*e*Government Network: The Role of Information Technology in Managing Networks

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How could information technology assist the management of networks for public purposes? This paper develops an analytical framework for the role of information technology in managing networks for public decision-making and services. The framework is the first step in conducting investigations into the possible links between the use of information technology and the performance of networks. This inquiry has both theoretical and practical implications.

The theoretical contribution of this paper is two-fold. First, it aims to enhance the understanding of the role of information technology in network management. Information technology holds significant potential for facilitating major network activities such as information exchange and joint decision-making. However, we currently have little understanding about how and under what conditions that information technology would make a difference. There is little empirical testing of how information technology may play a role in enhancing the management of intergovernmental networks. The proposed framework hypothesizes relationships between the use of information technology and network performance, which prepares for empirical testing and theory building.

Second, the framework offers additional theoretical insights into the enactment of information technology, particularly about its impact on networked setting. Studies of digital government recognize the influence of institutional forces on the design and use of information technology (Heeks, 1999; Fountain, 2001). However, most studies are descriptive and rarely deal directly with networked forms of inter-organizational arrangements. This group of studies has also not benefited from theory-building through a large scale study to ascertain hypothesized relationships embedded in their arguments.

This paper establishes the framework for empirically investigating the link between information technology and network performance under various network, institutional, and technological constraints.

The practical significance of studying the role of information technology in managing networks comes from the concurrent growth trends in the use of information technology and in the network forms of intergovernmental arrangements. The application of information technology in the production and delivery of public services has become increasingly important. For instance, many states have built and continuously improved their web portals in an effort to provide one-stop online services. Existing studies explore such things as the status of e-government at various levels (Norris, 2003; GAO, 2001; Moon, 2002), reinvention and e-government (Ho, 2002), the management of information technology in the public sector (Garson, 2003; Chen and Perry, 2003), and its impact on organizations (Brown and Brudney, 2003). The other trend is the growth in inter-organizational arrangements across the public, private, and nonprofit sectors as well as at different levels of government (Agranoff and McGuire, 2003; Provan and Milward, 2001). Given budget problems, governments at all levels are looking at ways to leverage resources at other levels of government or in the private and nonprofit sectors. Some emerging public challenges, such as homeland security, also require cross-boundary cooperation in order to be successful.

The combination of information technology and network management holds the potential of allowing public managers to deal with new challenges more effectively and efficiently. One recent example is the effort among states to work together to increase their information sharing and analytical capability (Peterson, 2003). Another example is

the adoption of CopLink software to allow police departments in various jurisdictions to work together and share information. This software helps mitigate the problems of lack of information sharing as seen in the Washington D.C. shooting spree in 2002. The proposed analytical framework provides the first step in offering ways in which information technology can be better utilized to increase the benefits of cooperation across boundaries.

This paper is organized into the following sections. The first section will define networks and address the specific interest in *e*Government networks as those adopt information technology to manage networks. The following section reviews three bodies of literature that help illuminate the relationship between information technology and network management. Based on insights from relevant literature, an analytical framework as well as its related hypotheses will be developed in the next section. The last section concludes with some initial discussion about research design issues and research opportunities.

Networks and *e*Government Networks

Networks are defined as arrangements that link more than two network entities.[1] In the social network tradition, these social entities can be individuals, groups, or organizations. These entities are usually referred to as actors in a network (Wasserman and Faust, 1994, p. 17). Organizations can be corporations, government agencies, or even nation-states. Moreover, there is no assumption of a formal arrangement such as

[1] One distinction needs to be made between physical telecommunication and computer networks and networks of organizations. Physical computer and telecommunication networks are composed of hardware, software, and communication protocol. Organizational networks consist of organizations, individuals, and rules governing the operation of the networks.

those expressed by contracts (Agranoff and McGuire, 2003, p.4; O'Toole, 1997). In its simplest form, the regular information exchange among neighboring cities on garbage or traffic problems can be regarded as a network.

The broad interest of this paper is in networks that are formed to add values to public services. Most of these networks involve government entities, although non-profit and private organizations are possible network participants. For example, a regional agreement between neighboring local governments to share police resources is considered a network. Private partners are more prominent when a network relies on their resource and technical input, such as a user network on geographic information systems in government. Another feature of these networks is the focus on organizations rather than individuals as network entities. For instance, in the example of the Department of Education, state and school districts of the entire state constitute the actors of a network. Individual teachers, administrators, and students are not the focus of a network study focusing on organizations.

This research is particularly interested in *e*Government networks. *e*Government networks are networks of organizations that use information and communication technology for the provision of access and delivery of information and service to the public.[2] Since the primary focus of this study is on understanding the role of information technology in network management, those *e*Government networks that utilize information technology to achieve collective goals are most relevant. For instance, TexasOnline, the official portal for the state of Texas, employs a network of organizations that work together for decision-making. Key network member

[2] The use of information technology for enhancing the access to and delivery of government information and service is the essence of e-government (General Accounting Office, 2001, p.1).

organizations include the Texas Department of Information Resources, KPMG, citizen and business groups, local government representatives, and other state agencies (TexasOnline Authority, 2002).

The focus on the use of information technology in networks helps explore opportunities that exist in integrating various functions of networks such as information sharing, decision-making, learning, and action-taking through the use of information and communication technologies. Information technology is an enabler in the public sector. The key issue is when and how information technology may play a role in enabling networks to provide faster, better, and cheaper public services. A review of existing literature provides some initial insights.

Network Management and Information Technology: A Review of Literature

Three bodies of literature are informative when examining the role of information and communication technologies in managing public management networks. Intergovernmental and network management literature sheds lights on the general issues related to the nature and operational characteristics of networks for public decision-making. The second area is business organization literature, which looks at the adoption and deployment of information systems across organizations. Lastly, the studies of public management information systems and e-government offer insights into the unique challenges and opportunities of using information technology in the public sector.

Intergovernmental Network Management

The literature on intergovernmental network management offers several insights. First, a theoretically productive and practical way of studying network management is to study network management activities. A recent systematic test of a formal theory of managing government programs in a networked context demonstrates that network management matters for program performance (Meier and O'Toole, 2001). To further advance the knowledge in network management, the follow-up question is what managers should do and when (O'Toole, 1997; McGuire, 2002). One way of thinking about network management activities is to think about the specific types of management activities involved. Some common general categories grounded in management literature include planning, organizing, and implementing. A middle ground between specific management tasks and general common categories would be those associated with various stages of network management (McGuire, 2002). One example is the management activity to identify network members and tap into their expertise. These management activities serve as the specific focus of attention when information technology is used.

Second, researchers need to clearly define the level of networks they wish to study and address the possibility of having inconsistent goals and interests when evaluating their effectiveness. Taking a broad perspective of networks, Provan and Milward (2001) propose three levels of network for study: community, network, and organization/participant levels. Community level is the highest level that includes principals and clients such as client advocacy groups, the general public, and politicians. The network level is the second level. Principals such as primary funding agencies and

agents such as member organizations are two of its main groups. On the organization/participants level, we have both agents (i.e. member agency broads) and clients (individual clients). Provan and Milward (2001) argue that the effectiveness at one level may not be congruent with that at another level. For example, closing down some inefficient service broads could mean efficiency gain for the funding agencies at the network level. However, it also means the loss of convenient access for some participants served by that particular agency broad. One way to deal with the difference in effectiveness is to clearly define the level of network under study. The other lesson is for any framework for evaluating network performance to account for the possibility of inconsistent interests for network actors at various levels.

Lastly, network performance is multi-dimensional and its assessment needs to account for the nature of the network and environmental constraints. Multi-dimensional implies the use of multiple criteria for evaluating performance. For example, a collaborative arrangement may increase the ability of individual network members to attain their goals. Another criterion for network performance may be process-based that deals with the generation of social capital (Thomson, 2001). The specific criteria may be related to specific objectives of the network. A human service network may have service access as one main effectiveness indicator (Provan and Milward, 2001), while decision-making network may choose to measure the number of decisions made and the time taken for a decision to be reached. An inquiry into the link between management activities and outcomes should address its multidimensional nature. Careful modeling is required in this case to capture the multi-dimensional nature of value addition activities and the role that information technology plays in them.

Information Technology in Inter-Firm Network

One key insight in the business literature is multiple perspectives in understanding the management and use of information technology in inter-organizational settings (Kumar and Dissel, 1996; Moss-Kanter, 1994). Resource, technical, and institutional perspectives are the three main ones that will be discussed below. Another insight is the potential for information technology application to have greater efficiency in an inter-organizational arrangement (Barrett and Konsynski, 1982).

Resource dependence theory helps explain resource exchange in an inter-organizational network with a particular focus on control and coordination of organizational relations. Resource dependence refers to the need of an organization to establish a relationship with another organization who possesses the resource it needs (Pfeffer and Salancik, 1978; Provan et al, 1980). The level of participation depends on the extent to which a network participant's dependence on the resource provided through the network. For instance, if a supplier's business depends on a large corporation such as General Motors, it needs to gain access to GM's global exchange network to gain business.

In this context of resource exchange, the role of information technology can be viewed as a facilitator or inhibitor to such exchange. The recent development in modeling such as the dependency network diagram captures both the management actions in terms of control, coordination and IT design (Tillquist et al., 2002). For instance, a car insurance company's claim revenue depends on the government traffic rules and regulations as well as fees charged by the vehicle repair industry.

Technical consideration involves the functionalities an organization desires from participating in an inter-organizational arrangements and its ability to be linked to the cross-boundary information systems. The level of participation in an inter-organizational information-sharing system can be determined by cost commitment, responsibility, and complexity (Barrett and Konsynski, 1982). If an organization requires functionalities that exceed its current technical capacity, there is an issue of cost associated with acquiring such a capacity. If an organization has the resources to commit and is also technologically sophisticated, it can be a driver for the inter-organizational systems in terms of its design and implementation.

Institutional considerations also shape the adoption and use of information technology in a network. Isomorphic pressures (coercive, mimetic, and normative) operate through networks of organizations (DiMaggio and Powell, 1983). For instance, in the business world, these pressures can be measured by examining the extent of adoption among competitors (mimetic), the perceived dominance of customer adopters (coercive), and participation in trade association (normative). A recent study has demonstrated the influence of institutional forces in the adoption of an electronic data interchange (EDI) system (Teo et. al. 2003). It has been argued that the main institutional and organizational forces vary between the public and private sectors (Bretschneider, 1990; Bretschneider and Wittmer, 1993; Dufner, 2002). Therefore, caution should be taken in identifying the types of institutional forces involved.

Information technology and systems that power networks have been an area of growth in the business literature. Growth areas in networking and business data communications include the wider use of electronic mails, listserv and newsgroups, web-

enabled database access, and wireless networks (Panko, 2000). Moreover, applications of network technologies for organizations include group decision support systems and knowledge management systems (Laudon and Laudon, 2002). These applications are increasingly web-enabled for fast collaboration and global access.

Information Technology, Public Organizations, and Networks

The studies of information use in government shed light on the design and use of information and communication technologies in the public sector as well as on the use of information technology in inter-governmental collaboration. A thorough understanding of the design and use of information technology, however, requires the study of institutional forces as well (Fountain, 2001). Moreover, the types of organizations and their characteristics both play a role in shaping information technology. On the other hand, the use of information technology also shapes organizations. For instance, one empirical study shows that the deployment of information technology is associated with a decrease in the size of middle management (Pinsonneault and Kraemer, 1997).

Policies and regulations shape the landscape of information technology use in government. Political influences, accountability, and complex objectives are all challenges facing the management of information technology in the public sector (Bozeman and Bretschneider, 1986; Bretschneider and Wittmer, 1993). Political influences have been a major force in selecting and implementing information technology projects in government (Rocheleau, 2003). Election and budget cycles as part of the political process also have implications for managing government information technology. For instance, election cycles present challenges for long-term strategic IT/IS planning beyond four years (Fletcher, 1999; Dufner, 2002). Being responsive to public

demands and winning public trust are part of the accountability equation. One example of that is the recent effort of incorporating security and privacy features in the government information system. The complex and competing objectives of government further present challenges for the design of large information systems.

The experience of deploying IT in the public sector has shown the ways in which technology may play a role in organizational performance. Information technology assists the management of information for decision-making (Kraemer and Dedrick, 1997). The recent interest in knowledge management is a natural extension of more advanced applications of information technology for better decision-making. For example, the Canadian government has launched several knowledge management initiatives to create virtual communities of public managers to help each other (Wagner, 2003). The other key lesson from using information in the public sector is the need to integrate IT into broad business processes, management, implementation, and evaluation. This is where IT can ultimately make a significant impact on outcomes.

Studies of intergovernmental information systems projects suggest some factors which affect the success in the use of information technology to enable collaboration (Prefontaine et al, 2000; Dawes, 1996). The institutional and organizational factors include resistance to change, organizational/programmatic/legal complexities, changing priorities, and overlapping or conflicting missions among the participating organizations (Dawes et al, 1997, Dawes and Prefontaine; 2003). Technical factors include the maturity of a shared, reliable computing infrastructure, understanding of both technology and programs, level of technology, and current ICT use (Prefontaine et al. 2000).

Taking the Three Streams of Literature Together

The above three streams of studies provide only a broad and initial understanding of the role of information technology in network management for the public sector. Taken together, they suggest a focus on management activities, multiple sources of influence over the use of information technology in a networked environment, and a multi-dimensional nature of network performance. Although developed separately in their own disciplines, these bodies of literature share some common intellectual traditions. The most notable of these are organization theory, institutionalism, social network, and the adoption of information technology. Some studies offer initial evidence on the impact that information technology can make on the performance of programs.

What is lacking in the current network management literature is a formal treatment of the role that information technology plays in network management and subsequent changes in performance. Moreover, little effort has been made to synthesize the three streams of literature. This study aims to take the first step in theory building by developing an analytical framework for the role of information technology in network management.

An Analytical Framework

The proposed analytical framework builds on three premises drawn from the existing bodies of knowledge to further understand the link between information technology and network performance. First, the use and impact of information technology should be understood in its institutional and organizational context (Fountain, 2001; Garson, 2003; Heeks, 1999). Technical considerations alone are problematic in

fully understanding the design and deployment of information technology in a networked environment. Second, information technology needs to be coupled with management techniques to generate results. For information technology to have any positive effect on a network, it needs to be used in concert with broader business processes (Kraemer and Dedrick, 1997). Third, management and technological choices are central to improvement in network value addition activities. Management can modify the rules and relationships to respond to external challenges to a network and generate positive results (Meier and O'Toole, 2001).

The framework has grouped factors affecting network performance into three categories: network structure, institutional forces, and technology. Network structure is important to study because a better understanding of structural characteristics is important for modeling how it responds to its surrounding environment (O'Toole, 1997). Institutional forces play an important role in deciding the adoption and use of technology. An independent category of technology allows us to inventory the current use of technology and track its influence on network performance over time. Hypotheses will be developed for possible relationships between these factors and network performance.

Network performance is measured by change in network-enabled capacity, including information exchange, joint decision-making, and capacity-building. Management activities and technology are treated as mediating factors that shape network performance.

Network Structure

The literature on networks in general has suggested several ways that the structural characteristics of a network may have an impact on its performance. The

existence of core members that provide essential services to the network actors is one of the critical success factors for a network (Agranoff, 2003). The core member concept is based on the understanding that most networks have a focal organization to provide essential services for the entire network. This reality in part has prompted Agranoff and McGuire (2003) to characterize city collaborative management strategy as jurisdiction-based. For instance, in the area of economic development, the chamber of commerce can serve as the focal organization that brings in neighboring cities, businesses, and civic groups in coordinating economic development strategies.

These core members provide benefits to the rest of the actors in the network through administrative support and generation and dissemination of knowledge and innovative ideas. These core members engage in the production of network resources that the general membership shares. For instance, if a network currently lacks core group members to contribute to an information resource pool, the installation of a constellation of technological tools to support information management functions probably has a very limited impact. The relationship between core member contribution and network performance can be captured in hypothesis #1.

H1: The higher the level of core member contributions to the network, the more likely that the network will have a higher level of performance.

The other structural characteristic of the network is the professionalism and the culture of reciprocity exhibited by network actors. Network actors constantly need to balance or find synergy between the interest of their home organizations and that of the network. The dual loyalty of network participants usually creates tensions when their home organization's interest is not aligned with those of the network. Some of these

tensions can be traced to the protection of turf when working in a network (Bardach, 1996).

Professionalism and the culture of reciprocity add a certain level of predictability in the possible benefits from engaging in network-centered activities. They help make the case for spending an agency's time and resources on a joint effort with other agencies. Professionalism captures the timeliness and manner in which resource exchange is conducted. The culture of reciprocity, grounded in the social network literature, is critical to sustain a network. For example, if a metropolitan city provides its detailed planning information to neighborhood cities via a cross-boundary agreement, it may expect reciprocal information sharing to justify its efforts. A study of inter-local agreements in the Kansas city metropolitan area has suggested that the culture of reciprocity is the major driving force in cooperation in the network (Thurmaier and Wood, 2002). The effect of professionalism and reciprocity on network performance is stated in the hypothesis below.

H2: A network with higher a level of professionalism and reciprocity is more likely to be a network of better performance.

The third relevant structural characteristic is the good match between incentives and responsibilities. Institutionalists have long argued that the distribution of costs and benefits significantly affects the effectiveness of a collective management agreement where a direct authority is lacking (Knight, 1992; Libecap, 1989; Ostrom, 1990). For instance, if a particular group is privileged well beyond its contribution in the network, it is likely to create tension in the group. The opposite of this distribution is a minimum return on the core members' contribution to the public good of the network. These core members may stop providing these public goods when the costs to them outweigh the

benefits. Studies of inter-organizational information systems also suggest that a fair distribution of resources provides structural support for the stability of an inter-organizational arrangement (Kumar and Dissel, 1996; Dawes, 1996). If the cost commitment exceeds the benefits that an organization can gain from participating in a network arrangement, that organization is likely to stop participating.

One main distinction to be made is intangible versus tangible costs and benefits. In public management networks, benefits are sometimes intangible. One example of these benefits is the reputation gained by key network actors that they possess the skills to operate in a networked environment. Incentives could also come in the form of resources such as information that is not easily quantifiable. The share of personnel and financial resources among network members is usually difficult to quantify. To reach a summary judgment of fair distribution of costs and benefits, the best strategy seems to measure the perception of network members because it is the perception rather than actual distribution of costs and benefits that drives individual members' decisions. This approach is also advantageous because it measures some benefits and costs that are not easily quantifiable. The relationship is reflected in the hypothesis below.

H3: When there is a perceived better match of costs and benefits by individual network members, network performance is likely to be higher.

The last main structural characteristic is the level of congruence of interests among network actors. The perception of congruence of interests provides the condition for network members to work together. Network members may have conflicting goals as the result of differences in policy instruments or in a general understanding of the problem among network members. If network actors are competing for the same resource, the competitive force is likely to generate division among them and lead to the

demise of the network. Conversely, if all network actors gain from a network arrangement, they are more likely to act in concert.

The other dimension of congruence of interests is the vertical dimension -- among network actors at different layers of the network. Provan and Milward (2001) identified multiple layers of networks for the purpose of evaluating network effectiveness. They also implied that the interest of one level may not be consistent with those at another level. The problem seems to be more pronounced in the area of regulatory policy, where industry and regulators' interests are usually at odds with one another. The empirical study of the Zinc debate illustrates that particular policy problem in the context of a policy network (Van Bueren et al, 2003). However, this multi-level conflict may be less a problem if the network of focus is mostly operational in nature such as inter-local agreements on sharing policing and other resources. The relationship can be hypothesized as:

H4: A higher level of congruence in the interests of network actors is associated with a higher level of network performance.

Institutional Forces

Institutional forces are the incentives and constraints placed by a set of rules (Ostrom et al., 1994). These rules manifest themselves in laws, regulations, and formal or informal joint agreements to prescribe the authority and responsibility of network actors (North, 1990). Since the focus of this study is on public services networks, the institutional forces are mostly those governing government operations. Three main institutional forces identified are legal or political mandates, existing anchoring organizations, and the maturity of supporting rules for collaboration among network actors.

A mandate from a higher level of government is likely to have an impact on network performance. A mandate is the reflection of political wills. These political forces shape the objectives and scope of networks. Moreover, they shape the use and adoption of information technology (Rocheleau, 2003). A new federal mandate whose successful implementation requires cooperation among public agencies may provide the institutional pressure for forming and maintaining a network. For example, the implementation of the No Child Behind policy may prompt individual Departments of Education in various states to look at the possible gain from sharing information about students transferring from one state to another. A mandate as a result of policy change may also have a negative impact on a network. This framework does not assume the direction of impact. A mandate works through various types of institutional pressures such as mimetic ones to have an impact on the behavior of network actors and subsequently on network performance. Network member organizations may decide to join the network if they start to see the benefits gained by some early participants.

H5: When a mandate fosters cooperation in a network, it is more likely that the network will perform better.

The existence of a well-established anchoring association provides fertile ground for the formation of networks to address specific issues. Conversely, the lack of such organizations is likely to make the formation and activation of a network difficult. The establishment of a network is easier when the network is a subset of well established organizations. For instance, an inter-state effort to share information and analytical capability was quickly built on the membership of the National Association for Chief Information Officers. A lack of anchoring organizations for collaboration has the opposite effect on network performance. A case in point is the amount of effort required

to organize among governments from all three levels (local, state, and federal) for cooperation on homeland security issues.

The anchoring organization offers the needed social capital for collaboration. Social capital is the trust, shared values, common behavioral norms, and shared objectives developed among association members via regular interactions with one another (Rockart and Short, p. 192). This is an important foundation for establishing a network for information sharing and decision-making because the social capital serves as a foundation for collaboration as well as better use of information.

H6: A network performs better when its membership is mostly composed of those from a well-established organization.

The maturity of a coherent legal and regulatory framework helps assist cross-boundary cooperation. North (1990) has argued for the importance of legal institutions for economic performance. Public organizations need to follow laws and regulations as part of an overall effort to be accountable to citizens. If existing laws prevent them from engaging in information exchange with other network members, the effectiveness of a network could be significantly limited. For example, a lack of nation-wide privacy laws and policies impedes the cooperation between local and state governments in the design and development of their web portals and the sharing of information.

The maturity of regulatory frameworks also indicates that there is a sound causal theory between the objectives of the regulations and the means to achieve them. One recent example is the homeland security effort to fight identification fraud. Most of the existing laws and regulations that rely solely on querying a database do not require verification of the authenticity of identification presented. For instance, a border security officer is only required to check drivers' licenses of US citizens but not passports for

identification purpose. He/she does not need to check the authenticity of such an identification. This practice as stipulated in rules and regulation presents a security vulnerability (General Accounting Office, 2003).

H7: The maturity of a regulatory scheme surrounding network collaboration is positively associated with network performance.

Technology

The existing set of technology currently employed by a network also creates opportunities and constraints on the coupling of information technology and management techniques. The technology infrastructure, the use of collaborative software, the technological capability of network actors, and the complexity of the deployed technology all play a role in network performance.

A common set of technologies and standards used among key actors provides the technology infrastructure for collaboration. The technology infrastructure provides a common platform for the exchange of information and resources. For instance, if all agencies that are involved in the implementation of the No Child Behind policy use the same database software and shared a common data standard, the information could be shared easily and comparison would be possible. One of the main barriers for the provision of seamless *e*Government services is the lack of enterprise standards and technologies that allow various departments and agencies to share information and resources. Leading digital states are moving into the enterprise model for the production and delivery of public services (Gant et al., 2002).

Studies have shown the importance of a common standard and technology platform. A study of state-local intergovernmental information systems supports the importance of technology infrastructure in inducing interoperability and cooperation

(Dawes et al., 1997). A cross-country comparison also points to the importance of having a common set of technology infrastructure including standards (Dawes and Prefontaine, 2003).

H8: An existing common technology standard or platform is positively associated with higher network performance.

The existence and use of collaborative IT tools serves as a foundation for better network management. It could be a simple scheduling tool or a sophisticated group decision making tool that allows online collaboration. The use of collaborative software reduces the cost and time involved in collaboration either in the form of information exchange or joint production of services (Dawes and Prefontaine, 2003). One recent example is the knowledge management tool. Some recent experience has suggested that knowledge management tools show promise in improving decision-making in government (Wagner, 2003; Brown and Brudney, 2003). More detail about the classification of various levels of collaborative information technology is included in the later part of this paper.

H9: The more extensive use of collaborative information technology, the better performance the network will have.

Moreover, the capability of network actors in using information and communication technologies is also significant. IT capability will likely determine their level of adoption and use of information and communication technology (Cohen, 1990). A recent study of cities has shown the importance of such capacity in adopting internet technologies for e-government (Melitski, 2003). If individual network actors' capabilities are low, the existing technology network infrastructure and capability will not be utilized. For example, some city governments fail to take advantage of web portal

hosting services available via the League of Cities mainly because they lack the understanding of information and communication technology related to hosting a web portal.

H10: The higher the capability of network users in the use of information technology, the better the network is in using the technology to improve network performance.

Ease of use of current technology in the network also affects network management. This is one of the main factors determining the adoption of new technologies (Davis, 1989; Davis et al. 1989). The same logic can be extended to organizations that participate in a network. If current technology is easy to use, it is more likely for organizations to participate in the electronic exchange of information and services. Adoption decisions are directly linked to the perceived ease of use rather than to the objective ease of use. Therefore, this is what will be measured. It should be noted that the perceived ease of use can be adjusted over time as users learn more about information systems (Venkatesh, 2000). Users will feel more comfortable with information technology once they have more direct control and enjoyment.

H11: The greater the perceived ease of use for an information technology, the better a network can perform.

Dependent Variable: Network Performance

Networks perform when they add values to the existing arrangements. Established in the information systems literature is the role that information technology plays in creating values through an electronic network by reducing the costs of transactions. Intergovernmental networks also create values for network actors (Meier and O'Toole, 2001).

Network performance is a multi-dimensional construct. It captures gained capacity as a result of having a network. Although performance is an outcome measure varied by the strategic intention of the network, some common value addition activities can be identified. For public services, networks have the potential to increase information exchange, joint decision-making, and capacity of participating organizations. These can be used to form a profile for an internal audit to measure the extent to which the strategic goal of the network is accomplished. Moreover, they can be used for a cross-network comparison.

One performance measure is the efficiency and effectiveness of information exchange. Information exchange is one main activity engaged by networks of local governments (Agranoff, 2003). Efficiency depends on the speed and cost for information to be shared by network actors. Effectiveness measures extent to which information reaches network members and the quality of information exchanged. The content of information can be about an emerging and relevant piece of technology, grant opportunities, technical resources, financial information, and/or policing information.

The change in joint decision-making capability is the second dimension of network performance. Some of the common decision-making activities for public inter-organizational networks include identification of policy problems or decision items, planning for cross-boundary projects, and joint programming to carry out mandates (Agranoff, 2003). Networks accomplish this through stabilizing a set of rules for the roles and responsibility of network actors and a specific set of rules and protocol for organizing and making decisions.

Capacity building is another indicator of network performance. Capacities include analytical capacity in information processing, program implementation, and identifying and leveraging resources. Capacity building is achieved through resource gain and resource sharing. For example, a school district may gain knowledge about a grant opportunity to finance its telecommunication infrastructure by participating in a network of school districts that regularly share information about grant opportunities.

Information Technology and Management Activities

The role of information technology is in its enabling effect. The impact of information technology should be put in the context of processes or activities that it aims to enable. A single focus on linking the type of technology used to outcomes usually gives only mixed results because of the existence of other determinants. Therefore, the proposed framework models information technology with management activities that it aims to enable. Management activities can shape network structures, institutional forces, and technology, although with varying degrees. Technology coupled with management activities can be employed to increase the effectiveness of those activities.

Classification Schemes

The proposed framework relies on two classification schemes to capture the coupling of management activities and information technology. One classification scheme is about management activities. McGuire's (2002) classification scheme has been adopted in this research because the same interest on ultimately informing public managers. The other advantage of this classification scheme is its flexibility in dealing with specific situations and change. This classification groups management activities

into activating, framing, mobilizing, and synthesizing. Activating identifies and involves stakeholders as network members and taps their skills, knowledge, and resources. Framing refers to managing the perception of a network's individual members by shaping its norms and values. Mobilizing means garnering support from stakeholders, who could be current network members or a stakeholder individual or organization outside the network. Synthesizing activities are those that create a conducive environment for a productive interchange among network participants.

The other classification is the information technology employed for enabling network management activities. This classification is not specific to a particular set of technologies. The focus is on functionalities on four levels with increasing levels of sophistication. Level 1 technology supports listserv functions and an e-mail directory of network actors. At this level, members can have one-to-one or one-to-many interaction with other members for information only exchange. Since e-mail is the primary means of communication, individual participants are responsible for saving information and keeping track of correspondence. Level 2 network information technology adds a central administrative function that supports central archiving and the management of correspondence and information. Central management of information can include a web site that has calendar information. However, the means of communication is still e-mail.

Level 3 further adds collaborative information systems to facilitate the exchange of information. At this level, network members can take advantage of a group decision support system that supports real-time online conferencing and session archiving. Also, data linking is possible for one network member to access information housed by another network member. A web portal can be part of the group decision support system. Level

4 adds a fully developed information system to manage knowledge and resources for its network members. It allows network members to create, store, share, and apply knowledge. It requires the ability to work with a central repository of information and resources. Network members can engage in interaction with the support of needed knowledge for real-time decision-making.

Coupling of Management Activities and Information Technology

Although there are sixteen possible combinations of management activities and information technology use, the current use of information technology and the stage that a network is in will limit viable choices. The following hypothesized relationships capture the ways in which the coupling of management techniques and information technology will first affect the three groups of factors. The change of these three groups of factors will in turn affect the value addition of the network. The discussion in this section will focus on the relatively significant effects that the coupling of management technique and information technology may have. Although the discussion below is not exhaustive, it serves as an initial attempt to capture the dynamics and complexity of management activities. The section below is organized into two possible levels of information technology use for one management activity.

At the initial stage of network formation, activating is considered as one key management activity (McGuire, 2002). If there is no information and communication technology currently employed, activating can be done much more efficiently with the help of a listserv that connects core members of the network. The initial members can quickly identify the main stakeholders that need to be involved in the process and share thoughts on interests that various stakeholder groups may have. This coupling is likely to

help form a stronger core member group for the network. As a result, it is likely to help create resources for the network.

Activating can be coupled with real-time online collaborative information technology (level 3) to reenergize a relatively sluggish network that already has the level 3 technology capability. The collaborative tool that connects network members together allows quick identification of skills and resources available from network members. The archived information exchange available at this level can also provide some clues as to who the experts are in a specific knowledge area. These core members can be activated to deal with various issues affecting the network, such as misalignment between incentives and responsibilities, or legal and regulatory constraints. Once a problem is identified, the area expert can initiate thoughts and actions to tackle it. The collaborative tool can also increase the flow of knowledge from area experts and novices in a subject area. As a result, this creates incentives for the marginal and inactive members to participate in network activities.

Framing can be coupled with level 2 information technology to shape the norm and values of the network. It could be a way for proposing, discussing, and voting on the network activities geared toward the development of a coherent protocol or framework for the exchange of resources and information among network members. Moreover, it can provide a mechanism for enforcing rules. Gradual sanctioning sends signals to members of an institutional arrangement to clarify what constitutes appropriate behavior (Ostrom et al, 1994). When the network has the professional culture in place and the right institution for collaboration, it is easier for network members to increase their information exchange and joint decision-making power.

Level 4 information technology can be used in conjunction with framing for maintaining a network. An information system with knowledge and resource exchange capability can help maintain a network. Specifically, the constant exchange of resources and information can shape both the reality and the perception of benefits and costs associated with network participation. If everything else is equal, this high level of information technology employment should provide quicker shaping of norms and values than the deployment of a lower level of technology. If the perception is consistent with the primary value proposition of the network, it is likely that the network will sustain and even prosper.

Mobilizing is usually associated with e-mailing campaigns (Level 1) in a network environment. If network members understand the benefits of being a network member, e-mailing and generating discussions on an e-mail list are relative effective in mobilizing support from current network members. Managers of a network can gather outside support if they are enabled with information technology allowing them to reach outside stakeholders quickly and effectively.

Mobilizing will also be much more effective if an existing information system is in place for collaboration. At that level of integration and interdependence, network members understand the consequences of not actively participating a joint arrangement. They have a vested interest in getting the support for the network either from their home organization or other stakeholder groups outside the organization. The knowledge and information resource exchange system will allow them to demonstrate the tangible benefits of participating. The other critical component is the ability to quickly

communicate to a selected group audience. Communication is regarded as a key in this high level collaboration among network members (Dawes et al., 1997).

Synthesizing is more effective with the deployment of higher level technologies. Effective synthesizing requires some groundwork in activation, framing, and mobilizing. Moreover, it requires a higher level of interaction among network members. Member electronic mailing and notification, as Level 1 technology can offer, probably has a very limited impact. Some online collaborative tool is a relatively good starting point for synthesizing. In essence, collaborative tools serve a complementary role in enabling the capability of exchanges.

An integrated information system with a knowledge management capacity can further enable synthesizing activities. With a thorough knowledge and a strong analytical capability, network members can identify partners in the network that have the resources complementary to their own. The entire network can funnel resources to promote the environment for fostering synergistic activities. For example, a web portal, serving as a knowledge and resource exchange platform powered with a natural language search, can empower individual network members to take advantage of expertise brought to the network from individual members. For government agencies, this could be grant opportunity or technical information related to their programmatic pursuits.

Discussions and Conclusions

Appropriate research design and modeling techniques present unique challenges for the proposed framework. At least a two-stage process is needed. The first stage is to test the strength, direction, and significance of the relationship between three groups of independent variables and network performance. A large data set is necessary for

engaging that analysis. One idea is to survey local governments that enter formal or informal agreements with neighboring ones for joint decision making or provision of services. Each agreement covering several local governments, private, and nonprofit entities will be a network. Since local governments that have entered some form of agreement with neighboring entities are relatively large in number, it will be possible to apply multivariable regression analysis. One example of these networks is councils of governments that facilitate a regional approach to cooperation in the planning and provision of public services. Survey and document analysis will be the main methods of collecting data on network characteristics, institutional forces, and current use of technology. Network performance can be measured by the general perception of key network members. It can be supplemented by objective outcome indicators such as the level of resource and information sharing and the number of successful joint agreements.

The first stage captures an overall picture how these various groups of factors may affect network performance. It establishes correlations among network characteristics, institutional forces, technology, and network performance. The results can be used to guide efforts to promote network performance. However, little can be said about the dynamics that are critical for network management.

The additional benefit of the first stage of data collection for the second stage of data analysis on dynamics is the establishment of baseline information. This will establish the technology used, structural characteristics of networks, as well as institutional forces driving the network.

The second stage deals with the mediating effect of the coupling of management strategies and information technology. This can be accomplished by a multi-year study

that looks at change. To establish the link, it will utilize baseline information collected at the first stage. Then, it will model the change as mediated by the combination of management activities and information technology. These changes will be captured by the changes in three groups of independent variables. For example, the use of more advanced technology will be part of the technology equation. The result of management activities is reflected in the network structure and institutional characteristics. These changes will be translated to network performance.

The proposed framework is the first step in linking technology, institutions, and network structure to network performance. The coupling of network management activities and information technology is modeled as to capture the dynamic and change over time. This paper contributes the knowledge about the role that information technology plays in managing networks and improving their performance. Drawing from three bodies of literature and various intellectual traditions, this paper develops a list of hypothesized relationships. The next logical step is the testing of these hypothesized relationships for developing a model for using information technology for network management.

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