



Learning processes in municipal broadband projects: An absorptive capacity perspective

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ABSTRACT

Effective knowledge management is important to the success of information technology projects. This research applies the integrated lens of the absorptive capacity theory and the social process model of information system development projects to examine the dynamic of knowledge activities concerning broadband infrastructure development in the context of municipal broadband networks. The research questions are: (1) What is the extent of the dynamic of knowledge activities involved in the development process?, (2) What are the events that trigger knowledge activities in municipal broadband development?, and (3) How does a city create and utilize new knowledge in the development process? This study examines municipal wireless projects in three cities (Chaska, MN; Hermosa Beach, CA; and Fredericton, Canada). Events that trigger knowledge activities are assignment of personnel, physical system construction, performance problems, resistance, and reassignment of organizational roles. Four factors that influence knowledge activities and project performance are the dynamic of technology development, partnership commitments, limitation of external knowledge and learning-by-doing, and political dynamics. The study has policy implications for cities that are in the process of planning and deployment. A good project planning, user expectation management, systematic performance evaluation, a careful partner selection process, and the use of service level agreements are important to project success. In addition, cities need to take into consideration that the technology is not a plug and play technology and that considerable efforts are needed to integrate the technology with other solutions to deliver broadband services as well as to configure the system according to topologies, street conditions, buildings, density of trees, among others.

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1. Introduction

Access to basic telecommunications services is considered as one of the necessities for individuals and organizations in the global information society (Crandall, Lehr, & Litan, 2007; Lee, O'Keefe, & Yun, 2003; Wilhelm, 2003). In the U.S., for example, the broadband market is primarily dominated by a duopoly of the telephone and cable companies. As a result, broadband access and usage is concentrated among individuals and businesses in metropolitan and other economic

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booming cities (Horrigan, Stolp, & Wilson, 2006). The lack of competition does not provide incentives for private operators to expand their coverage to rural areas, to lower their prices, and to upgrade broadband speeds (Daggett, 2007).

Following the ideology of the government's role as infrastructure developer (Gillett, Lehr, & Osorio, 2004; Sawyer, Allen, & Lee, 2003), many cities worldwide have considered deploying municipal wireless networks (citywide networks) with the goals of universal, affordable access to broadband infrastructure for all. Mandviwalla, Jain, and Banker (2007) defined municipal wireless networks as "wireless Internet access networks developed with active local leadership and involvement". Weill, Subramani, and Broadbent (2002) classified the needs for infrastructure development into three levels: business unit, firm, and public infrastructure. By following this classification, municipal wireless networks are viewed as public infrastructure with the goal to provide fundamental telecommunication services to the general public. According to muniwireless.com, the number of U.S. counties and cities that are in the deployment or planning stage of wireless broadband networks substantially grew by 240% from 122 in June 2005 to 415 in August 2007.

Infrastructure development can be understood broadly as an information systems development (ISD) process. ISD is conceptualized as a complex social process concerning "the tasks that developers build technical artifacts and make technical choices within a complex social process that involves multiple stakeholders engaged in multiple agendas and transactions in their interactions with each other" (Sambamurthy & Kirsch, 2000, pp. 400–401). Municipal wireless projects provide an interesting study context and should add new theoretical insights to both the ISD and knowledge management literatures. This is because there are a number of challenges associated with a municipal wireless project in addition to those found in traditional ISD. First, several cities have an ambitious goal to have broadband coverage for the entire city areas, thus increasing the projects' complexity in scale and scope. The Wireless Philadelphia project (<http://wirelessphiladelphia.org>), for example, is planned to cover a 135 square mile area. Second, there are a number of stakeholders, some of whom may have conflicting goals and interests. Mandviwalla et al. (2008) report that at least 13 diverse stakeholders are involved in the Wireless Philadelphia project, ranging from state and city government, community residents, businesses, telecoms and ISPs, to public schools and higher educational institutions. Third, several have expressed serious concerns regarding wireless broadband technology including the scalability of the technology which was originally designed for small-sized hotspots, the lack of standards for the mesh technology required to install wireless broadband networks in large areas, and the possible rapid obsolescence due to new innovations and standards (Jain et al., 2007). Fourth, some critics express doubts on the capability and knowledge of local government to develop and manage technology infrastructure including its lack of market discipline and technology capability (Feiss, 2007), its exclusion of some operational costs such as maintenance and network operations center costs in the budget (McClure, 2005), and its lack of resources to maintain the network in the long run (Cox, 2004).

Research in IT infrastructure and ISD has emphasized that experience, knowledge, and skills are critical to convert IT components into valuable services (Armstrong & Sambamurthy, 1999; Byrd & Turner, 2000; Fink & Neumann, 2007). However, most studies in the IT infrastructure literature focus on examining existing IT infrastructure and its components as antecedents of strategic organizational value including organizational agility (Fink & Neumann, 2007; Sambamurthy, Bharadwaj, & Grover, 2003), organizational performance (Bharadwaj, 2000; Bharadwaj, Bharadwaj, & Konsynski, 1999; Brown, Gatian, & Hicks, 1995), and process performance (Froehle, 2006; Karimi, Somers, & Bhattacharjee, 2007; Ray, Muhanna, & Barney, 2005). Similarly, studies in the ISD literature concentrate on using the variance approach to identify antecedents of successful ISD projects (Sabherwal & Robey, 1995; Sambamurthy & Kirsch, 2000). Several researchers suggest that studies concerning ISD process are required to advance the knowledge of the complex social process concerning systems development (Hirschheim, Klein, & Newman, 1991; Sabherwal & Robey, 1993). More specifically, the absorptive capacity theory (Cohen & Levinthal, 1990; Zahra & George, 2002) conceptualized as a capability related to four knowledge activities (acquisition, assimilation, transformation, and exploitation) should broaden an understanding on the influence of the knowledge processes in large-scale infrastructure development projects.

The purpose of this paper is to apply the integrated lens of the absorptive capacity theory and the social process model of ISD projects to examine the dynamic of knowledge activities concerning infrastructure development process in the context of municipal wireless networks. Note that the dynamic social process involved in infrastructure development emerges from complex interactions among stakeholders that subsequently shape the outcome of the development process (Hirschheim et al., 1991; Newman & Robey, 1992; Sambamurthy & Kirsch, 2000). In particular, the infrastructure development process is conceptualized as a sequence of events by highlighting critical events that unfold during the municipal wireless network development process among selected cities from the knowledge management perspective (Kling & Iacono, 1984; Newman & Robey, 1992; Poole, Van de Ven, Dooley, & Holmes, 2000; Sabherwal & Robey, 1993).

The specific research questions are:

- What is the extent of the dynamic of knowledge activities involved in the development process?
- What are the events that trigger knowledge activities during the course of municipal wireless network development?
- How does a city create and utilize new knowledge in the process of municipal wireless network development?

2. Infrastructure development process as a social learning process: an absorptive capacity model

Municipal wireless development can be viewed as a social process that involves multiple stakeholders and multiple agendas (Hirschheim et al., 1991; Sambamurthy & Kirsch, 2000). A stakeholder is "a person or group with a vested interest

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