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Institutionalizing IT-enabled Social Innovations: The Case of Municipal Broadband Innovations

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ABSTRACT

This research develops an understanding of the institutional process of IT-enabled social innovations in the context of municipal broadband innovations. IT-enabled social innovations consist of two interdependent elements: (1) social innovations, in our case, the enhancement of social and economic development such as developing a digitally inclusive community, enhancing public safety and emergency responses, and creating economic opportunities for businesses and individuals, and (2) IT innovations, in our case, the broadband innovations used to implement the initiatives and realize the goals in the social innovations. Drawing on the institutional and the social movement theories, our institutional process of IT-enabled social innovations encompasses four activities: framing, mobilization, network formation, and legitimation. The findings suggest that institutional actors engage in a number of collective actions (e.g., framing municipal broadband as a solution to broadband crisis, and using a web site and industry conferences to create a collective identity and mobilize resources). Empirical evidence also illustrates the extent of coevolution between the institutional process of IT innovations and social innovations.

Keywords: IT-enabled social innovations, municipal broadband innovations, innovation theory, institutional theory, social movement theory

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"Although there is real competition to sign up new broadband subscribers in some communities, broadband competition in many local markets remains all too limited. Not surprisingly, municipalities have begun to consider policies designed to solve this problem. The municipal broadband movement is a grassroots effort by this country's local officials—many of whom recognize that broadband Internet access is increasingly essential to economic growth—to respond to real needs on the part of their constituents to make broadband more available and affordable."

U.S. Federal Trade Commissioner, Jon Leibowitz, 2006

INTRODUCTION

Access to basic telecommunications services, in general, and broadband Internet, in particular, is increasingly viewed as one of the necessities for individuals and organizations in the global information society. In the past, the U.S. government used a number of policy instruments to expand the reach and quality of broadband services. These initiatives include the Telecommunications Act of 1996 to promote competition, the universal service fund to expand the reach of broadband services, and various funding and grants to increase broadband use, among others (Frieden, 2005; Wilhelm, 2003). Despite these legislative and regulatory efforts from the government, observers openly criticize the failure of such policy tools to promote broadband development citing the monopolistic structure, political power of incumbent telecommunications providers, and entrenched management as the major problems (Ferguson, 2004; Hammond, 2005).

The failure of the top-down approach to enhance broadband deployment has encouraged many grassroots efforts to build wireless hotspots as an alternative bottom-up approach for the widespread diffusion of broadband (Schmidt and Townsend, 2003). More recently, a new movement emerges from the local government. Due to rapid advancement in wireless broadband technology, cities, large and small, have intended to develop their own city-wide broadband infrastructure. Some of these cities act out of frustration of the lack of broadband services from private companies while others aim to increase the competitiveness of their cities in attracting and retaining businesses. These projects widely referred to as municipal broadband networks or municipal wireless networks, represent a promising alternative to achieve the goal of broadband access for all. If successful, they can be instrumental in enhancing social and economic opportunities in the communities. Therefore, it is important to understand the process involving how interested actors shape the structure of the communities to facilitate the institutionalization of municipal broadband innovations.

We argue that municipal broadband innovations are classified as IT-enabled social innovations. An IT-enabled social innovation consists of two interdependent elements: (1) *social innovations*, in our case, the enhancement of social and economic development such as developing a digitally inclusive community, enhancing public safety and emergency responses, and creating economic opportunities for businesses and individuals, and (2) *IT innovations*, in our case, the employment of broadband innovations to implement the initiatives and realize the conceptual goals put forth in the social innovations. Given the costs and related benefits, some of the attractive technological choices that cities evaluate are largely wireless broadband innovations, with Wi-Fi innovations being popular technologies chosen by a number of cities. Therefore, we will focus on Wi-Fi broadband innovations in this study.

Despite increasing IT use for social benefits, IS innovation research primarily focuses on IT-enabled business innovations such as Internet computing (Lyytinen and Rose, 2003), E-Business (Zhu and Kraemer, 2005), and software process technology (Fichman and Kemerer, 1997). First, many studies were developed primarily with a narrow focus on business values to organizations, thus providing little insights in a context of an application of IT innovations for broader social values. Second, these studies follow what Fichman (2004) refers to as the "dominant paradigm" and often employ the variance models (Markus and Robey, 1988) to explain innovation. Although these studies provide ample evidence and significant insights to guide adoption decisions, they do not provide a theoretical model that illuminates the complexity involved in how disparate organizations with diverse interests in an innovation co-produce a supporting environment for institutional change. Municipal broadband innovations represent collective efforts by cities and other organizations to institutionally change the provision of broadband services from the private telecom industry. In the context of municipal broadband innovations, actors such as cities, citizens, businesses, telecommunications service providers, state governments, and the federal government, who mobilize resources to shape their institutional environment, are institutional entrepreneurs. These institutional entrepreneurs share collective visions of IT-enabled social innovations (Swanson and Ramiller, 1997) but they also simultaneously have their own private interests that might conflict with other actors. Therefore,

these actors often apply their social and political skills (Fligstein, 1997) in cooperative and competitive collective actions as well as engage in shaping these processes to embrace their private interests.

To address the gaps in the literature, this study engages in theory development that seeks to advance our understanding of the formation process of IT-enabled social innovations. The research questions are:

- How can we develop an institutionalization process of IT-enabled social innovations to understand its complex and dynamic process of institutional change?

- What is the institutionalization process of municipal broadband innovations?

- Given the interrelationships of IT innovations in social innovations, how does an institutional process of social innovations influence an institutional process of IT innovations and vice versa in the context of municipal broadband innovations?

To answer these research questions, we first look into the institutional theory and the social movement theory to develop an integrated framework to study institutional processes of IT-enabled social innovations. Next, we use this framework to derive empirical evidence to understand the institutional process of municipal broadband innovations as well as to gain insights into the coevolution of institutional processes of Wi-Fi broadband innovations (IT innovations) and municipal broadband innovations (social innovations). Finally, we use the empirical evidence to theorize about an institutionalization process of IT-enabled social innovations in general.

MUNICIPAL BROADBAND INNOVATIONS

This section provides background information on the municipal broadband innovations.

Municipal Broadband Innovations: A Solution to Market Failure

The municipal broadband innovations are unorganized collective efforts among local governments to address the failure of the use of market-based mechanisms to promote universal, affordable access to broadband technology. Several studies provide substantial evidence to elaborate many forms of such failure. For instance, Crandall et al. (2007) suggest that the current market for the U.S. Internet services is primarily dominated by a single cable company and a single phone company. Some ten percent of households do not have any access to broadband. Despite the recent strong growth of broadband adoption, broadband penetration is not equally distributed across geographical areas and demographic groups. According to the

Pew Internet report (Horrigan, 2006), in 2006, 18% of rural residents have broadband connections at home, compared with 31% of urban residents and 14% of Black Americans have broadband connection at home, compared with 31% of White Americans. Daggett (2007) suggests that the lack of competition does not provide incentives for private operators to expand coverage to rural areas, lower prices, and upgrade speed.

In recent years, U.S. cities have increasingly deployed or planned to deploy municipal broadband networks on their own or, in some cases, in collaboration with private partners. Gillett et al. (2006) referred to this kind of local government action as government as infrastructure developer. In 2007, according Muniwireless.com, there were 415 cities and counties that either developed their broadband infrastructure or have planned to do so.

Although cities appear to make similar decisions to involve in broadband infrastructure development, their decisions, when examined closely, vary in a number of ways. The differences are reflected in their plans towards targeted users, technology, applications, and government responsibility (Gillett et al., 2004; Mandviwalla et al., 2008). Plano, TX, for example, focuses on public safety applications while Corpus Christi, TX's primarily use broadband infrastructure in utility applications (i.e., remote meter reading). From technology perspectives, several cities (e.g., Philadelphia, PA, Chaska, MN, and Hermosa Beach, CA) chose Wi-Fi mesh technology while other cities chose different broadband technologies (e.g., WiMAX for Grand Rapids, MI, and Fiber optics for Grant County, WA). Municipal broadband development also varies in terms of government responsibility. Some cities (e.g., Hermosa Beach, CA) own the infrastructure but allow private companies to act as service providers yet other cities (e.g., Chaska, MN) act as an owner and an operator.

AN INSTITUTIONALIZATION MODEL OF IT-ENABLED SOCIAL INNOVATIONS

We develop a model of institutional processes in IT-enabled social innovations by drawing on the institutional theory (DiMaggio and Powell, 1991; Scott, 1995), and the social movement theory (McCarthy and Zald, 1977; Tilly, 1978). The institutional theory offers a perspective of the dynamic and evolving relationship between institutional actors and structures to explain emerging institutions. The social movement

theory, by framing institutional change as social movements, offers a process perspective to understand collective actions to achieve broader social benefits through IT innovations.

Institutional Theory: A Regulatory, Social, and Cognitive Process of Institutional Change

The institutional theory views that institution structures provide meanings to actions and subsequent actions, in turn, shape institutional structures (DiMaggio and Powell, 1991; Scott, 1995). These institutional arrangements may evolve over time as institutional actors constantly debate and negotiate over emerging issues (Hoffman, 1999). As issues evolve over time, the composition and the role of institutional actors may also change. Such coevolution of issues, institutional actors, and structures makes an institutional process dynamically complex and emergent.

An institution consists of three interconnected systems, which Scott (1995) called pillars: the *regulative*, *normative*, and *cognitive*. A regulative system is mostly in the form of laws, regulations, and state policies. A normative system is in the form of rules-of-thumb, standard operating procedures, occupational standards, routines, conventions, training programs, and educational curricula. Through their professionalization and socialization, organizations are likely to comply with these norms based on the moral and ethical obligation. A cognitive (or cultural) system includes symbols and cultural rules that facilitate an understanding of the nature of reality and provide frameworks through which meaning is made. Organizations take these cultural consensus and cognitive rules for granted and abide by them without conscious thought (Zucker, 1983).

While most institutional research focuses on the stability and homogeneity of organizations by studying how institutions, once created, are adopted and diffused (Bala and Venkatesh, 2007; DiMaggio and Powell, 1983; Teo et al., 2003), very little is known about an institutionalization concept of change (DiMaggio, 1988; Fligstein, 1997; Hargrave and Van de Ven, 2006). (See Van de Ven and Hargrave, 2004 for an extensive review of institutional theory and institutional change.) Others also argue that an institutional theory perspective does not pay enough attention to the role of actors in the interpretation of data (Barley and Tolbert, 1997; Scott, 1987).

To address these limitations, recent research focuses on how actors often referred to as institutional entrepreneurs engage in shaping emerging institutions. This line of research adds significant new knowledge

of how institutions can be created as new technologies and their innovative applications emerge. The municipal broadband innovations, for instance, were driven at least by the rapid development of a myriad of wireless broadband technologies such as Wi-Fi, WiMAX, and the third-generation (3G) mobile technology. An institutional process generally does not pertain to specific industries or technologies. In contrast, the process involves a collective of organizations who share common interests around specific issues such as environmental protection (Child et al., 2007; Hoffman, 1999), technology standards (Garud et al., 2002), and health care (Currie and Guah, 2007). In our study, institutional actors may include local, state, and federal governments, private broadband service providers, technology equipment vendors, solution providers, system integrators, consultants, analysts, among others.

Institutional actors "lead efforts to identify opportunities, frame issues and problems, and mobilize constituencies" (Rao et al., 2001, p. 240). Essentially, the activities of these actors include *legitimation* through framing and resource *mobilization*. To be successful, institutional actors engage in the management of shared meaning through their influences in establishing new structures, practices, and behaviors. To do so, they use social skills and strategic actions to produce needed actions, organize interests, as well as distribute resources (Fligstein, 1997). Social skills are defined as "the ability to motivate cooperation in other actors by providing those actors with common meanings and identities in which actions can be undertaken and justified" (Fligstein, 1997, p. 398). In their study of Sun's sponsorship of Java technology, Garud et al. (2002) found that Sun displayed social skills to mobilize support of a large number of actors around its standard. Some of these actions are the adoption of an open systems strategy and the use of the image of a common enemy (i.e., Microsoft). From the legitimation perspective, Sun employed a number of strategic actions by allowing software developers to download Java for free, making Java easy to learn, promoting its potential to become a comprehensive networking platform, and seeking the endorsement from the International Organization for Standardization (ISO) for Java to become an open international standard.

Institutional scholars have increasingly identified disruptive events as central in explaining change processes (Child et al., 2007; Fligstein, 1991; Hoffman, 1999; Lorange et al., 1986; Meyer, 1982). Other terms to refer to disruptive events are critical events, shocks, jolts, and discontinuities. Disruptive events are

defined as events that overcome institutional inertia as well as trigger the path of institutional development. Hoffman (1999), based on corporate environmentalism institutionalization, classifies disruptive events into three types: milestones (e.g., Earth day), disasters (e.g., major pollution accidents), and legal/administrative events (e.g., parliamentary hearings, trials, and release of environmental white papers). Theorizing on systematic classifications of disruptive events has yet to emerge from the literature.

Social Movement Theory: A Political Process of Institutional Change

Although several studies (e.g., Currie and Guah, 2007; Hoffman, 1999) suggest that an institutionalization of innovations is political and social in nature, the institutional theory does not have concepts to explicitly explain the underlying political process. Also, social movements by means of collective actions have been used as one of the effective mechanisms to address several social problems in the past. Since IT-enabled social innovations are designed to address social issues through IT innovations, the social movement theory provides an important complementary perspective to enable a better understanding of their institutional processes.

The social movement theory views the process of institutional change primarily as a political process of mobilizing resources to legitimate a social or technological innovation (Hargrave and Van de Ven, 2006; Rao, 2001). A social movement is defined as "an action system comprised of mobilized networks of individuals, groups and organizations which, based on a shared collective identity, attempt to achieve or prevent social change, predominantly by means of collective protest" (Rucht, 1999, p. 207). The theory emphasizes the importance of conflict, power, and politics in explaining institutional change. The process of institutional change involves issue framing, resource mobilization, and ideology contest between oppositions to achieve social change.

Originally developed in Sociology, the social movement theory has been applied to study collective actions to address perceived social problems, injustices, and failed public policies such as the civil rights movement (McAdam, 1982), the labor movement (Wilton and Cranford, 2002), and the peace movement (Meyer and Whittier, 1994). The literature suggests two related factors as central elements to explain the development of social movements: *framing* and *network formation* (Benford and Snow, 2000). The framing

processes are those by which social movement actors and their oppositions engage in framing and reframing the meanings of relevant social issues. Over a period of time, the two groups often involve in framing battles to gain broader legitimacy and dominance in order to achieve their own collective goals. The network formation is a process by which actors organize networks to build a coalition with other actors who have complementary interests, skills, and resources to produce institutional change.

There is empirical evidence to support the importance of framing in social movement success. Lounsbury (2005), for example, illustrates the importance of framing towards the broader success of garbage recycling. Initially, because the environmental activists argued that recycling is a means to address problems such as mass consumerism, the advocacy groups that joined the coalition were limited to those states that were favorable to ecological activism. Later, broader participation in recycling advocacy groups emerged as the activists reframed recycling as an alternative to incineration. Wilton and Cranford (2002) documented the efforts of a coalition of workers, students and community members at the University of Southern California to win the contract negotiations. Vital to the coalition's success is the efforts to link the labor conflict to social and spatial inequalities between the university and the surrounding neighborhoods.

Similarly, research has documented the critical role of network formation in facilitating and structuring collective actions to achieve theirs goals. In their study of anti-pollution policies during 1956-1976, Stearns and Almeida (2004) found that favorable policies leading to environmental reforms were the result of loosely-coupled coalitions between anti-pollution movements and state agencies, opposition political parties, local governments, and the courts. Meyer and Whittier (1994) reported that the peace movement is comprised of at least two groups with overlapping interests. One is the religious groups who critically critiqued U.S. foreign policy and called for transformation of governmental and social institutions. The other is the liberal-internationalist groups who promoted the use of multinational agreements and arms control to manage international conflict and nuclear weapons.

An Integrated Institutional and Social Movement Perspectives: Explaining the Institutionalization of IT-Enabled Social Innovations

As discussed above, the institutional theory offers insights to understand an institutional process of innovations while the social movement theory offers broader interpretations to explicitly understand the

underlying social and political processes in the institutional change. In particular, the institutional theory focuses on the mobilization and legitimation processes. The social movement theory highlights the importance of framing and network formation towards the success of social movements. Drawing on these explanations, this study develops a framework of an institutional process of IT-enabled social innovations that encompasses four related activities: *framing*, *mobilization*, *network formation*, and *legitimation*. We use this framework to examine the institutional process of municipal broadband innovations.

However, it is important to point out that studies in these two literatures primarily treat an innovation as an independent element (Garud et al., 2002; Wang and Swanson, 2007; Stearns and Almeida, 2004; Wilton and Cranford, 2002). Recently, social innovations increasingly rely on IT innovations to support their goals. The use of mobile phones to improve healthcare management and services is a good example (infoDev, 2006). This trend opens up new challenges and calls for additional theory development. We conceptualize IT-enabled social innovations as those innovations that comprise social innovations (innovations with social and economic development goals) and IT innovations. Social innovations and IT innovations are viewed as interdependent elements and IT innovations are central elements to successful social innovations. Therefore, we argue that concepts from institutional and social movement theories that treat innovations as independent are not adequate to develop a complete understanding of the underlying institutional processes of IT-enabled social innovations. There is a need for a new theory to explain the reciprocal relationship between the institutional processes of social innovations and related IT innovations that simultaneously shape these innovations. This research is an attempt towards the development of such theory.

RESEARCH METHODOLOGY

Research Setting

We study IT-enabled social innovations in the context of municipal broadband innovations. The study of municipal broadband innovations in particular and IT-enabled social innovations in general can provide significant theoretical, managerial, and policy contributions to the IS innovation literature. First, despite the increasing use of IT in social innovations, this research area is under theorizing in the IS innovation literature. Second, in the information society, Internet access has become indispensable for citizens and

organizations. Governments worldwide take active actions to achieve universal broadband Internet penetration. In recent years, several U.S. cities have invested resources to develop their own broadband infrastructure. Widespread adoption of municipal broadband networks has the potential to increase the digital inclusion and move communities closer towards universal broadband Internet penetration. Third, municipal broadband innovations as collective movements have to undergo an uphill battle with the entrenched ideology that broadband infrastructure and services should be a private sector's business and public entities should not challenge such status quo. Therefore, understanding of the institutionalization of municipal broadband innovations is important to the future of broadband policies and services in the U.S and perhaps in other countries that share a similar goal of universal broadband access.

Method and Data

The objective of this study is to understand the institutionalization process that involves institutional changes in social and IT innovations related to municipal broadband innovations. Van de Ven and Hargrave (2004), in their extensive review of the interdisciplinary literature on institutional change, distinguished four perspectives of institutional change: institutional design, institutional adaptation, institutional diffusion, and collective action. Our integrated institutional and social movement theories is similar to the collective action model that focuses on institutional change processes at the organizational field level through interactions among groups who share similar interests. Organizational field refers to "a community of organizations that partakes of a common meaning system and whose participants interact more frequently and fatefully with one another than with actors outside the field" (Scott, 1995, p. 56). In our context, the field is formed around social and technological issues related to municipal broadband innovations that bring together various organizational constituents with disparate and sometimes conflicting purposes.

Phillips et al. (2004) suggest that institutional change is produced through texts that are embedded in discourse generated by actions and interactions among members. Following this conceptualization, we collected articles published in trade journals that discuss municipal broadband innovations. By using the keywords "municipal wireless" and "municipal broadband" as search terms in the ABI-INFORM database in December 2007, we collected 206 articles published in various trade publications (e.g., Wireless News,

Business Wire, and Wall Street Journal) from 2003 to 2007 and used them as a basis to construct the institutional change process of municipal broadband innovations (Hargrave and Van de Ven, 2008).

Data Analysis

The data analysis proceeded in three steps. First, we identified disruptive events (Child et al., 2007; Hoffman, 1999) that are central to the institutional change process from the collection of articles retrieved from ABI-INFORM. We present the disruptive events discovered from our data in the next section.

Second, following our framework of an institutional process of IT-enabled social innovations that encompasses four related activities: *framing*, *mobilization*, *network formation*, and *legitimation*, we use the conceptual definitions of these activities from the literature to code contextual data from the 206 articles to identify related social activities by various institutional actors. Two separate codings were performed for social innovations and IT innovations underlying municipal broadband innovations. Since institutional actors do not necessarily share the same beliefs and attitudes towards municipal broadband innovations, our data analysis focuses on identifying activities pertinent to those supporting and opposing views towards municipal broadband innovations. The coding structure and textual examples for the social innovations and IT innovations associated with municipal broadband innovations are shown in Appendix 1 and Appendix 2 respectively.

Third, we used coded data for social and IT innovations to construct the process of institutional change for each type of innovation. Then, we reassembled the coded data for both the social innovations and IT innovations to understand the interrelatedness of their institutional processes.

FINDINGS

In this section, we answer the research questions (#2 and #3) concerning the empirical findings in the context of municipal broadband innovations. We provide the answer to the theorizing research question (#1) in the Discussion section.

Institutional Process of Municipal Broadband Innovations

Research question #2: What is the institutionalization process of municipal broadband innovations?

Our data analysis revealed several disruptive events that are significant in shaping the institutional process of municipal broadband innovations. Table 1 presents these disruptive events and their time lines.

Table 1. Disruptive Events in the Institutional Process of Municipal Broadband Innovations	
TIME	**EVENTS**
July 2003	The launch of Muniwireless.com, an information source of municipal broadband development. Esme Vos, an intellectual property attorney, is a leading advocate of the municipal broadband movement.
August 2004	The city of Philadelphia, the first big city, announced the Wireless Philadelphia initiative.
August 2005	Intel along with other leading companies in the computing and network industries announced the digital community initiatives to publicly endorse the municipal broadband.
November 2004	Pennsylvania passed the state law requiring cities to seek permission from local phone companies before offering paid telecom services. The city of Philadelphia was allowed to pursue its initiative.
September 2005	The first Muniwireless.com conference held in Silicon Valley, San Francisco. The conference was attended by over 300 participants and was supported by over 20 sponsors and exhibitors.
October 2005	The city of Philadelphia awarded the contract to build the network to Earthlink with the condition that Earthlink funds the entire cost of network building.
2005	At least 14 states proposed the bills to restrict municipal broadband efforts.
2006	Telecommunications companies changed from their strong opposition towards municipal broadband to trying to partner with cities to build broadband networks. For example, AT&T put in a bid for Washtenaw county, Michigan.
October 2006	AT&T received the first municipal broadband project from Riverside, CA.
November 2007	Earthlink announced that it will not make additional investments in municipal broadband partnerships with cities and it seeks solutions to the agreements that it currently had with several cities.

At the outset, municipal broadband innovations were broadly framed as a solution to the national broadband penetration problem primarily caused by the failure of the market-based broadband innovation. In 2000, the U.S. was ranked 3rd among nations worldwide in terms of per capita broadband access. The U.S. ranking was significantly dropped to 16th in the world in 2005 and slipped down to 24th in 2006, according to the International Telecommunication Union. This broad framing of municipal broadband innovations generated significant attention among institutional actors particularly local city governments, allowing them to create a collective identity and build coalition of actors who share similar ideology towards using municipal broadband innovations to address the national broadband issues.

Another layer of framing occurs at the local government level. Some accentuate the national broadband issues while others contextualize broadband problems in their local communities. The city of Philadelphia, for example, wanted everyone in the city to have affordable access to broadband. Another example, the city of Scottsburg, framed its problem as the city in crisis as businesses were leaving the community because they did not have broadband. Yet, others framed municipal broadband innovations around local goals such as building high-tech cities (e.g., Philadelphia), improving city operations (e.g., Ferrysburg, Rome, and Spokane), narrowing digital divide (e.g., Dayton, Delray Beach, and Roper), and enhancing public safety (e.g., Boulder city, Granbury, and Spring Lake).

Initially, resources were mobilized through localized city initiatives to develop their broadband infrastructure. Broader legitimation of municipal broadband innovations emerged when Esme Vos, an intellectual property lawyer, launched the muniwireless.com web site in July 2003. Vos has been instrumental in this social space through her vocal advocate of these grassroots initiatives. The web site provides channels for institutional actors to share knowledge, issues, and learn about other cities' initiatives, thus reinforcing the allies' collective identity. Subsequently, a number of activities to further legitimate municipal broadband innovations came from disparate groups with complementary interests and resources. First, several major cities including Chicago, Houston, Minneapolis, Philadelphia, and San Francisco, announced their initiatives. Second, a number of major companies in the computing and network industry launched initiatives, programs, products, and services to publicly endorse the municipal broadband. For example, Intel along with 20 other companies (e.g., Cisco, Dell, IBM, and SAP) initiated the digital communities project in August 2005. The goal of this project is to provide funding, equipment, and expert consultation support to local municipal broadband innovations. Third, a growing recognition of municipal broadband innovations was evidenced in the establishment of a specific committee in industry associations (e.g., the setup of the municipal wireless committee in the Wireless Communication Association), the industry discussion and showcase of municipal broadband innovations in major conferences (e.g., the Interop, one of the leading IT conferences), and a growing number of reports by industry analysts forecasting a strong growth of municipal broadband (e.g., ABI Research, Forrester Research).

However, similar to other movements, the municipal broadband has its opponents and telecommunications companies (phone and cable companies) appear to be the archrivals. Similar to the alignment and coalition formation by municipal broadband supporters, those who oppose the innovations engaged in their framing process to align interests and recruit their groups. Their counter-framing attempts to thwart the innovations both at the collective level and at the local level. At the collective level, phone and cable companies claimed that cities have unfair advantages through free access to infrastructure, tax exemption, and public funding. For example, Verizon, BellSouth, Cox Communications, and many others argued that government-owned broadband networks should operate by the same rules as other service providers. By building coalition with other telecommunications companies as well as state and federal governments, these opponents use the legal mechanisms in the form of state and federal bills to protect their business and simultaneously restrict local governments from entering the broadband market. In 2005, legislatures in at least 14 states proposed legislation to restrict municipal broadband efforts. The Nebraska Legislative Bill 645 and the Pennsylvania House Bill 30, for example, prohibited local governments from competing with the private telecommunications industry. Note that Verizon agreed to allow Philadelphia to proceed with its municipal broadband project.

Parallel with the attempts at the collective level, these opponents engaged in a number of framing contests against the municipal broadband at the local level. Some of these framings include claims that the city lacks experience and undermines the efforts and resources involved in the management of networks and services. In some cases, these opponents cited that cities use risky business models (e.g., free services with the funding support from advertising). In other cases, they publicized disappointing results (i.e., cost overrun, project delay, slow uptake of demand, and scrapped projects). An example is the case of MetroFi, a private partner which runs a free broadband network in Cupertino, Santa Clara and Sunnyvale. MetroFi initially offered broadband services in the areas at $19.95 a month but found few subscribers. Later, in an attempt to increase the number of subscribers, the company began offering the service with advertising support for free. However, in June 2006, the company managed to sign up only 10,000 users in an area with a population of about 250,000. However, it is important to note that, in 2006, when the municipal broadband industry was

somewhat established as part of the overall broadband industry, some phone and cable companies (e.g., AT&T, Cox Communications) have started to actively participate in bidding for contracts from cities. The spokesperson for AT&T Connecticut discussed the company's role as "We agree, there are ways for the public sector and private sector to work together, and we are not opposed to working toward that end. We are hopeful that we will be actively playing a role as this initiative plays out in Hartford, Connecticut."

The framing battles between the two coalitions with opposing views towards municipal broadband are still ongoing through the regulatory, normative, and cognitive institutional arrangements. In some instances, the proponents gained their legitimation through the state bills that allow cities to offer broadband services. The states of Texas and Connecticut are good examples. In other instances, the opponents advanced their legitimation through the well publicized failures of several major cities (e.g., Chicago, Houston, New Orleans, Philadelphia) after Earthlink (the private partner in all these projects) shut down all operations related to municipal broadband projects and laid off at least 900 employees mostly in its municipal wireless division.

The Coevolution of Institutional Processes of Social and IT Innovations

- **Research question #3:** Given the interrelationships of IT innovations in social innovations, how does an institutional process of social innovations influence an institutional process of IT innovations and vice versa in the context of municipal broadband innovations?

In this study, we situate the institutional process of broadband innovations in the context of municipal broadband innovations. However, economists might argue that broadband innovations may be classified as general-purpose technologies, the term used to refer to those innovations that can affect the entire economy and redefine society (Helpman, 1998). We do not disagree with this classification. Obviously, there are many different kinds of broadband innovations in the industry (e.g., cable Internet, digital subscriber lines, and fiber optics) but the development of these innovations is primarily in the control of private telecommunications companies. Thus, they do not play an important role in the municipal broadband innovations. Moreover, these wired broadband technologies have not experienced much technological improvement in the past few years.

More recently, wireless broadband technologies have undergone rapid development (Akyildiz et al., 2005). The Wi-Fi mesh technology, in particular, has emerged as the most popular technological choice by many cities for at least four reasons. First, the Wi-Fi mesh technology operates on unlicensed open spectrum (2.4 and 5.8 GHz) and does not require spectrum licenses to operate. Second, Wi-Fi mesh offers high-speed broadband connections as well as mobility, which is increasingly important for mobile workers. Third, the cost of Wi-Fi mesh appears to be lower compared to the costs of other wireless broadband technologies. Fourth, Wi-Fi mesh networks leverage a large number of Wi-Fi enabled devices in use globally. Consequently, the Wi-Fi mesh vendors primarily target the municipal broadband market. Our discussion that follows primarily focuses on the Wi-Fi mesh technologies as the IT innovations that are used to implement municipal broadband innovations.

Initially, Wi-Fi mesh was framed by analysts, vendors as well as city governments as the most cost-effective technology, thus creating a collective agreement among institutional actors over the technology choice for municipal broadband innovations and simultaneously supporting the framing of social innovations of affordable broadband access. Besides, the technology was also perceived as working well outdoors, highly scalable, and easy to implement. Such framing promotes broader mobilization of cities' resources to deploy Wi-Fi mesh in their broadband projects. The sheer number of these projects legitimizes the Wi-Fi mesh to the point that it becomes the dominant design (Utterback and Abernathy, 1975). The growth of municipal Wi-Fi mesh also attracts several leading equipment vendors to launch their products. Cisco, for example, launched its first mesh network systems in November 2005 after acquiring Airespace in March.

The interdependence between broadband innovations and municipal broadband innovations means that their institutional processes are intertwined. On one hand, the institutional process of broadband innovations influences that of municipal broadband innovations. For example, several cities finished their implementation and began to provide broadband services on Wi-Fi mesh networks around 2006. During that time, several pointed out the drawback of Wi-Fi mesh including signal interference with Wi-Fi hotspots, the scalability problems, unreliable signals, slow speeds, and the unexpected large number of outdoor access points needed. Perhaps, two of the most critical flaws were the fact that there is no standard around Wi-Fi

mesh and that the rapid change of technology may lock cities into outdated technologies. Note that the 802.11s standard for meshing Wi-Fi systems is under development while Wi-Fi mesh systems in the market rely on proprietary technologies for routing and network management. The issues surrounding poor performance of Wi-Fi mesh allow the municipal broadband opponents to use them to suggest that cities lack experience and knowledge about technologies and subsequently delegitimize their social innovations of municipal broadband efforts.

Similarly, the activities around municipal broadband innovations influence the institutional process of broadband innovations in a number of ways. First, as critics increasingly cited technology as one of the reasons that municipal broadband projects fail, it puts remarkable pressure on the industry to mobilize resources to create better solutions. Consequently, several leading Wi-Fi mesh vendors (e.g., Motorola, Tropos, Strix systems) upgraded their products from single-radio access points to dual-radio access points. The single-radio equipment uses one radio frequency (2.4 GHz) for both user access and backhaul connections. The dual-radio equipment improves the overall network performance because it uses one radio frequency (2.4 GHz) for user access and the other frequency (5.8 GHz) dedicated to backhaul connections. Second, municipal broadband initiatives increasingly move towards public safety applications. Since public safety applications work on the licensed 4.9 GHz public safety band, equipment vendors mobilize their resources towards developing products to serve these growing needs. Finally, the underestimation of the number of access points to get reasonable network coverage leads many municipal broadband opponents to use it to argue that cities lack appropriate knowledge and experience with technology. Such framing also leads to the delegitimation of Wi-Fi mesh technology.

DISCUSSION

The findings of this study provide an account of the framing, network formation, mobilization, and legitimation processes of IT-enabled social innovations in the context of municipal broadband innovations. In this section, we consider the generalization of our findings to an institutional process of IT-enabled social innovations.

Towards an Institutional Process of IT-Enabled Social Innovations

> **Research question #1**: How can we develop an institutionalization theory of IT-enabled social innovations to understand their complex and dynamic process of institutional change?

We position institutional arrangements (i.e., regulatory, normative, and cognitive systems) as structural conditions. These conditions enable and constrain institutional actors' actions and their subsequent actions also shape institutional arrangements. This reciprocal relationship between social structures and human agency is drawn from the structuration theory (Giddens, 1984; Orlikowski and Robey, 1991). This observation is not entirely new because other institutional researchers also point out such interdependent constructs (e.g., Garud et al., 2002). However, we extend this line of theorizing to explain the structuration of the interlinked social and IT innovations.

Our empirical evidence suggests that institutional arrangements of social innovations shape and are shaped by activities of actors in the interrelated IT innovations. For instance, from the regulatory system, the Federal Communication Commission (FCC) decided to designate the 4.9 GHz frequency band for public safety purposes. This decision led many wireless broadband vendors to mobilize their resources to design and develop network equipment to serve this new segment. Similarly, the dedicated public safety frequency band also led a number of cities to frame their municipal broadband initiatives around enhancing security and safety and increasing quality of life. Such framing allows municipal broadband projects to have broader appeal to the general public and fits the beliefs of the role of cities to serve public interests. From a normative perspective, in the early days of municipal broadband innovations, the rule of thumb in the industry was to use 20 access points per square mile to provide a good coverage in a Wi-Fi mesh network. This industry rule was applied to the municipal network deployments among cities who are early adopters. As it turns out, this industry standard backfired and technology problems (e.g., signal loss, unreliable connections, and slow speed) were used by the opponents to undermine the municipal broadband innovations. Finally, from the cognitive perspective, the early perception of Wi-Fi mesh as cost-effective and easy-to-implement broadband solutions help cities gain their legitimation of creating an affordable broadband solution for all. This suggests:

Proposition 1: In addition to their own structuration process, institutional arrangements of social innovations shape and are shaped by institutional activities of related IT innovations

Similarly, our empirical evidence also suggests that institutional arrangements of related IT innovations shape and are shaped by activities of actors in the social innovations. From the regulatory perspective, some proposed state bills support local governments to provide broadband services while many others restrict local governments from doing so. The similar situation also applies at the federal level. The Community Broadband Act, for example, frames Internet access as a public utility and encourages local governments to play active roles in providing broadband services. Clearly, the shape of the institutional process of broadband innovations or Wi-Fi mesh in particular depends on which legislatures are passed into laws at the state and federal levels. From the normative perspective, local governments were increasingly pressured from opponents who often frame a technology choice as one of the causes of municipal broadband failures. This pressure reflects in the increasing demand from cities for vendors to explicitly define service level agreements in contracts. As a result, several vendors (e.g., BelAir Networks) develop certified network programs to assure a reliable and consistent level of coverage and performance of broadband equipment. Finally, from the cognitive perspective, the emergent dominant design around Wi-Fi mesh in municipal broadband innovations provides concentrated opportunities for vendors to learn from multiple installation sites and conference venues to stimulate Wi-Fi mesh technology development. This suggests.

Proposition 2: In addition to their own structuration process, institutional arrangements of related IT innovations shape and are shaped by institutional activities of social innovations

CONCLUSION

This research attempts to develop an understanding of an institutional process of IT-enabled social innovations as well as generate empirical insights in the context of municipal broadband innovations. Drawing on the integrated perspectives from the institutional theory and the social movement theory, we develop an institutional framework that consists of framing, network formation, mobilization, and legitimation processes. The findings suggest that institutional actors constantly engage in framing, re-framing, and framing contests that require resource mobilization, alignment with other actors to pool resources and skills and form coalition.

This research contributes to theory in a number of ways. First, by viewing IT-enabled social innovations through an institutional view and a social movement view, this research contributes to both literatures. In particular, it provides novel theoretical insights of the structuration of institutional processes of the interlinked IT innovations and social innovations. Second, by conceptualizing IT-enabled social innovations as emergent social production, this research provides insights into the unintended and wide-reaching consequences of the institutional processes. Third, this research answers the critique by IS scholars that IS research seems to promote a rational economic view of a phenomenon with particular emphasis on for-profit industries (Chiasson and Davidson, 2005; Orlikowski and Barley, 2001). This research examines the IT-enabled social innovations that are largely bold initiatives by local governments to address a much larger national problem of broadband development. By doing so, we address the void in IS research to examine not-for-profit industries that may shed further theoretical insights. In this respect, we also answer the call by Chiasson and Davidson (2005) to include industry in theory development to increase generalizability of IS research and enhance practical relevance.

This study also has managerial and policy insights for institutional actors to influence institutional change through IT-enabled social innovations. To be successful in their attempt, institutional actors may have to define their interests more broadly and engage in coalition formation with a broad array of actors in the industry, other local governments, as well as state and local governments. In addition, actors also need to monitor strategies, issues, and activities in both the social innovation and IT innovation spaces to develop a complete view of the institutional process.

REFERENCES

Akyildiz, I.F., Wang, X., and Wang, W. "Wireless Mesh Networks: A Survey," *Computer Networks* (47:4), March 2005, pp. 445-487.

Bala, H., and Venkatesh, V. "Assimilation of Interorganizational Business Process Standards," *Information Systems Research* (18:3), September 2007, pp. 340-362.

Barley, S. R., and Tolbert, P.S. "Institutionalization and Structuration: Studying the Links between Action and Institution," *Organization Studies* (18:1), 1997, pp. 93-117.

Benford, R.D., and Snow, D.A. "Framing Processes and Social Movements: An Overview and Assessment," *Annual Review of Sociology* (26), 2000, pp. 611-639.

Chiasson, M.W., and Davidson, E. "Taking Industry Seriously in Information Systems Research," *MIS Quarterly* (29:4), December 2005, pp. 591-605.

Child, J., Lu, Y., and Tsai, T. "Institutional Entrepreneurship in Building an Environmental Protection System for the People's Republic of China," *Organization Studies* (28:7), 2007, pp. 1013-1034.

Cox, A. "Cities find Wi-Fi future," October 18, 2004, Available online at http://www.cnn.com/2004/TECH/internet/10/18/wireless.city/index.html, Last Access on September 12, 2008.

Crandall, R., Lehr, W., and Litan, R. "The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data," Working Paper, *The Brookings Institution*, 2007.

Currie, W.L., and Guah, M.W. "Conflicting Institutional Logics: A National Programme for IT in the Organisational Field of Healtcare," *Journal of Information Technology* (22:3), September 2007, pp. 235-247.

Daggett, B. V. "Localizing the Internet: Five Ways Public Ownership Solves the U.S. Broadband Problem," *Institute for Local Self-Reliance*, January 2007.

DiMaggio, P.J. "Interest and Agency in Institutional Theory," in *Institutional Patterns and Organizations: Culture and Environment*, L.G. Zucker (Ed.), Ballinger, Cambridge, MA, 1988.

DiMaggio, P.J., and Powell, W.W. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," *American Sociological Review* (48:2), April 1983, pp. 147-160.

DiMaggio, P.J., and Powell, W.W. "Introduction," in *The New Institutionalism in Organizational Analysis*, W. Powell and P. DiMaggio (Eds.), University of Chicago Press, Chicago, IL, 1991.

Eisenhardt, K.M. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), October 1989, pp. 532-550.

Feiss, G. "Government, Broadband not a Perfect Marriage," Available online at http://www.missoulian.com/articles/2007/07/17/opinion/opinion3.txt, July 17, 2007, Last Access on September 12, 2008.

Ferguson, C.H. *The Broadband Problem: Anatomy of a Market Failure and a Policy Dilemma*, Brookings Institution Press, Washington DC, 2004.

Fichman, R. G. "Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods," *Journal of the Association for Information Systems* (5:8), August 2004, pp. 314-355.

Fichman, R.G., and Kemerer, C.F. "The Assimilation of Software Process Innovations: An Organizational Learning Perspective," *Management Science* (43:10), October 1997, pp. 1345-1363.

Fligstein, N. "The Structural Transformation of American Industry: An Institutional Account of the Causes of Diversification in the Largest Firms: 1919-1979, " in *The New Institutionalism in Organizational Analysis*, W. Powell and P. DiMaggio (Eds.), University of Chicago Press, Chicago, IL, 1991.

Fligstein, N. "Social Skill and Institutional Theory," *American Behavioral Scientist* (40:4), February 1997, pp. 397-405.

Frieden, R. "Lessons from Broadband Development in Canada, Japan, Korea and the United States," *Telecommunications Policy* (29:8), September 2005, pp. 595-613.

Garud, R., Jain, S., and Kumaraswamy, A. "Institutional Entrepreneurship in the Sponsorship of Common Technological Standards: The Case of Sun Microsystems and Java," *Academy of Management Journal* (45:1), February 2002, pp. 196-214.

Giddens, A. *The Constitution of Society: Outline of the Theory of Structuration*, University of California Press, Berkeley, CA, 1984.

Gillett, S.E., Lehr, W.H., and Osorio, C.A. "Local Government Broadband Initiatives," *Telecommunications Policy* (28:7-8), August-September 2004, pp. 537-558.

Gillett, S.E., Lehr, W.H., and Osorio, C.A. "Municipal Electric Utilities' Role in Telecommunications Services," *Telecommunications Policy* (30:8-9), September-October 2006, pp. 464-480

Glaser, B., and Strauss, A. *The Discovery of Grounded Theory: Strategies of Qualitative Research*, Wiedenfeld and Nicholson, London, United Kingdom, 1967.

Hammond, A.S. "Universal Service: Problems, Solutions, and Responsive Policies," *Federal Communications Law Journal* (57:2), March 2005, pp. 187-200.

Hargrave, T.J., and Van de Ven, A.H. "A Collective Action Model of Institutional Innovation," *Academy of Management Review* (31:4), October 2006, pp. 864-888.

Helpman, E. *General Purpose Technologies and Economic Growth*, the MIT Press, Cambridge, MA, 1998.

Hoffman, A.J. "Institutional Evolution and Change: Environmentalism and the U.S. Chemical Industry," *Academy of Management Journal* (42:4), August 1999, pp. 351-371.

Horrigan, J. "Home Broadband Adoption 2006," *Pew Internet and American Life Project*, 2006, Available online at http://www.pewinternet.org/pdfs/PIP_Broadband_trends2006.pdf, Last accessed on September 12, 2008.

infoDev. "Improving Health, Connecting People: The Role of ICT in the Health Care in Developing Countries," Working paper, *Information for Development Program (infoDev)*, The World Bank, Washington DC, 2006, http://www.infodev.org/en/Publication.84.html, Last accessed on September 12, 2008.

Jain, A., Mandviwalla, M., and Banker, R.D. *Can Governments Create Universal Internet Access? The Philadelphia Municipal Wireless Network Story,* E-Government Series, IBM Center for the Business of Government, 2007.

Klein, H.K., and Myers, M.D. "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly* (23:1), March 1999, pp. 67-94.

Lenard, T. L. "Government Entry Into the Telecom Business: Are the Benefits Commensurate With the Costs?", The Progress and Freedom Foundation, February 2004, Available online at http://www.pff.org/issues-pubs/pops/pop11.3govtownership.pdf, Last Accessed on September 12, 2008.

Lorange, P., Morton, S., and Ghoshal, S. *Strategic Control Systems*, West Publishing, St.Paul, MN, 1986.

Lounsbury, M. "Institutional Variation in the Evolution of Social Movements: The Spread of Recycling Advocacy Groups," in *Social Movements and Organization Theory*, J. Davis, D. McAdam, W.R. Scott and M. Zald (Eds.), Oxford University Press, Oxford: United Kingdom, 2005.

Lyytinen, K., and Rose, G.M. "The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations," *MIS Quarterly* (27:4), December 2003, pp. 557-595.

Mandviwalla, M., Jain, A., Fesenmaier, J., Smith, J., Weinberg, P., and Meyers, G. "Municipal Broadband Wireless Networks," *Communications of the ACM* (51:2), February 2008, pp. 72-80.

Markus, M.L., and D. Robey "Information technology and organizational change: Causal structure in theory and research," *Management Science* (34:5), May 1988, pp. 583- 598.

McAdam, D. *Political Process and the Development of Black Insurgency, 1930-1970*, University of Chicago Press, Chicago, IL, 1982.

McCarthy, J.D., and Zald, M.N. "Resource Mobilization and Social Movements: A Partial Theory," *American Journal of Sociology* (82:6), May 1977, pp. 1212-1241.

McClure, D.P. "The Myth of Municipal Wireless Networks," New Millennium Research Council, Washington, D.C., February 2005.

Meyer, A. "Adapting to Environmental Jolts," *Administrative Science Quarterly* (27:4), December 1982, pp. 515-537.

Meyer, D.S., and Whittier, N. "Social Movement Spillover," *Social Problems* (41:2), May 1994, pp. 277-298.

Orlikowski, W.J., and Barley, S.R. "Technology and Institutions: What can Research in Information Technology and Research on Organizations Learn from Each Other," *MIS Quarterly* (25:2), June 2001, pp. 145-165.

Orlikowski, W.J., and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2:2), June 1991, pp. 143-169.

Pentland, B.T. "Building Process Theory with Narrative: From Description to Explanation," *Academy of Management Review* (24:4), October 1999, pp. 711-724.

Phillips, N., Lawrence, R.B., and Hardy, C. "Discourse and Institutions," *Academy of Management Review* (29:4), October 2004, pp. 635-652.

Rao, H. "The Power of Public Competition: Promoting Cognitive Legitimacy through Certification Contests," in *The Entrepreneurship Dynamic: Origins of Entrepreneurship and the Evolution of Industries*, C.B. Schoonhoven and E. Romanelli (Eds.), Stanford University Press, Stanford, CA, 2001.

Rao, H., Morrill, C., and Zald, M.N. "Power Plays: How Social Movements and Collective Action Create New Organizational Forms," in *Research in Organizational Behavior*, B.M. Straw and R.I. Sutton (Eds.), JAI Press, Greenwich, CT, 2001.

Rucht, D. "The Transnationalization of Social Movements: Trends, Causes, Problems," in *Social Movements in a Globalized World*, D. Della Porta, H. Kriesi and D. Rucht (Eds.), MacMillan, London, United Kingdom, 1999.

Schmidt, T., and Townsend, A. "Why Wi-Fi Wants To Be Free," *Communications of the ACM* (46:5), May 2003, pp. 47-52.

Scott, W.R. "The Adolescence of Institutional Theory," *Administrative Science Quarterly* (32:4), December 1987, pp. 493-511.

Scott, W.R. *Institutions and Organizations*, Sage Publications, London, United Kingdom, 1995.

Stearns, L.B., and Almeida, P.D. "The Formation of State Actor-Social Movement Coalitions and Favorable Policy Outcomes," *Social Problems* (51:4), November 2004, pp. 478-504.

Swanson, E.B., and Ramiller, N.C. "Organizing Vision in Information Systems Innovation," *Organization Science* (8:5), 1997, pp. 458-474.

Teo, H.H., Wei, K.K., and Benbasat, I. "Predicting Intention to Adopt Interorganizational Linkages: An Institutional Perspective," *MIS Quarterly* (27:1), March 2003, pp. 19-49.

Tilly, C. *From Mobilization to Revolution*, Addison-Wesley, Reading, MA, 1978.

Utterback, J., and Abernathy, W. "A Dynamic Model of Process and Product Innovation," *Omega* (3:6), 1975, pp. 639-656.

Van de Ven, A.H., and Hargrave, T.J. "Social, Technical, and Institutional Change: A Literature Review and Synthesis," in *Handbook of Organizational Change and Innovation*, M.S. Poole, and A.H. Van de Ven (Eds.), Oxford University Press, New York, NY, 2004.

Wang, P., and Swanson, E.B. "Launching Professional Services Automation: Institutional Entrepreneurship for Information Technology Innovations," *Information and Organization* (17:2), January 2007, pp. 59-88.

Wilhelm, A.G. "Leveraging Sunken Investments in Communications Infrastructure: A Policy Perspective from the United States," *The Information Society* (19:4), 2003, pp. 279-286.

Wilton, R.D., and Cranford, C. "Toward an Understanding of the Spatiality of Social Movements: Labor Organizing at a Private University in Los Angeles," *Social Problems* (49:3), August 2002, pp. 374-394.

Zhu, K., and Kraemer, K.L. "Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry," *Information Systems Research* (16:1), March 2005, pp. 61-84.

Zucker, L. "Organizations as Institutions," in *Research in the Sociology of Organizations*, S. Bacharach (Ed.), JAI Press, Greenwich, CT, 1983.

Appendix 1. Coding Structure and Textual Examples for the Social Innovations Underlying Municipal Broadband Innovations

ACTIVITIES	TEXTUAL EXAMPLE
Legitimation	• A new website designed to promote municipal wireless projects has been launched under the initiative of Amsterdam-based legal and consulting services company Lemon Cloud. (+) • MobilePro and Sacramento decided to call it quits. … the city will now start the process over again… (-)
Mobilization	• Google, the Internet search giant, last week said it would bid to provide free wireless broadband to the city of San Francisco. (+) • The debate has reached the highest levels of government, with competing federal bills introduced lat year that would either ban cities from offering municipal wireless in places where the private sector does, or protect their ability to do so. (-)
Framing	• There are much better solutions to the problem of extending broadband to the masses - such as municipal networks. (+) • Verizon opposes paid services offered by cities and municipalities on the grounds that governments have unfair advantages, such as the ability to tap public funds and not having to pay taxes. (-)
Network formation	• … Many cities are pursuing public/private partnerships that would enable residents to enjoy low-cost Wi-Fi…. For example, Granbury, Texas, owns its Wi-Fi network, but its contractor, Frontier Broadband, owns the equipment and sells subscription to residents for $20 per month. (+)

Note: "**+**" is used to reflect the support of municipal broadband innovations and "**–**" is used to reflect the opposition of municipal broadband innovation.

Appendix 2. Coding Structure and Textual Examples for the IT Innovations Underlying Municipal Broadband Innovations

ACTIVITIES	TEXTUAL EXAMPLE
Legitimation	• The technology choice for cities is wireless mesh networks, which work well outdoors and can scale across city blocks. (+) • Andy Seybold calls the networks "a joke". Seybold, …, believes municipalities should stay out of the business. He said municipal wireless services typically require the purchase of boosting equipment to sustain an indoor signal. Even then, the systems tend to lack reliability because of interference with other signals, buildings or trees between the antenna and the user. (-)
Mobilization	• Sputnik, a leading provider of Wi-Fi management products and services, today introduced the Sputnik AP 250, a high-powered, dual-radio wireless access point that extends the range of the company's distributed wireless networks serving hotels, multi-tenant dwellings, airports, campuses, and municipal wireless venues. (+)
Framing	• She equates high-speed Internet connectivity with other basic infrastructure. "Many municipalities think this is like electricity and water," Ms. Vos says. "You can't live in the world today and be productive and do research without broadband." (+) • The danger that cities could be locked into a proprietary mesh network should vanish in 2008, when a mesh networking standard called IEEE 802.us is due to be ready. Alternatively, cities could do without Wi-Fi altogether and instead use WiMAX, a system for wireless internet access for which an IEEE standard already exists, and which has a range of 2 kilometers from each antenna. (-)
Network formation	• Cisco has partnered with Hewlett-Packard and IBM to develop its wireless mesh networking strategy, with HP and IBM providing network management and back-end software and hardware. (+)

Note: "**+**" is used to reflect the support of municipal broadband innovations and "**–**" is used to reflect the opposition of municipal broadband innovation.