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EMERGING TRENDS OF ICT ADOPTION IN INNOVATION CONTEXTS: A NETWORK FRAMEWORK

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Abstract

Given the growing prominence of innovation in service sciences and international competitiveness, the context of innovation has emerged in adoption research. This study explores emerging trends of ICT adoption in an innovation context. More specifically, given the increased importance of inter-organizational networks in fostering innovation, the study uncovers drivers of adoption of inter-organizational systems that support the innovation process. Particularly, to enhance understanding of innovations that are entrenched in networks of heterogeneous actors, this study employs an interdisciplinary approach as it applies network and relationships marketing literatures to the adoption and inter-organizational systems literatures. Based on qualitative research incorporating a focus group and sixteen in-depth interviews, the study provides a network framework for understanding key drivers of ICT adoption, including trust, commitment, coordination and communication efficiency, in innovation contexts.

Keywords: innovation, networks, adoption, inter-organizational systems.

1 INTRODUCTION

Innovation has recently enjoyed increased attention due to globalisation trends and major economic shifts. Globalisation and the subsequent intensification of networks and the blurring of boundaries of financial systems and organizations have led to a redistribution of wealth and power among nations. Consequently, innovation has become prominent in a growing number of both emerging and developed economies. Governments in many countries, including China, India, the United States, UK and Australia, have developed innovation policies and are competing in the race towards innovation, for example, in relation to sustainable energy solutions (Thavasi et al. In-press; Tsai et al. In-press).

Service innovation has also captured increased attention of policy makers and management. The service sector is the largest exporter and employer internationally (Kleinaltenkamp 2007). Service innovation draws on the service marketing literature (Chen et al. 2009; Eisingerich et al. 2008). A core element of this literature is the service dominant view whereby all industries are viewed as service industries and should look for opportunities to enhance value to consumers through service innovation (Edvardsson et al. 2005; Vargo & Lusch, 2004). Governments in the UK and Finland have developed policies on service innovation (DTI 2007). Additionally, an international institute, the Service Research Innovation Institute (SRII), has been established comprising organizations such as IBM, HP and Microsoft which call for universities to do more research in service innovation, given its strong potential to increase value to customers, revenues to firms and exports for countries.

Networks are important in fostering innovation including service innovation (Homburg et al. 2003; Moller et al. 2008). For instance, in the ICT industry, innovation in speech recognition services has been facilitated through networks between IBM, Vlingo which provide speech services for Yahoo, Phonetag which converts mobile voice mail to text, and Jajah which offers real time phone translation from English to Mandarin. Networks are growing in significance as an effective way of pooling and spreading both risks and costs and of accessing greater resources and capabilities for developing innovations and even wider markets for their commercialisation (Kaushik 2009).

Given the growing importance of innovation and the integral role of underlying networks that support it, this study contributes to an improved understanding of emerging trends concerning the adoption of inter-organizational systems in this context. An ICT innovation is defined as an information communication technology that is new to adopting organisations or individuals (Swanson 1994) whereas its adoption is the “decision to make full use of an innovation as the best course of action available” (Rogers, 2003, p. 177). While adoption literature has predominantly focused on individual adoption through the technology acceptance model (TAM) and its extensions, and organizational adoption through the technology-organizational-environment framework, more research is needed for inter-organizational adoption, particularly for inter-organizational systems in the innovation domain (Grover et al. 2007). Inter-organizational systems (IOS) are “computer-based information systems that facilitate the exchange of information electronically using telecommunications between different organizations’ computer systems.” (Golden et al. 2004, p. 301). IOS reflect the networks of collaborating organizations (Kumar et al. 1996). Their importance is increasingly recognized as they strengthen linkages among innovation collaborators (Cavaye et al. 1995).

Further research is needed to investigate emerging contexts in IOS research that bring about more strategic gains rather than the extant focus on predominantly operational and transactional contexts (Bendoly et al. 2007). This is especially important given trends towards innovation as a strategic priority for management and policy makers (Möller et al. 2009; Rampersad et al. In-Press). While innovation can occur through various stages of the value chain, this study focuses on an under-researched area, pertaining to the adoption of IOS to enhance the strategic interface between R&D, administration, and marketing, a core aspect of the innovation process (Gupta et al. 1986; Song et al. 2006). The study is based on the particular setting of a university and a technology transfer office which provides a unique opportunity for exploring the use of IOS to strengthen the interface between R&D, administration, and marketing in the commercialization process and to facilitate collaboration with external partners.

2 THEORETICAL BACKGROUND

The inter-organizational literature pertaining to network and relationship marketing theories can be employed to investigate the adoption of IOS in innovation networks (Perry et al. 2002). Network theory can aid in understanding the adoption of IOS in innovation networks, given the growing prominence of networks in innovation (Rampersad et al. In-Press). In particular, the industrial networks literature is relevant as it has explored the realm of innovation networks (Möller et al. 2007; Rampersad et al. In-Press). Networks can be broadly defined groups of actors and relationships between them (Iacobucci 1996). Innovation networks are relatively loosely tied groups of organizations that may comprise members from university, industry and government who collaborate to achieve innovation goals (Möller et al. 2007; Rampersad et al. In-Press). Relationship Marketing (RM) theory can also be applied to examine the adoption of IOS in innovation networks. This prolific research stream has established itself as a fundamental part of marketing theory and has also been applied to the innovation and technology transfer literature (Mora-Valentín et al. 2004).

This study focuses on key relational and network characteristics that are essential in innovation networks that have been identified in the literature, namely, coordination, trust, commitment and communication efficiency (Rampersad et al. In-Press). Coordination in innovation settings can vary to that of intra-organizational systems in transactional settings, as it spans the boundaries of one organization with internal organizational lines of authority (Möller et al. 2007; Powell 1990). Governance based on trust may also play a role given the diversity of participating organizations and their goals. In an innovation context, there may be a variety of partners, including businesses, research organizations, universities, and government agencies that may engage in project-based high-risk innovations rather than in ongoing structured low-risk transactional collaborations. Therefore, the range of innovation partners and projects may require particular strategies to achieve coordination and communication efficiency.

Trust has been recognized for its importance in inter-organizational contexts. Benefits of trust include cost reduction from a decreased need for monitoring and oversight and decreased innovation development cycles through reduction in bureaucracy (McCutcheon et al. 2000). Trust can be conceptualized as the “willingness to rely on an exchange partner in whom one has confidence” (Moorman et al. 1992, p. 315). Few authors have attempted to employ RM and related inter-organizational literature in information systems contexts (Lai et al. 2009; Meier 1995; Pavlou 2002). Commitment is also fundamental to inter-organizational relationships (Anderson et al. 1992; Morgan et al. 1994; Perry et al. 2002; Siguaw et al. 2003). It can be defined as “a desire to develop a stable relationship, a willingness to make short-term sacrifices to maintain the relationship, and a confidence in the stability of the relationship” (Anderson et al. 1992, p. 19). While extensively examined in RM, few studies have investigated commitment in the information systems literature and particularly in an innovation context (Lai et al. 2009).

In addition to trust and commitment, coordination and communication efficiency emerged as important from the network literature. Coordination is defined as the extent to which different parties in the relationship work well together for accomplishing a collective set of tasks (Mohr et al. 1996). While rigid coordination may stifle innovation, some degree of coordination is critical in ensuring that joint innovation goals are achieved (Ojasalo 2004; Powell 1990). Furthermore, a single authority is needed to coordinate actions beyond the boundaries of an organization as prescribed in traditional management (Ojasalo 2004; Rampersad et al. 2009). Further research is required to understand the role that coordination can play in the adoption of IOS to reduce the difficulties which organizations encounter from inadequate coordination (Grover et al. 2007). In addition to coordination, communication efficiency has emerged as a relevant concept as the inter-organizational innovation context provides unique challenges surrounding intellectual property, different jargons used by collaborating organizations which may include researchers or business executives and the costs of communication as frequency may not always equate to effectiveness (Rampersad et al. 2009). Communication efficiency is defined as communication effectiveness given communication costs. Communication effectiveness includes the transparency, credibility and codification of communication, whereas communication costs include economic costs and secrecy issues (Moenaert

et al. 2000). Further research is necessary to substantiate the relevance of communication efficiency in the adoption of IOS in innovation networks.

A network framework emerged from the network and RM literatures as illustrated in Figure 1. The validity of the framework is investigated through qualitative research.

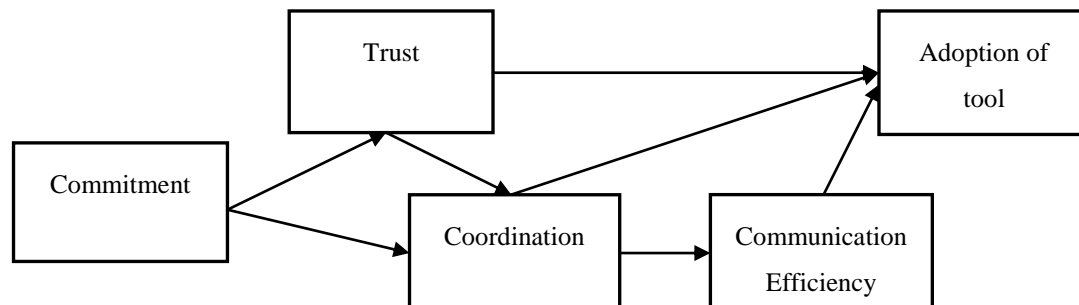


Figure 1. A network framework for ICT adoption in innovation contexts.

3 METHOD

This exploratory study is based on a case study, an empirical inquiry that attempts to investigate a problem in its real-life context. A case study is an adequate means for accomplishing our aim because it allows “the capture of ‘reality’ in considerably greater detail (and the analysis of a considerably greater number of variables)” (Galliers 1990, p. 162). In the first stage of the case study, a focus group was used. A focus group was advantageous as it produced rich cumulative and elaborative data inexpensively. Semi-structured questions were used in order to establish further familiarity with the topic. The discussion amongst focus group members was free-flowing and flexible (Ticehurst et al. 2000), increasing the likelihood of new topics emerging (Kinnear et al. 1996). In the second stage, in-depth face-to-face interviews were conducted which were seen as valuable as information was expected to vary considerably (Ticehurst et al. 2000). Moreover, interviews are flexible, in that they empower interviewers to control the sequencing and wording of questions, while also providing opportunities for seeking clarifications (Walsham 1995).

The case study was conducted in an Australian mid-sized university and a technology transfer office (TTO). This setting was considered to be ideal given the importance of such organizations in fostering innovation at national level (Arnold et al. 1998). The TTO operates as an independent organization with its own board of directors and management team. The innovation IOS was an application which aims at assisting different organizations in dealing with the development and commercialization of innovations. It provides a web-based interface for analyzing research projects, assessing market readiness and viability and advising on requirements before ideas or research outcomes can be commercialized. Most importantly, the application provides an engagement and evaluation setting supporting all parties, including researchers, the TTO, university management and other internal and external stakeholders, that attempt to create value from research.

Judgment sampling was employed in this study and included staff from both the university and TTO who, at the time of data collection, had been exposed to the innovation IOS. The first stage, the focus group, comprised six researchers and research administrators. The second stage was based on sixteen in-depth interviews with four researchers (researchers#1-4) and three research administrators from university (administrators#5-7) and nine TTO staff (TTO#8-16). The data collected from the focus group and interviews were analyzed thematically. Codes were developed as patterns emerged which assisted in identifying and analyzing unfolding themes hermeneutically (Carson et al. 2001). Data relevant to each theme were subsequently assembled incrementally before triangulation against secondary data and extant literature was carried out and representative quotations short-listed for argument support. Construct validity has been adequately addressed. First, information was sourced in focus group and interview settings from multiple types of informants who carry out different roles

thereby providing different perspectives (Yin 1994). Furthermore, the chain of evidence, tracing conclusions to the focus group and interview summaries and to the collected data was also maintained. These measures have enhanced construct validity and the reliability of this research, thereby improving its overall quality.

4 RESULTS AND ANALYSIS

This section validates the framework using qualitative data from the innovation context.

Commitment: Commitment was unanimously confirmed as an important factor in an innovation context both in the focus group and interviews. Commitment is important in fostering coordination and success (Irwin et al. 1998) and in identifying and materializing opportunities (administrator#7). In particular, interviewees emphasized the significance of commitment from top management such as heads of faculties and schools (TTO#9, researcher#4 and administrator#7). Commitment has been recognized for its impact on trust and coordination. In extant IOS literature, commitment is considered to be an antecedent of trust as argued (Roth et al. 2008). Extant RM literature offers contradictory findings on precedence between commitment and trust (Morgan et al. 1994; Seppanen et al. 2007). Consistent with findings that commitment advances familiarity and may lead to trust (Medlin et al. 2005), our results indicate that commitment precedes trust in the innovation context, with interviewees also pointing out that lack of commitment may reduce the effectiveness of coordination efforts (administrator#7).

Trust: The qualitative data confirmed the importance of trust, consistent with research in the RM and network literatures. Researcher#4 argues that the IOS can bring parties towards relationships as commerce is essentially about trust. Generally, interviewees agreed that the innovation IOS can foster the development and maintenance of trust as it generates transparency in the interaction process. The importance of trust, and the ability of the IOS to facilitate it, either directly or indirectly, emerged clearly from the data (administrator#6). Therefore, consistent with previous research, trust was confirmed to be a key ingredient and a valuable asset in launching, assimilating, and maintaining successful IOS. The influence of trust on adoption and coordination has been widely recognized. For example, trust has been discussed for its impact on adoption (Belanger et al. 2008). Similarly, many argue that trust also impacts on network coordination, as networks with higher trust levels have reduced governance costs, given that collaborating organizations spend less time protecting themselves from opportunistic behaviors (Belanger et al. 2008; Powell 1990; Rampersad et al. In-Press; Seppanen et al. 2007).

Coordination: The qualitative data supported findings of previous network studies which argued that moderate coordination is needed. Administrator#7 felt that there should be adequate coordination and a single clear leader such as a high profile person to put forward an 'organized face'. Consistent with the literature, the interviewees argued that there should be representation from the partnering organizations in coordination. Interviewees argued that the innovation IOS can provide support for coordination in facilitating input for various collaborating organizations, by synchronizing their efforts and contributing towards more professional and durable collaborations. In fact, one of the espoused benefits of the innovation IOS is that it: "allows the collation of information in a single point" (administrator#7), thereby facilitating coordination. Interviewees also confirmed the importance of coordination and its impact on communication efficiency and adoption. For example, researcher1 emphasized the impact of coordination on adoption by noting that she would use the innovation IOS as it "helps formalize the process". Additionally, the influence of coordination on communication efficiency was also recognized (TTO#14).

Communication efficiency: The data confirmed the findings in the literature that communication efficiency was important. Interviewees confirmed the importance of transparency as TTO#12 pointed out that the IOS is beneficial in consolidating information to facilitate easy reference to it at a later date, which increases transparency among partners. As the IOS is database-driven, interviewees also felt that it improved credibility as information can be clarified and shared (administrator7). The importance of the IOS in fostering codification issues were also observed by interviewees as everyone

is using a common language (researcher#3, TTO#9). Furthermore, communication costs were also deemed important, particularly in relation to the cost of time as researchers were time poor and the IOS greatly reduced the amount of time needed for commercialization (researcher#1, TTO#10,11,14,15). Interviewees also expressed concern about secrecy issues and information getting to the wrong people (researcher#1). The influence of communication efficiency on adoption was recognized. In fact, there was consensus among interviewees that communication efficiency was one of the main benefits of the innovation IOS and the core reason for adopting it is as it “crystallizes communication” with collaboration partners (TTO#9).

5 CONCLUSION

This study has contributed to the adoption and IOS literatures by providing a network framework for enhancing existing understanding of emerging trends in ICT adoption in innovation contexts. By integrating the network and RM literatures with qualitative findings, the study uncovers insights which may be of interest to managers responsible for the introduction and adoption of ICT tools to support the innovation process. Given the strategic importance of innovation to organizations (Rampersad et al., In-Press), this study is significant as it investigates unique challenges that exist in inter-organizational innovation network settings. Thus, it contributes to the IOS literature by including relationship management constructs providing a qualitatively validated conceptual framework for the adoption of IOS tools in innovation networks (Cavaye and Cragg 1995). Specifically, managers should demonstrate commitment to partners and facilitate trusting relationships. Coordination is also an important consideration for managers. While coordination should not be overly rigid so that collaborators avoid spending a high proportion of their time with burdensome reporting, there should be adequate coordination to ensure that joint innovation development and commercialization goals are achieved. The system should serve a single coordinating point with a synchronizing role in innovation initiatives rather than overly bureaucratic one. This study also underlines the role of communication efficiency including transparency, credibility, and codification of communication and the need to reduce the costs of communication and to reap time saving rewards while addressing IP issues.

While this study offers important insights, these should be interpreted in the light of a number of limitations. First, this study is exploratory and was conducted in a specific context of university research commercialization. This context is well suited for our purpose in jointly capturing the perspectives of R&D, marketing, and administration. Future research could be based on other contexts as the innovation IOS permeates a wider array of organizations. Second, this study was conducted during the early adoption stages of the innovation IOS in the case study organizations. Investigating adoption in an early stage does have advantages. The majority of the extant literature provides a post-adoption investigation of ICT innovations and further research is necessary that focuses on how adoption emerges (Andersson et al. 2008; Lyytinen et al. 2003). Additional future research can incorporate quantitative dimensions that test the conceptual framework proposed in this study or longitudinal research that explores the evolution of both the network and the IOS through time. A network framework provides a rich and dynamic opportunity for understanding emerging trends in ICT adoption in innovation contexts.

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