions. We consider two broad groupings of theory. Diffusion and adoption theory form the basis for our understanding about mechanisms of technology transfer, which in turn help us to understand how new technology spreads and becomes visibly present. In the context of IT, these theoretical lenses help us to understand, for example, why new products and services, such as mobile phones, online purchasing, and entertainment services, or information services, such as Twitter, Google, and Wikipedia, quickly diffuse and become heavily used. The second broad set of theoretical lenses come mostly from sociology and consider how these new products and services work their way into institutional arrangements, organizational structures, and processes. We end this section with a discussion of how their models inform our understanding of information and communication technology's effect on government.

Adoption and Diffusion of New Technology

Two broad theories form the basis for most of our understanding of how new technology spreads. The first one, diffusion theory, describes aggregate phenomena and derives from the theory of contagion applied to disease process as early as the eighteenth century (Mahajan and Peterson 1985). The core explanation embedded here is that as individuals adopt something new (or contract a disease), when they come into contact with others, they communicate their experiences about the innovation (Coleman, Katz, and Menzel 1957; Strang and Soule 1998). This process of communication spreads the idea and increases the number of new adopters. The classic S-shaped curve used to explain cumulative adoption over time develops as the new idea spreads through a fixed population. Elements of the process that affect the speed of adoption typically include the nature of the innovation, the nature of the channels used to communicate the innovation, and characteristics of the members of the social system who consider individual adoption (Rogers and Shoemaker 1971; Rogers 2005). A number of enhancements to these models have also been considered that include economic variables such as price. These models have successfully explained numerous specific IT and telecommunication technology diffusions (Grajek and Kretschmer 2009) as well as aggregate diffusion of IT (Gurbaxanai and Mendelson 1990).

The second theoretical framework that informs our knowledge about technology transfer focuses on the decision-making process of individuals and groups with regard to new technology. Here, the unit of analysis switches from the aggregate number of adopters at a specific point in time to the individual or organization. Adoption models can be dynamic to look at the adoption process over time, though in many cases data are a simple cross section of cases at one point in time. These models typically focus on organizational and economic factors that

affect adoption. Bretschneider and Wittmer (1993) applied this framework to explain greater adoption rates by public organizations than by private firms of comparable size, prior experience with computer technology, and overall investments in IT. Moon (2002) applied concepts from diffusion theory and organizational characteristics of local governments to explain adoption of e-government by U.S. local government. In a follow-up work by Norris and Moon (2005), the authors found that local governments were rapidly deploying e-government Web site applications, but in most cases these applications did not reflect any major organizational or procedural transformation in how local government conducted their operations.

The net result from applying diffusion and adoption models to each new wave of IT over the past forty years paints a somewhat consistent picture. Over time government organizations adopt new technology such that the pattern over time follows the classic S-shaped curve. The speed at which adoption occurs is affected by organizational characteristics but probably more so by general economic factors such as availability and price. Even small local governments make use of personal computers the way typewriters and filing cabinets systems were the core technology in use sixty years ago. A similar case can be made with regard to Internet and Web technology, though it is certainly not as ubiquitous across all levels or government as are personal computers. As with personal computing, cell phone technology and Web sites, diffusion through all levels of government is inevitable, but its form, level of use, and impact are not.

Models of Technological Change

Clearly, diffusion of technology is necessary but not sufficient for institutional and organizational change. Thus, we need to consider theories of how technological change affects organizational and institutional change. Garson (2006) summarizes four generic theories of how technology leads to change: technological determinism, reinforcement theory, sociotechnical theory, and systems theory. Technological determinism takes the view that technology is an "unstoppable" force that will refashion the world regardless of how human action manifests itself. Reinforcement theory, by contrast, focuses on preexisting institutions and organizations, which then shape and adjust how technology will manifest, typically in support of the status quo. Sociotechnical theory suggests that neither technology nor preexisting institutions matter, but that individuals may shape technological systems to their needs through design. Finally, the systems-theory approach transforms organizations through technocratic applications led by technicians.

Garson (2006) organizes these models into a factor-environment matrix to illustrate how each theory views the role of the environment on outcomes from the change process and the relative importance of technology versus human factors in producing the change (see Table 12.1).

The sociotechnical and reinforcement approaches tend to be human centered, with reinforcement theory suggesting that the preexisting environments into which the technologies emerge are overpowering forces. In a similar fashion, technological determinism views the environment as determining the outcome but in this context through the overpowering influence of the technology not the human institutions. Finally, systems theory, like sociotechnical theory, suggests that the environment does not determine the outcome but that technical expertise can refashion institutions and organizations. While Garson (2006) suggests that none of these models are an explanation, each contains an element of truth. The two competing dimensions of this analysis ask to what extent humans and technological forecasts drive change and to what extent these forecasts freely affect the nature of the changes produced. To some extent these dimensions parallel the ideas from structuration theory (Giddens 1984) and the role of structure and human agency. Work by DeSanctis and Poole (1994) and Orlikowski (2000) have adapted this framework to relationships

Table 12.1

The Factor-Environment Matrix

	Environmental Determinants	
Technology Factors	Unconstrained	Constrained
High-technology	Systems theory	Technological determinism
High-human	Sociotechnical	Reinforcement

Source: Based on Garson 2006: 7.

with IT. Finally, Fountain's (2001) technology enactment model also attempts to balance the role of structure and human agency to understand the process by which IT changes institutions and affects organizational outcomes.

The bottom line from this review is that the diffusion process spreads technology, but preexisting structure and human actions affect the final impacts and potential from these changes.

Once organizations have adopted a new technology, how it is used and its extent of use matter. In the private sector, the introduction of personal computing in the early eighties took at least a decade to begin to evidence economic gains (Dedrick, Gurbaxani, and Kraemer 2003). In the public sector, our ability to assess IT impact on final outcomes has been and continues to be significantly more difficult. Diffuse property rights, diffuse power and decision-making authority, and the use of political processes instead of markets lead to more complex decision processes with mixed incentives. Thus, the decisions to obtain new technology and to acquire consulting services to implement that technology are influenced by a complex mix of criteria. For example, Ni and Bretschneider (2007) found that U.S. state governments applied a complex mix of economic and political rationales in contracting out over a wide range of e-government services. Thus, economic gains in cost savings are not the only outcome associated with government investment in IT. The nature of the decision process in turn affects the potential use and impact of technology. Since economic gains are not the only expected outcome for adoption and use, different outcomes are expected and indeed occur. Other important decision criteria and concerns include but are not limited to equity of service, quality of service, and capacity to promote future economic development or business growth and to increase political participation.

The main conclusions from this analysis are twofold. First, normal adoption and diffusion processes push each new wave of technology into government. Clearly, organizational characteristics such as size and resources affect this process. Large, better-resourced governments tend to adopt earlier than small and poor ones. New technology and its diffusion through government provide the potential for simple, complex, minor, and major change in organizations and institutions, but they certainly do not guarantee them. Nevertheless, each new wave of technology penetrates and is then adapted to functional purposes within government. The second conclusion is that the process by which the adopted technology is adapted to government organizations involves a form of structuration process where preexisting structures and human agency interact to determine the form and use of the technology. Bozeman and Bretschneider (1986) provide a general framework for differentiation of public from private sector organizations in this regard, but certainly other important differentiating features are level and form of government, function, size, and culture. In order to develop a set of predictive propositions, though, we must examine the historical trends and impacts of technological change in both information and telecommunications.

HISTORICAL TRENDS IN INFORMATION AND TELECOMMUNICATIONS TECHNOLOGY

Over the past sixty years, organizations have experienced a number of changes in both information and communications technology. It is useful to organize these into a series of eras or waves around which central characteristics of the technology enabled different approaches to utilizing IT and communications systems in support of organizational operations. Table 12.2 attempts to organize these into five overlapping time periods and identifies six key characteristics around which clear trends emerge. It should be noted that while each of these five eras has a central ethos, many of the technologies and effects carry forward so that even today, large, complex, centralized computers are used, computerization of noncomputer processes is still a major focus for organizations, and e-mail is still a major form of communication.

The earliest introduction of computing into organizations is reflective of the preexisting structures and institutions and the nature of the technology itself. Large complex computers required specialized knowledge to operate and organization structure at the time reflected the principles of work specialization. Thus, analytic specialists in finance and human resources were the principle users of computer-generated information, and the systems to provide that information required specialized systems-analytic and computer technology skills. Most applications focused on converting paper systems into more automated versions. Communications systems remained separate from computing technology.

Two technical changes emerging in the late 1960s led to a new IT approach in the 1970s. First, smaller computers dubbed minicomputers were being developed. These smaller and less expensive machines in comparison to mainframes accelerated the diffusion process and led to more and more adoption and use of computer technology by smaller and smaller organizations. Second, the nature of the human interface with computer technology changed to what at the time was referred to as multiprogramming operating systems. These new operating systems, which eventually were applied to large mainframes as well, allowed direct terminal interaction of multiple users at the same time through one computer. Along with these changes, the level of technical expertise required to interact with computers was declining and training programs were reaching more and more people. This new arrangement broadened the base of end users to include substantive analysts and managers. It increased the variation in types of applications. Early types of data-analysis applications emerged that supported managerial decision making. During this era, the idea of database management systems emerged as a tool for unifying all data resources for an organization. Database management systems provide an instructive example of many of the points made earlier about diffusion and institutional change. Even today most organizations have not fully integrated database management systems as they were conceived of theoretically. The concept reemerged under a different name almost twenty years later, data warehousing, but continues to run into significant real organizational constraints in implementation. For example, compare Martin's (1976) definition of database management systems with Kimball and Ross's (2002) definition of data warehousing. Finally, the multiprogramming systems provided a critical new application, e-mail, which began the slow but continuing process of convergence between information and communication technology.

The advent of microcomputers in the 1980s was another major shift in computer technology. The development of local area networks and early wide area networks continued to accelerate the process of diffusion and adoption of computer technology by both organizations and individuals. Home computers, mostly for entertainment, further broadened the end-user base and diffusion of general knowledge on the nature of and use of IT. Within organizations, the dominant user group was more and more managers, and applications more and more served to support data analysis and managerial decision making. The research literature introduces concepts such as management information systems and decision support

Table 12.2

Historical Waves of Information and Communications Technology

Era	Central computer ethos	End user	Development process	Data/Data collection process	Effects	Communications
1950s–1960s	Central mainframe	Analysts	Professional system analysis	Transactions/File systems/Existing data collection systems	Automation	Mail, phone
1970s–1980s	Central timeshare	Analyst/ managers	Professional systems analysis/End users	Transactions/File systems/Existing data collection systems	Automation	E-mail
1980s–1990s	Minicomputer, LANs	Managers	End-user development	Multiple data types/ Database systems and GIS/New collection systems	Automation/ Decision support/ Organizational change/Personal computing in the home	E-mail
1990s–2000s	Internet	Managers/ Citizens	End-user development	Multiple data types/ DBS-GIS/Electronic sensing collection	Decision support/ Organizational change/Citizen participation/ Mobile computing	E-mail, cell phones, IM, listserves
2005 and beyond	Internet, Web 2.0, mobile devices	Citizens/Cross-organizations	End-user development	Citizen data entry/ Inter- and Intra-agency data exchange	Citizen participation, Democratization/ Transparency, Collaboration	Online social networking platforms

systems to support the idea that IT systems were for more than just automation. Many of the software systems available during this era permitted the end user to be the actual developer of the application. The broadening base of computers and growing access to networks further increased the use of e-mail. This was also the era when third-party network service providers emerged.

Interestingly, the fourth era was less about introducing any major new technology and more about increasing quality and performance and reducing cost for personal computing and network systems. The main changes in the 1990s were enhanced Internet systems with huge growth in bandwidth, reduced cost to personal home computing, and the rapid diffusion of mobile phones. All of these changes made e-mail almost ubiquitous across the work and home environments. They also permitted the development of n-way communication systems such as instant messaging. The further convergence of IT and communications technology led to the development of handheld phone-Internet-computing devices. One of the major outcomes from all these changes was the capacity of an organization to make use of IT through the Internet as a basic means of interacting with individuals. In the context of government organizations, this meant citizens who act as both indirect policy makers and direct service recipients. It was in this era that the concepts of e-government, e-democracy, and e-participation emerged. Looking at four of the categories identified in Table 12.2—computing, software, communications, and data—we can track under each a major change process or trend. Under computing we have moved from centralized blocks of computing capacity within organizations to an extremely decentralized computing environment.

The fifth era can be identified as an extension of the use of Internet within and across government and, more important, to its citizens. Using mostly free and open-source social networking platforms, government agencies are beginning to explore the use of so-called Web 2.0 tools (O'Reilly 2007). We define *Government 2.0* as the use of social media applications to increase participation, transparency, and interagency collaboration in the public sector. Prominent tools are, among others social networking platforms, content creation and sharing tools, Weblogs, and microblogging tools that allow for a bidirectional information exchange within governmental organizations and in governments' interactions with citizens. The main difference from previous e-government Web applications is a higher degree of interactivity as well as content production by both government and citizens (Cormode and Krishnamurthy 2008). These new technologies are being used both internally and externally to target Internet-savvy citizens and can reach users who are not using the traditional ways of interacting with government. The U.S. General Services Administration has signed prenegotiated agreements with social media providers, so that agencies can use the services for free to reach out to citizens (Aitoro 2009).

Even though the underlying technology itself is not new, the recent increase of social media applications can be attributed to their ability to support social networking needs of individuals whether they are citizens or public sector employees—people have the need to share success stories as well as report negative events in order to receive emotional support. The direct and quick feedback circles on social networking sites create a form of social justification that exists in the offline world typically through face-to-face interactions (Boyd and Ellison 2007; Joinson 2008). Younger employees also provide increased pressure for government to implement social media applications in the same way previous generations pushed for e-mail. Demographic shifts will change the makeup of the government workforce as baby boomers retire and are replaced by a younger generation with a high level of familiarity with these new technologies plus a lower threshold for exposing themselves on the Internet ("digital natives"; Liikanen, Stoneman, and Toivanen 2004; Palfrey and Gasser 2008). In addition to these psychological traits that support the use of social media applications, part of the current success of tools such as Twitter or Facebook can be attributed to a relatively high degree of technological literacy—so-called *slack capacity* within society to use social media applications for private purposes (e.g., sharing pictures or videos, writing Weblogs).

With most households operating one or more personal computers and the wide-scale use of mobile phones with direct access to the Internet, we expect a future where most individuals have immediate access to some computing capacity. Trends in software also make it possible for even relatively low-skilled individuals to create their own software applications and to make use of newly developed applications by others as they become available (see, for example, BlackBerry or iPhone applications for constant connectivity). In a world where each individual has computing capacity, has access to software applications, and is networked, mobile phones and the Internet allow individuals immediate communication to all other individuals and organizations. Similarly, this type of decentralized computing, access to software, and networked communications allow organizations to have immediate access to all relevant individuals and information sources. Finally, all of these trends also lead to major changes in both data capturing and data retrieval. Each individual (e.g., citizen) may now act as an input source of data about himself or herself, others, and their environment. We see this in the increasing ability of citizens to report events as they happen, including but not limited to fires, crimes, and traffic accidents (Ovide 2009; Gillmore 2006).

Embedded in each of these trends are some significant potential problems, particularly for government organizations. Problems of *standardization* and *integration* occur as market-driven diffusion of these technologies generates significant heterogeneity in hardware, software applications, and communication protocols. Unlike firms, government cannot target citizens but rather must typically deal with all individuals. Thus they will face higher variation than any business in just providing access or services. *Security* is a problem across all of these areas as well. Privacy issues faced by government are also more complex, as in most cases there exist statutes and rules not faced by business (Flaherty 1979). Another major problem faced by these new arrangements is best defined as increased *volatility in attitudes* and preferences of citizens. Constant and immediate access to information can lead to rapid but short-term changes in attitudes and behavior that can be problematic (Baird and Fisher 2005–6). The recent swine flu outbreak provides an example of how misinformation is spread as easily as information in this new environment (Morozov 2009; Sutter 2009; Wildstrom 2009). Such effects are well-known and systematically exploited to manipulate opinions and attitudes. Another problem that derives from this new environment is increased *fractionalization of groups* into smaller and smaller subdivisions with regard to preferences for public goods and services. This process increases the transaction costs required for generating equilibrium solutions over which public goods are to be provided. It also opens the Internet as a platform for mobilization and activism for even the smallest and most radical groups (such as terrorists; Chen, Thoms, and Fu 2008), as well as presidential campaigns (Noyes 2007).

Finally, and maybe most problematic, are issues of *aggregation of preferences.* Preferences for private goods and services are separable so that they are easily aggregated, but this is not true for preferences for public goods and services. An individual may highly value national defense and the environment but be faced with choices from a small set of political representatives whose preferences do not match those of the individual, leading to compromised decisions. Breaking individuals into smaller and smaller groups compounds the problems of political aggregation of preferences and makes equilibrium harder to find and less stable over time.

PREDICTIVE PROPOSITIONS FOR THE FUTURE DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGY IN GOVERNMENT

E-government is at an early stage of implementation and has not yet proven itself. Moreover, performance metrics to predict cost savings are difficult to evaluate (Moon 2002). According to West (2004,

2005), e-government initiatives have the possibility of enhancing democratic responsiveness and support the public belief that government is effective, although, at this point, it is unclear if investments in e-government have the potential to transform service delivery and public trust in government. While there are examples of very creative use of e-government applications in the public sector, there are also reports of failures, and we lack evidence to support the claim that the use of technology for service delivery truly results in less bureaucracy and increased service and information quality (Hazlett and Hill 2003). Clearly the current impacts are both uneven and not well understood. Nevertheless, in this section we provide some predictive propositions for the future development of technology use in the public sector and some of the conditions that support the trends we currently observe.

Proposition 1: Trends Will Force Major Changes to the Information-Sharing Paradigm of the Public Sector

As noted in our discussion of historic trends, new information and communication technology emphasizes improved communication through more diverse and broader channels of communications. This increases the potential for both individual and organizational communication across boundaries though a series of mechanisms. First, all types of costs are dramatically decreased: technology costs, human resource costs, and capital and operating costs. Second, greater contact with citizens increases demand for more integrated responses from any given government agency to include relevant information from other agencies. Dealing with the Social Security Administration often increases demand for information about taxes and health benefits, for example. The integration of the technology at the individual level, available 24/7, will continue to merge and blur personal and professional activities, creating even more demand for information sharing within and beyond government organizational boundaries.

A good example is found in current changes associated with homeland security. Supported by specific events, such as the 9/11 terror attacks, and a series of laws, government agencies have shifted from a need-to-know mentality of the cold war era to a need-to-share information paradigm. The urgency to improve information sharing before and after 9/11 resulted in laws and regulations, such as improvements to the Freedom of Information Act (U.S. Department of Justice 2008), the Information Sharing Strategy of the Intelligence Community (U.S. Office of the Director of National Intelligence 2008), or the Knowledge Management Act of the army (U.S. Army 2008). New technologies and the way that people have used the technology have forced government to rethink how to store and share information. While implementing some procedures and allowing social media tools to be applied within hierarchical and bureaucratic command-and-control organizations, government agencies will quickly bump up against various organizational boundaries and will have to be sensitive toward structural and institutional challenges as well as legal and cultural constraints.

Proposition 2: Increased Transparency and Accountability Lead to Political Authority

With the introduction of several new forms of sharing data created within government, we predict a higher degree of *transparency* and *accountability.* Currently citizens have had to file a Freedom of Information Act request to get access to information government agencies are producing. The Open Government Initiative of the Obama administration has led to several new transparency applications that include tracking of stimulus-package money on recovery.gov, as well as sharing of nonsensitive data produced in government agencies on data.gov. Citizens were asked to participate

in online contests such as "Apps for Democracy" (iStrategyLabs 2008) in Washington, D.C., and "Apps for America" (Sunlight Foundation 2009) to create innovative social media applications using the data provided on both Web sites. Clearly a precondition for these approaches is direct access by citizens to government data. For example, one application under "Apps for Democracy" accessed city contracts and their dollar values to various vendors (iStrategyLabs 2008). These examples show the potential for increases in accountability that are possible, but more important, having more and more citizen access to information and communication technology at all times increases the demand for access to government held-data. Besides this positive development of sharing governmental data with the public, it seems necessary to move beyond the mere display of raw data in order to create an even higher degree of transparency. The general public probably doesn't have the tools and capabilities to fully understand and digest machine-readable data but needs easier-to-understand and more useful displays and visualizations of data along the lines of Google Flu Trends (Google 2008). Third parties such as Google, and other information service organizations, including NGOs, will also fuel this increased demand and help to track and report public information.

Proposition 3: Increased Width and Breadth of Communication Channels for Public Participation and Inclusion

Social media shows the potential to support increased *public participation* and *inclusion.* Citizens can now directly connect through a collection of diverse Web 2.0 applications to government agencies as outlined on USA.gov (U.S. Office of Citizen Services and Communications 2009), or submit their questions for the president to "Open for Questions" (White House 2009). Moreover, citizens can rate the submitted questions to highlight the urgency of a topic area, thereby potentially influencing the public agenda. The president addresses these questions, in Internet town hall meetings, blog posts, or weekly YouTube addresses. This two-step process of submission and rating has the property of creating a semi-automated ranking of the vast amounts of submitted questions, though it creates serious issues of selection and bias in the rankings. As opposed to the traditional condensed form of press releases, the social media content may be accessible to a broader and potentially different audience. Especially during crisis situations or public agenda–building processes, social media applications have shown their strength at mobilizing citizens: The Iranian election in 2009 showed that even when a government decides to block all news and communications channels, social-networking platforms and text messaging have the potential to supplement or even replace traditional news channels. Moreover, in situations such as natural disasters—the 2008 earthquake in China, for example—social-networking services gave citizens onsite reporting tools to broadcast their need for help live on YouTube, Facebook, and Twitter. Major news sites received their information through these channels instead of formal press releases or government information channels. In previous years, government officials needed days or weeks to understand and publicize disasters in distant and mostly disconnected parts of the country.

The more public officials use social networking technologies, the more they are also exposed to the public and at the same time change who is involved in the public agenda–building processes. For example, during the 2007–8 presidential campaign, then candidate Obama established a Web site, MyBarackObama.com, that offered supporters the opportunity to connect with one another and allowed the candidate to publish his position on specific topics. The interactive element of the Web site supported group building among citizens to add their opinions and exchange ideas with the candidate but, more important, with their peers. At the time, Obama promised to vote on the Foreign Intelligence Surveillance Act bill but changed his opinion over time (National Public Radio

2008). A wave of disapproval was published immediately on his Web site. Instead of taking the controversial issue off the platform, Obama responded to the criticism on the site and in the form of a press release, explaining his reasons for his voting decision. The opposing opinions of the audience were not controlled or dismissed, but convened and broadcasted, making the Internet a vehicle for a many-to-many platform instead of a unidirectional display of controlled information. The high degree of inclusiveness made the audience full participants instead of passive observers.

The demands for information sharing and peer production within traditional bureaucracies are emergent and are likely to challenge current organizational processes (Mergel, Schweik, and Fountain 2009). Another possible effect of higher degrees of inclusion and participation is increased uncertainty and variance in message content and the media used to transmit the message. This may create greater instability of all institutional forms, as the public demands more immediate reactions and responsiveness, leaving less time for deliberations and situational or contextual assessments.

Proposition 4: Increased Use of Interorganizational Collaboration Tools Will Lead to Increased Lateral Communications and Resource Sharing

Public organizations will continue to *increase lateral communications and resource sharing* both *within* and *across* organizational boundaries (see proposition 1). The example of Intellipedia within the intelligence community has shown that these changes will increase intra- and interorganizational *collaboration* with a simultaneous increase in coordination and governance efforts (Mergel 2010). Intellipedia—a wiki platform to share intelligence information across all sixteen intelligence agencies in the United States—was created to reduce the costs of parallel data processing and to break up knowledge silos that exist when information is stored and shared only within preselected e-mail lists, shared hard drives, or documents. The wiki platform—in accordance with the success of Wikipedia.org—allows authorized editors to upload information that others can edit, extend, and discuss, with the goal of creating controversies instead of unified opinions. The hope within the intelligence community is to reach better decisions based on conflicting information and conversations instead of unidirectional and single expert reports and opinions (Andrus 2005). Similar approaches now exist in other federal agencies, such as Techpedia (Department of Defense) or Diplopedia (Department of State). The prerequisite is to understand which agency is performing which tasks, and understand information needs as well as information creation at various levels of government. One downside to increases in lateral communication is the potential need for increased coordination and cultural adaptations in order to successfully share information across a governmental unit. These types of competing views of the data across agencies is also likely to lead to problems in policy formation and presentation, as political leaders try to use such data to push forward specific policies.

Proposition 5: Mission- and Target-Specific Information Sharing May Lead to Higher Effectiveness of Governmental Routines

We predict a potentially higher *effectiveness* of some governmental routines through an enhanced, broader, and more target-specific information dissemination. In 2009, the CDC used social media and networking tools during the swine flu outbreak and earlier during the salmonella contamination of peanut butter to reach citizens and endangered parts of society "where they are" (Centers for Disease Control 2009; Nagesh 2009). Tools such as Facebook pages and Twitter messages led to an enhanced immediacy and relevancy of information spread, while at the same time reaching specific target groups. The information channels used led to repostings of the messages in traditional

news formats and were also supposed to create information ownership and prevent misinformation and rumors (Morozov 2009). What this example shows is the need for other institutions with a wider and in this case potentially worldwide reach, such as the World Health Organization, to take ownership of these new technologies. Moreover, applying mash-ups, such as healthmap.org/swineflu, where for example a Google Map is combined with government data about flu outbreaks, can help authorities track public perception—or, more important, misperceptions—to understand when to intervene and supply more relevant and mission-specific information.

Proposition 6: Information Overload Increases the Need for New Warranting Processes to Ensure Information Quality

The current examples of social software in Government 2.0 show some innovative and surprising side effects that might lead to procedural and organizational innovations (Kelman 2009). One major consequence of these changes is an increasing potential for problems associated with *information overload.* The standard response to information overload is to filter information, usually based on the individual's specific processes for assessing the accuracy and quality of the information. Consequently, some prefer news from the *New York Times* and others from Fox Broadcasting. In order to understand the quality and accuracy of the information created in different channels, which might then be replicated and reposted more broadly, government might have to create new warranting processes to ensure its own reputation and trustworthiness. This suggests that not only government, but society in general will need to develop new forms of *read and write literacy* for the vast amounts of information that are produced using social media in the public sector (DiMaio 2009). Citizens themselves need to learn to understand how to quality check information that is freely available on the Internet—not all information replicated and reposted on blogs is true. Mechanisms need to be developed to not only trust preferred sources but also verify online information. Besides reading ability, appropriate writing skills need to be developed: While some are carelessly publishing on social networking platforms, such as Facebook or Twitter, the personal warranting process needs to be refined to establish a writing literacy that protects individuals from future cost related to personal and professional reputation. These requirements are likely to change both the educational and socialization process of society.

Proposition 7: New Information-Sharing Possibilities Lead to Increased Volatility and the Need for More Specific Information Targeting

The new information-sharing possibilities also come with an *increased volatility in information and the need for more specific information targeting.* The swine flu example shows that there is an increased need for information warranting. The question is, therefore, Does government have to increase its role in setting standards, rules, and regulations? Government itself is more often held accountable and needs to lead by example, controlling the quality and standards of its information-sharing processes before it allows access to the public. We do acknowledge the apparent advantages of the current convergence of old and new information-sharing mechanisms (Giles 2005) but also need to take the potential downsides and unsolved issues into account.

CONCLUSIONS

It is difficult to predict future effects of new technology while living through a period of rapid changes in the technology itself. We do, however, see both benefits and problems deriving from

the new technologies, as well as managerial and cultural challenges that public managers and chief technology officers are facing on all levels of government. It is important to evaluate the emerging applications on both their positive and negative dimensions. Moreover, what are missing at the moment are reliable evidence-based evaluation measures of current impacts.

The so-called Government 2.0 bundle of new information and communication technology applications has the potential to change the way government creates and shares information. They might also lead to an increased transparency and accountability of public authority. The broader range of communication and interaction channels resulting from these new information technologies may lead to increased inclusion and public participation. Responses, especially when it comes to mission-specific information, may therefore lead to an increased reaction speed and might enhance governmental effectiveness. As mentioned earlier, limited effectiveness and performance measures are available for the (now) traditional e-government applications, so that it is difficult to predict and evaluate the actual impact of new media tools. Specifically, very successful organizations using existing IT systems might see managerial and cultural challenges in adopting an additional Government 2.0 strategy. The current changes and innovations in IT can therefore create a more volatile (higher degrees of variation over time) political environment for organizations, which might threaten the status quo of the established information-sharing culture and organizational capacity. The bureaucratic organizational processes and existing infrastructure might have to be reevaluated to harness the power of social media in the public sector. Though such changes will be mediated by existing organizational and political environments, there is an increasing need for researchers to understand the managerial, cultural, and technological factors during the implementation and adoption phases.

The biggest challenge is not the technology itself, but the adaptation of technology within the given political and bureaucratic situation and institutional barriers (Federal Computer Week 2009). The bureaucratic top-down information-reporting strategies still exist but are now complemented and only partially replaced by a more vertical information-sharing approach—with unpredictable consequences. The resulting greater diversity in organizational structure to support the parallel set of new communication channels within and across government and with its citizens is enabled by the new technology but its ultimate impact will depend more on how they become embedded in the preexisting institutions.

Finally, we see a number of significant future challenges and issues that are unresolved when it comes to Government 2.0.

Cybersecurity, accountability, and *identity management* are open issues that deal with the question of how government data can be protected from unintended access, to whom government will allow access, and how government will warrant an individual identify. So far, mainly nonsensitive government data have been published on Web sites, such as data.gov, in the context of the transparency and open-government initiative of the Obama administration. Even though the actual use by the public is open, ownership rights remain an issue, especially when data are about citizens. These transparency efforts increase the likelihood of security breaches. Allowing public sector employees to post blog entries and to send out Twitter messages as representatives of their government organizations leads to two important accountability issues: To what extent are opinions published valid official governmental statements and to what extent should government be held accountable?

A topic currently being discussed but not yet fully implemented is the use of *cloud computing* and *shared services and resources.* This new model of computing involves outsourcing services and the access of computing capacity only when needed. Although this approach promises cost savings and enhanced efficiency, such proposed systems also might potentially remove flexibility

and reduce organizational responsiveness. This type of contracted and multicentered computing service with a greater degree of decentralization is likely to lead to major problems of security and privacy. While this type of outsourcing of services is not an innovative practice in the public sector, it can lead to a diffusion of control and services with an overall loss of control. As soon as services are outsourced and moved beyond the organizational boundaries, the focal agency exerts only indirect control.

The *digital divide* among government organizations themselves needs to be mentioned as another unresolved issue: We do obverse unprecedented innovation on the federal government level when it comes to Web 2.0 applications (see, for example, Whitehouse.gov), with some spillover effects to the state level (see, for example, Utah.gov for a Web 2.0–style state portal designed with the help of the citizens). On the local and municipal levels, public managers are dealing with very different problems of capacity and resource limitations, which have led to voluntary collaborative governance initiatives, such as MuniGov2.0, to learn from each other without hiring expensive consultants and with minimal access to training opportunities. The digital divide also becomes evident in cases where government organizations either do not have Internet connections in their agencies or restrict Web access and publishing due to limited resources. As noted earlier, it is likely that eventually even the smallest government unit will have a Web presence and some applications, but capacity issues are likely to prevent most of these smaller governments to develop any meaningful applications involving two-way communication or social networking (West 2005).

As mentioned earlier, traditional e-service delivery performance research and evaluation have provided limited proof for the successful diffusion of e-government applications. It remains unclear the extent to which online services are improving responsiveness, reach, efficiency, and cost savings. The current Government 2.0 initiatives are driven less by conscious top-down strategies of the agencies themselves, but are mostly a response to successful use of social networking services outside of government. Cross-jurisdictional, hierarchical, and vertical studies are needed to understand this new phenomenon and its implications for managerial, cultural, procedural, and informational aspects of diffusion and their overall impacts (Mergel, Schweik, and Fountain 2009).

Also from a research perspective, these new technologies enable individuals to generate extensive amounts of data. In order to analyze these data and understand the impact of these new technologies, we suggest capturing more observations of passive behavioral data into e-government research (Lazer et al. 2009). This could include, for example, analyzing blog contents or the linkage structures of blogs. Future research should also include the use of pure experiments, natural experiments, and quasi-experiments to generate evidence-based prescriptions for alternative organizational structures and applications of technology to be able to gain deeper insights into the potentially sustainable changes we are observing.

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