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## **Digital Government in the U.S.: Technological Innovation in Public Organizations**

by

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### **INTRODUCTION**

The rapid adoption of computer networks, such as the Internet and the World Wide Web (WWW), within various segments of society has spurred an increased interest in using such technologies to enhance the performance of organizations in both the public and private sectors. While private sector organizations now commonly employ electronic commerce, or e-commerce, strategies to either augment existing business activities or cultivate new groups of customers, organizations at all levels of government have also begun to pay renewed attention to the prospects of using new forms of *Information and Communication Technology* (ICT) in order to improve the production and delivery of services. As with many technologies, the increased use of ICT by government was in response not only to the increased use of ICT by government stakeholders, such as citizens or businesses, but also in response to a growing call for governmental reform during the 1990s. As public organizations at the federal, state, and even local level began to initiate organizational reforms that sought to bring private sector norms to government, they often sought to employ ICT as means to increase efficiencies and organizational coordination (Osborne and Gaebler, 1993; Gore, 1998). Such attempts to reform the operations of public organizations

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were a key factor in promoting an increased interest in use of new forms of ICT (Fountain, 2001). This growing focus on the broader use of ICT by public organizations came to be known as digital government.

The term, *digital government*, grew to mean the development, adoption and use of ICT within a public organization's internal information systems, as well as the use of ICT to enhance an organization's interaction with external stakeholders such as private-sector vendors, interest groups, or individual citizens. Some scholars more specifically characterize this broader use of ICT by public organizations according to its intended purpose. Electronic government, or *e-government*, has often been used to describe the use of ICT by public organizations to provide programmatic information or services to citizens and other stakeholders (Watson and Mundy, 2001). For example, providing an online method through which citizens could conduct financial transactions, such as tax or license payments, would be a typical e-government activity. Other uses of ICT include the promotion of various types of political activity and are often described as electronic politics, or *e-politics*. These types of ICT-based activities are often characterized as those that may influence citizens' knowledge of, or participation in, the political processes. For instance, the ability of an elected body of government, such as a state legislature, to put information about proposed legislation online for public comment or to actually allowing citizens to contact members of the legislature directly would be simple example of e-politics.

However, ICT is not a panacea for every organizational challenge. ICT can introduce additional challenges to the organization. For example, the increased attention on employing ICT to achieve agency goals has also brought to the forefront the potential difficulty in successfully developing large-scale ICT systems within U.S. government agencies. For example, the Federal Bureau of Investigation's (FBI) recent announcement that it may have to scrap its project to develop a Virtual Case File system that was estimated to cost \$170 million (CNN, 1-13-05). The adoption of new ICT is often marked by setbacks or failures to meet expected project goals and this characteristic certainly not limited to public organizations. However, adherence to public sector norms of openness and transparency often means that when significant problems do occur, they happen within view of the public. More significantly, such examples highlight the difficulty of managing the development and adoption of large-scale ICT systems within the public sector. However conceptualized or defined, the development, adoption, and use of ICT by public organizations is a phenomena oriented around the use of technology with the intended purpose of initiating change in an organization's technical and social structure. Since the development and adoption of new ICT or new ways of employing existing ICT are necessarily concerned with employing new technologies or social practices to accomplish an organizational goal, they meet the basic definition of technological innovations (Rogers, 1995; Tornatsky and Fleischer, 1990). If public organizations are to improve their ability to adopt and implement new ICT, they should better understand the lessons and issues highlighted by a broader literature concerning technological innovation.

## **TECHNOLOGICAL INNOVATION AS A THEORETICAL FOUNDATION FOR DIGITAL GOVERNMENT**

Since the adoption and use of ICT by public organizations can be considered a form of technological innovation, studies examining various aspects of the development, adoption, and eventual routine use of new technologies may illuminate the social and technological factors that influence digital government initiatives and strategies. Researchers often describe technological innovation in terms of loose overlapping stages or steps. Some conceptualizations of the innovation process include up to five progressive stages: awareness, matching, adoption, implementation, and routinization (Tornatsky and Fleisher, 1990). Other researchers have collapsed these five stages into just two broad phases, initiation and implementation, because each of the two stages is influenced by different factors (Damanpour, 1991). The initiation stage includes activities such as problem perception, information search, attitude formation, and the attainment of resources. Implementation includes activities such as modification of the technology or practice, the adjustment of necessary organizational practices or operations, early use and more routine use of the innovation. Regardless of the actual number of stages in the innovation process, it

is important to note that the process may, or may not, occur in a linear fashion, and all innovations may not experience each stage. In fact, some research specifically highlights the occurrence of setbacks, and even reversal, with regards to the innovation process (Tornatzky and Fleischer, 1990; Rogers and Agarwala-Rogers, 1976).

While the broader process of technological innovation is often described in terms of stages, the interaction of the actual technology with social and technical factors of the organization plays an important role in how the innovation will progress. A technology's particular characteristics strongly influence whether or not a particular technology will be adopted and implemented by a particular organization. While studies of innovation have examined numerous technologies, relative advantage, ease-of-use, and compatibility of the respective technology seem to be repeatedly linked to whether or not a particular technology will be adopted by an organization (Tornatzky and Klein, 1982). The extent to which a particular technology alters current organizational processes or outputs also plays a key role in the innovation process. So-called, radical innovations usually involve a major transformation of an organization's processes or outputs, and/or significantly impact the organization's key stakeholders (Dewar and Dutton, 1986; Ettlie, Bridges, O'Keefe, 1984). Radical innovations that are clear departures from an organization's technological norms generally experience more risks for failure or setbacks than do technological innovations that involve only slight changes in an organization's current technological environment.

In addition to the characteristics of the technological innovation itself, several key types of organizational factors seem to influence the process of technological innovation. These include awareness or knowledge of the innovation, available resources, ties to the external environment, and organizational structure (Rogers and Agarwala-Rogers, 1976). During the initial stages of the innovation, the organization must detect some need to use a new technology to alter organizational processes, and performance, and must be aware of the potential advantage of employing a particular technology. This awareness and knowledge may come in the form of personnel within the organization or from external experts, but the organization must be able to both detect the need to undergo technologically grounded change and must be able to match that need to a new technology that already exists or will be developed. Once the need and desire for a technological innovation exists, the organization must then have enough resources to acquire the technology and integrate it into organizational processes. Resources may come in the form of the expertise already possessed by an organization's personnel, existing technologies and technical infrastructure, or the financial assets required to attain such resources from outside the organization itself.

In addition to the role of knowledge and resources, an organization's structural arrangements can also play an important role in successfully adopting and developing new technologies. For instance, organizations with high levels of structural complexity, less formalization, and low centralization tend to adopt more technological innovations than do organizations with high levels of formalization and more centralized structural characteristics (Duncan 1976; Damanpour, 1991). This does not however mean that such factors automatically promote the successful implementation of new technologies, since in some situations successful implementation often requires the resources and support of key organizational personnel, such as senior managers. Such support and attention might be available more readily in organizations with more formal and centralized organizational structures (Wilson, 1989; Rogers and Rogers-Agarwala, 1976).

Closely tied to the issue of organizational structure is how closely the organization is tied to its external environment. An organization that is tied closely to its external environment through legal or market mechanisms may more readily perceive performance shortfalls that may cause the need for new technological innovations. In addition, such ties to the external environment may also facilitate awareness of new technologies that may be applied in an attempt to implement technologically based change. Furthermore, organizations that have relatively porous boundaries with their external environment, and which are accountable to stakeholders within that environment, will be more likely to be innovative than organizations with more stringent boundaries. Organizations will, in fact, attempt not only to adapt to

meet requirements or demands emanating from external environment, but to control them (Thompson, 2004).

Taking these broad points into consideration, an organization's ability to successfully adopt, implement, and use new forms of technological innovations, such as ICT, seems to be an interactive result of socio-technical factors arising from the technology, resources, organizational structure, and ties to the external environment. It is important to note that technological innovation is not an inevitable process that must take place or that must successfully move through a progression. An organization may never initiate the innovation process or the innovation may end at any one of the stages. Furthermore, it is important to understand that organizations may not make decisions in a hyper-rational manner during the innovation process. They act within a form of bounded rationality that results from limits on information about the innovation process and their ability to process what information is available (Simon, 1976; March and Simon, 1958).

## **APPLYING KNOWLEDGE OF TECHNOLOGICAL INNOVATION TO STRATEGIES OF DIGITAL GOVERNMENT**

Studies of innovation have already led to more specific theories of innovation focused on the acceptance of ICT by individual users. For instance, the Perceived Characteristics of Innovating (PCI) draws upon Roger's diffusion of innovation characteristics (1995) to evaluate a potential adopter's perception of ICT (Moore and Benbasat, 1991). While the literature technological innovations is broad in terms of specific technologies and socio-technical factors examined, the literature does provide some important specific dimensions to consider with regards to the adoption, development, and implementation of ICT within public organizations. It is apparent that public organizations must consider the characteristics of the specific ICT, as well as factors such as knowledge, resources, structural arrangements, and the external environment.

### **Characteristics of Digital Government ICT**

With regards to digital government, the characteristics of the actual ICT play a significant role in the progression of the innovation process. While the use of Internet-based technologies, such as hypertext markup languages (HTML), extensible markup language (XML), browser software, and even wireless networks are now almost ubiquitous characteristics of modern computing, the broader configurations of such technologies occur in a variety of ways, depending on the respective objective or task. For example, essentially the same basic component technologies can be used to develop an intranet for communication and data processing within an organization's environment or can be constructed to disseminate information to stakeholders external to the organization through some form of extranet. While there have been a steady stream of new technologies that facilitate the technical systems development inherent in using ICT to accomplish organizational tasks, the degree to which such technologies are significantly different from preexisting information systems, or the way in which such systems are used, may play a significant more role in how such innovations are perceived and adopted within public organizations. ICT applications that are clear departures from an organization's existing ICT infrastructure or that seek to accomplish core tasks in different ways may experience more difficulty and resistance during the innovation process. For example, many public organizations have adopted Enterprise Resource Planning (ERP) systems that were originally designed as modular software systems intended to improve the administration of business functions, such as budgeting, procurement, and human resources. The software modules are connected to a common database that is used to centralize information and improve organizational decision-making (Sawyer and Southwick, 2002). The awareness and adoption of such systems has been quite popular among public organizations at all levels of government, however many implementations have experienced significant difficulties because such systems are departures from existing ICT systems and are often difficult to integrate within preexisting business procedures and norms (Sawyer and Tapia, 2002).

### **Knowledge of ICT**

The extent to which an organization is aware of how new ICT may be applied to accomplish organizational goals is an important factor in the initiation of the innovation process. As mentioned previously, digital government in its broadest sense is not a new phenomenon. Public organizations have been using ICT for many years in order to carry out key tasks, such as data processing. The extent to which organizational actors, such as managers or technical experts, seek out new ICT in order to achieve goals is an important contributing factor to the innovation process. For example, managers may consider the adoption of new forms of ICT as a means of addressing problems within their scope of responsibility. Their interest in adopting new ICT may be viewed as a response to a perceived organizational need or their own more narrow need to enhance information processing or communication within the organization. Simultaneously, the perceived ease of use and overall usefulness of ICT to such managers may also increase the adoption and implementation of new technologies (Bugler and Bretschneider, 1993). Knowledge of new ICT applications is also closely tied to the extent to which organizational personnel seek out and receive ICT-related information from sources external to their normal work environment. Organizations whose personnel interact with professional associations, educational institutions, consulting firms, or vendors of ICT products may be more aware of how ICT may be used to address organizational tasks.

### **Resource Availability**

With regards to digital government innovation, an important enabling factor is the sufficient availability of organizational resources to adopt and implement the ICT or ICT-oriented practice in question. With regards to the adoption of ICT, resources may come in several forms, including sufficient personnel with knowledge of the ICT of interest, the status of existing ICT systems, or even sufficient time to adopt and implement the ICT, in addition to ordinary organizational activities. Significant problems often arise out of the lack of sufficient financial resources to obtain the hardware and software systems of interest or the necessary personnel resources to oversee the implementation of the new ICT innovation. Public organizations are often reluctant to use budgetary funds to invest in new ICT innovations when they may be already earmarked for existing organizational activities. For example, Hinnant and O'Looney (2003) indicated that financial costs were a factor in whether or not local governments were interested in adopting advanced ICT practices, such as personalization of online services. Other research has indicated that organizations are more likely to adopt new ICT systems or practices when the financial resources are at least partially provided above and beyond normal budgetary expectations. For example, the Commonwealth of Pennsylvania created the Technology Investment Program (TIP) in the late 1990's to assist agencies with additional funds to upgrade systems that were potentially vulnerable to year 2000 problems and to cooperatively adopt ICT systems that were being championed by the governor's Office for Information Technology (Hinnant and Sawyer, 2003). Such funding schemes reduced the risk for individual public agencies to both initiate and implement new ICT systems. However, unless such funding programs are protected from the possibility of government revenue shortfalls, they may be greatly diminished or eliminated altogether.

### **Organizational Structural Arrangements**

The type of administrative arrangements present within a particular public organization play an important role in how innovative public organizations will be in the innovation process. A classic depiction of public organizations is of highly bureaucratic structures with high degrees of centralization and formalized procedures. If this stereotype is true, public organizations may have more difficulty adopting new forms of ICT, especially if they do not clearly enhance the accomplishment of key tasks. After all, public organizations develop bureaucratic structures and formal routinized procedures at least in part due to the need to produce services in a stable and equitable manner. In such cases, public organizations will be weary of new ICT that might initially disrupt the production of public services (Wilson, 1989). However, in situations where public organizations see new ICT as a clear means of improving organizational processes or improving the production of services, public organizations may be more likely to positively perceive the new ICT system or application. In addition to centralization and

formalization, the level of complexity is thought to affect the process of technological innovation. Heightened levels of horizontal and vertical differentiation of responsibilities and decision-making power is thought to increase the ability of public organizations to adoption new ICT.

Taking such expectations into account, it is also important to highlight the interaction between ICT and an organization's structure. As a technology oriented on altering information flows either within or across organizational boundaries, ICT may in and of itself, influence a public organization's formal and informal structure. For example, Kraemer and King (1986) found that the new ICT reinforced preexisting social arrangements or shifted power towards higher levels of management. In other situations, power may be shifted down and outward within the organizational hierarchy to those who more closely understand and manage the new ICT (Kraemer and King, 1986; King, Dunkle, and Lane, 1989). With the adoption of newer forms of ICT that make use of wide-area networks, such as the Internet or WWW, to expand communication, structure may be affected more extremely than previously. Such findings indicate that structure plays an important role in the ability of public organizations to initiate and fully implement new forms of ICT, however the ultimate reciprocal effects are difficult to accurately predict.

### **The External Environment**

The broader external environment within which a public organization resides also plays a role in how the innovation process unfolds. Economic and political actors in their external environment often heavily influence public organizations (Rainey, 1997; Bozeman, 1987). As already mentioned, the financial resources available to a public organization are one factor that influences the process of technological innovation. Since the budgets of most public organizations are directly or indirectly influenced (through tax revenues) by the vigor of the greater economy or political decisions regarding fiscal policy, their ability to adopt and implement new forms of ICT is affected by the external economic environment. Similarly, public organizations are also influenced by the actions of political actors external to their organization. In the case of public organizations, elected officials, appointed officials, citizens, and businesses can all influence the adoption of new ICT. For example, the initial adoption and successful implementation of new inter-agency criminal justice database systems were linked to a consistent level of support from public officials who hold key elected or appointed positions within the government (Hinnant and Sawyer, 2003). In a similar manner, businesses, interest groups, or private citizens, as actors who either impact the generation, delivery, or receive public services can each influence the adoption of ICT. For example, interest in the adoption of new online practices by cities and counties has been linked to a perceived need or demand for such practices by the citizens within the local government's jurisdiction. Situations often develop when specific ICT or ICT-practices are used to interact with businesses. For example, many governments are adopting ICT systems to streamline the procurement processes that are used to buy goods and services from the private sector (Moon, 2002; Hinnant and Sawyer, 2003). As in the case of organizational structure, the adoption and use of specific ICT by government not only is influenced by external actors, but may also help shape the use of ICT by those actors.

At a broad level, the process with which ICT is adopted and implemented by public organizations is not as straightforward and linear as discussed here. While it is safe to say that the factors discussed ICT characteristics, technical knowledge, resources, structural arrangements, and the external environment all influence the process with which new ICT are adopted and implemented, the process is more interactive and nonlinear than presented here. For instance, relatively early studies of personal computers in local government indicated that computer applications with greater public visibility and less uncertainty with regards to cost were more likely adopted (Perry and Kraemer, 1979; Perry and Danziger, 1980). Similarly, public managers may seek to use new forms of ICT, such as a portal on the WWW, to communicate more easily with external stakeholders, but find their efforts limited by budgetary limitations imposed by the economic environment (Gant, Gant, and Johnson, 2002).

## **FUTURE RESEARCH ISSUES: BROADER ISSUES OF ICT AND TECHNOLOGICAL INNOVATION FOR DIGITAL GOVERNMENT**

The use of technological innovation as a theoretical basis for examining the adoption and development of digital government by public organizations seems valid, but it is important to understand that public organizations are only parts of a greater institutional framework of government. In essence, concern should be paid to the broader performance and results of improving the use of ICT by government institutions and not just to the adoption of ICT by a particular agency or organization. One means of achieving such study is to consider an institutions technological core as architecture, or set of ICT design decisions, that bring together different elements of ICT systems into a more coherent whole. Therefore, architectural innovation, might take a broader view of how innovation and change within and between subunits, such as organizations, influences the overall performance of broader institutional relationships and performance (Henderson and Clark, 1990; Agre 2000, 2003).

In addition to examining the broader connections between ICT, innovation, and government institutions, more attention needs to be paid to the differences between the actual goals and limitations of employing ICT in public, versus private, organizations and institutions. Government faces many challenges with regards to realizing the potential of digital government activities. One challenge that is often discussed concerns citizen and stakeholder access to ICT. While private sector firms only have to market and provide services to set groups of customers who may buy or make use of a specific good or service, government must be accountable to broader segments of the population. For example, some citizens have adopted ICT, such as the Internet, WWW, or wireless technologies, for their daily use. However, some demographic groups have been found to have more limited access to the ICT that digital government often relies upon or may have insufficient technical skills to fully make use of such technologies (Thomas and Streib, 2003; Mossberger, Tolbert, and Stansbury, 2003). Issues of access may serve to in some ways limit the ability of public organizations to adopt new ICT especially if adopting ICT is intended to enhance communication or provide services to citizens or external stakeholders. However, if external users adopt new ICT at high levels themselves, they may actually serve as a means to drive innovation on the part of public organizations.

Other challenges to developing digital government innovations also exist. Many governments are being forced to deal with technical and administrative issues that arise from the employment of ICT itself. For example, employing ICT to deliver services to the public requires more attention to issues, such as information assurance, ICT systems security and overall organizational accountability. If public organizations wish stakeholders, such as citizens and private sector firms, to be willing participants in digital government activities, it must provide assurances that such information-intensive activities are well planned out and relatively secure from potential abuse. In essence, governments must seek to promote trust on the part of participants in the innovation process (Welch, Hinnant, Moon, 2005).

## **CONCLUSION**

If the adoption of ICT by public organizations and their broader institutions of government is to lead to the benefits of improved efficiencies in the production and delivery of public services, public organizations must develop a clearer understanding of the social and technical factors that influence the process of technological innovation. The failure of large-scale ICT projects is not uncommon in either the private or public sector. However, the openness and transparency of public sector activities, as well as broader issues of accountability to the public at large, will always bring any failures or shortcomings within the innovation process to the light of public scrutiny. While this may cause some public sector organizations to be more apprehensive to undertake the development and adoption of new ICT, a greater lesson is that public organizations must pay special attention to identify and address possible problems within the innovation process itself. Furthermore, while the ICT inherent to current incarnations of digital government practices may be an important driver of change, its impact within the greater social structure of organizations or institutions is often difficult to anticipate. As public organizations increasingly look to ICT and digital government as a core part of their operations, they must seek a better understanding of

how the factors within the innovation process interact together and, ultimately, impact the level of success of such ICT systems.

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## **Terms and Definitions**

**Architectural Innovation:** Innovations that involve a significant redesign of an organization's architecture. For instance, architectural innovation may require reconfiguring the technological components or systems of an organization or network of organizations in order to produce a significantly different aggregate arrangement.

**Digital government:** The development, adoption, or use of ICT by government organizations and actors.

**Electronic commerce (e-commerce):** Conducting business and communication transactions over electronic computer networks. This may include the selling of goods and services, as well as the transfer of funds from customers. This may also include inter-firm (business-to-business) transactions, as well as intra-firm computer-based activities.

**Electronic government (e-government):** The use of ICT, such as the Internet and WWW, by public organizations, such as government agencies, to provide information and public services to citizens and other government stakeholders.

**Electronic politics (e-politics):** The use of ICT, such as the Internet and WWW, by political actors to inform and facilitate public participation in the political process.

**Internet:** A large system of interconnected computer networks composed of backbone networks, mid-level networks, and local networks. This includes networks owned and managed by public, private, and nonprofit sector organizations.

**Radical innovation:** Technological innovations that are clear departures from an organization's current technological norms and as a result are perceived to impose significant risks if adopted and implemented.

**Technological Innovation:** the development and introduction of knowledge-derived tools, artifacts, and devices by which people extend and interact with their environment (Tornatzky and Fleischer, 1990).

**World Wide Web (WWW or web):** A hypertext-based client-server system that is one component of the larger Internet. The hypertext-based format of the WWW allows users to navigate through the system by using graphical user interface software known as browsers.