TWO FACES OF NETWORK CLOSURE: A USER ADAPTATION THEORY OF IT SYSTEM USE

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DECLARATION

I hereby declare that this thesis is my original work that it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.

Wu Yi

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15 August 2014

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SUMMARY

Currently, users are more likely to rely on their advice networks (i.e., a set of relationships that are developed for exchange of information for work-related tasks) for adapting to changes induced by a new IT system in organizations. This thesis explores how users' advice giving and seeking networks influence IT system use. However, few studies have investigated the relationships between advice seeking and giving network closures and IT system use. Motivated by this research gap, this thesis aims to theorize a user adaptation theory of IT system use by drawing on theories of advice networks, coping and models of IT system use.

Specifically, a cognitive-affective-behavioral framework of user adaptation is identified. Thereafter, this thesis establishes a theoretical connection from advice seeking and giving network closures to IT system use via the underlying mechanisms of user adaptation. Upon that, a contingent theory of IT complexity on the theoretical links between seeking and giving network closures and user adaptation is proposed and justified, according to the socio-technical systems theory.

The proposed research model was tested via a field study of a newly implemented EMR system in a hospital, where network data and objective system logs of 104 doctors were collected. Particularly, it was found that seeking network closure is positively associated with cognitive but negatively associated with affective and behavioral user adaptation, while giving-network closure is negative associated with cognitive but positively associated with affective and behavioral user adaptation. Further, IT system use is positively

associated with cognitive and negatively with affective user adaptation, whereas it is not influenced by behavioral user adaptation. In addition, both seeking and giving network closures have a greater impact on user adaptation for a complex IT system.

Overall, this thesis makes several contributions to research. First, it advances our knowledge by proposing and verifying a user adaptation theory of IT system use. Second, this thesis also advances knowledge on user adaptation in IS research by theoretically proposing and empirically justifying a cognitive-affective-behavior framework. Third, this work also contributes to IS research by enhancing our understanding of advice networks in IT system use. Finally, this work, one of the relatively few, advances knowledge in the social networks literature in general and the debate between network closure and structural holes in particular by disaggregating advice networks into advice seeking and giving networks.

On the one hand, this thesis offers important suggestions for organization managers. Our findings have implications for managerial interventions that support a new IT system implementation in organizations. These interventions can be targeted to better support user adaptation of new IT systems, and more effective leveraging and constructing of advice networks. On the other hand, this work provides methodological guidelines in terms of measuring networks and utilizing different data sources for a network research in a real setting.

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CHAPTER 1. INTRODUCTION

1.1 Research Motivations

Recent IT systems are complex with numerous features and pose significant challenges for users. Newly implemented IT systems introduce uncertainties in the work environment and often result in realignments of business processes (Sykes et al. 2014). Users are facing great knowledge barriers about IT system use, the extent to which a user actively interacts with IT systems while performing one's work (Beaudry and Pinsonneault 2010). Evidence in the trade press as well as academic journals suggests that users' underutilization of newly implemented systems results in the failure to garner the expected benefits and threatens the long-term viability of such systems in organizations (Jasperson et al. 2005; Venkatesh et al. 2008).

End-user training is a critical intervention adopted in organizations to promote IT system use (Compeau and Higgins 1995). However, despite large investments made in it, expectations of IT system use are frequently not realized (Sharma and Yetton 2007). Even with end-user training to help learn the procedural functions of IT systems, it typically does not provide a business process orientation and the integrative knowledge that can help users adapt IT systems to their particular works (Sasidharan et al. 2012). Learning to use a new IT system entails a knowledge transfer process across users with different levels of skills (Sykes et al. 2009). Informal interpersonal networks play a critical role in the knowledge transfer process in organizations (Reagans and McEvily 2003). Currently, users are more likely to rely on their advice networks (i.e., a set of relationships that are developed for exchange of information needed to accomplish work-related tasks) to overcome knowledge barriers for better leveraging a new IT system (Magni et al. 2012; Sykes et al. 2009).

Although advice networks have been identified as a critical determinant of IT system use (e.g., Bruque et al. 2008; Magni et al. 2012; Sasidharan et al. 2012; Sykes et al. 2009; Venkatesh and Sykes 2013), scarce study has theoretically distinguished the effects of advice giving and seeking networks. Advice seeking network is a set of relationship that are developed to seek information from others to accomplish one's work-related tasks, and advice giving network is a set of relationship that are developed to give information to others to accomplish their work-related tasks. It is difficult to track directions of information through a unitary conceptualization of advice networks, especially in the case of a newly implemented IT system that involves active exchange of information. The knowledge heterogeneity among users leads to non-reciprocal or asymmetric information exchanges (Gargiulo et al. 2009). Thus, users have an imbalance in their giving and seeking of advice (Flynn 2003). Zagenczyk and Murrell (2009) figured out that advice giving and seeking networks have different effects on problem solving, e.g., using a new IT system. Therefore, making the distinctions between advice giving and seeking networks adds new values to existing network research on IT system use.

Users have different network structures in their advice giving and seeking networks (Gargiulo et al. 2009), and the network structural differences introduce varying benefits to the embedded users (Adler and Kwon 2002; Borgatti and Halgin 2011). The stream of network research presents two different important types of benefits from advice networks: (1) information access from advice seeking network, and (2) power and influence from advice giving network (Adler and Kwon 2002; Venkatesh and Sykes 2013). We argue that the debate between views of network closure (Coleman 1988) and structural holes (Burt 1992) for network benefits still exist in studying IT system use. Therefore, studying network closure provides a useful lens for investigating influences of advice seeking and giving networks on IT system use (Magni et al. 2012). For instance, previous network research has shown that seeking network closure, i.e., the extent to which a user's contacts are connected to one another in the advice seeking network, and giving network closure, i.e., the extent to which a user's contacts are connected to one another in the advice giving network, improve IT system use by offering different levels of benefits (Battilana and Casciaro 2012; Gargiulo et al. 2009).

Despite the importance of network closures, there is still a black box on how network closures impact on IT system use (Elie-Dit-Cosaque and Straub 2011). Research attention has been called to broaden the conceptualization of IT system use by studying user adaptation toward IT systems (Barki et al. 2007; Benbasat and Barki 2007). It becomes important to understand user adaptation because it helps explain IT system use (Kock et al. 2006). User adaptation, i.e., efforts exerted by a user to manage changes associated with an IT system in the work environment (Beaudry and Pinsonneault 2005), explains the underlying mechanisms between seeking and giving network closures and IT system use (e.g., Bruque et al. 2008). Network closures can enhance user adaptation toward IT systems by providing a stream of physical energy from information access and mental energy from power and influence (Hobfoll 2001).

Users with appropriate user adaptation are more likely to achieve a fit between IT systems and tasks for IT system use (Orlikowski 2000). Prior work (e.g., Bruque et al. 2008) tends to regard user adaptation as a global concept, without specifying various types of user adaptations and missing richness of the relationships between users, IT systems and tasks. Based on the coping theory (Lazarus and Folkman 1984), a cognitive-affective-behavioral framework of user adaptation is developed. Particularly, cognitive user adaptation refers to the degree to which a user looks for something positive in an IT system (Carver et al. 1989), affective user adaptation is defined as the degree to which a user directs attention away and detaches oneself from an IT system (Yi and Baumgartner 2004), and behavioral user adaptation is about the degree to which a user changes an IT system in aspects of system functions and task procedures to fit personal preferences (Barki et al. 2007). This framework of user adaptation assists in examining the nuances of seeking and giving network closures on IT system use.

According to the socio-technical systems theory (STST) which has had a rich tradition of being applied in the study of IT implementation (e.g., Lapointe and Rivard 2005; Sykes et al. 2014), there are two separate subsystems in organizations: social and technical (Bostrom and Heinen 1977). Besides the importance of network benefits from the social subsystem, technological artefacts from the technical subsystem would interact with social subsystem for explaining IT-related outcomes. Regarding to a newly implemented IT system, IT complexity is the most important factor (Sharma and Yetton 2007).

IT complexity, i.e., the degree of difficulty in understanding, learning and using an IT system (Cho and Kim 2001; Premkumar and Roberts 1999), results in significant technological challenges (Thompson et al. 1991) and requires users to exchange complex knowledge in adapting to an IT system (Attewell 1992; Sharma and Yetton 2007). IT complexity amplifies a transfer problem in knowledge exchange for user adaptation: willingness and ability (Hansen 1999). The source may be unwilling to share knowledge, perhaps because of the cost of moving knowledge. Even if both parties to the transfer are willing to make the efforts, however, they may be unable to transfer smoothly due to knowledge complexity (e.g., level of codification). Therefore, we argue that the effectiveness of knowledge exchange for user adaptation in advice seeking and giving networks will be contingent on IT complexity.

1.2 Research Objectives and Scope of the Thesis

To summarize, the goal of this thesis is to theorize a user adaptation theory of IT system use from social network perspective. Specifically, to achieve the research goal and fill the preceding research gaps, this study aims to address the following research questions:

(1) What are the impacts of seeking and giving network closures on user adaptation?

(2) What are the influences of user adaptation on IT system use?

(3) How are the impacts of seeking and giving network closures on user adaptation contingent on IT complexity?

This thesis focuses on the context of a newly implemented IT system in organizations, due to that a newly implemented IT system induces significant changes that require user adaptation. Further, the outcomes of solving technological uncertainties and structural realignment in the transition period of a newly implemented IT system decide the success or failure of an IT system implementation. Issues of mature IT systems are beyond the scope of this thesis.

1.3 Theoretical and Practical Contributions

The research provides significant theoretical contributions. First, this study theorizes a user adaptation approach to help researchers understand IT system use by integrating theories of advice networks, coping and models of IT system use. Second, we investigate the importance of user adaptation in IT system use by opening the black box between network closures and IT system use. Third, this research distinguishes the impacts of advice seeking and giving network closures on the cognitive-affective-behavior framework of user adaptation, and contributes to the continuing debate between views of network closure and structural holes in social network research. Finally, it reconciles these impacts of network closures on user adaptation by developing a contingency theory of IT complexity.

This thesis also offers twofold important practical contributions. On the one hand, it provides practical suggestions for organization managers. Our findings have implications for managerial interventions in two areas that support a new IT system implementation in organizations: importance of advice networks and user adaptation. These interventions can be targeted to better support user adaptation of a new IT system, and more effective leveraging and constructing of advice networks. On the other hand, this work provides methodological guidelines for a network research in a real setting in terms of measuring networks and using different data sources.

1.4 Thesis Structure

The subsequent chapters of the thesis are organized as follows.

Chapter 2 reviews extant literature on the coping theory and social network research of IS and presents the theoretical foundations for this thesis. The coping theory literature provides theoretical basis for identifying the cognitive-affective-behavior framework of user adaptation and arguing the "key" function of user adaptation in opening the black box between network closures and IT system use. Meanwhile, social network research suggests theoretical perspective for distinguishing advice networks into advice seeking and giving networks and justifying the rationales between network closures and user adaptation. Finally, the theoretical foundation for the contingency of IT complexity is also elaborated.

Chapter 3 introduces a research model for IT system use in organizations based on user adaptation, social network perspective and a contingency theory of IT complexity, and it presents the development of these hypotheses.

Chapter 4 describes the research methodology for this thesis. It includes description of research setting and subject sample, survey distribution procedure, operationalization of variables of the model and the assessment of concept validation. It also includes the results of a pilot study and the illustration of social network analytics used in this thesis.

Chapter 5 elaborates the analysis results of the flied survey data for the model. It consists of the evaluation of measurement and structural models.

Chapter 6 depicts the interpretation of results, a supplementary analysis on IT system use, limitations of the thesis and directions for future research, and implications for both theory and practice.

Chapter 7 summarizes and concludes the thesis.

CHAPTER 2. THEORETICAL BACKGROUND

2.1 User Adaptation and Coping Theory

2.1.1 Importance of User Adaptation

Currently, IT systems are complex with numerous features and pose significant challenges for users. It is widely accepted that users underutilize new IT systems to a narrow set of features, often with low utilization (Jasperson et al. 2005). Indeed, the term “shelfware” has become part of the business lexicon, in referring to IT systems that are acquired by organizations and not utilized to their fullest extent (Magni et al. 2012). Consequently, a major challenge facing organizations is that of adapting to changes induced by the introduction of a new IT system that influence daily work practices. Given the rapid pace of implementing new IT systems and the fact that many organizational functions strongly depend on effectively using IT systems, the degree to which organizational employees adapt to a new IT system can have a major impact not only on the effectiveness of the operations that are directly based on the IT system but indeed on the performance of the organization as a whole (Bruque et al. 2008).

User adaptation has been diversely understood and defined in the context of IS research (e.g., Beaudry and Pinsonneault 2005; DeSanctis and Poole 1994; Elie-Dit-Cosaque and Straub 2011; Majchrzak and Cotton 1988; Orlikowski 1996). It fundamentally focuses on a key phenomenon: the way users respond to changes induced by a new IT system (Beaudry and Pinsonneault 2005). When there is an introduction of a new IT system, users come across to cope with the changes occurred for adapting to that IT system. Draw on the coping theory, user adaptation is defined as efforts exerted by users to manage specific consequences associated with a new IT system in their work environment (Beaudry and Pinsonneault 2005).

Studying user adaptation assists in understanding the mechanisms of how users response to working with a new IT system. Elie-Dit-Cosaque and Straub (2011) figured out that there is a virtually unstudied "black box" between IT system use and its frequently studied antecedents (e.g., these from Information System Success Model (DeLone and McLean 2003), Technology Acceptance Model (Davis 1989), Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003), and Task-Technology Fit (Goodhue and Thompson 1995)). For instance, models of IT acceptance and use literature employing TAM as a theory base neither conceptualizes nor tests user adaptation (Benbasat and Barki 2007). It is important to understand user adaptation because they assist in explaining specific positive or negative IS outcomes (e.g., acceptance, diffusion, and avoidance) (Kock et al. 2006).

User adaptation is particularly important when a new IT system has to be assimilated by all employees in organizations. Usually employees do not have the discretion in regard to a new IT system, however, employees, subjected to such changes, have the discretion to use the new IT system more or less effectively, to vary in the degree to which they take advantages of the possibilities offered by the new IT system, and consequently, determining to which degree the technological capacity indeed translates into effective behaviors in their workplace (Bruque et al. 2008). Therefore, employees' IT system use toward a new IT system is still a critical problem in organizations that we need to pay attention on.

Based on the coping model of user adaptation (Beaudry and Pinsonneault 2005), Elie-Dit-Cosaque and Straub (2011) argued that user adaptation is the key to open the black box through four adaptation strategies (i.e., benefits maximizing, benefits satisfying, disturbance handling, and self-preservation strategy). However, the four adaptation strategies failed to examine what happens to a user, an IT system or a task, because user adaptation should be conceptualized in terms of the three fundamental elements: user, IT system and task (Burton-Jones and Grange 2012; Burton-Jones and Straub 2006). On the other hand, prior work (e.g., Bruque et al. 2008) tends to regard user adaptation as a global concept. Without specifying various types of user adaptations, the richness of the relationships between user, IT system and task is missing. Since the aim of user adaptation is to further improve a user's IT system use when performing a task (Barki et al. 2007), we propose that there should be a further step by examining user adaptation.

2.1.2 Overview of Coping Theory

We draw on the coping theory to conceptualize user adaptation, because user adaptation essentially is the same as coping. Coping theory deals with the adaptational acts that an individual performs in response to changes that occur in his/her environment (Lazarus 1993). Coping is defined as constantly spending cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding individuals' personal resources (Lazarus and Folkman 1984). Finally, the ways in which individuals cope depend upon the resources (i.e., physical, psychological, and social) that are available to them (Lazarus and Folkman 1984).

Individuals apply a combination of problem- or emotion-focused coping, to cope with the changes (Lazarus and Folkman 1984). Problem-focused coping aims at managing the disruptive issue itself. On the other hand, emotion-focused coping aims at changing one's perceptions or reducing emotional distress toward the situation (Lazarus and Folkman 1984). Further, a third coping, appraisal-focused coping, has often been added, especially in studies of work-related coping (Ashford 1988). This third coping, which had been subsumed under emotion-focused coping in Lazarus's scheme, has received prominent attention in alleviating undesired stress from changes or disruptions (Begley 1998).

To move to a more neutral and general set of categories, appraisal-focused, emotion-focused and problem-focused coping can be regarded as representing cognitive, affective and behavioral forms of coping respectively (Begley 1998). In sum, cognitive coping is about redefining the stressful situation in more palatable terms, affective coping involves attempts to regulate the emotional response to the problem, and behavioral coping represents steps taken to develop plans and engage in actions intended to respond directly to the problem creating the stress (Begley 1998).

The specific combination of cognitive, affective and behavioral coping depends upon one's appraisal of a given situation (Lazarus and Folkman 1984). Individuals tend to choose the coping strategy that promises the greater chance of success and the restoration of a sense of well-being (coping outcomes) (Begley 1998). However, all the three types of coping function in parallel almost (Folkman and Lazarus 1985).

2.1.3 A Framework of User Adaptation

In the context of IS research, the coping model of user adaptation proposes user adaptation as problem-focused and emotion-focused user adaptation (Beaudry and Pinsonneault 2005). Being consistent with the theoretical improvement made to coping theory, we apply the cognitive-affective-behavioral framework of coping in user adaptation, because user adaptation essentially is the same as coping (Beaudry and Pinsonneault 2005). Therefore, a cognitive-affective-behavioral framework of user adaptation is identified (see table 2.1), including how a user restores emotional stability, changes personal perceptions and modifies their tasks procedures and system functions (Beaudry and Pinsonneault 2005).

Table 2.1 A Framework of User Adaptation

Adaptation dimensions	Definition
Cognitive user adaptation	The degree to which a user looks for something positive in an IT system (Carver et al. 1989)
Affective user adaptation	The degree to which a user directs attention away and detaches oneself from an IT system (Yi and Baumgartner 2004)
Behavioral user adaptation	The degree to which a user changes system functions of an IT system and task processes to fit each other (Barki et al. 2007)

Social psychologists find that ***cognitive user adaptation***, the degree to which a user look for something positive in an IT system (Carver et al. 1989), is the main theme of the cognitive adaptation theory in changing a user's perceptions toward an IT system (Davis et al. 1998; Taylor 1983). It is oriented toward user's self and aims at changing one's perception of the consequences of an IT system implementation (Beaudry and Pinsonneault 2005). The premise is that, even for an event as adverse as a terminal illness, individuals can construct beneficial meanings about their predicament. These constructions do not suggest these events are not objectively difficult or adverse. Rather, they suggest that individuals have the discretionary to interpret events differently and that these differences have a profound impact on successful adaptation.

Cognitive user adaptation, i.e., search for meaning, involves not only understanding why the event occurred, but what its implications for one's life are now (Taylor 1983). It is a cognitive strategy for reframing a situation to view it in a positive light. It is akin to the concepts of benefit reminding and downward social comparisons, both of which enable individuals to appraise a difficult situation more positively (Folkman and Moskowitz 2000). The aim of cognitive user adaptation is to manage negative experience rather than an IT system itself, and construing an IT event in positive terms should intrinsically lead a user to continue active interactions toward an IT system (Carver et al. 1989). Cognitive user adaptation createss a positive affect (Folkman and Moskowitz 2000) and increases a user's commitment (Sonenshein and Dholakia 2012) toward a new IT system, so that it finally increases IT system use.

Affective user adaptation, i.e., the degree to which a user directs attention away and detaches oneself from an IT system (Yi and Baumgartner 2004), is applied by a user to deny both the fact and the implication of a new IT system to restore emotional stability (Beaudry and Pinsonneault 2005). It is oriented toward a user's self and aims at reducing emotional distress of the changes induced by a new IT system (Beaudry and Pinsonneault 2005).

Although affective user adaptation helps to restore emotional stability from the IT-induced changes, it is detrimental to IT system use (Beaudry and Pinsonneault 2010). Affective user adaptation is characterized by mental disengagement which orients a user's attention and cognitive process away (Gutierrez et al. 2007). It minimizes the perceived negative consequences of an IT system and restores emotional stability by directing attention away from an IT system through strategies such as mental disengagement, psychological distancing, denial and escape/avoidance (Yi and Baumgartner 2004).

Behavioral user adaptation, i.e., the degree to which a user changes functions of an IT system and task processes to fit each other (Barki et al. 2007), is the dominant behavioral coping aiming to achieve theoretical importance of "fit" from the perspectives of task-technology fit theory (TTF) (Goodhue and Thompson 1995) and adaptive structuration theory (AST) (DeSanctis and Poole 1994). It aims at managing the issues associated with an IT system directly. There are two aspects from behavioral user adaptation: IT adaptation and task adaptation (Barki et al. 2007).

TTF highlights the importance of matching an IT system to the needs of a task or a user in order to optimize outcomes of an IT system (Goodhue and Thompson 1995). IT adaptation can take many forms (e.g., personalize system interface, invent new functions) which are unique to an IT system and do not extend to the task or the user within the work context (Barki et al. 2007). On the other hand, task adaptation also results in a higher fit between an IT system and a task, and it is positively related to IT system use (Beaudry and Pinsonneault 2010). AST suggests that an IT system adopted is associated with changes to work processes with predictive implications for IT system use (DeSanctis and Poole 1994). Users try to increase the benefits associated with use of an IT system through behavioral user adaptation to achieve certain fit between an IT system, tasks and users (Beaudry and Pinsonneault 2005). Additionally, If a user invests efforts in behavioral user adaptation, s/he is self-motivated to use an IT system more, in order to realize the expected benefits from his/her investments (Bhattacherjee and Harris 2009).

2.1.4 Coping Theory in IS Research

In general, IS research on coping theory is quite scarce, with several notable exceptions of Beaudry and Pinsonneault (2005), Liang and Xue (2009) and Kwahk (2011). Little research to date has been directed at ways in which users cope with changes induced by a new IT system. With an introduction of a new IT system, there are significant changes to users' daily work. Users are demanded to spend efforts in adjusting these changes, and such efforts could be cognitive, affective or behavioral user adaptation (Beaudry and Pinsonneault 2005).

According to the coping outcomes, the purpose of user adaptation is to improve users' further interaction with an IT system (Barki et al. 2007). Because the coping theory explains users' response to changes that occur in their environment, it serves as a new lens through which to study use of a new IT system. Specifically, because of the limitations of end-user training, they mostly rely on their advice networks in organizations (Venkatesh and Sykes

2013). Advice networks, as a kind of social support, have been the most frequently studied coping resource where significant others can provide instrumental assistance for a focal user to cope with the changes induced by external environment (Thoits 1995). As shown in organizational studies, advice networks have been employed as a main mechanism for reducing uncertainties from organizational changes (Weick 1995). In the following section, we elaborate the roles of advice networks in user adaptation toward a new IT system.

2.2 Advice Networks and User Adaptation

2.2.1 Network Theory and Advice Networks

A network consists of a set of actors along with a set of ties of a specified type that link them. Network theory refers to the mechanisms and processes that interact with network structures to yield certain outcomes for actors (Borgatti and Halgin 2011). It examines how an actor's ties with others in a network influence outcomes of interest, ranging from attitudes and perception (e.g., Ibarra and Andrews 1993) to behaviors (e.g., Obstfeld 2005; Perry-Smith 2006; Venkatesh and Sykes 2013; Wu et al. 2012). Explaining a phenomenon using the lens of network theory complements understanding gained from individual-level factors (e.g., personality, cognitive styles, and absorptive capability).

Prior research has identified two different types of ties on the basis of their functions (Ibarra and Andrews 1993): expressive ties and advice ties. Expressive ties are more likely to convey social support, values, friendship, and information that is more affect-laden. By contrast, advice ties are considered pathways for task-related help, where the primary objective is the exchange of information that is instrumental for accomplishing a task, such as solving changes induced by a new IT system. While expressive and advice ties are not mutually exclusive and an overlap in them can occur (Borgatti and Foster 2003), research suggests that focusing on advice ties is preferred when investigating task-related phenomena (Reagans and McEvily 2003; Sparrowe et al. 2001).

Given our objective of exploring the importance of network structures on IT system use, we focus on advice ties that are predicted on the exchange of informational resources to resolve changes induced by a new IT system. Because learning to use a new IT system entails a knowledge transfer process across users with different levels of skills (Sykes et al. 2009), advice networks play a critical role in the knowledge transfer process in organizations (Reagans and McEvily 2003). Currently, users are more likely to rely on their advice networks to overcome knowledge barriers for better leveraging a new IT system (Magni et al. 2012; Sykes et al. 2009).

2.2.2 Disaggregation of Advice Seeking and Giving Networks

Although prior social network research has typically treated advice networks as a unitary concept, we make the case that a more nuanced treatment of advice networks is necessary. We argue that it is difficult to track directions and explain the nuances of information exchange through a unitary conceptualization of advice networks, especially in the case of a newly implemented IT system that involves active exchange of information. The issue of unitary versus nuance treatments of constructs also related to the bandwidth-fidelity paradox (Cronbach and Gleser 1965). The paradox reflects tradeoffs associated with either narrowly defining and measuring variables or having a single construct that broadly captures many different characteristics (Sykes et al. 2014).

The majority of existing studies on advice networks do not consider whether a user gives or seeks advice, despite the fact that these are two very different acts. Cross et al. (2001) point out that the traditional treatment of advice networks only illustrates the situation of seeking information, without attention on the situation where individuals give work-related information. Although this stance on advice network is over a decade old and there has been much recent research utilizing advice networks, there has been little in the way of opening up the black box of advice networks itself (Zagenczyk and Murrell 2009).

We disaggregate advice networks for the following important reasons. Firstly, the disaggregation is theoretically justified, each of the components can be clearly defined, and each of the components can be distinctly measured. Secondly, each of the components can account for useful non-error variance in the dependent variable of interest. Thirdly, due to the resource cost in creating and maintaining social ties: such as time and cognitive effort (Kilduff and Tsai 2003), users in organizations must choose the ties to create, the ties to maintain, and the ties to dissolve. Fifthly, knowledge heterogeneity among users may lead to asymmetric information exchanges where they would play predominantly a giver role in some exchanges and a seeker role in others (Gargiulo et al. 2009). The incurred imbalance in giving and seeking of information perhaps result into paradoxical personal behaviors (Flynn 2003).

Finally, Mors (2010) suggested that we need to consider the contexts, where ties are developed (i.e., seek or give information), to better understand the impacts of different network structures. Therefore, by disaggregating advice networks, we can gain a deeper understanding of specificities that advice seeking and giving networks provide. Such a disaggregation also adds values to existing network structural research that typically looks at the presence and/or strength of ties, not at the directionality of ties in advice networks.

Specifically, Zagenczyk and Murrell (2009) figure out that advice giving and advice seeking networks have different effects on work-related attitudes and problem-related perceptions. In addition, according to the resource allocation theory (Becker 1965), advice giving and seeking would have different effects in solving creative problems, e.g., adapting to a new IT system (Mueller and Kamdar 2011). Therefore, we argue that advice seeking and giving networks would have different impacts on user adaptation toward a new IT system.

2.2.3 Benefits of Advice Networks

Social network researchers argue for a deeper treatment of the concept of network structure by directly considering ties within advice networks (Sykes et al. 2014). The pattern of ties in a network yields a particular network structure, and actors occupy certain positions within that network structure. It is highly acknowledged that it is more important to study network structure rather than network size for interests (Borgatti and Foster 2003; Burt 1992). Users have different network structures in their advice giving and seeking networks (Gargiulo et al. 2009), and the network structural differences introduce varying benefits to the embedded users (Adler and Kwon 2002;

Borgatti and Halgin 2011). The stream of network research presents two different types of benefits from advice networks: (1) information benefit from advice seeking network, and (2) power and influence benefit from advice giving network (Adler and Kwon 2002; Venkatesh and Sykes 2013). However, the debate between views of network closures (Coleman 1988) and structural holes (Burt 1992) for network benefits still exist in IS research.

2.2.3.1 Advice Seeking Network: Information Benefit

The benefit of advice seeking network is the access to others' information and resources (Adler and Kwon 2002; Borgatti and Halgin 2011). Such an information benefit from advice seeking network accrues to users who have network closures where a user's contacts are closely connected with each other in the advice seeking network (Coleman and Coleman 1994). Focusing on the network structure provides a useful lens for investigating the influences of advice seeking network on IT system use issues (Magni et al. 2012).

Although structural holes in an advice seeking network benefit users with opportunities to access to diverse problem-related information (Burt 2004). However, these opportunities may be impaired if they require active cooperation of sources and such cooperation is not forthcoming or taken for granted (Gargiulo et al. 2009). Because the presence of common third parties is likely to facilitate trust between users and to create incentives to cooperate out of concerns for one's reputation and collective sanctions (Coleman 1988), a user should be better off if his/her advice seeking network has "closure" – that is, if his/her contacts seek advice from each other.

Because a user in a dense advice seeking network is well connected to other actors, he/she is better able to use those relationships to find the information needed (Burt 1992). When seeking advice on how to solve a specific problem of a new IT system, a user is exposed to both explicit information he/she collects through asking for advice and more implicit information, for example, by observing the combinations of functions other users prefer and use (Magni et al. 2012). Response to this asking and the willingness to allow the observations cannot be taken for granted without trust and cooperative norms.

Given that the focal user's information benefit means information loss or communication cost caused to a source, the reputation and cooperative norms from network closure ensures intrinsic motivations for the source to engage in the information exchange (Reagans and McEvily 2003). Gargiulo et al. (2009) stated that a user benefits from seeking-network closure when they need others to behave according to his/her expectations like seeking relevant information. Therefore, we adopt the concept of seeking network closure, i.e., the extent to which a user's contacts are connected to one another in advice seeking network, to explore influences of information benefit on user adaptation.

2.2.3.2 Advice Giving Network: Power and Influence Benefit

Advice giving network indicates that a user has power and influence over how he/she deals with the problems via responding to others' requests (Adler and Kwon 2002), as the requests the focal user receives indicate that he/she is perceived as being knowledgeable (Settoon and Mossholder 2002), influential (Borgatti and Halgin 2011), and powerful of information (Brass 1985). One user's power and influence benefit in advice giving network also stems from the structure of his/her advice giving network (Ibarra and Andrews 1993).

Structural holes theory (Burt 1992; Burt 1997) makes a strong case that a user in a sparse advice giving network (i.e. few network closure) becomes a critical connecting link between other users and a conduit for smooth information flow (Burt 1992). Such a structure of the focal user's advice giving network increase others' dependence on him/her, because others have few alternative information sources except for this focal user (Brass 1984). According to the feelings-as-information theory, a powerful and influential user perceives oneself as be self-capable in handling changes induced by a new IT system (Schwarz and Clore 2003).

However, in a dense advice giving network, a user may perform and feel badly in solving problems due to the social pressure from common third parties (Reagans and McEvily 2003), when he/she is in a need to perform according to others' expectations (Gargiulo et al. 2009). Reactive helping occurs in response to the needs of others, requiring active and purposeful engagement of a focal user (Spitzmuller and Van Dyne 2012). Therefore, the user is most likely to perform an additional role in a dense advice giving network. Resources allocation theory notes that time and energy a person has are finite (Becker 1965), the extra-role acts induce role overload to the focal user. The focal user struggles to find resources needed to satisfactorily complete his/her own in-role works and feels a high level of stress (Bolino and Turnley 2005). Thus, the existence of network closure in advice giving network results in the cost of the focal user's freedom and finally leads to a loss of power and influence benefit.

By diminishing the actual amount of time a user has to spend on his/her own work, extra advice giving may also increase the feeling of resource pressure that may cause anxiety and hinder the user's creative thinking in problems like using a new IT system (Bergeron 2007). Otherwise, lack of connections between contacts results in a greater freedom for the focal user to act as he/she sees fit (Gargiulo et al. 2009). Therefore, we adopt the concept of giving network closure, i.e., the extent to which a user's contacts are connected to one another in advice giving network, to explore influences of power and influence benefit on user adaptation.

2.2.4 A Black Box between Network Closures and IT System Use

Upon the identified benefits from advice seeking and giving networks, the underlying mechanisms of why users with different network benefits would perform IT system differently are still not clear. Specifically, when there is a new IT system that introduces changes to a user's daily works, how this user leverages network benefits to achieve IT system use by overcoming these changes remains a black box. Following a new IT system implementation, a user typically experiences it through his/her interactions and initial training, then he/she may engage in additional and continuous adaptation to make the IT system better fit oneself or tasks for further use (Orlikowski 2000). Thus, grounding on the "black box" argument from Elie-Dit-Cosaque and Straub (2011), we contend that user adaptation is the key to open the black box between network closures and IT system use (see Figure 2.1).

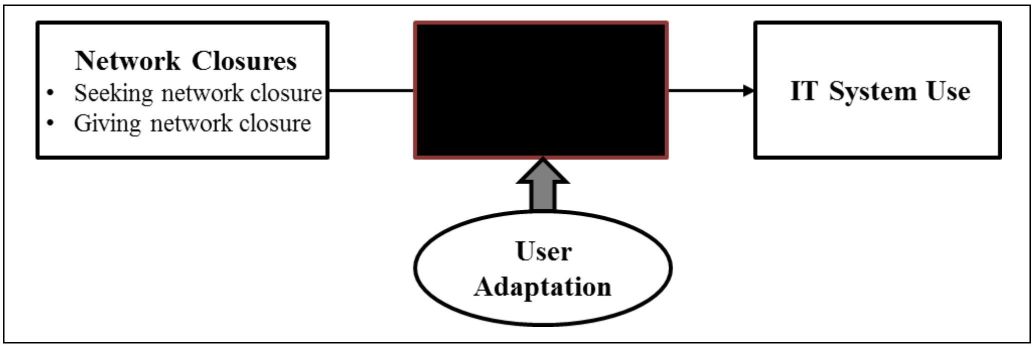

Figure 2.1 A Black Box between Network Closures and IT System Use

2.2.5 Network Benefits and User Adaptation

2.2.5.1 Information Benefit and User Adaptation

Information benefit from existence of seeking network closure, as a type of social resources (Thoits 1995), influences user adaptation toward a new IT system (Lazarus and Folkman 1984). Information benefit can widen a user's pool of available resources and abilities to adapt to a new IT system by providing a stream of physical energy (e.g., knowledge, information) (Hobfoll 2001).

On the one hand, a user would leverage various user adaptation to invest the resource of information benefit for obtaining further benefits from using a new IT system, because a user intrinsically strives for gaining benefits according to the conservation of resources theory (Hobfoll 1989). On the other hand, the perceived value of the physical energy hinges on its value in promoting or supporting one's perceived mastery on a new IT system (Hobfoll 2001). Information benefit is an important complementary resource for personal human capitals, when a user evaluates his/her control over a new IT system. Specifically, the denser the advice seeking network is, the more a user enjoy information benefit (Reagans and McEvily 2003), then the more self-capable of an IT system a user perceives oneself (Hobfoll 2001). A self-capable user is more likely to spend efforts in cognitive and behavioral user adaptation rather than affective user adaptation to promise a greater chance of success (Begley 1998).

2.2.5.2 Power & Influence Benefit and User Adaptation

Power and influence from lack of giving network closure, as another type of social resources (Thoits 1995), also influences user adaptation toward a new IT system (Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984). Power and influence can enhance a user's abilities to cope with changes induced by a new IT system by providing a stream of mental energy (e.g., self-esteem, self-efficacy) (Hobfoll 2001).

On the one hand, a user would perform various user adaptation to protect oneself from losing power and influence regarding a new IT system, since users sensitively strive against resource losses (Hobfoll 1989). To retain the benefit of power and influence, a user would perform actively in solving the challenges induced by a new IT system in order to make oneself as a referral for others. On the other hand, the mental energy hinges on its value in promoting a positive self-sense toward a new IT system (Hobfoll 2001). Particularly, the sparser the advice giving network is, the more powerful and influential a user is (Gargiulo et al. 2009), then more self-capable of a new IT systems a user perceives oneself (Hobfoll 2001). Similarly, a self-capable user is more likely to spend efforts in cognitive and behavioral user adaptation rather than affective user adaptation to promise a greater chance of success (Begley 1998).

2.3 The Contingent Value of IT Complexity

2.3.1 STST and IT Complexity

According to the socio-technical systems theory (STST), there are two subsystems in organizations: social and technical (Bostrom and Heinen 1977).

The technical subsystem comprises devices, tools, and techniques needed to transform inputs into outputs in a way that enhance performance of the whole organization and embedded employees. The social subsystem comprises employees, and the attitudes, knowledge, needs, skills and values they bring to the work environment. STST has been used to help explain a wide variety of IT-phenomena including IT change (Lyytinen and Newman 2008), IT innovation (Avgerou and McGrath 2007) and work performance of post-IT implementation (Sykes et al. 2014).

One of the core tenets of STST is that the technical subsystem (e.g., technology) and social subsystem (e.g., users), with their own characteristics, interact with each other to achieve certain outcomes (Bostrom and Heinen 1977). This informs our context as well as we believe that the technical subsystem plays an important part when we study the impact of social subsystem (i.e., network benefits) on user adaptation. Besides the importance of network benefits from the social subsystem, the technological artifact from the technical subsystem would interact with them for explaining IT-related phenomenon. Regarding a new IT system, IT complexity is the most important artifact (Sharma and Yetton 2007).

IT complexity is defined as the degree to which it is difficult in understanding, learning and using an IT system (Cho and Kim 2001; Premkumar and Roberts 1999). It results in significant technological challenges for a user (Jasperson et al. 2005; Thompson et al. 1991) and discloses the limitations of personal knowledge toward a new IT system. IT complexity creates great knowledge barriers for successful use of an IT system and therefore increases risks in the user adaptation of that new IT system (Premkumar and Roberts 1999).

A complex IT system requires a user to work with an unfamiliar IT system and often require him/her to perform tasks in different ways (Attewell 1992). This requires enhancements to the content of a user's cognitions to overcome increased knowledge barriers (Sharma and Yetton 2007). A user could overcome these knowledge barriers through self-learning, if the IT system is not complex enough (Sharma and Yetton 2007). However, in the situation of a relatively complex IT system, a user mostly relies on external resources (e.g., training, peers' knowledge) to adapt to the changes induced by a new IT system. Robey et al. (2002) figured out that a user should acquire complex knowledge to overcome knowledge barriers related to a complex IT system.

When the knowledge to be used resides in a source, a focal user has to expend efforts in transferring the knowledge from the source. There are two explanations for why there may be a transfer problem in the knowledge exchange: willingness and ability (Hansen 1999). The source may be unwilling to share his/her knowledge, perhaps because of cost in moving complex knowledge. Even if both parties to the transfer are willing to make the efforts, however, they may be unable to transfer smoothly due to knowledge complexity (e.g., level of codification). The knowledge transfer is more difficult to the extent that the knowledge involved is more complex (Zander and Kogut 1995). Therefore, we argue that the magnitudes of seeking-network closure (i.e., ability to access information) and giving-network closure (i.e., willingness to share information) on user adaptation are contingent on IT complexity..

2.3.2 Contextual Effects of Seeking-Network Closure

IT complexity amplifies the effects of information benefit for user adaptation based on twofold reasons. On the one hand, in the situation of a relatively complex IT system, a user mostly seeks external resources to adapt to IT-induced changes through enhancing system-related knowledge (Sharma and Yetton 2007). IT complexity highlights the importance of information benefit from advice seeking network in the context of a complex IT system.

On the other hand, seeking network closure that characterizes densely connected contacts can act as a surrogate for strong ties, providing a user with indirect information on each other that can accelerate the emergence of trust, enabling the exchange to go forward (Burt 2005; Coleman 1988; Granovetter 1985). Transferring highly codified knowledge across both weak and strong ties should be unproblematic. When knowledge being transferred is complex, however, an established strong relationship between the two parties to the transfer is likely to be most beneficial for the seeker (Hansen 1999). In addition, strong ties often allow for a two-way interaction between the seeker and the source (Leonard-Barton and Sinha 1993). The two-way interaction afforded by a strong tie is important for assimilating complex IT knowledge, because the seeker most likely does not acquire knowledge completely during the first interaction with the source but needs multiple opportunities to acquire it (Hansen 1999). In contrast, in weak ties, the necessary interactions for transferring complex knowledge are absent.

Therefore, seeking network closure can assist in merging the ability problem of seeking complex knowledge in the process of user adaptation to changes induced by a complex IT system. Thus, we argue seeking-network closure should be appreciated by a seeker when facing a complex IT system.

2.3.3 Contextual Effects of Giving-Network Closure

IT complexity intensifies the impacts of power and influence for user adaptation through its influence on a giver's willingness to devote time and energy to others. Transferring complex knowledge to recipients often requires specific investments of time and energy by the giver (Hansen 1999; Reagans and McEvily 2003), and needs the giver's strong willingness to share such knowledge. Giving network closure has a positive effect on knowledge transfer, primarily through influencing willingness of the giver to devote time and energy to assisting others, due to the reputation and cooperative norms (Reagans and McEvily 2003). Otherwise, the giver would be sanctioned by connected contacts for uncooperative behaviors in future (Coleman and Coleman 1994).

Further, when facing a complex IT system, contacts usually propose different and difficult IT-related queries, sometimes even competing demands, to the giver. Structural holes in advice giving network provide the giver with a great freedom to avoid certain complex IT-related queries, and enable the giver's control to selectively respond to the contacts' questions about the complex IT system. However, the reputation and norm-enforcing mechanisms from giving-network closure forces the giver (i.e., passive willingness) to spend much time and efforts in transferring complex IT-related knowledge (Gargiulo et al. 2009). Sharing complex knowledge is most likely to cost multiple efforts, because the seeker most likely does not acquire the knowledge completely during the first interaction with the giver, but needs the giver's multiple opportunities to share it (Hansen 1999). If a user spends too much effort in other's concerns about a complex IT system, he/she probably suffers from resource pressure in user adaptation due to role overload and resource pressure (Zagenczyk and Murrell 2009).

Therefore, giving-network closure can compel a giver's willingness to share knowledge, resulting in extra role overload and resource pressure in the process of adapting to changes induced by a complex IT system. Thus, we contend that giving-network closure should be evaded by a giver when facing a complex IT system.

CHAPTER 3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

On the preceding theoretical foundations, this study aims to explore the impacts of advice seeking and giving network closures on different types of user adaptation, and how each type of user adaptation influences IT system use. Besides, we also explore the contingent values of IT complexity on the relationships between advice seeking and giving network closures and user adaptation. Figure 3.1 shows all the hypotheses.

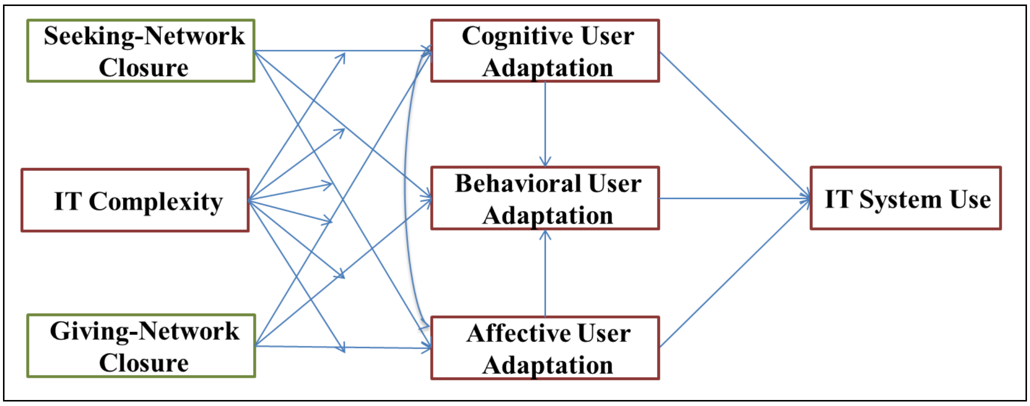

Figure 3.1 Research Model

3.1 Effects of Seeking-Network Closure on User Adaptation

3.1.1 Seeking-Network Closure on Cognitive User Adaptation

Seeking-network closure would increase a user's efforts in cognitive user adaptation toward a new IT system, because it enhancing a user's self-efficacy towards the IT-induced changes. A user embedded in a dense advice seeking network is confident in using a new IT system, since he/she has reliable and readily available information when in need due to trust and cooperative norms among his/her contacts (Coleman 1988). Such an information benefit makes the consequences from a new IT system controllable and triggers a user to view a new IT system in a positive way, although the IT system causes disruptions for the user's daily works.

In addition, a user in a dense advice seeking network can leverage his/her network advantage to get effective help as needed when he/she faces a new IT system. A user whose contacts are closely connected is less anxious and less likely of suffering stress, and has higher self-efficacy arising from the advice acquisition with others (Bandura 1982). As stated previously, a self-capable user would actively change his/her perception toward a new IT system by looking something positive from it. Therefore, we predict that:

> H1: *Seeking-network closure will be positively associated with cognitive user adaptation.*

3.1.2 Seeking-Network Closure on Behavioral User Adaptation

Seeking-network closure encourages a user to increase efforts in changing system functions and task processes to fit each other. Behavioral user adaptation, i.e., a type of new work, requires regular access to reliable and readily available advice sources who are willing to assist and are familiar with the particular job or role requirements in questions (Morrison 2002). Seeking-network closure provides this type of advice and helps a user to become familiar with systems functions (Bruque et al. 2008). Information benefit helps a user learn unique features of a new IT system and gain new skills needed to use it (Sykes et al. 2009). This improves a user's perceived control of a new IT system and raise his/her ability to change a new IT system according to personal preferences (Beaudry and Pinsonneault 2005).

At the same time, information benefit from seeking-network closure (Burt 1992) can assist a user in learning new working processes of a new IT system and fitting the exiting task processes to working processes of that IT system (Sykes et al. 2009). Specifically, seeking-network closure enables a user to learn the ways others are using a new IT system both via direct and indirect information flows. Since information of performing tasks using a new IT system is private and confidential for sources, seeking of that information will be impaired without seeking-network closure (Reagans and McEvily 2003). Conversely, with seeking-network closure, a user can easily obtain task-related information from source (Morrison 2002). Therefore, we posit that:

> *H2: Seeking-network closure will be positively associated with behavioral user adaptation.*

3.1.3 Seeking-Network Closure on Affective User Adaptation

Seeking-network closure would reduce a user's efforts on affective user adaptation, since information benefit diminishes a user's anxiety and stress incurred by a new IT system. A user intends to psychologically keep away from a new IT system if he/she has knowledge barriers, resulting into anxiety and stress. Seeking-network closure creates a safe environment for exchanges not only because it promotes trust but also because it facilitates the enforcement of cooperative norms among users (Coleman 1988).

A user in a dense advice seeking network is able to appropriately seek his/her peers' expertise to deal with challenges associated with a new IT system, and is confident to overcome the knowledge barriers associated. A confident user is self-efficient in restoring emotional stability and less likely to psychologically disengage or distance from a new IT system (Beaudry and Pinsonneault 2010; Yi and Baumgartner 2004). Therefore, we hypothesize that:

> *H3: Seeking-network closure will be negatively associated with affective user adaptation.*

3.2 Effects of Giving-Network Closure on User Adaptation

3.2.1 Giving-Network Closure on Cognitive User Adaptation

Giving-network closure will decrease a user's efforts in reappraising a new IT system in a positive way. A user in a sparse advice giving network will feel being relied by his/ her peers (Brass 1985), and perceived knowledgeable of a new IT system (Settoon and Mossholder 2002). Thus, he/she will experience less anxiety and stress and have higher self-efficacy when addressing professionally challenging situations (Bruque et al. 2008). A confident user is self-capable in handling the stress incurred by a new IT system and able to find the potential positive outcomes from a new IT system. Furthermore, a user responding to disconnected contacts is more likely to observe the benefits of a new IT system via discrete IT-related queries (Sasidharan et al. 2012), increasing his/her perceived relevance toward a new IT system. Then, he/she will engage in more cognitive user adaptation to gain the future benefits from using a new IT system, to protect from loss of such control benefit by empowering oneself about the IT system (Hobfoll 2001).

Otherwise, giving-network closure would reduce the power and influence benefit, since the contacts have other alternative information sources (Foa and Foa 1975). The connected contacts in a user's advice giving network propose almost similar concerns about a new IT system, the focal user would perceive the concerns as severe problems and doubt his/her own capability in solving these concerns. Such a situation directly decreases the focal user's confidence in estimating the positive things of a new IT system. The additional responsibilities from being expected by others from giving-network closure raise the focal user's feeling of stress toward a new IT system (Bolino and Turnley 2005). Thus, a stressful user is less likely to evaluate a new IT system in a positive way. Therefore, we predict that:

> *H4: Giving-network closure will be negatively associated with cognitive user adaptation.*

3.2.2 Giving-Network Closure on Behavioral User Adaptation

Giving-network closure will shorten a user's efforts in behavioral user adaptation, because the decreased benefit of influence and power harms the formation of a positive self-sense over a new IT system (Hobfoll 1989; Hobfoll 2001). Giving-network closure pushes a user to perform according to others' expectations (Gargiulo et al. 2009). The role overload from extra responsibilities causes the focal user to struggle in finding time and energy on his/her own works in behavioral user adaptation (Bolino and Turnley 2005). Behavioral user adaptation, requiring big amounts of efforts in changing system functions and task processes, is impaired when reactive helping costs the focal user too much efforts (Bergeron 2007).

Conversely, structural holes in advice giving network enhances the focal user's power and influence to avoid concerted control from these contacts, which results in greater freedom (Gargiulo et al. 2009). The freedom enables the focal user to selectively respond to contacts' questions about a new IT system (Becker 1965). Therefore, the focal user can reserve enough time and efforts for own works like behavioral user adaptation. On the other hand, when disconnected others send almost different IT-related requests to a powerful user, the user becomes more knowledgeable about functions and working processes of a new IT system by learning from and thinking about these diverse requests (Venkatesh and Sykes 2013). Since a user intrinsically strives to protect the power and influence (Hobfoll 1989; Hobfoll 2001), he/she is more likely to increase efforts in behavioral user adaptation to make oneself outstanding as others' referral as well as to gain benefits from an IT system (Hobfoll 1989; Hobfoll 2001). Therefore, we hypothesize that:

> *H5: Giving-network closure will be negatively associated with behavioral user adaptation.*

3.2.3 Giving-Network Closure on Affective User Adaptation

Resource pressure from giving-network closure arouses a user's anxiety and decreases self-efficacy towards a new IT system, leading to his/her affective user adaptation (Bolino and Turnley 2005). When a user feels stress towards a new IT system in a dense advice giving network (Bolino and Turnley 2005), he/she would probably stop trying the IT system and become psychologically away from the IT system. By diminishing the actual amount of time a user has to spend on his or her behaviors, extra advice giving may also increases perceptions of time pressure that may cause anxiety (Amabile et al. 2002). Stress triggers affective user adaptation, that is, directing one's attention away from the situation and detaching oneself from it (Beaudry and Pinsonneault 2010; Yi and Baumgartner 2004).

Conversely, a user in a sparse advice giving network has a better understanding of others' system perceptions and is perceived as knowledgeable of a new IT system (Settoon and Mossholder 2002). Such an influential position advantage decreases his/her anxiety and increases perceived control toward a new IT system, leading to eliminate directing attention away and detaching oneself from a new IT system (Lazarus and Folkman 1984). Therefore, we hypothesize that:

> *H6: Giving-network closure will be positively associated with affective user adaptation.*

3.3 Interactions among User Adaptation

3.3.1 Cognitive User Adaptation on Affective User Adaptation

Cognitive user adaptation aims to manage a user's negative experience toward a new IT system through construing it in positive terms, such that it is associated with a positive affect to the new IT system (Folkman and Moskowitz 2000). The positive affect assists in reducing a user's anxiety or stress from a new IT system, thus a user is less likely to keep psychologically away from this new IT system (Lazarus and Folkman 1984). For an example, if a user could find positive aspects from a new IT system, s/he will be more likely to pay more attention on the new IT system. Therefore, we hypothesize that:

> *H7: Cognitive user adaptation will be negatively associated with affective user adaptation.*

3.3.2 Cognitive User Adaptation on Behavioral User Adaptation

The aim of cognitive user adaptation is to construe a new IT system in positive terms to intrinsically lead a user to continue active actions e.g., behavioral user adaptation (Carver et al. 1989). For instance, if a user could appraisal benefits from a new IT system, s/he will be more likely to spend efforts on capitalizing these benefits by changing system functions or task procedures to fit each other. Therefore, we propose that:

> *H8: Cognitive user adaptation will be positively associated with behavioral user adaptation.*

3.3.3 Affective User Adaptation on Behavioral User Adaptation

Affective user adaptation aims to restore emotional stability by directing attention away from a new IT system (Yi and Baumgartner 2004). Therefore, a user with affective user adaptation would most likely keep oneself away from making efforts in changing system functions or task processes. Additionally, psychological keeping away from a new IT system reduces motivations to act actively toward a new IT system. Therefore, we propose that:

> *H9: Affective user adaptation will be negatively associated with behavioral user adaptation.*

3.4 Effects of User Adaptation on IT System Use

3.4.1 Cognitive User Adaptation on IT System Use

Cognitive user adaptation is significantly and independently associated with a positive affect to an IT system (Folkman and Moskowitz 2000), which finally leads to the increasing use of an IT system. In an addition, cognitive user adaptation (i.e., benefits finding) most closely relates to organizational research on sensemaking of changes as threats or opportunities (Dutton and Jackson 1987). Through benefits finding with a new IT system introduces changes to the existing works, a user can come to view potentially adverse changes as positive and beneficial (Dutton and Jackson 1987). Because cognitive user adaptation increases a user's commitment to the changes like a new IT system, a user is more likely to have high levels of evolvement in use of an IT system (Sonenshein and Dholakia 2012). Therefore, we hypothesize that:

H10: Cognitive user adaptation will be positively associated with IT system use.

3.4.2 Behavioral User Adaptation on IT System Use

If a user invests efforts in behavioral user adaptation, the user is more motivated to utilize a new IT system more in order to realize the expected benefits from the investment of efforts (Bhattacherjee and Harris 2009). Regarding behavioral user adaptation, two aspects are included: IT adaptation and task adaptation (Barki et al. 2007). On the one hand, IT adaptation aims to match working processes of a new IT system to task processes, and it is positively linked to IT system use, according to the task-technology-fit theory (Goodhue and Thompson 1995).

On the other hand, IT disruption results in decisions by a user to appropriate a new IT system to specific tasks from the adaptive structure theory (DeSanctis and Poole 1994). Subsequently, task adaptation enables a user to take full advantages of a new IT system (Schmitz et al. 2010). A user is capable to utilize the appropriate functions of a new IT system to complete the modified tasks. The efforts of task adaptation result in a better fit and compatibility between a new IT system and tasks, which is positively related to IT system use (Beaudry and Pinsonneault 2010). Therefore, we predict that:

> *H11: Behavioral user adaptation will be positively associated with IT system use.*

3.4.3 Affective User Adaptation on IT System Use

Affective user adaptation minimizes the perceived negative effects of anxiety and helps to restore emotional stability by directing attention away from a new IT system (Yi and Baumgartner 2004). Therefore, a user with affective user adaptation would most likely keep one away from a new IT system. Affective user adaptation can also be dysfunctional because it impedes adaptive processes, hinders resolution of problems (Folkman et al. 1986) and adds to mal-adaptation (Billings and Moos 1984), all of which are detrimental for IT system use (Beaudry and Pinsonneault 2010). Therefore, we propose that:

> *H12: Affective user adaptation will be negatively associated with IT system use.*

3.5 Moderating Effects of IT Complexity

3.5.1 Moderations between Seeking-Network Closure and User Adaptation

The relationships between seeking-network closure and user adaptation will be moderated by IT complexity. On the one hand, information benefit becomes more important when changing system functions or task procedures and understanding benefits of a complex IT system, comparing to an easy IT system, since there are limitations of personal knowledge in solving the challenges induced by a complex IT system (Sharma and Yetton 2007).

On the other hand, seeking-network closure ensures a seeker's ability to move complex IT knowledge from sources. Transferring highly codified knowledge across both weak and strong ties should be unproblematic. When knowledge being transferred is complex, however, an established strong relationship between the two parties to the transfer is likely to be most beneficial for a seeker (Hansen 1999). Seeking-network closure is a surrogate of strong ties, and it guarantees multiple opportunities of a seeker to move complex IT knowledge from sources smoothly duo to the existing of two-way interactions.

When facing a complex IT system, the ensured ability of seeking advice from others is more important in enhancing a user's self-efficacy in controlling the system. The enhanced self-efficacy assists in significantly releasing negative experiences toward a complex IT system, where a complex IT system causes more stress or anxieties for a user than an easy IT system. Therefore, seeking-network closure is more important for a user to positive reappraise and psychologically focuses on a complex IT system than an easy IT system. Therefore, we propose these:

H13a: The positive relationship between seeking-network closure and cognitive user adaptation will be strengthened by IT complexity.

H13b: The positive relationship between seeking-network closure and behavioral user adaptation will be strengthened by IT complexity.

H13c: The negative relationship between seeking-network closure and affective user adaptation will be strengthened by IT complexity.

3.5.2 Moderations between Giving-Network Closure and User Adaptation

The relationships between giving-network closure and user adaptation will be moderated by IT complexity. It is widely acknowledge that knowledge about a complex IT system costs much more efforts for explaining and transferring for an advice giver, comparing to knowledge about an easy IT system. Further, sharing complex knowledge is most likely to cost multiple efforts, because a seeker most likely does not acquire knowledge completely during the first interaction with a giver, but needs the giver's multiple opportunities to share it (Hansen 1999).

When facing a complex IT system, others usually propose different IT-related queries, sometimes even competing demands, to a giver. Such a situation would cause more confusion or anxieties to a giver, so that he/she would more likely disengage in a new IT system. The structural holes in advice giving network provide a giver with a great freedom to avoid certain complex IT-related queries, and enable a giver's control to selectively respond to contacts' questions about the complex IT system. However, the reputation and norm-enforcing mechanisms from giving-network closure forces a giver (i.e., passive willingness) to spend much time and efforts in transferring complex IT-related knowledge, due to the exiting the social pressure from giving-network closure (Gargiulo et al. 2009). Otherwise, a giver would be sanctioned by connected others for his/her uncooperative behaviors (Coleman and Coleman 1994).

In advice giving network, if a user spends too much efforts in other's concerns about a complex IT system, he/she probably performances poorly in behavioral user adaptation due to the role overload and resource pressure (Zagenczyk and Murrell 2009). The caused resource pressure would hinder a user's positively appraisal of a complex IT system and eliminate directing attention away and detaching oneself from a complex IT system. A user's detaching from a complex IT system makes him/her to avoid others' IT-related queries. Therefore, we predict these:

H14a: The negative relationship between giving-network closure and cognitive user adaptation will be strengthened by IT complexity.

H14b: The negative relationship between giving-network closure and behavioral user adaptation will be strengthened by IT complexity.

H14c: The positive relationship between giving-network closure and affective user adaptation will be strengthened by IT complexity.

CHAPTER 4. RESEARCH METHODOLOGY

4.1 Research Context

4.1.1 Background of Research Context

The research model was tested via a field study in a leading hospital in one of the largest cities located at the northeast of the PRC. The setting for data collection is the introduction of an Electronic Medical Record (EMR) system in its outpatient department. This department consists of resident doctors, attending doctors, associate chief of doctors and chief of doctors from all other departments in the hospital who are qualified to provide clinic services for outpatients.

The EMR system was introduced into the hospital expressly for the purpose of providing a sharing knowledge management platform for the outpatient department, a common outpatients' database, and a centralized repository within which to store all doctor-outpatients interactions. The system was implemented to replace old paper-based medical record for outpatients. The EMR system was believed to bring benefits for both doctors and outpatients, e.g., fast storage, easy retrieval, efficient reuse and effective integration of outpatients' information. In simple terms, doctors in the outpatient department were expected to use the EMR system to save outpatients' medical records (e.g., name, disease information, prescriptions), make plans of patients' further consultations, share patients' information with other departments (e.g., payment department, medicine department).

The EMR system implementation was secondarily developed based on a commercial EMR product purchased. The deployment was conducted by a temporary technical team consisting of members from the IT center of the hospital and the EMR system provider company. The implementation started from January 2014 and is completed by the end of February 2014. In between the two months, several EMR-related system training sections were given to all the doctors. Since the doctors were very busy with their daily workload and were reluctant to devote time and efforts on performance-irrelevant tasks, they were voluntary to participate in certain parts of them.

4.1.2 Justifications of Research Context

This implementation of an EMR system is appropriate for the present study for the following reasons. First, although certain amounts of end-user training were given before the official release of the EMR system, doctors still faced knowledge barriers and needed to continue learning about the numerous complex system functions. Some users were even reluctant to use it and continued with the paper-based method, due to the perceived risks and complexity of use. For an example, using the EMR system would leave an accurate and complete record of the consultation results which are usually the causes of doctor-patient conflicts.

Second, this EMR system has user-friendly system design that enables customization, e.g., disease modules, display background and font size. Third, as is common with complex IT systems, new uses were discovered (e.g., integration with other information systems in the hospitals) as familiarity with the EMR system increases. Particularly, the EMR system could be linked with Prescription Management System for medicine distribution, Health

Information System for doctors' workload management and Financial IT System for bill payment.

Finally, based on our focused-group interviews with the director from the hospital's IT center, doctors reacted differently toward the EMR system during the training section. Several doctors tried to build disease modules in the system according to their work preferences, and provided a lot of technical feedbacks to the technical team for further improving the EMR system. Otherwise, there were still cases of complaints about the EMR system in terms of usability issues. Overall, upon these reasons, this context of a newly implemented EMR system fits well with our theoretical interests.

4.2 Construct Operationalization

Dependent variable. ***IT system use*** refers to the extent to which a user actively interacts with the EMR system while performing one's works (Beaudry and Pinsonneault 2010). Rather than using self-reported data, we used secondary data, i.e., system log, according to previous studies (e.g., Sykes et al. 2009; Venkatesh and Sykes 2013). Research has relied on subjective measures for both independent and dependent variables and may not be uncovering true, significant effects, but mere artifacts (Straub et al. 1995). Data gathered through minimally different methods often suffer from methods bias, e.g., self-report bias and hypothesis guessing[1] (Straub et al. 1995).

IT system use was measured through log data of EMR system log collected at the user level and reflects the actual number of daily interactions with the

[1]Hypothesis guessing occurs when respondents, noting the thrust of the questionnaire items, answer in a manner that confirms researcher expectations. It is one serious threat to validity that is difficult to prevent when independent and dependent

EMR system as assessed by medical record inputs. According to instructions of using objective measurement (Magni et al. 2012), we averaged the system log data over a three-month period from 1st March to 31st May in order to smooth peaks and valleys resulting from disruptions, such as vacations and holiday by turn.

Network measures were obtained using the roster-based method (Shah 1998) wherein each doctor was provided with a name list of other users of the EMR system within the hospital outpatient department. ***Advice seeking network*** captures interpersonal relationships that are developed for seeking IT-related information from others (Ibarra and Andrews 1993; Sykes et al. 2009; Venkatesh and Sykes 2013). It was collected by asking each doctor to check names of people in the roster from whom he/she sought IT-related information on a typical work day in the past two months (Sasidharan et al. 2012).

On the other hand, ***advice giving network*** represents interpersonal relationships that are developed for giving IT-related information to others (Ibarra and Andrews 1993; Sykes et al. 2009; Venkatesh and Sykes 2013). It was collected by asking each doctor to check the names of people in the roster to whom he/she gave IT-related information on a typical work day in the past two months (Sasidharan et al. 2012). We should note here that the two networks are based on perceptions of the doctors, and, as such, the two network matrices are not necessarily related to one another (i.e., the matrices are not the inverse of each other).

The traditional way for capturing advice networks is to ask a respondent to indicate communication frequency with each other based on certain scales (e.g., monthly, weekly, daily) (Burt 1992). However, a certain cutoff point of communication frequency is widely applied to dichotomize advice networks for further analysis (Scott 2000). Besides that, due to the heavy workload of doctors, we adapted a binary indication through a doctor's justification of communication with others based on a typical work day, to save the doctor's time and efforts to increase the response quality. This operation has been adapted in previous social network studies (e.g., Sasidharan et al. 2012).

Unlike other measures, such as effective size, constraints or density, betweenness centrality is used as a measure of structural holes and network closures (Mehra et al. 2001). It refers to the extent to which a user falls between other pairs of users, who are not themselves connected, on the path of any shortest distance (Scott 2000). This measure takes into account both direct and indirect ties and is viewed as preferable to the constraint measure offered by Burt (1992) that focuses primarily on direct ties. Since betweenness centrality reflects the extent of structural holes in a network, the reversed value of betweenness centrality is used as an indicator of network closure. The existence of structural holes means the lack of network closures (Burt 2005). It is the larger of a user's betweenness centrality, the less dense the network is. Thus, we calculated betweenness centrality in both advice seeking and giving networks using the flow betweenness procedure in UCINET 6 (Borgatti et al. 2002). Therefore, ***seek-network closure***, i.e., the extent of connectivity among a user's contacts in advice seeking network, was measured as the reversed value of betweenness centrality in advice seeking network. Meanwhile, ***giving-network closure***, i.e., the extent of connectivity among a user's contacts in advice giving network, was measured as the reversed value of betweenness centrality in advice giving network.

User adaptation measures were adapted from previous research. The four-item scale was adapted from Carver et al. (1989) to measure ***cognitive user adaptation***, i.e., the degree to which a user looks for something positive in the EMR system, and one sample question is "I tried to see the EMR system in a different light, to make it seem to be more positive." ***Affective user adaptation*** refers to the degree to which a user directs attention away and detaches oneself from the EMR system (Yi and Baumgartner 2004). We used three items to measure it, with a sample of "I wished that the situation of using the EMR system would go away or somehow be over with." ***Behavioral user adaptation*** is defined as the degree to which a user changes system functions of the EMR system and task processes to fit each other (Barki et al. 2007). Three reflective items were used to measure it, including one sample of "I spent efforts (in time and energy) on changing functions of the EMR system to fit my works." ***IT complexity*** was measured by three items, and one of them is "the skills required to use the EMR system would be complex for me." All the questions are reflective with a seven-point Likert scale. Items are described in table 4.1.

Control variables. User's demographic (i.e., gender, age, education level, title), years of computer experience, number of EMR system training sections attended and personal innovativeness in IT were included to control effects of individual capabilities and capitals. Gender, age, title and computer experience are important factors that influence IT system use (Sykes et al. 2009; Venkatesh and Morris 2000). Although there was certain training provided to all doctors, the participation was not compulsory. Therefore, we control the effect of ***system training*** (i.e., number of EMR system training sections attended) (Amoako-Gyampah and Salam 2004). ***Personal innovativeness in IT*** is an important individual trait factor in determining a user's attitude towards a new IT system, e.g., EMR. It is defined as a user's willingness to try out any new information technology and measured by four adapted reflective items from Agarwal and Karahanna (2000).

Although we were not theoretically interested with the effects of network sizes, holding network sizes constant is necessary to obtain accurate estimates of the network closure effect. In addition, controlling for network size should account for a possible unobserved tendency to over- or underreport ties (seeking network size) or for popularity effects (giving network size). On the one hand, the size of a user's advice seeking network influences his/her perceptions of information quality and task impacts of an IT system (Sasidharan et al. 2012). We measured ***seeking-network size*** as the number of direct contacts from whom the focal user seeks advice (Gargiulo et al. 2009). It corresponds to the focal user's out-degree centrality in advice seeking network. On the other hand, the size of a user's advice giving network influences time and energy in personal work like user adaptation (Bergeron 2007). We measured ***giving-network size*** as the number of direct contacts to whom the focal user gives advice (Gargiulo et al. 2009). It also corresponds to the focal user's out-degree centrality in advice giving network.

Table 4.1 Variables and Measurements (to be cont'd)

Variables	Items	Description	Scale	Source
Advice seeking network	ASN	"Please indicate these persons from whom you seek IT-related information on a typical work day."		Sasidharan et al. (2012)
Advice giving network	AGN	"Please indicate these persons to whom you give IT-related information on a typical work day."		
Seeking-network size	SNS	The out-degree centrality in advice seeking network	0 to N	Freeman (1979)
Giving-network size	GNS	The out-degree centrality in advice giving network	0 to N	
Seeking-network closure	SNC	The reversed value of flow betweenness in advice seeking network	-N to 0	
Giving-network closure	GNC	The reversed value of flow betweenness in advice giving network	-N to 0	
Behavioral user adaptation (BUA)	BUA1	I spent efforts (in time and energy) on changing functions of the EMR system to fit my works.	7-point scale: "not at all" to "very much"	Barki et al. (2007)
	BUA2	I spent efforts (in time and energy) on changing your tasks so that they better fit the EMR system.		
	BUA3	Overall, I spent efforts in recommending changes to the EMR system.		
Affective user adaptation (AUA)	AUA1	I wished that I could escape from the situation of using the EMR system.	7-point scale: "Strongly disagree" to "Strongly agree"	Yi and Baumgartner (2004)
	AUA2	I tried not to think about the situation of using the EMR system.		
	AUA3	I wished that the situation of using the EMR system would go away or somehow be over with.		

Table 4.1 Variables and Measurements (cont'd)

Variables	Items	Description	Scale	Source
Cognitive user adaptation (CUA)	CUA1	I tried to look for something good in using the EMR system.	7-point scale: "Strongly disagree" to "Strongly agree"	Carver et al. (1989)
	CUA2	I tried to see the EMR system in a different light, to make it seem to be more beneficial.		
	CUA3	I tried to learn something from the experience of using the EMR system.		
IT system use	USE	Average number of interactions with the EMR system every day in the past 3 months	Objective data	Magni et al. (2009)
IT complexity (ITC)	ITC1	I require continued technical assistance to use the EMR system.	7-point scale: "Strongly disagree" to "Strongly agree"	Premkumar and Roberts (1999)
	ITC2	The skills required to use the EMR system are complex for me.		
	ITC3	Integrating the EMR system in our current work practices is difficult.		
Personal innovativeness in IT (PII)	PII1	If I heard about a new information technology, I would look for ways to experiment with it.	7-point scale: "Strongly disagree" to "Strongly agree"	Agarwal et al. (2000)
	PII2	In general, I am hesitant to try out new information technologies.		
	PII3	I like to experiment with new information technologies.		
	PII4	Among my peers, I am usually the first to try out new information technologies.		
Use scope	SCOPE	Percentage of EMR functions that are used on a regular basis	<10%, 10-24%, 25-49%, 50-69%, 70-84%, 85-95%, >95%	Karahanna et al. (2006)

Table 4.1 Variables and Measurements (cont'd)

Affective commitment (AFC)	AFC1	I believe the value of this EMR system.	7-point scale: "Strongly disagree" to "Strongly agree"	Herscovitch and Meyer (2002)
	AFC2	This EMR system is a good strategy for our hospital.		
	AFC3	This EMR system is not necessary.		

4.3 Content Validity Assessment

Given that items for the constructs were adapted from various sources, all items were subjected to a two-stage content validation exercise according to the procedures prescribed by Moore and Benbasat (1991). Four PhD students participated in the first stage (unstructured sorting) as sorters. Each sorter was given the 16 items (for key constructs) printed on cards and mixed up. They were asked to sort the items by placing related items together and giving a label to each set of related items (which make up a construct). The labels given by the four sorters for the constructs almost corresponded closely to the names of the actual constructs, except for behavioral user adaptation.

Three of the four sorters placed the three items of behavioral user adaptation into two aspects with BUA1 and BUA3 labeled as IT-related and BUA2 as task-related. The situation is reasonable according to Barki et al. (2007) where they theoretically specified behavioral user adaptation (i.e., task-technology adaptation behaviors) as operational adaptation (i.e., IT-related) and organizational adaptation (i.e., task-related). However, they presented that it is acceptable not to distinguish the three items at the operationalized stage when measuring behavioral user adaptation. Oral feedbacks from these three sorters confirmed that they theoretically placed the three items at two categories and practically it is feasible to cluster them at a general level. Several suggestions on item wording and phasing from the four sorters were adopted. Further consultations with the IT director in the hospital convinced us that the doctors were not able to distinguish the items into task and IT aspects either, since they were with less IT-knowledge and the aim of different adaptations is to improve further personal interactions with the system. Therefore, the displacement of BUA2 is not a problem for the content validity of behavioral user adaptation. Overall, the four sorters correctly placed 93.75% of the items onto the intended constructs (shown in Table 4.2), which is satisfactory.

Table 4.2 Results of Unstructured Sorting Exercise

Construct		**Actual**							
		BUA	CUA	AUA	ITC	PII	Others	Total	%Hit
Theoretical	BUA	9					3	12	75
	CUA		12					12	100
	AUA			12				12	100
	ITC				11		1	12	91.7
	PII					16		16	100
Item Placement: 64, Hits: 60, overall "Hit Ration": 93.75%									

Table 4.3 Results of Structured Sorting Exercise

Construct		**Actual**							
		BUA	CUA	AUA	ITC	PII	Others	Total	%Hit
Theoretical	BUA	12						12	100
	CUA		12					12	100
	AUA			12				12	100
	ITC				11		1	12	91.7
	PII					16		16	100
Item Placement: 64, Hits: 63, overall "Hit Ration": 99.43%									

We then proceeded to the second stage (structured sorting), where another four PhD students participated as sorters. Each sorter was given the 16 items printed on cards and mixed up, together with names and definitions of the 5 constructs. They were asked to sort the items by placing each item into a construct category or an "other" (no fit) category. Except for one question (ITC1) for IT complexity that was placed in category of "other", all sorters correctly placed all of the items into the intended constructs (shown in Table 4.3). Given that it is desirable to have a minimum of three questions per construct (Kim and Mueller 1978), ITC1 was kept. All 16 questions were then consolidated into an instrument for survey administration.

4.4 Data Collection

4.4.1 Survey Administration

Data collection was primarily through a paper-based network-survey, along with archival data. There were 149 doctors who were using the EHR system in the outpatient department. Our network survey invited all of them to participate. User adaptation is a dynamic and continuing concept (Bruque et al. 2008). It is infeasible to capture advice networks and user adaptation through a single survey at the same time, when this study intends to explore how advice networks at the moment of system implementation impact on the post-implementation user adaptation. Upon that, a two-phase method was adopted.

The first phase of survey questionnaire (see Appendix A for details) was distributed immediately after the implementation at the end of February 2014. This survey was used to collect data on users' advice seeking and giving networks, demographics, moderating and control variables. We adopted a combination of ego-centric and socio-metric methods to correctly capture a doctor's whole advice seeking and giving networks. Specifically, each doctor was provided with the department roster of the 149 doctors. They were asked to check the names of people they sought or gave IT-related information on a typical work day in the past 2 months.

Since the doctors had heavy workloads, they could only fill our survey in between sequential visits of patients. To encourage their participation, organizational support was obtained from the hospital’s top management team and a gift incentive of SGD10 was provided. Among the target population of 149 doctors, a total amount of 115 was gained. However, among the 115 respondents, we dropped 4 incomplete respondents, resulting into a usable sample of 111 respondents.

The network response rate, 75%, is almost closely to the recommend response rate of 80% (Wasserman and Faust 1994) for network studies, and it is acceptable. It would be noted that in studies using primary social network data, a sample size of 111 is considered to be quite large (Borgatti and Cross 2003). Non-respondents were due to a lack of desire to participate, incomplete responses, fail to access, etc., and the researchers had no control over these problems but the high response rate alleviate concerns about non-response bias.

The second phase of survey questionnaire (see Appendix A for details) was conducted three months after the first one in the last week of May 2014. This survey was used to collect data of user adaptation. Archival system logs of 3-month EMR use (i.e., March, April, May of 2014) was also obtained from the IT center of the hospital. The structure of the system logs included information about the EMR user names, use date and time, and related activities (see Figure B1 in Appendix B for details). Among the 111 usable respondents from the first-phase survey, 104 of them completed the second-phase survey with qualified data. Five of them provided incomplete data and the rest two doctors were inaccessible during the survey distribution. Similarly, another incentive gift of SGD10 was given to the respondents to encourage participation and response quality. Given that the study duration was three months and had two separate surveys, it was not practical to have all doctors participated through the study, although it certainly would have been ideal.

Three important features of the study should be noted. First, the study was conducted concurrently with the system implementation rather than on a retrospective basis. Second, data collection with objective use data from archival system logs ensured that there were no temporal or perceptual biases. Third, since the doctors were required to indicate their real names in the questionnaire, they were convincing that the survey results would be strictly anonymous for the hospital managers and irrelevant to their work performance evaluation before the questionnaire distribution. This operation assists in eliminating the potential overestimation of cognitive user adaptation or underestimation of affective user adaptation. Finally, as already noted, the study was conducted in a real-world setting.

4.4.2 Sample Description

Table 4.4 presents demographics of the 104 doctors engaging in both phases of surveys. Among the doctors, 62.5% are female, and 65% are older than 40 years old. 74 of them are with a bachelor degree, 28 of them are with a master degree, one holds a degree below bachelor and one is a Ph.D. Additionally, above half of them have a computer experience of no less than 10 years, and the majority of them hold a title of associate or chief of professor. Finally, almost 90% of them attended less than 3 sections of the EMR system training, perhaps due to the work overload as mentioned by the IT director.

To check for non-response bias between the two phases of surveys, we compared demographics between second-phase respondents and nonrespondent (i.e., only phase one respondents). We detected no significant difference between the two phases of surveys in comparison of doctors' demographics in terms of gender, age, education level, title and years of computer experience (see Appendix C for details). Therefore, our dataset was not contaminated by non-response bias.

Table 4.4 Sample Demographics

Demographics	Category	Frequency	Percentage (%)
Gender	Female	65	62.50
	Male	39	37.50
Age	Less than 30 years	1	0.96
	30-35 years	25	24.04
	36-39 years	10	9.62
	40-43 years	11	10.58
	44-47 years	14	13.46
	48-51 years	18	17.31
	52-55 years	11	10.58
	More than 55 years	14	13.46
Education	Below Bachelor	1	0.96
	Bachelor	74	71.15
	Master	28	26.92
	PH.D	1	0.96
Years of computer experience	Less than 2 years	3	2.88
	2-5 years	18	17.31
	6-8 years	19	18.27
	9-10 years	18	17.31
	11-15 year	30	28.85
	More than 15 years	16	15.38
Title	Resident Doctor	10	9.62
	Attending Doctor	20	19.23
	Associate Professor	23	22.12
	Chief Professor	51	49.04
Number of training sections	1 or none	33	31.73
	2	37	35.58
	3	22	21.15
	4	4	3.85
	5	4	3.85
	6	2	1.92
	7 or more	2	1.92
Notes: The sample size used in the analysis is 104 [2].			

[2] 104 out of total 149 doctors participated in both surveys.

4.5 Pilot Study

We conducted a pilot study within a student sample. Although it would have been ideal to conduct the pilot study in our research setting, the major practical constraint facing all primary social network studies (i.e., need for a site where we could obtain a response rate over 80% to a network survey) precluded the same. Participants in the pilot study were part-time master students in a course. We invited all 26 students to participate and 25 of them filled out our surveys for a response rate of 96%, which is above the response rate threshold of 80% necessary for network studies (Wasserman and Faust 1994).

The roster-based method was utilized by asking the students to check persons whom he/she seek work-related advice from and give work-related advice to. The result shows that the number of identified persons ranges from 2 to 9 with an average of 5.04. Paired-sample test shows that the paired differences between seeking-network closure and giving-network closure are significant with $t=3.427$ and $p<0.05$. Therefore, we contended that individuals have different structures in advice seeking and giving networks.

As the study proceeded without any problem, the pilot study provided evidence that our data collection procedure was appropriate, and both questionnaires were clear and understandable. It took about 20 minutes for first-phase survey and 10 minutes for second-phase survey. Based on the feedbacks from out participants, we concluded that it was important to communicate the time it takes to complete the surveys to set appropriate expectations about the time commitments, especially because our survey was longer than a typical survey and our target population has limited free time.

4.6 Data Analysis Techniques

After data collection, we used UCINET 6 (Borgatti et al. 2002) to analyze the sociometric data and visualize both advice seeking and giving networks. The theoretical model is multistage, suggesting the need for a structural equation modeling technique. Partial Least Square (PLS) (SmartPLS 2.0.M3) was chosen primarily. First, as a second-generation structural equation modeling (SEM) technique, it can estimate the loadings (i.e., assessing construct validity) and the causal relationships among constructs in multistage models (Fornell and Bookstein 1982). Second, in comparison with covariance-based (CB) SEM, PLS is robust with fewer statistical identification issues. Moreover, it is most suitable for models with relatively small samples (Hair et al. 2011), which is the case in our study. Additionally, whereas CB-SEM is regarded as being more appropriate for theory confirmation, PLS does provide a good approximation of CB-SEM in terms of final estimates (Hair et al. 2011).

4.7 Illustration of Social Network Analysis

We used UCINET Version 6.29 (Borgatti et al. 2002) to analyze the socio-metric data. The visual representations of both advice seeking and giving networks with the 111 doctors are described in Appendix D. It can be seen that a user has different advice seeking and giving networks. For an instance, user 99 is isolated in advice seeking network, whereas he/she is connected with user 32 and user 98.

To make it simple, we illustrate the social network analysis conducted on the full sample with the help of a small subsample of the socio-metric data. Table 4.5 and 4.6 show the data for six users (the names used are pseudonyms) obtained through our survey. Social network analysis is generally concerned with dichotomous ties within a network, either being present or absent (1 or 0).

Table 4.5 captures the extent to which a focal user (row) seeks IT-related information from the other five users (columns). For example, we see that Anne seeks IT-related information from Bob, Mike and Scott on a typical work day, whereas Olivia doesn't seek IT-related information from any other in this subsample. Table 4.6 captures the extent to which other users get advice from a focal user (i.e., the people to whom the focal employee gives advice). For example, we see that Mike only gives IT-related information to Scott, whereas Scott gives IT-related information to all the other five users on a typical work day.

Figures 4.1 and 4.2 provide a visual depiction of the patterns of advice interactions in this network of six users. In the advice seeking network figure, an arrow from one user to another indicates that the user seeks advice from the person the arrow is pointing to. In the advice giving figure, an arrow indicates that the user gives advice to the person the arrow is pointing to. In both types of figures, a double-headed arrow indicates a reciprocal relationship. As other studies have suggested, advice seeking or giving network is not necessarily symmetrical matrices because people may not reciprocate advice seeking or giving from each other (Marsden 1990). It is to say that the ties between users may be not necessarily double-arrowed. As can be observed in the advice seeking network, users have significant variance in how many other users they approach for advice. Scott seeks IT-related information from all other five users (i.e., Anne, Bob, Jack, Mike, and Olivia), but Olivia doesn't seek IT-related information from any of the other five on a typical work day. Similarly, there is variation in the advice giving network (e.g., Mike and Scott).

Table 4.7 summarizes the social network analytics calculated for these two networks. Paired samples t-test shows that the paired differences between seeking-network size and giving-network size are significant with t=3.342 and p=0.021, and the paired differences between seeking-network closure and giving-network closure are significant with t=2.812 and p=0.037 (see Appendix E). It can be seen from the statistics that users have different advice seeking and giving networks in terms of network size and closure.

Table 4.5 Advice Seeking Network

	Anne	Bob	Jack	Mike	Olivia	Scott
Anne	0	1	0	1	0	1
Bob	1	0	0	0	1	0
Jack	1	0	0	1	1	1
Mike	1	0	0	0	1	0
Olivia	0	0	0	0	0	0
Scott	1	1	1	1	1	0

Table 4.6 Advice Giving Network

	Anne	Bob	Jack	Mike	Olivia	Scott
Anne	0	1	0	1	1	0
Bob	0	0	0	0	1	0
Jack	1	0	0	1	1	1
Mike	0	0	0	0	0	1
Olivia	1	1	1	1	0	1
Scott	1	1	1	1	1	0

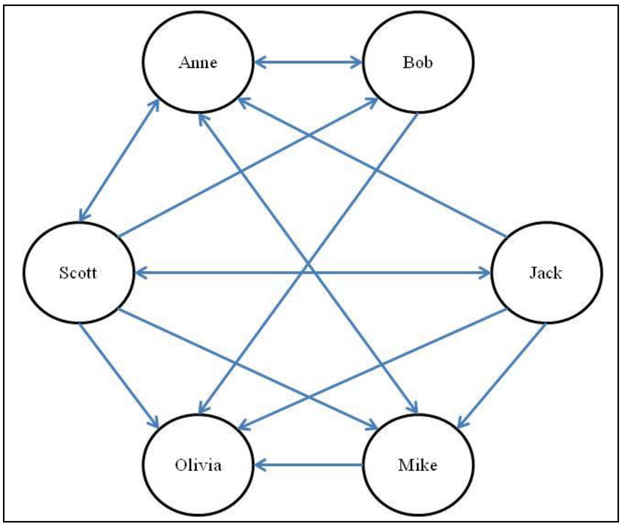

Figure 4.1 Visualization of Advice Seeking Network

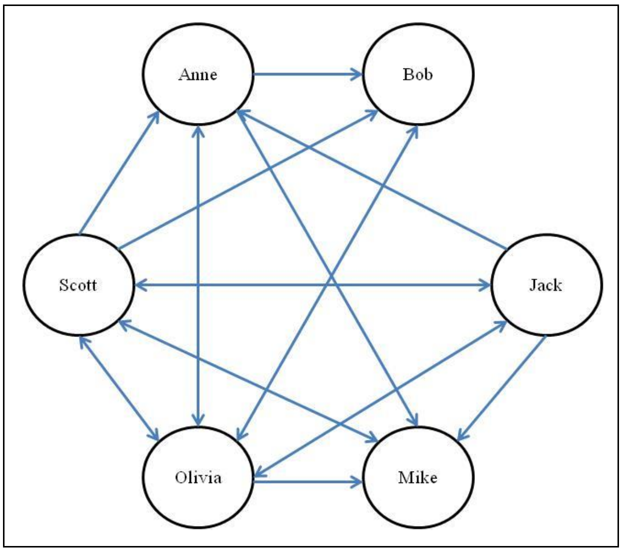

Figure 4.2 Visualization of Advice Giving Network

Table 4.7 Social Network Analytics

	SNS	SNC	GNS	GNC
Anne	3	-4.00	3	0
Bob	2	-1.00	1	0
Jack	4	0.00	4	0
Mike	2	-1.00	1	0
Olivia	0	0.00	5	-5.83
Scott	5	-3.83	5	-4.33
Note: SNS: seeking-network size; GNS: giving-network size; SNC: seeking-network closure; GNC: giving-network closure				

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CHAPTER 5. DATA ANALYSES

5.1 Evaluating the Measurement Model

Table 5.1 shows the descriptive statistics. The averaged seeking-network size is 3.14, with a minimal size of “0” (i.e., never seek advice from anyone) and a maximal size of “8”. On the other hand, the averaged giving-network size is 3.23, with a minimal size of “0” (i.e., never give advice to anyone) and a maximal size of “11”. That is to say, in general the doctors had a relatively small advice seeking or giving network. They did contact with a small number of others among the 104 doctors. The average values for seeking-network closure and giving-network closure are “-5.034” and “-4.366”. It is to say the doctors only fall into the paths between 5.034 and 4.366 pairs of disconnected others in advice seeking and giving networks respectively at average. Therefore, we contend that the doctors’ advice giving and seeking networks are relatively dense, based on the whole network size of 104.

Among user adaptation, behavioral user adaptation (Mean = 3.444) and affective user adaptation (Mean = 3.082) have a mean below neutral[3], whereas cognitive user adaptation (Mean = 5.451) has a mean above neutral. This shows that doctors performed differently among different types of user adaptation. The mean of IT system use is 3.240[4]. Additionally, our doctors perceived the EMR system as slightly complex with a mean of IT complexity (Mean = 2.755) below neutral, and the doctors are slightly innovative in using

[3] Neutral is taken as the value of 4, the center of the 7-point Likert scale.

[4] Herein, the value of use frequency is the logged value of daily interactions with the EMR system for each doctor. As shown by the original value of “IT system use”, the daily average of actual interaction with the EMR system is 32.69.

a new IT system with a mean of personal innovativeness in IT (Mean = 4.987) above neutral.

Table 5.2 shows that correlations among the studied variables. Inter-correlations were acceptable in general, except a positive correlation of 0.582 between seeking network size and giving network size. Although there isn't any high correlation among the interest variables, we still proceeded to test the potential multicollinearity. To check on the severity of the multicollinearity, we examined the variance inflation factor (VIF) with each independent and control variables. All the VIF values (ranging from 1.009 to 1.817) are less than 3.3 (Diamantopoulos and Siguaw 2006). Multicollinearity thus posed no serious threat to the validity of our analyses (refer to Appendix F for details).

Reflective constructs were assessed in terms of content validity, convergent validity and discriminant validity. Content validity was established based on the exiting literature and information opinions. Convergent validity was assessed by examining composite reliability, Cronbach's alpha, item loadings, and average variance extracted (AVE) for the measures. The questions were tested for validity using factor analysis with principal components analysis and varimax rotation. Convergent validity was assessed by checking loadings to see if items within the same construct correlate highly amongst themselves. Discriminant validity was assessed by examining the factor loadings to see if questions loaded more highly on their intended constructs than on other constructs. Loadings of 0.450 to 0.540 are considered fair, 0.550 to 0.620 are considered good, 0.630 to 0.700 are considered very good, and above 0.710 are considered excellent (Kankanhalli et al. 2005). Factor analysis showed that the loading of ITC1 on IT complexity was 0.265, which is below the considered level of 0.450 (see Table G1 item-factor loading in Appendix G). Therefore, ITC1 was removed. Additionally, PII4, a reversed item of personal innovativeness in IT, was removed to avoid noise. Item-factor loadings before and after dropping of ITC1 can be found in Table G1 and G2 located in Appendix G.

As shown in table 5.3, all the Cronbach's alpha and composite reliability values exceeded the criterion of 0.700 (Chin 1998), and all the AVE values were above the recommended threshold of 0.500 (Hair et al. 1998). In addition, item loadings were all above 0.710 and significant at the level of 0.01. Discriminant validity was verified by comparing the square root of AVEs with correlations among constructs. The square root of AVE (see Table 5.2) for each construct was greater than the levels of the correlations involving the construct, confirming discriminant validity (Fornell and Larcker 1981).

Because the survey data were collected using a single method, common method bias could be a concern (Xu et al. 2010). To assess the common method bias, this study employed Harman's single-factor test (Podsakoff et al. 2003). All of the self-reported variables (i.e., behavioral user adaptation, cognitive user adaptation, affective user adaptation, IT complexity and personal innovativeness in IT) were loaded into an exploratory factor analysis (EFA) and the unrotated factor solution was examined. Results demonstrated that common method bias was not a threat to our findings given that a principal components analysis (1) identified five factors explaining 79.98% of the variance; (2) the first factor did not account for all the variance (28.36%);

and (3) there was no general factor in the unrotated factor structure (refer to Appendix H for details).

Table 5.1 Descriptive Statistics of Variables

Variables	Mean	Std. D	Min	Max
Gender[5]	1.360	0.483	1	2
Age	4.730	2.121	1	8
Education	2.260	0.465	1	4
Title	3.110	1.024	1	4
Years of computer experience	3.970	1.431	1	6
Number of training sections	2.260	1.334	1	7
Personal innovativeness in IT	4.987	1.393	1	7
IT complexity	2.755	1.344	1	7
Seeking-network size	3.140	1.893	0	8
Giving-network size	3.230	2.247	0	11
Seeking-network closure	-5.034	10.091	-71.167	0
Giving-network closure	-4.366	8.606	-55.750	0
Behavioral user adaptation	3.444	1.597	1	7
Cognitive user adaptation	5.451	1.134	1	7
Affective user adaptation	3.082	1.372	1	7
USE*	3.240	0.761	1	5
Notes: variables are the averaged values of multiple items. USE*: logged value of IT system use.				

[5] 1: female; 2: male.

Table 5.2 Inter-Correlations of Variables

Var	Gender	Age	EDU	Title	CEXP	TRN	PII	ITC	SNS	GNS	SNC	GNC	BUA	CUA	AUA
Gender	**N/A**														
Age	-0.238	**N/A**													
EDU	-0.426	0.046	**N/A**												
Title	0.523	-0.288	-0.061	**N/A**											
CEXP	-0.163	-0.004	0.173	-0.094	**N/A**										
TRN	0.117	-0.017	-0.156	0.007	-0.176	**N/A**									
PII	-0.174	0.076	0.025	-0.138	0.168	0.087	**0.903**								
ITC	0.232	0.020	-0.144	0.139	-0.203	0.052	-0.292	**0.917**							
SNS	0.004	-0.006	0.075	0.071	0.160	-0.058	0.051	-0.012	**N/A**						
GNS	0.190	0.122	-0.039	0.121	-0.024	-0.040	-0.061	0.118	0.582	**N/A**					
SNC	-0.045	0.054	-0.183	-0.203	0.140	-0.177	0.067	0.030	-0.449	-0.323	**N/A**				
GNC	-0.033	-0.171	-0.146	-0.100	0.032	-0.005	0.032	0.055	-0.117	-0.279	0.135	**N/A**			
BUA	-0.197	0.154	0.223	-0.133	0.088	0.028	0.049	0.143	0.043	-0.121	-0.061	0.093	**0.885**		
CUA	-0.033	-0.103	0.045	-0.082	-0.096	-0.051	0.107	-0.347	-0.002	0.053	0.138	-0.066	-0.038	**0.825**	
AUA	0.037	0.002	-0.053	0.006	-0.239	0.197	-0.115	0.444	0.113	0.024	-0.186	0.067	0.108	-0.376	**0.895**
USE*	0.291	-0.135	-0.141	0.285	-0.157	0.073	-0.051	0.073	0.035	0.081	-0.074	0.054	0.131	0.132	-0.081

Notes: Diagonal elements are the squared roots of AVEs of reflective variables; off-diagonal elements are correlations among latent constructs.
CEXP: computer experience; TRN: number of training sections; SNS: seeking-network size; GNS: giving-network size; GNC: giving-network closure; SNC: seeking-network closure; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation; ITC: IT complexity; PII: personal innovativeness in IT; USE*: logged value of IT system use

Table 5.3 Convergent Validity for Reflective Constructs

Constructs	Item	Loading	T-value	Indicator Reliability	Composite Reliability	Cronbach's Alpha	AVE	Squared Root of AVE
Behavioral user adaptation	BUA1	0.828	30.258	0.686	0.915	0.864	0.783	0.885
	BUA2	0.919	84.409	0.845				
	BUA3	0.905	62.576	0.819				
Cognitive user adaptation	CUA1	0.812	24.276	0.659	0.865	0.766	0.681	0.825
	CUA2	0.851	32.985	0.724				
	CUA3	0.811	23.140	0.658				
Affective user adaptation	AUA1	0.940	19.475	0.884	0.923	0.877	0.801	0.895
	AUA2	0.772	17.631	0.596				
	AUA3	0.961	23.603	0.924				
IT complexity	ITC2	0.891	39.874	0.794	0.913	0.813	0.840	0.917
	ITC3	0.941	33.443	0.885				
Personal innovativeness in IT	PII1	0.944	60.304	0.891	0.930	0.890	0.816	0.903
	PII2	0.961	10.519	0.924				
	PII3	0.796	14.099	0.634				

5.2 Evaluating the Structural Model

Subsequently, we examined the structural model in terms of path significance and explanatory power using a boot-strapping procedure. All constructs were modeled as reflective and included in the model using multiple indicators rather than summated scales, with the exception of IT system use. We ran PLS once and the results are shown in table 5.4. To explore the effects of network closures, it is theoretically necessary to control the effects of network sizes (Gargiulo et al. 2009).

5.2.1 Main Effects Testing

To facilitate the interpretations, the results of the twelve main hypotheses are displayed in figure 5.1. For cognitive user adaptation, table 5.4 shows that the model explained 17.9% of the variance. Specifically, the impacts of seeking-network closure (β=0.245, t=3.072) and giving-network closure (β=-0.192, t=1.953) on cognitive user adaptation were significant, suggesting that H1 and H4 are supported. However, seeking-network size (β=-0.016, t=0.326) was not a significant factor of cognitive user adaptation, whereas giving-network size (β=0.142, t=2.608) was significant.

For behavioral user adaptation, table 5.4 shows that the model explained 8.8% of the variance. Although seeking-network closure (β=-0.107, t=2.172) and giving-network closure (β=0.122, t=4.106) were significant factors, the results are opposite to the hypothesized direction. Therefore, H2 and H5 were not supported. We also found that neither cognitive user adaptation (β=0.049, t=0.881) nor affective user adaptation (β=0.001, t=0.024) impacted on behavioral user adaptation. Hence, H8 and H9 were not supported.

Additionally, seeking-network size has a significant positive effect (β=0.155, t=2.435) on behavioral user adaptation, whereas giving-network size has a significant negative effect (β=-0.218, t=3.437).

Table 5.4 Result of PLS Analysis

Variables	Cognitive User Adaptation	Affective User Adaptation	Behavioral User Adaptation	IT System Use
SNS	-0.016 (0.326)	0.096* (1.761)	0.155** (2.435)	
GNS	0.142** (2.608)	-0.112* (2.058)	-0.218** (3.437)	
SNC	0.245** (3.072)	-0.252** (4.106)	-0.107* (2.172)	
GNC	-0.192** (1.953)	0.167* (2.100)	0.122** (4.106)	
CUA		-0.214** (5.702)	0.049 (0.881)	0.193** (3.900)
AUA			0.001 (0.024)	-0.121** (2.677)
BUA				-0.073 (1.556)
ITC	-0.329** (6.739)	0.395** (8.959)	0.164** (3.158)	
SNC*ITC	0.053 (0.542)	-0.152* (2.074)	0.012 (0.193)	
GNC*ITC	-0.217 (1.297)	0.165* (1.745)	0.143* (2.051)	
Gender				-0.038 (0.772)
Age				0.081** (2.858)
EDU				-0.036 (0.980)
Title				0.212** (6.911)
TRN				0.018 (0.625)
CEXP				-0.065 (1.013)
PII				0.005 (0.138)
R^2 (%)	17.9	30.7	8.8	16.4

Notes: SNS: seeking-network size; GNS: giving-network size; SNC: seeking-network closure; GNC: giving-network closure; EDU: education level; CEXP: computer experience; TRN: number of training sections; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation; BUA: behavioral user adaptation; EDU: education level; CEXP: computer experience; TRN: number of training sections; PII: personal innovativeness in IT*p≤ 0.05; **p≤ 0.01; one-tailed test.

For affective user adaptation, table 5.4 depicts that the model explained 30.7% of the variance. Specifically, seeking-network closure (β=-0.252, t=4.106) and giving-network closure (β=0.167, t=2.100) were significant, suggesting that H3 and H6 are supported. We found that cognitive user adaptation has a significant negative effect (β=-0.214, t=5.702) on affective user adaptation, thus H7 is supported. Moreover, both the effects of seeking-network size (β=0.096, t=1.761) and giving-network size (β=-0.112, t=2.058) on affective user adaptation were significant.

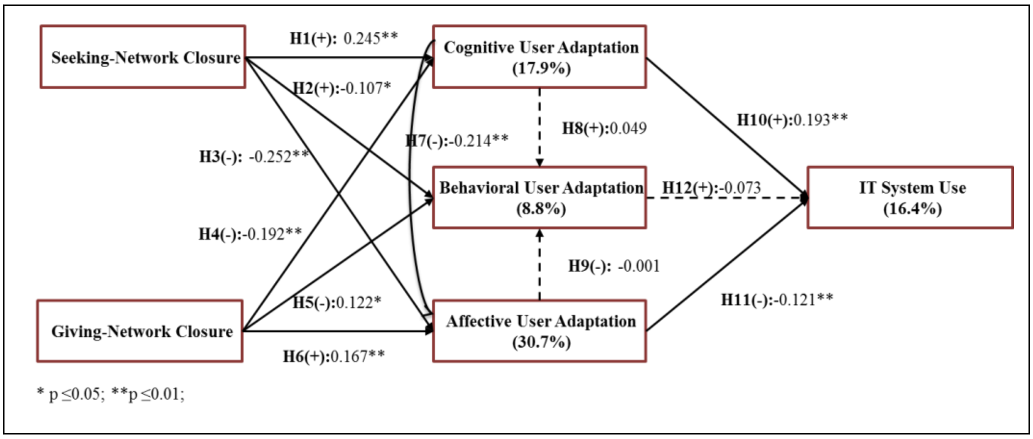

Figure 5.1 PLS Results for Main Effects

In regard to IT system use, as can be seen from table 5.4, the model explained 16.4%. Specifically for cognitive user adaptation, its positive effect is significant on IT system use (β=0.193, t=3.900), suggesting that H10 is supported. For affective user adaptation, its negative effect on IT system use (β=-0.121, t=2.677) is also significant, suggesting that H11 is supported. However, behavioral user adaptation (β=-0.073, t=1.556) does not significantly impact on IT system use, thus H9 is not supported.

5.2.2 Moderating Effects Testing

To testing the moderating effects, standardized indicators were chosen because Likert scales were employed in this study, and the indicators were considered to be theoretically parallel. To further understand the interaction effects, we plotted these interaction effects in the following figures.

As can be seen from table 5.4, the interaction of seeking-network closure and IT complexity did not significantly impact on cognitive user adaptation (β=0.053, t=0.542) and behavioral user adaptation (β=0.012, t=0.193), therefore H13a and H13b are not supported. To further confirm the testing results, we can see from figure 5.2 and figure 5.3 that the slops of both solid line and dotted line are almost the same, without significant differences. Therefore, the effects of seeking-network closure on cognitive user adaptation and behavioral user adaptation are not contingent on IT complexity.

However, the interaction term had a significant negative effect (β=-0.152 t=2.074) on affective user adaptation, hence H13c is supported. As can be seen from figure 5.4, the slop of the dotted line (i.e., high level of IT complexity) is much larger than the solid line (i.e., low level of IT complexity), meaning that the negative effect of seeking-network closure on affective user adaptation is much larger under a high level of IT complexity than under a low level of IT complexity. Therefore, we can conclude that the negative effect of seeking-network closure on affective user adaptation is strengthened by IT complexity.

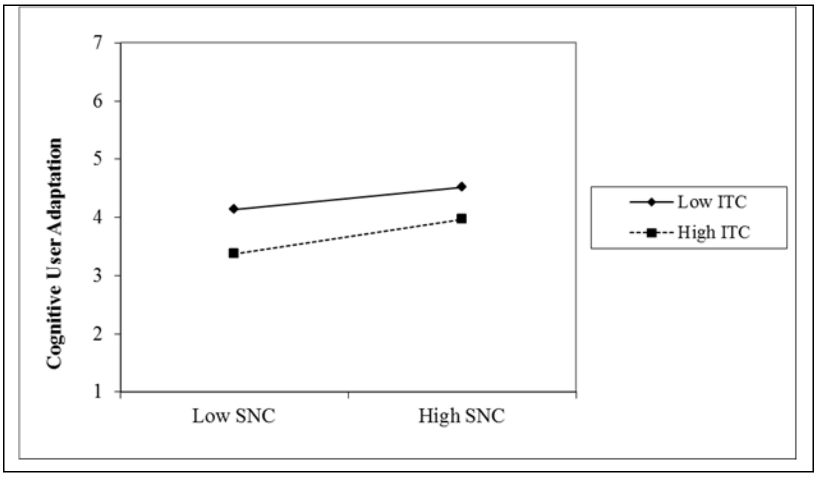

Figure 5.2 Interaction of seeking-network closure on cognitive user adaptation

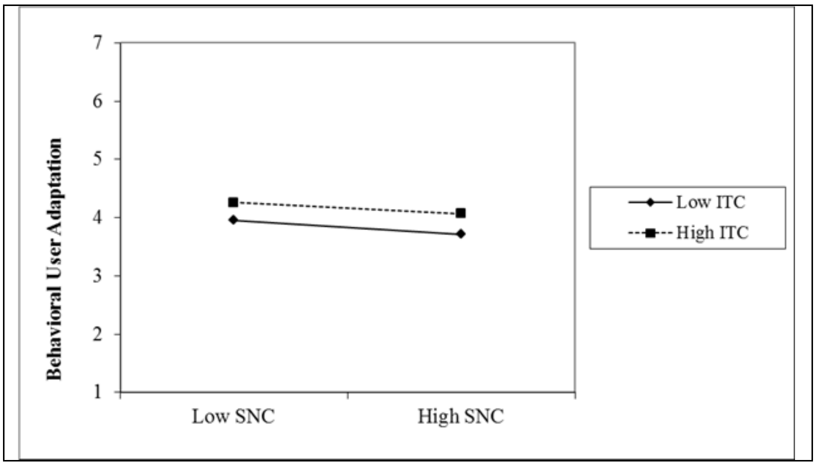

Figure 5.3 Interaction of Seeking-network closure on behavioral user adaptation

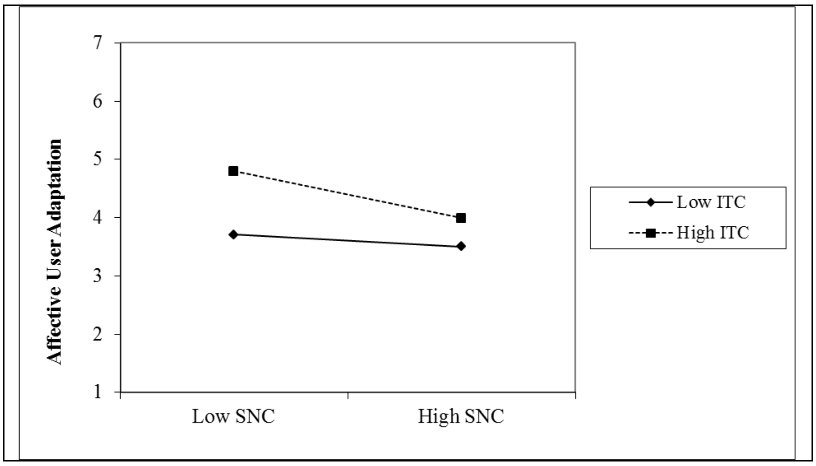

Figure 5.4 Interaction of seeking-network closure on affective user adaptation

Regarding the moderating effects of IT complexity on the relationships between giving-network closure and user adaptation, the interaction of giving-network closure and IT complexity did not significantly impact on cognitive user adaptation (β=-0.217, t=1.297). Therefore, H14a is not supported. As can be seen from figure 5.5, the slops of both dotted line and solid line are almost the same, thus, the influence of giving-network closure on cognitive user adaptation is not contingent on IT complexity.

However, the interaction term had a significant positive effect (β=0.143, t=2.051) on behavioral user adaptation, meaning H14b is supported. As can be seen from figure 5.6, the slop of the dotted line (i.e., high level of IT complexity) is much larger than the solid line (i.e., low level of IT complexity), meaning that the positive effect of giving-network closure on behavioral user adaptation is much larger under a high level of IT complexity than under a low level of IT complexity. Therefore, the positive effect of giving-network closure on affective user adaptation is strengthened by IT complexity. Moreover, we found that the interaction term had a positive effect (β=0.165, t=1.745) on affective user adaptation, meaning H14c is supported. The plotting in figure 5.7 confirms our statistical finding of H14c. Therefore, we conclude that the positive impact of giving-network closure on affective user adaptation is strengthened by IT complexity.

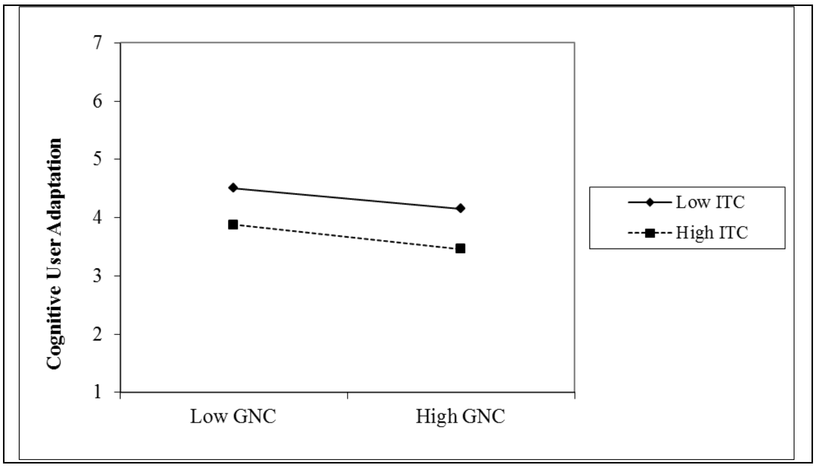

Figure 5.5 Interaction of giving-network closure on cognitive user adaptation

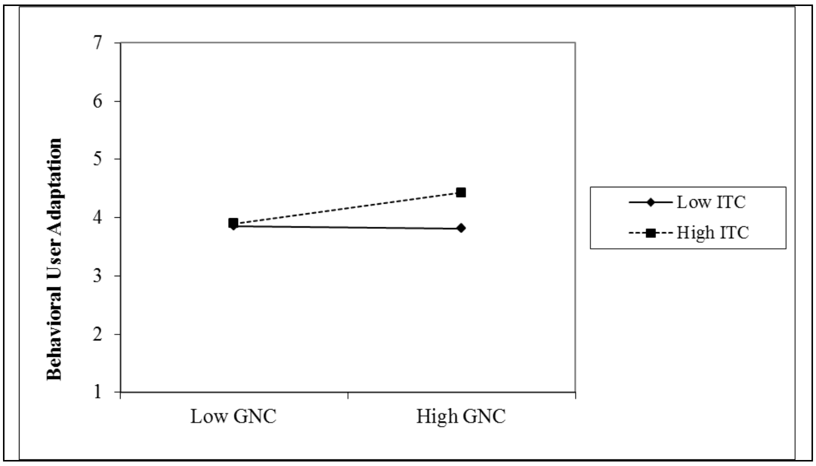

Figure 5.6 Interaction of giving-network closure on behavioral user adaptation

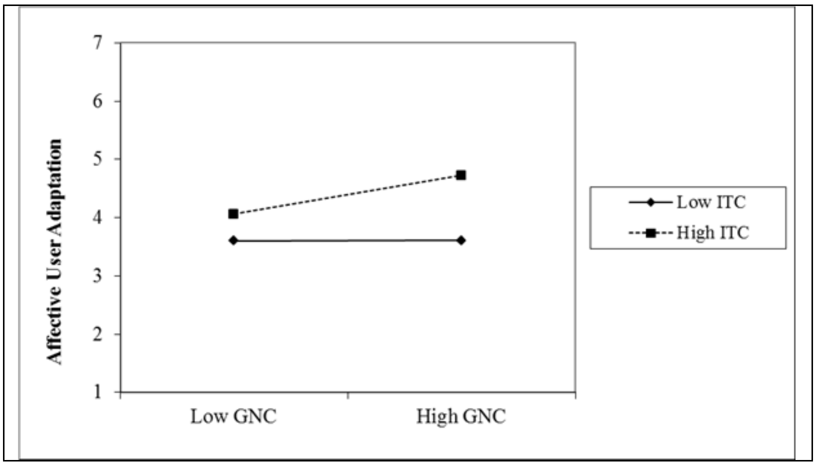

Figure 5.7 Interaction of giving-network closure on affective user adaptation

CHAPTER 6. DISCUSSION AND IMPLICATIONS

6.1 Discussion of Findings

6.1.1 User Adaptation Predicted IT System Use

This research investigates how seeking-network closure and giving-network closure influence IT system use through the mediation of user adaptation and the contextual effects of IT complexity.

Specifically, cognitive user adaptation indeed increases IT system use. It helps to construe a new IT system in a positive way so that a user is encouraged to use it frequently to manage personal works (Carver et al. 1989), especially for these mandatory IT systems. In addition, cognitive user adaptation pushes a user to view a new IT system as an opportunity to improve and manage personal works (Dutton and Jackson 1987), and then a user is willingness to utilize the IT system much frequently. The frequency with which a new IT system is used tends to be structured around many of the activities that make up a user's job (Venkatesh et al. 2008).

Affect user adaptation does lead to a user's decreasing of IT system use. Acknowledging the benefits of restoring emotional stability, affective user adaptation moves a user's attentions or interests from a new IT system (Yi and Baumgartner 2004). This situation results into a user's mental disengagement (Gutierrez et al. 2007) to interact with a new IT system. That's why affective user adaptation is found to be significantly and positively associated with IT system use.

Finally, to our surprise, behavioral user adaptation does not affect IT system use, although it improves the fit among users, tasks and a new IT system. This finding is almost consistent with the proposition of the direct link between task-technology fit (TTF) and IT system use in term of frequency from Goodhue and Thompson (1995). An alternative explanation given by Goodhue and Thompson (1995) is that attitudes and behavior theories such as habit and social norms may dominate the decision to use a new IT system frequently instead of a better TTF from behavioral user adaptation. The doctors in this research context were most likely to view use of the EMR system as mandatory. Mandatory use can be thought of as a situation where social norms to use it are very strong and overpower other considerations such as TTF or beliefs and affects toward a new IT system (Goodhue and Thompson 1995). Therefore, although a user invests efforts to modify system functions and task processes to fit personal preferences, the user is perhaps not motivated to utilize the IT system in order to realize the expected benefits from the investment of efforts.

6.1.2 User Adaptation Shaped by Network Closure

The results also demonstrate that user adaptation toward a new IT system can be influenced by seeking-network closure and giving-network closure. Specifically, cognitive user adaptation is positively influenced by seeking-network closure and negatively influenced by giving-network closure, being consistent with our predictions. On the one hand, the information benefit from seeking-network closure (Coleman 1988) ensures a user's confidence and self-efficacy (Bandura 1982) in changing his/her perceptions toward a new IT system through looking something positive from it, especially when facing negative experiences toward a new IT system (Bruque et al. 2008). In addition, a user with information benefit intrinsically intends to view a new IT system in a positive way to enjoy further benefits from using it (Hobfoll 2001).

On the other hand, control benefit, which is dampened by giving-network closure, also raises a user's self-efficacy by eliminating incurred anxiety and stress when addressing IT-induced challenges (Bruque et al. 2008), and it empowers a user's understanding toward a new IT system via the discrete IT-related queries (Sasidharan et al. 2012). It finally leads to a user's engagement of cognitive user adaptation of a new IT system to obtain further resources and protect any loss of the exiting control benefit (Hobfoll 2001). However, giving-network closure raises a user's stress toward a new IT system due to the resource pressure of extra responsibilities for others' IT-related queries (Bolino and Turnley 2005; Gargiulo et al. 2009). The stressful advice giver is less likely to reappraisal a new IT system in a positive way.

Secondly, affective user adaptation is negatively impacted by seeking-network closure but positively impacted by giving-network closure. This is consistent with our theoretical predictions. Information benefit from seeking-network closure increases a user's capabilities to overcome the knowledge barriers associated with a new IT system (Sykes et al. 2009) and lessens the experienced anxiety if any. Hence, a user is less likely to keep psychological distance from a new IT system (Beaudry and Pinsonneault 2010). However, a user with giving-network closure is compelled to behavior according to others' expectations, resulting into resource pressure (Gargiulo et al. 2009). Such a resource pressure arouses a user's anxiety and decreases his/her self-efficacy toward a new IT system (Bolino and Turnley 2005). The anxiety and decreased self-efficacy trigger affective user adaptation, i.e., directing one's attention away from and detaching oneself from a new IT system (Beaudry and Pinsonneault 2010).

Finally, contrary to our prediction that seeking-network closure increases behavioral user adaptation by enabling access to others' information, our result shows that such an access is detrimental for behavioral user adaptation toward a new IT system. One alternative explanation is that what that matters for behavioral user adaptation is the diversity of information sought, rather than the ability of access to redundant information. Behavioral user adaptation, i.e., changing system functions and task processes, is mostly viewed as creative rather than routine-based, and it requires a user's creative thinking. Organizational research shows that diverse information is an important and necessary condition to creative works like changing system functions or work processes (Fleming et al. 2007).

Although network closure enables a user's access to others' information about an IT system, it does decrease information diversity. Contacts embedded in network closure are likely to have similar information and therefore provide redundant information, whereas non-redundant contacts in structural holes offer information benefits that are additive rather than redundant (Burt 1997). A lack of network closure in a user's advice seeking network indicates that the contacts circulate in different flows of information. The more structural holes spanned there are, the richer the information benefit is. Although network closure indeed ensures ability to access information, the benefit of network closure comes at the cost of structural holes (i.e., richness of information benefit) (Reagans and McEvily 2003).

Another alternative explanation lies on the issue of information usefulness. Network closure means a strongly immersed cluster of contacts (Coleman 1988). Research on product development shows that product developers rely on established connections in which they are strongly immersed. Because of this immersion, strongly tied contacts are less likely than weekly tied contacts (i.e., existing of structural holes among) to search for knowledge outside their existing contacts and forge new ties while conducting searches for useful knowledge (Hansen 1999). It results in the decreased usefulness of the information. This rationale is also applicable for behavioral user adaptation which needs useful information. Therefore, it is reasonable to conclude that seeking-network closure is detrimental for behavioral user adaptation which requires creative thinking.

Although giving-network closure was proposed to reduce a user's efforts in behavior user adaptation, the empirical result reveals that it improves behavioral user adaptation. This finding denies the value of control benefit from advice giving network where a focal user can reserve time and energy oneself through avoiding to behavior according to others' expectations. One alternative explanation is the contextual effects of individuals' espoused cultural values on social capital from social networks. Specifically, the control benefit from structural holes in advice giving network is theorized from studies in the western contexts where research subjects espouse cultural value of individualism (Xiao and Tsui 2007). In our research setting, all the subjects are Chinese who are believed to espouse a cultural value of collectivism emphasizing goals of the collective over their own personal goals (Srite and Karahanna 2006). Xiao and Tsui (2007) figured out that individuals' performance is impaired by such a control benefit if they espouse a cultural value of collectivism. Therefore, we argue that control benefit is detrimental for problem solving like behavioral user adaptation.

Another promising evidence for this surprising finding attributes to a user's commitment to organizations. Our backup data shows that affective commitment[6] to the EMR system, i.e., a desire to support changes based on beliefs about the benefits the EMR system brings (Herscovitch and Meyer 2002), is with a mean of 5.100 and standard deviation of 1.340 based on a seven-point Likert scale. Therefore, we are confident to contend that this hospital is a high-commitment organization. Control benefit of structural holes is constrained because of the effective sanction mechanism in high-commitment organizations (Xiao and Tsui 2007). This minimizes the comparative advantage of "a great freedom" from structural holes in high-commitment organizations. Otherwise, connected contacts in a focal user's advice giving network indeed assist in distributing his/her information among the peers, lowering the focal user's efforts in explaining repeated IT-queries from these contacts. This would aid the focal user to spend many efforts in personal creative work like behavioral user adaptation given the finite individual resources (Becker 1965). Therefore, the positive relationship between giving-network closure and behavioral is reasonable in our research setting.

Although psychology research has shown the interactions between cognition, attitude and behavior (Ajzen 1991), there isn't any influence of cognitive or

[6] The doctors were asked to rate their responses (1 = "strongly disagree" to 7 = "strongly agree") on three adapted items (see Table 4.1 for details), including a sample of "I believe in the value of this EMR system".

affective user adaptation on behavioral user adaptation in this study. There is a plausible explanation. The purpose of cognitive and affective user adaptation is to manage the negative experience and restore emotional stability, and both of them are viewed as emotion-focused coping. On the other hand, behavioral user adaptation is about problem-focused coping aiming at managing a new IT system (Carver et al. 1989). Previous research shows that emotion-focused coping and problem-focused coping function paralleled during the adaptation process to changes induced by a new IT system (Beaudry and Pinsonneault 2005). Within the area of emotion-focused coping, how a user thinks about a new IT system definitely impacts on how he/she feels about the IT system. This finding is consistent with psychological principle of cognition-affection interaction (Breckler 1984).

6.1.3 The Contingency Theory of IT Complexity

According to the socio-technical systems theory (STST), we proposed that the social subsystem (i.e., seeking-network closure, giving-network closure) and IT complexity interact with each other to yield certain user adaptation.

While acknowledging the importance of information benefit for behavioral user adaptation, the ability of information access overpowers information richness when the situation is to seek complex IT-related information for a complex IT system. Seeking-network closure, a surrogate for strong ties, provides users with indirect information on each other that can accelerate the emergence of trust, enabling exchange to go forward (Burt 2005; Coleman 1988; Granovetter 1985). The knowledge about a complex IT system is usually believed to be complex. Therefore, an established strong relationship between two parties to the transfer is likely to be most beneficial for a seeker (Hansen 1999). Strong ties allow for a two-way interaction between a source and a seeker (Leonard-Barton and Sinha 1993). The two-way interaction afforded by a strong tie is important for seeking complex IT knowledge, because transferring of complex knowledge usually requires for multiple opportunities for interaction (Hansen 1999).

As organization research shows that solving problems requires regular access to reliable and readily available information sources who are willing to assist and are familiar with the particular requirements of a seeker (Morrison 2002). Accordingly, seeking-network closure is appreciated by a user when he/she perceives a new IT system to be complex and need to seek relevant knowledge from others; otherwise, structural holes in advice seeking network would function better for behavioral user adaptation. That is, when changing functions of a complex IT system or task processes for a complex IT system, a user with connected contacts in his/her advice seeking network performs better than one with disconnected contacts.

Upon the positive effect of giving-network closure on behavioral user adaptation, a user is much voluntary to devote time and energy for giving IT-related information to others, especially for these users with an espoused cultural value of collectivism or in high-commitment organizations. Transferring complex knowledge to others often requires specific investments of time and energy by a giver (Hansen 1999; Reagans and McEvily 2003), and needs a giver’s strong willingness to share knowledge. To avoid the public sanction from reducing a focal user’s wiliness to share, the connections between a focal user's contacts appear to be much more important for saving a focal user's time and efforts in the condition of a complex IT system.

Besides the cost of transferring complex knowledge for a complex IT system, indirect information flow also reduces diversity and complexity of IT-related queries from contacts for a focal user, because network closure increases information redundancy among the contacts (Burt 1997). This helps to save a focal user's personal resource to a further step, leading to better reservation of time and energy for personal problem solving in behavioral user adaptation. Hence, giving-network closure becomes more important for behavioral user adaptation toward a complex IT system than a simple one. That is, when changing functions of a complex IT system or task processes for a complex IT system, a user with connected contacts in his/her advice giving network performs better than one with disconnected contacts.

The self-efficacy stemmed from information benefit and power and influence benefit motivates a user to engage in a new IT system through positive appraisal of it. Such a motivation is not contingent on whether it is a complex IT system or an easy IT system. Particularly, it is the information about usefulness of a new IT system from seeking-network closure that impacts on a user's positive thinking about the IT system. This type of information of a new IT system is not dependent on IT complexity; otherwise, information about the operation of a new IT system does depend on IT complexity. On the other hand, the efforts in giving usefulness information of a complex IT system are not significantly different from that of an easy IT system. That is why there is not any contingent effect between seeking-network closure, giving-network closure and cognitive user adaptation on IT complexity.

However, self-efficacy from information benefit and power and influence benefit indeed functions more important in shaping a user's feeling about a complex IT system than an easy IT system. Specifically, the ensured ability of information access from seeking-network closure eliminates a user's negative stress from a complex IT system, arousing his/her positive feelings of this IT system. As stated previously, in the situation of a complex IT system, a user mostly relies on external supports to overcome negative experiences (Sharma and Yetton 2007). On the other hand, the social pressure from giving-network closure pushes a user to reactively devote time and efforts in helping others (Reagans and McEvily 2003), such a situation amplifies resource pressure and stress of a user when giving information about a complex IT system. The resource pressure and stress triggers a user's negative feelings of a complex IT system more. Therefore, the impacts of seeking-network closure and giving-network closure on affective user adaptation are strengthened by IT complexity.

6.2 Summary of Main Findings

In sum, network closures have two faces for IT system use. Specifically, seeking-network closure and giving-network closure lead to different IT system use via the underlying mechanisms of user adaptation. Behavioral user adaptation does not influence on IT system use. Therefore, network closure in advice seeking network and structural hole in advice giving network help a user to increase IT system use via the underlying mechanisms of cognitive and affective user adaptation.

Although a negative relationship between seeking-network closure and behavioral user adaptation is found, such a negative relationship is not contingent on IT complexity. Meanwhile, upon the positive relationship between giving network closure and behavioral user adaptation, users would appreciate giving-network closure. Under the condition of a complex IT system, seeking-network closure and giving-network closure are important in influencing how a user positively feels about a new IT system. However, how seeking-network closure and giving-network closure impact on a user's positive thinking about a new IT system is not contingent on technical characteristics of a new IT system, e.g., IT complexity.

6.3 Supplementary Analysis about IT System Use

To further explore the insignificant relationship between behavioral user adaptation and IT system use (i.e., use frequency herein), we draw on research about theoretical conceptualization and measurement of IT system use. It is empirically shown that there are differences in underlying predictors that drive different conceptualizations of IT system use (Venkatesh et al. 2008). IT system use has indeed been measured in many different ways, i.e., objective measures in term of system logs (e.g., Straub et al. 1995) and subjective measures in terms of user assessments of depth and breadth (e.g., Karahanna et al. 2006).

Recently, Burton-Jones and Straub (2006) found that prior research has primarily used "lean" measures of IT system use, and they proposed a two-stage approach to conceptualize IT system use couples theory with operationalization. Therefore, it is critical that conceptualizations of IT system use should be theoretically tied to proposed predictors (Burton-Jones and Straub 2006). In regard to the predictors of user adaptation in this study, we are interesting to capture a user's assessment of a new IT system in the process of adapting to the changes induced by this new IT system.

Jasperson et al. (2005) found that much prior research has treated IT system use as a black box and there are only a few studies that have incorporate IT system functions in the operationalization of IT system use. Burton-Jones and Straub (2006) proposed that IT system use is an activity that involves three elements: (1) a user, i.e., the subject using the IS, (2) a system, i.e., the object being used, and (3) a task, i.e., the function being performed, and they defined IT system use as a user's employment of system functions to perform tasks. Although an IT system has many more functions than those mandated for work accomplishment, a user's active exploration, adoption, use and extension of system functions are voluntary (Jasperson et al. 2005). Therefore, a function-center view of IT system use can eliminate the noises of mandatory or voluntary contexts.

In order to employ a rich conceptualization of IT system use (Jasperson et al. 2005), we adopted another subjective perspective for capturing the way through which a user interacts with the EMR system. This operation is consistent with theoretical suggestion that IT system use should be factored into both objective and subjective system use (Straub et al. 1995). Thus, we collected supplementary data of IT system use at system function level. Specifically, we adapted one item from Karahanna et al. (2006) tapping the percent of system functions used regularly by the respondents, i.e., use scope. The doctors were asked to indicate subjective assessment based on 7-point scale (i.e., 1: <10%, 2: 10-24%, 3: 25-49%, 4: 50-69%, 5: 70-84%, 6: 85-94%, 7: >95%). Descriptive statistic shows that use scope is with a mean of 4.830 (SD = 1.402), indicating that the majority functions of the EMR system were used by most of the doctors. This measurement is similar to conceptualization of deep structural usage from Burton-Jones and Straub (2006). Details of inter-correlations for this supplementary analysis is described in Appendix I.

We ran a PLS regress of cognitive user adaptation, affective user adaptation, behavioral user adaptation and control variables on the subjective IT system use in term of use scope. As can be seen from table 6.1, the full model explained 22.9% and the theoretical model explained 8.2% of the variance respectively. Specifically for cognitive user adaptation, it is not significantly nor positively associated with use scope (β=0.032, t=0.648). Although there are many functions in current IT systems, not all of them would be perceived as useful. Instead of evaluating a whole IT system, a user usually focuses on the cores functions of a new IT system or the personally interested ones, due to limited understanding and exposure toward a new IT system. Previous research has noted that a user typically uses only 20% of system functions found in technologies with 80 % of the time (Jasperson et al. 2005). That is why the prior research has focused on the core functions used in tasks when studying usage of an IT system (e.g., Burton-Jones and Straub 2006; Sun 2012). Therefore, cognitive user adaptation does not necessarily lead to use scope of an IT system.

Second, affective user adaptation is significantly and negatively related to use scope (β=-0.161, t=3.664). Acknowledging the benefit of restoring emotional stability, affective user adaptation indeed moves a user's attentions or interests from a new IT system (Yi and Baumgartner 2004). This situation results into a user's mental disengagement (Gutierrez et al. 2007) to try various system functions of a new IT system. Therefore, affective user adaptation is found to be significantly and positively associated with IT system use.

Table 6.1 Result of PLS Analysis (DV: Use Scope[7])

Variables	Theoretical Model	Full Model
Gender		-0.318** (7.830)
Age		0.114** (2.617)
EDU		0.214** (4.124)
Title		-0.125** (3.939)
TRN		-0.007 (0.158)
CEXP		-0.027 (0.652)
PII		0.177** (4.128)
CUA	0.042 (0.765)	0.032 (0.648)
AUA	-0.158** (2.999)	-0.161** (3.664)
BUA	0.245** (6.044)	0.242** (6.345)
R^2 (%)	8.2	22.9

Notes: SNC: seeking-network closure; GNC: giving-network closure; EDU: education level; CEXP: computer experience; TRN: number of training sections; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation; *p≤ 0.05; **p≤ 0.01; one-tailed test

[7] To distinguish from objective IT system use in table 5.5, herein we use "use scope" to represent "subjective IT system use".

Finally, behavioral user adaptation has a significant positive effect on use scope (β=0.242, t=6.345). Behavioral user adaptation does improve the fit among users, tasks and an IT system (DeSanctis and Poole 1994; Goodhue and Thompson 1995) that actually leads to the increasing use of IT system functions. Specifically, Beaudry and Pinsonneault (2010) presents that changing task processes according to working processes in a new IT system helps a user to increase functional use of a new IT system (i.e., using IT to support different roles such as resources allocation, negotiation, figure head and informational roles in an enterprise accounting system).

Comparing results between table 5.4 and table 6.1, we found there is difference between predictors of user adaptation for different conceptualizations of IT system use. This finding is based on theoretical implications from Venkatesh et al. (2008). It is that use frequency[8] is impacted by cognitive and affective user adaptation, while use scope is influenced by affective and behavioral user adaptation.

6.4 Interesting Findings of Control Variables

There are some interesting findings regarding the control variables. Although we were not theoretically interested with the sizes of advice seeking and giving networks, they were included as control variables to eliminate their effects on user adaptation. As can be seen from table 5.4, giving-network size significantly impacts on cognitive user adaptation, whereas seeking-network size does not. The more persons a user gives IT-related information to, the

[8] Use frequency refers to the objective measurement of "IT system use" we used in the main analysis section. It is a user-level measurement, reflecting a doctor's number of interactions with the EMR system daily.

more self-capable the user would perceive oneself to be. However, the more persons a user seeks IT-related information from, it does not necessarily lead to the user's more positive appraisal of a new IT system. One explanation is that what matters for positive appraisal is the relevance or importance of a new IT system for a user's work (Beaudry and Pinsonneault 2005). Such a relevance or importance is mainly based on a user's personal understanding that is not dependent on other's information of that IT system.

We found that seeking-network size is positively associated with affective user adaptation and giving-network size is negatively associated with it. It means if a user seeks IT-related information from more persons, he/she would suffer from more confusion regarding a new IT system, then he/she will be more likely to negatively feel about a new IT system (Yi and Baumgartner 2004). Additional, if a user gives IT-related information to more persons, he/she would also perceive his/herself as more self-capable, thus, he/she will be less likely to keep psychological away from a new IT system (Yi and Baumgartner 2004).

In addition, table 5.4 shows that seeking-network size has a positive effect on behavioral user adaptation, whereas giving-network size has a negative effect on behavioral user adaptation. Seeking-network size, indicating the potential amount of accessed information, positively influences behavioral user adaptation (Bruque et al. 2008). Giving-network size, indicating the potential amount of efforts to be spent on others, negatively impacts on behavioral user adaptation (Bergeron 2007).

For IT system use, doctors are likely to view use of this EMR system as mandatory according to their work load. In the hospitals, senior doctors were most consulted by patients. That is why age and title are positively associated with EMR system use (see table 5.4 for details). Additionally, education level was not found to impact on EMR system use. In regard to use scope, it is a type of creative work which requires much new knowledge. That is why there is a positive relationship between education level and use scope (see table 6.1 for details). Age is found to be positively associated with use scope, meaning senior doctors tried more functions of the EMR system. However, both gender and title are negatively associated with use scope. An alternative explanation is that female doctors are more curious than male doctors, leading them to try more of the system functions. Meanwhile, highly ranked (i.e., a high title) doctors are with high workload, and then they are too busy to functionally play EMR system.

Another surprising finding is that system training doesn't improve IT system use either in use frequency or use scope. The reasons are twofold. On the one hand, the average number of system training sections attended by the doctors is 2.260 (see table 5.1), and the majority of the doctors (70 out of 104, see table 4.5) attended no more than 2 sections. Therefore, the effectiveness of system training is questionable. On the other hand, this finding is consistent with the statement of Sharma and Yetton (2007) that system training is usually lacked of business-process knowledge and with a high rate of failure for the expected outcomes.

Because the EMR system is different from personal computers, previous computer experience is implausible to influence use of the EMR system. Thus, there is not any significant relationship found between computer experience and IT system use in aspects of use frequency and use scope. Personal innovativeness of IT is an individual trait reflecting a willingness to try out any new technology (Agarwal and Karahanna 2000). Hence, it is also found to be positively associated with use scope of the EMR system. However, it is not significantly associated with use frequency which is relative to routine-based activities.

6.5 Limitations and Future Research Directions

Before discussing the implications of this thesis, it is necessary to specify the limitations and potential future extensions. First, this research was based on a sample embedded in one organization (i.e., outpatient department in a children's hospital in China) and one IT system (i.e., Electronic Medical Record System). Thus, more generalizable and reliable findings would likely result from examining the key hypotheses in multiple samples from different organizations with diverse cultural backgrounds. We encourage researchers to more rigorously test the effects of seeking-network closure and giving-network closure on user adaptation toward a new IT system by investigating multiple organizations with multiple cultural backgrounds.

Second, to reduce doctors' cost of time and cognitive efforts in fulfilling our questionnaires, both advice seeking and giving networks were measured based on communication on a typical work day. The traditional way of constructing advice networks by measuring "communication frequency" (Burt 1992) was not adopted in this study. Despite of missing richness of "communication frequency", the results of this study would not be different between the two types of network measurements. Because social network analysis is mostly based on binary matrices, certain cutoff point on communication frequency is necessarily applied to dichotomize the network matrices (Scott 2000). Anyway, future research could adopt the traditional way of measuring “networks” and contribute to compare results between the two different measurement methods.

Third, social network studies focused on collecting primary network data are often difficult to conduct. Therefore, we limited our social network data collection to a focal business unit (e.g., outpatient department). Data about ties to the IT center and those outside the outpatient department, including across organizational boundaries and communities of practice (Sykes et al. 2014), would help deepen our understanding of the role of advice seeking and giving networks on user adaptation when they solve challenges posed by a new IT system, because these are known avenues people exchange advice. To address the practical limitation, researcher could examine such ties and strength of ties by examining e-mail or bulletin board archives (e.g., Wasko and Faraj 2005). Future studies that incorporate such data would be valuable as these sources help to objectively construct a user’s advice networks, avoiding the self-report bias.

Fourth, we did not investigate the use of specific communication media for seeking and giving advice. Past research suggests that use of communication media (e.g., e-mail, micro-blogging) is linked to the effectiveness of transmission and processing for the exchanged advice (Dennis et al. 2008). For instance, degree centrality in online and offline workplace communication networks are expected to differently associated with employees’ problem solving performance (Zhang and Venkatesh 2013). Although this study is mainly theoretical interesting to look at the structures of advice networks, a potential extension is to specify advice seeking and giving networks as online and offline, resulting into 4 different types of networks: online advice seeking network, offline advice seeking network, online advice giving network and offline advice giving network. In addition, we only focused on one type of network: advice. Integrating other types of networks (e.g., friendship, hindering) with disaggregation presented in this paper could help garner further insights into user adaptation toward a new IT system. For instance, friendship ties, ties characterized by high levels of intimacy, trust, and social support, may also influence individuals' attitudes, perceptions and behaviors (Zagenczyk and Murrell 2009).

Finally, this current study only theoretically focuses on individual-level social network, i.e., seeking-network closure and giving-network closure. A further theoretical investigation is possible to include the group-level or unit-level social network (e.g., internal unit closure, external group bridging, and team centralization) and also the cross-level social networks. Although there are a lot of research caring this point, Ibarra et al. (2005) still emphasizes that research should pay attention on the effects of the broader unit structures within which individuals locate.

6.6 Implications for Theory and Practice

6.6.1 Implications for Theory

In terms of the IS literature, this work advances our knowledge by developing a user adaptation theory of IT system use through synthesizing theories of advice networks, coping and models of IT system use. This is important because a new IT system introduces changes for organizational employees (Beaudry and Pinsonneault 2005). Understanding the dynamic process of how employees adapt to these changes can help to achieve implementation success (Bruque et al. 2008). This work first proposed and empirical justified a cognitive-affective-behavioral framework of user adaptation. This theoretical framework highlights the richness of user adaptation instead of viewing user adaptation as a global concept. The findings from user adaptation provide insights on studying topics on IT-induced changes, responding to the research attention call of studying user adaptation during IT system use (Barki et al. 2007; Benbasat and Barki 2007).

This paper also advances knowledge on user adaptation in IS research. First, based on the coping model of user adaptation from Beaudry and Pinsonneault (2005), this study is the first one to provides quantitative evidences for user adaptation, specifying and measuring different types of user adaptation. Second, since the purpose of user adaptation is to achieve certain fit among tasks, users and an IT system, our conceptualization of user adaptation also enriches understanding of task-technology fit theory (Goodhue and Thompson 1995) and adaptive structuration theory (DeSanctis and Poole 1994). Clearly, the lens of user adaptation can explain the underlying mechanisms between characteristics of task and technology and the achieved fit. Further, the specific knowledge about user adaptation also functions as a key to open the black box between IT system use and its frequently studied determinants (Elie-Dit-Cosaque and Straub 2011).

This paper also contributes to IS research by deepening our understanding of social networks in IT system use, going beyond traditional attributes theories (e.g., task-technology fit) or cognition processes of IT acceptance (e.g., theory of reasoned action, technology acceptance model) and these tapping social influence and social norms that are general associated with the concept of social network structures. Our study suggests that the social network constructs effectively capture interpersonal information exchange that may not be accounted for by the behavioral intention constructs or attribute constructs. For instance, the introduction of network structural lens in IS research enhances the knowledge of social influence/support/norms through deeply investigating the sources and forms of such influence/support/norms. As one of the few recent studies (e.g., Bruque et al. 2008; Sasidharan et al. 2012; Sykes et al. 2009; Sykes et al. 2014), our work emphasizes the usefulness of social network analysis in IS research in general and IT-related changes in particular. Social network perspective, helps us view IT-related problems differently, identifies new explanations, and creates opportunities for further research that could potentially question, challenge, or clarify earlier findings and, thus, advance the state of knowledge.

This work, one of the relatively few, advances knowledge in the social networks literature by explicating the differences found in the directions of knowledge exchanges and the different roles (i.e., giver, seeker) an employee plays within these exchanges. In some part, this paper answers the call for further understanding of advice networks given by Cross et al. (2001). The disaggregation of advice networks as advice seeking and giving networks can clearly define, accurately measure, and completely capture the useful non-error variance of each component. This rich disaggregation provides insights on looking at the paradox organizational findings where a unitary conceptualization of advice networks is applied.

Further, this work utilizes a network structural perspective in order to better understand the benefits of advice seeking and giving networks toward IT-induced changes. Understanding the benefits from advice networks is important, since one's advice networks are important complementary resource for personal capitals in solving challenges (Adler and Kwon 2002). Through the theoretical lens that network benefits accrue to users with certain network structures (Adler and Kwon 2002), this study contributes to the network benefits debate between views of network closure (Coleman 1988) and structural holes (Burt 1992). Specifically, we gain an in-depth understanding that information benefit (i.e., ability of access) from advice seeking network and power and influence benefit from advice giving network function differently in user adaptation toward a new IT system. Therefore, this disaggregation could be useful in future network studies concerning about network closure and structural holes.

In addition, besides extending social network theories to IS research, this work also riches social network research by IS research. As stated by STST (Bostrom and Heinen 1977), there are two subsystems in organizations that shape the outcomes of employees and whole organizations: social and technical subsystems. Specifically, the contingent effects of IT complexity on the values of information and power and influence benefits for behavioral and affective user adaptation suggest the importance of the contextual cues when studying social networks. In the future social network studies, it becomes necessary to theoretically include the characteristics of technical subsystem (e.g., task, device, tools) due to the interaction effects of the two subsystems. This suggestion is consistent with the call of research attention on "bring the individuals back" from Kilduff and Krackhardt (1994) and "context effects" from Mors (2010).

6.6.2 Implications for Practice

Our findings have implications for managerial interventions in two areas that support a new IT system implementation in organizations. These interventions can be targeted to better support user adaptation of a new IT system and more effective leveraging and constructing of advice networks. Organizational must recognize the informal networks of advice exchange in organizations, diagnose them, and in response, proactively create appropriate interventions to better enjoy the benefits from these networks. This study captures IT system implementers' attention on the importance of interpersonal information exchange for promoting IT system implementation success in organizations.

An exploration of advice seeking and giving networks on user adaptation toward a new IT system shows the usefulness of advice networks in organizations. To better complement human capitals (e.g., end-user training, personal capabilities), the managers should attend to isolated users who may be cut off from advice seeking and giving networks within organizations. Such users might be given more formal support, like personal training. Overtime, such isolated users might also be encouraged to engage with other employees through socialization activities.

From the advice seeking perspective, the managers should encourage the employees to proactively engagement in seeking helps from colleagues when in need by providing certain interventions like small group discussions. From the advice giving perspective, the managers also need to understand how to maintain the "super-users" (i.e., these whom are mostly sought by others). On one hand, mangers could reduce some aspects of their tasks to make sure these super-users will not spend too many efforts and time on daily work, and let them reserve enough efforts for helping others. On the other hand, the mangers could leverage these super-users to deliver knowledge of a new IT system to the other users. The managerial team could organize advanced training sections for these super users, instead of investing large resources on the whole user pool. This intervention is critically important in the future where an implemented IT system continues to be in update.

To better support user adaptation, managers should pay attention to the customized requirements of a new IT system for users. If a new IT system provides large flexibility for users to personalize system according to their personal preferences, behavioral user adaptation should be encouraged by managers. Although behavioral user adaptation is not helpful to increase use frequency of a target system, it does assist users in finding appropriate system functions in need. Therefore, new information about system functions or working processes in a new IT system could be provided to users, because we found that information richness from seeking network structural holes improves behavioral user adaptation. On the other hand, because cognitive user adaptation is useful and affective user adaptation is harmful for using a new IT system, managers should try to improve employees' understanding of the advantages of a new IT system and be careful with employees' negative experiences.

Managers should also need to consider the differences among users from our findings of IT complexity. Users usually have different levels of perceived IT complexity toward a single IT system, due to different personal capabilities. Even though two users have the same sizes and structures of advice seeking and giving network, their users adaptation may be distinct due to the differences in their perceived complexity of a new IT system. This provides some hints to the managerial team when they evaluate users' IT system use, especially when there are dramatic differences existing.

Our study also provides practical guidelines for IS researchers. First, choosing a proper way of measuring networks is important to guarantee response quality. While acknowledging the benefit of capturing richness of communication frequency on constructing networks, it is feasible and appropriate to apply certain network analytical principle (i.e., dichotomization of ties based on certain cutoff point) in the data collection. Such a strategy contributes to decrease non-responses and increase survey quality, especially when there is a long list of network questions.

Second, this work again emphasizes the importance of using different data sources (e.g., subjective and objective data sources) to accurately measure interest variables (Magni et al. 2012). This work contributes to the conceptualization of IT system use, alongside with previous works (e.g., Jasperson et al. 2005; Straub et al. 1995; Venkatesh et al. 2008). The findings of this work add some new insights in emphasizing different conceptualizations of IT system use with different types of data sources. Specifically, while we measured IT system use in term of use frequency by using objective system use logs, it might be biased since use frequency is correlated with workload to some extent. Therefore, use frequency perhaps is a proxy of reactive IT system use. Upon that, we used subjective questions to capture IT system use from a subjective assessment perspective, e.g., in a term of functional use. Scope of use could be viewed as a proxy of proactive IT system use.

CHAPTER 7. CONCLUSION

Facing with a high risk of IT implementation failures and underutilization of new IT systems in organizations (Sasidharan et al. 2012), this study explores how users' advice giving and seeking networks influence their user adaptation toward IT-induced changes to improve IT system use. Besides the critical intervention of end-user training, users are more likely to rely on their advice networks to adapt to the changes for IT system use (Magni et al. 2012; Sykes et al. 2009).

Based on research of coping theory (Lazarus and Folkman 1984), a theoretical specification is applied to user adaptation which is usually treated as a global concept. Particularly, a cognitive-affective-behavioral framework of user adaptation is developed: cognitive, affective and behavioral user adaptation. Thereafter, drawing on theories of advice networks, this thesis establishes a theoretical connection from seeking-network closure and giving-network closure to IT system use (i.e., use frequency, use scope) via the underlying mechanism of user adaptation. Upon that, a contingent theory of IT complexity on the theoretical link between seeking-network and giving-network closure and user adaptation is investigated, according to the core theme of the socio-technical systems theory (Bostrom and Heinen 1977).

Through a two-phase study of a newly implemented EMR system in a hospital, network survey data of 104 doctors were obtained, plus their EMR system use logs for three months in between the two survey phases. The proposed research model was tested and validated with this research setting. It was found that seeking-network closure and giving-network closure impact differently on user adaptation. Particularly, seeking-network closure is positively associated with cognitive user adaptation and negatively associated with affective and behavioral user adaptation, while giving-network closure is negative associated with cognitive user adaptation and positively associated with affective and behavioral user adaptation. Further, use frequency is positively impacted by cognitive user adaptation and negatively impacted by affective user adaptation, and use scope is positive influenced by behavioral user adaptation and negatively influenced by affective user adaptation. In addition, both network closures in both advice seeking and giving networks are appreciated by users in order to perform user adaptation.

Overall, this thesis makes several contributions to research. First, it advances our knowledge by developing a user adaptation theory of IT system use through synthesizing theories of advice networks, coping and models of IT system use. Second, this paper advances knowledge on user adaptation in IS research by theoretically justifying a cognitive-affective-behavior framework of user adaptation. The deepened understanding of user adaptation contributes to open the black box of IT system use. Third, this work contributes to IS research by deepening our understanding of social networks in IT system use, going beyond traditional attributes theories, cognition-based theories and these tapping social influence and social norms that are general associated with the concept of social network structures. Finally, this work, one of the relatively few, advances knowledge in the social networks literature in general and the debate between network closure and structural holes by disaggregating advice networks into advice seeking and giving networks.

This thesis also offers important suggestions for organization managers who are in charge of IT system implementation and IS researchers who are interested with changes induced by a new IT system. On the one hand, our findings have implications for managerial interventions in two areas that support new IT system implementation in organizations. These interventions can be targeted to better support the user adaptation process of a new IT system, and more effective leveraging and constructing of advice networks. On the other hand, this work provides potential methodological guidelines in terms of measuring networks and using different data sources for conducting a network research in a real setting.

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Appendices

Appendix A. Surveys for Both Phases

Chinese Questionnaire for Phase One:

儿童医院门诊电子病历系统的问卷调查

欢迎您参与本次由**医院信息中心**组织的关于**门诊电子病历系统**的调查问卷，**感谢您**宝贵的时间完成这份问卷。本次问卷主要是关于您日常工作中**利用信息交流技术**（比如：信息获取、信息提供）如何更好地帮助您**使用**门诊电子病历系统。您的反馈有助于**信息中心**更好的**优化**和**改进**门诊电子病历系统，以便您更有效的掌握和使用该系统。

本次调查不是测验，答案**没有对错**之分，请您尽**最大的努力**，根据您对问题的**真实想法和理解**作答，请对号打“√”。

第一部分：基本信息

性别:	□ 男	□ 女						
年龄段:	□ < 30 岁	□ 30-35 岁	□ 36-39 岁	□ 40-43 岁	□ 44-47 岁	□ 48-51 岁	□ 52-55 岁	□ > 55 岁
学历:	□ 大专	□ 本科	□ 硕士	□ 博士及以上				
使用计算机的年限	□ < 2 年	□ 2-5 年	□ 6-8 年	□ 9-10 年	□ 11-15 年	□ >15 年		
职称：	□ 住院医师	□ 主治医师	□副主任医师	□ 主任医师				

姓名：___________________

第二部分:信息获取和信息提供

2.1、 信息获取： 请您从下列的人员表中**勾选出**（打“√”）您**日常工作中**从哪些人**获取**有关**门诊电子病历系统**、其他**医疗信息系统**或者**某种网络技术**的信息技术相关信息。这些信息有助于您**解决**操作中遇到的**难题**和**提高**对系统的**认识和掌握能力**。请**忽略**那些您**从来没有获取**信息的人。

请勾选出（打“√”）您日常工作中从下列哪些人员获取信息技术相关信息													
科室	姓名		科室	姓名		科室	姓名		科室	姓名		科室	姓名
外科一	□姓名		五官科	□姓名		内科一	□姓名		皮肤科	□姓名		骨科	□姓名
	□姓名			□姓名			□姓名			□姓名			□姓名
	□姓名			□姓名			□姓名			□姓名			□姓名

……

2.2、 信息提供： 请您从下列的人员表中**勾选出**（打“√”）您**日常工作中**向哪些人**提供**有关**门诊电子病历系统**、其他**医疗信息系统**或者**网络技术**的信息技术相关信息。这些信息有助于他们**解决**操作中遇到的**难题**和**提高**他们对系统的**认识和掌握能力**。请**忽略**那些您**从来没有提供**信息的人。

请勾选出（打“√”）您日常工作中向下列哪些人员获取信息技术相关信息													
科室	姓名		科室	姓名		科室	姓名		科室	姓名		科室	姓名
外科一	□姓名		五官科	□姓名		内科一	□姓名		皮肤科	□姓名		骨科	□姓名
	□姓名			□姓名			□姓名			□姓名			□姓名
	□姓名			□姓名			□姓名			□姓名			□姓名

……

第三部分:个体偏好与对门诊电子病历系统的认识

基于您对下列每个描述的理解，请勾出（**打“√”**）相应的选项作为您的回答。

	描述	非常不同意	不同意	有点不同意	中立	有点同意	同意	非常同意
3.1	我需要持续的**技术支持**来使用门诊电子病历系统	1	2	3	4	5	6	7
3.2	使用门诊电子病历系统所必需的技能对我来说**太复杂了**	1	2	3	4	5	6	7
3.3	将门诊电子病历系统整合到我目前的实际工作中是**非常困难**的	1	2	3	4	5	6	7
3.4	如果我听说一项**新的信息技术**（比如：微信），我会想办法去体验	1	2	3	4	5	6	7
3.5	我**喜欢体验**新的信息技术（比如：微信，网络购物）	1	2	3	4	5	6	7
3.6	在我的周围，我经常是**第一批**尝试使用新的信息技术的人	1	2	3	4	5	6	7
3.7	总体来说，在尝试新的信息技术上我**犹豫不定**	1	2	3	4	5	6	7
3.8	请问您总共参加过**几次**门诊电子病历系统的培训课程？ □不多于 1 次 □2 次 □3 次 □4 次 □5 次 □6 次 □7 次及以上							

Chinese Questionnaire for Phase Two:

儿童医院门诊电子病历系统追踪调查

首先非常感谢您对**医院信息中心**工作的大力支持。在此，我们真诚的邀请您参与门诊电子病历系统的**追踪调查问卷**。**非常感谢您**宝贵的时间完来成这份问卷。本次追踪问卷主要是想了解您对门诊电子病历系统的**适应过程、使用评价、以及个体理解**的情况。您的反馈有助于**信息中心**更好的**优化**和**改进**门诊电子病历系统，以便您更有效的掌握和使用该系统。

请您放心，问卷收集的所有信息会被**严格保密和匿名处理**，并且只作为**研究所用**。本次调查不是测验，答案**没有对错**之分，请您尽**最大的努力**，根据您对问题的**真实想法和理解**作答，请对号打"√"。

请问您的姓名：________________

第一部分：门诊电子病历系统的适应过程

请表明您在以下各方面的付出时间和精力的程度	没有	非常小	小量	一般	大量	非常大	极其大
我提出**改进**门诊电子病历系统**功能**（比如：医嘱、电子处方）的**建议**使它便于我的工作	1	2	3	4	5	6	7
总之，我**提出**改进门诊电子病历系统的**建议**	1	2	3	4	5	6	7
为了适应门诊电子病历系统，我对**工作流程**提出改进意见	1	2	3	4	5	6	7

我**期待**使用门诊电子病历系统的**效果**（比如：快速查询、高效输入）
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

我试图从一个**不同的角度**看待门诊电子病历系统，从而使它看起来**更有用处**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

我尝试从使用门诊电子病历系统的经历中**学到**一些**东西**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

我希望可以**不使用**门诊电子病历系统
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

我试图**忘记**门诊电子病历系统的这回事
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

我希望可以**远离**门诊电子病历系统
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

第二部分：门诊电子病历系统的使用评价

您对以下关于门诊电子病历系统使用评价的认同程度

我**非常愿意**使用门诊电子病历系统
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统使我**感到很满意**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统是**很糟糕的**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统是**很不愉快的**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统使我在**每个病历**上花费的**时间更少**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统使我在**检索和存储**病历上**节省了时间**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统使**管理电子病历**变得**更耗费时间**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

使用门诊电子病历系统使我**效率更高**
□非常不同意 □不同意 □有点不同意 □中立 □有点同意 □同意 □非常同意

请您估计一下您**日常工作**中使用门诊电子病历系统的多少功能（百分比）
□ <10% □ 10-24% □ 25-49% □ 50-69% □ 70-84% □ 85-95% □ >95%

第三部分：门诊电子病历系统的个人理解

您多大程度上同意以下各项描述	**非常不同意**	**不同意**	**有点不同意**	**中立**	**有点同意**	**同意**	**非常同意**
我相信门诊电子病历系统能够为我们**创造价值**	1	2	3	4	5	6	7
使用门诊电子病历系统是我们医院的一个**好策略**	1	2	3	4	5	6	7
我觉得**没必要**使用门诊电子病历系统	1	2	3	4	5	6	7

问卷完毕，再次感谢阁下完成本问卷！

English Questionnaire for Phases One:

Survey on Advice Networks and EMR System Use

Thank you for participating in this academic survey. The objective of this survey is to examine your **social networks** (e.g., information seeking, information giving) and **utilization** of Electronic Medicine Record System (**EMR**) in your work. Please feel free to leave any comment regard anything in this questionnaire.

Please be assured that all information captured within this survey will be kept **strictly confidential**, and will only be used for research purposes. This is **NOT related** to your work evaluation in your hospital. Please complete **all** sections and questions **honestly** and **carefully**, and to the **best of your ability**. Please click "√" your responses.

Section 1: Demographics

Gender: □ Male □ Female

Age: □ < 30 □ 30-35 □ 36-39 □ 40-43 □ 44-47 □ 48-51 □ 52-55 □ > 55

Degree: □ Diploma □ Bachelor □ Master □ Ph.D.

Number of years of computer experience: □ < 2 □ 2-5 □ 6-8 □ 9-10 □ 11-15 □ >15

Tenure: □ Resident Doctor □ Attending Doctor □Associate Professor □ Professor

Name:____________________

Section 2: Information Seeking and Giving

2.1. Please check **names** in the following list from whom you **seek** EMR-related or other IT-related information on a **typical working day**. Please leave the corresponding cells **blank** if you **do not** seek information from that person at all.

Please click (√) all the names from whom you **SEEK** IT-related information									
Department	**Name**	**Department**	**Name**	**Department**	**Name**	**Department**	**Name**	**Department**	**Name**
	□ Name		□ Name		□ Name		□ Name		□ Name
Cardiology	□ Name	**ENT**	□ Name	**Medicine**	□ Name	**Dermatology**	□ Name	**Orthopedics**	□ Name
	□ Name		□ Name		□ Name		□ Name		□ Name

…….

2.2. Please check **names** in the following list to whom you **give** EMR-related or other IT-related information on a **typical working day**. Please leave the corresponding cells **blank** if you **do not** give information to that person at all.

Please check (√) all the names to whom you **GIVE** IT-related information									
Department	**Name**	**Department**	**Name**	**Department**	**Name**	**Department**	**Name**	**Department**	**Name**
	□ Name		□ Name		□ Name		□ Name		□ Name
Cardiology	□ Name	**ENT**	□ Name	**Medicine**	□ Name	**Dermatology**	□ Name	**Orthopedics**	□ Name
	□ Name		□ Name		□ Name		□ Name		□ Name

…….

Section 3: Personal Preferences and Perceptions Toward EMR System

To what extent do you agree with the following statements? Please click ONE in the following table.

Item	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
3.1. I require continued **technical assistance** to use the *EMR system*.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.2. The skills required to use *the EMR system* are **too complex** for me.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.3. Integrating *the EMR system* in our current work practices is difficult.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.4. If I heard about a new information technology, I would look for ways to experiment with it.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.5. In general, I am hesitant to try out new information technologies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.6. I like to experiment with new information technologies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.7. Among my peers, I am usually the first to try out new information technologies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.8. How many training sections of EMR system did you receive? ◻ no more than once ◻ 2 times ◻ 3 times ◻ 4 times ◻ 5 times ◻ 6 times ◻ 7 times and above							

English Questionnaire for Phases Two:

A Follow-Up Survey on Advice Networks and EMR System Use

Thank you for participating in this academic survey. This is a follow-up survey of the previous one in January 2014.

The objective of this survey is to examine your **adaptation**, **evaluation** and **perceptions** toward the EMR system during these 3 months. Please feel free to leave any comment regard anything in this questionnaire.

Please be assured that all information captured within this survey will be kept **strictly confidential**, and will only be used for research purposes. This is **NOT related** to your work evaluation in your hospital. Please complete **all** sections and questions **honestly** and **carefully**, and to the **best of your ability**.

Please indicate your **name**:____________________

Section 1: Adaptation Process Toward the EMR System

To what extent do you agree with the following statements? Please click ONE in the following table.

Please indicate the amount of time and effort you spent in	Not at all	Very Small Extent	Small Extent	Moderate Extent	Large Extent	Very Large Extent	Extremely Large Extent
Suggesting to changing **functions** of the EMR system to fit your tasks	1	2	3	4	5	6	7
Suggesting to changing **task processes** to fit the EMR system	1	2	3	4	5	6	7
Suggesting to changing the **EMR system** in general	1	2	3	4	5	6	7

I tried to look for **something good** in using the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I tried to see EMR system in a different light, to make it seem to be **more beneficial**. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I tried to **learn something** from the experience of using the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I wished that I could **escape** from the situation of using the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I tried **not to think** about the situation of using the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I wished that the **situation** of using the EMR system would **go away** or somehow be over with. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree

Section 2: Personal Evaluation of the EMR System

To what extent do you agree with the following statements? Please click ONE in the following table.
I am very **satisfied** with the use of the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
I am very **pleased** to use the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
It is absolutely **terrible** to use the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
It is absolutely **unhappy** to use the EMR system. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
Since using EMR system, I need **less time** to do my job. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
Since using EMR system, it **saves my time** in jobs like search/retrieve/store medical records. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
Since using EMR system, it is **more time-consuming** to do work like medical record management. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
Since using EMR system, it helps me to be **more productive**. □ Strongly Disagree □ Disagree □ Somewhat Disagree □ Neutral □ Somewhat Agree □ Agree □ Strongly Agree
What **percent** of EMR system **functions** would you estimate that you use on a fairly regular basis? □ <10% □ 10-24% □ 25-49% □ 50-69% □ 70-84% □ 85-95% □ >95%

Section 3: Personal Perceptions Toward the EMR System

Please indicate your agreement to the following statements	**Strongly disagree**	**Disagree**	**Somewhat disagree**	**Neutral**	**Somewhat agree**	**Agree**	**Strongly agree**
I believe the **value** of this EMR system.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
This EMR system is a **good strategy** for our hospital.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
This EMR system is **not necessary**.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Appendix B. EMR System Description

Doctor Name

Visiting Time

病人姓名	性别		年龄	医生姓名	就诊日期
	男	女			
1	√		8岁5月	万XX	2014-03-01 12:06
2	√		1岁10月	万XX	2014-03-01 00:02
3	√		11岁7月	万XX	2014-03-01 12:29
4	√		1岁10月	万XX	2014-03-01 00:39
5	√		1岁10月	鞠XX	2014-03-01 00:47
6	√		1月17天	鞠XX	2014-03-01 12:56
7	√		1月8天	芦XX	2014-03-02 09:59
8		√	2岁8月	芦XX	2014-03-01 03:42
9		√	2岁8月	芦XX	2014-03-01 01:31
10		√	4岁6月	芦XX	2014-03-01 01:32

Figure B1. Data Structure of the EMR System Log

“Doctor Name” includes that names of all the doctors, and “Visiting Time” consists of information about exact time that the corresponding doctor is visited by a patient. Based on the two sets of data, i.e., Doctor Name and Visiting Time, we can calculate the actual number of interactions with the EMR system for each doctor every day. For personal privacy concerns and confidential issues, we replaced the doctors’ first name by “XX” in the displayed figure.

Appendix C. ANOVA Test for Non-Response Bias

Table C1. Result of Non-Response Testing

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	.294	1	.294	1.147	.287
	Within Groups	27.670	108	.256		
	Total	27.964	109			
Age	Between Groups	.060	1	.060	.013	.911
	Within Groups	513.295	108	4.753		
	Total	513.355	109			
Education	Between Groups	.071	1	.071	.299	.585
	Within Groups	25.747	108	.238		
	Total	25.818	109			
Computer experience	Between Groups	.176	1	.176	.090	.765
	Within Groups	209.824	107	1.961		
	Total	210.000	108			
Title	Between Groups	.451	1	.451	.422	.517
	Within Groups	115.449	108	1.069		
	Total	115.900	109			

Appendix D. Visual Representations of Advice Seeking and Giving Networks among the Sample

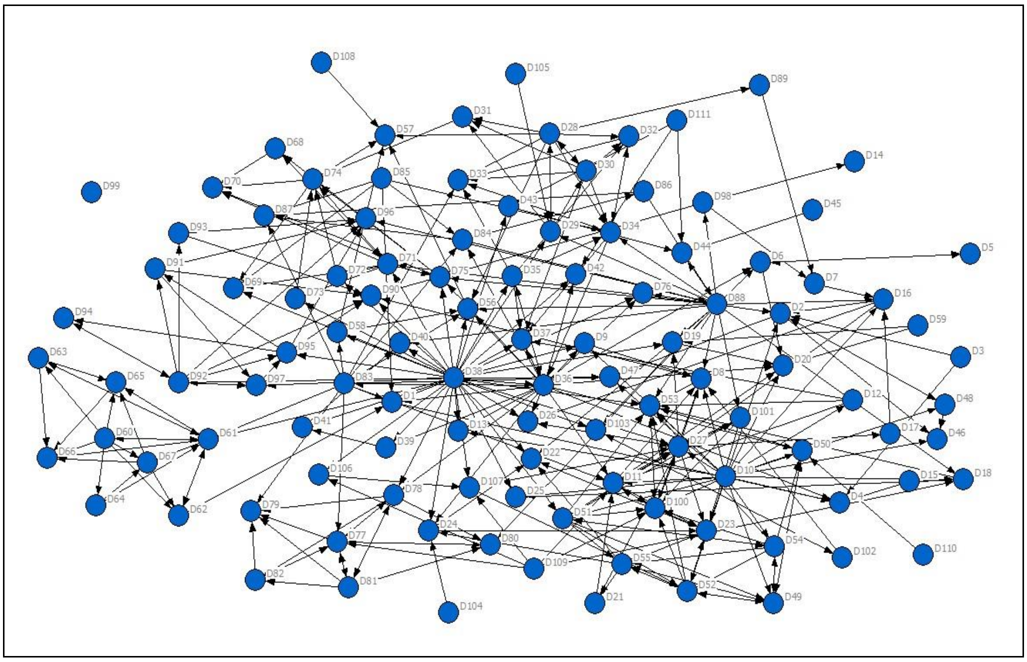

Figure D1. Visualization of Advice Seeking Network

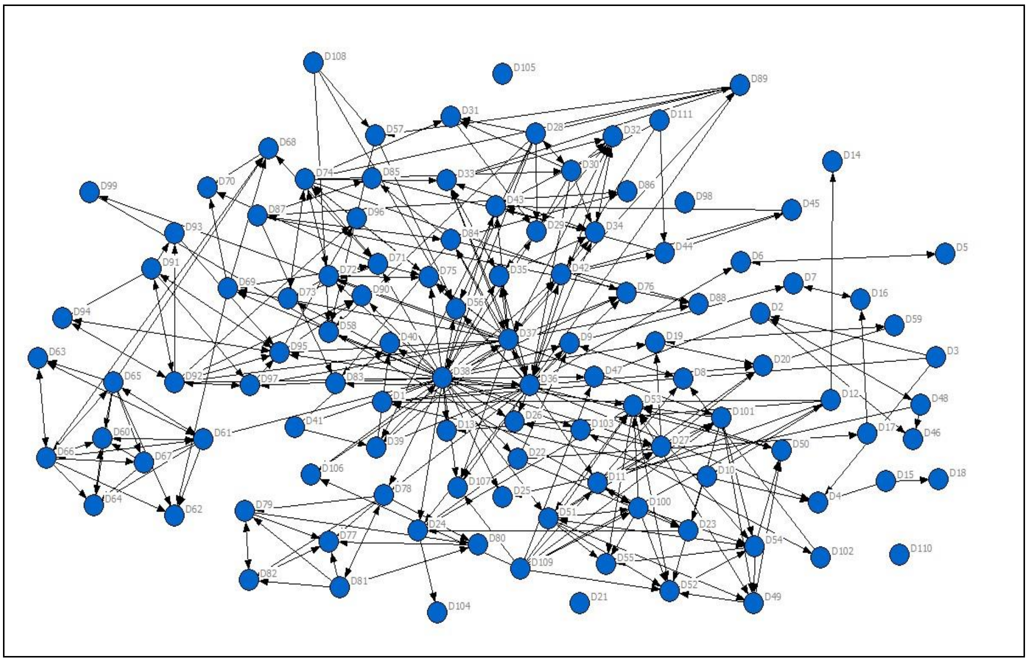

Figure D2. Visualization of Advice Giving Network

Appendix E. Paired Sample T-test for Social Network Analysis

Table E1. Result of Paired Sample T-test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	SD	SE	Lower	Upper			
SNS - GNS	4.305	3.155	1.288	0.994	7.616	**3.342**	5	**.021**
SNC - GNC	4.860	4.233	1.728	.417	9.302	**2.812**	5	**.037**

Notes: SNS: seeking-network size; GNS: giving-network size; SNC: seeking-network closure; GNC: giving-network closure

Appendix F. Multicollinearity Testing Among Studied Variables

Table F1. Collinearity Diagnostics

Variables	Tolerance	VIF	Eigenvalue	Condition Index
Gender	0.866	1.155	0.658	3.761
Age	0.550	1.817	0.267	5.904
Education	0.736	1.359	0.226	6.422
Title	0.653	1.532	0.169	7.430
Years of computer experience	0.824	1.213	0.128	8.528
Number of training sections	0.910	1.099	0.084	10.549
Personal innovativeness in IT	0.905	1.105	0.077	10.998
Behavioral user adaptation	0.991	1.009	0.156	4.873
Cognitive user adaptation	0.869	1.151	0.128	5.388
Affective user adaptation	0.862	1.160	0.013	16.596
IT complexity	0.968	1.033	0.880	2.197
Seeking-network size	0.582	1.719	0.441	3.106
Giving-network size	0.565	1.770	0.237	4.232
Seeking-network closure	0.684	1.461	0.107	6.309
Giving-network closure	0.673	1.486	0.084	7.094

Appendix G. Principal Component Analysis

Table G1. Cross Item-Factor Loadings before Dropping

	SNS	GNS	SNC	GNC	USE*	BUA	CUA	AUA	ITC	PII
SNS	**1.000**	0.582	-0.449	-0.117	0.035	0.043	-0.002	0.113	-0.013	0.051
GNS	0.582	**1.000**	-0.323	-0.279	0.081	-0.121	0.053	0.024	0.117	-0.061
SNC	-0.449	-0.323	**1.000**	0.135	-0.074	-0.061	0.138	-0.187	0.032	0.067
GNC	-0.117	-0.279	0.135	**1.000**	0.054	0.093	-0.066	0.067	0.053	0.032
USE*	0.035	0.081	-0.074	0.054	**1.000**	-0.131	0.132	0.081	0.070	-0.051
BUA1	0.098	-0.046	-0.028	0.061	-0.095	**0.828**	-0.075	0.006	0.147	0.024
BUA2	0.096	-0.067	-0.082	0.160	-0.130	**0.919**	-0.014	0.158	0.114	0.064
BUA3	-0.055	-0.187	-0.046	0.022	-0.117	**0.905**	-0.026	0.094	0.134	0.036
CUA1	0.050	0.047	0.183	-0.034	0.109	0.002	**0.812**	-0.222	-0.268	-0.040
CUA2	-0.025	-0.028	0.153	-0.016	0.086	0.091	**0.852**	-0.307	-0.240	0.128
CUA3	-0.032	0.098	0.016	-0.105	0.127	-0.161	**0.811**	-0.396	-0.338	0.177
AUA1	0.136	0.034	-0.197	0.011	0.102	0.111	-0.364	**0.941**	0.443	-0.144
AUA2	-0.010	-0.032	-0.080	0.093	0.099	0.076	-0.196	**0.771**	0.246	-0.041
AUA3	0.132	0.039	-0.193	0.093	0.032	0.098	-0.402	**0.961**	0.447	-0.100
ITC1	-0.058	-0.001	0.164	-0.098	-0.124	0.180	-0.081	-0.103	**0.265**	-0.046
ITC2	0.009	0.170	0.014	0.032	0.067	0.087	-0.290	0.331	**0.890**	-0.278
ITC3	-0.026	0.063	0.038	0.064	0.067	0.165	-0.340	0.467	**0.942**	-0.261
PII1	0.055	-0.066	0.024	0.039	-0.041	0.059	0.097	-0.089	-0.247	**0.944**
PII2	0.014	-0.088	0.055	0.060	-0.044	0.066	0.146	-0.099	-0.308	**0.961**
PII3	0.089	0.018	0.146	-0.044	-0.064	-0.018	0.014	-0.148	-0.234	**0.796**

Notes: USE*: logged value of objective IT system use; SNS: seeking-network size; GNS: giving-network size; GNC: giving-network closure; SNC: seeking-network closure; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation; ITC: IT complexity; PII: personal innovativeness in IT

Table G2. Item-Factor Loadings after Dropping

	SNS	GNS	SNC	GNC	USE*	BUA	CUA	AUA	ITC	PII
SNS	**1.000**	0.582	-0.449	-0.117	0.035	0.043	-0.002	0.113	-0.012	0.051
GNS	0.582	**1.000**	-0.323	-0.279	0.081	-0.121	0.053	0.024	0.118	-0.061
SNC	-0.449	-0.323	**1.000**	0.135	-0.074	-0.061	0.138	-0.186	0.030	0.067
GNC	-0.117	-0.279	0.135	**1.000**	0.054	0.093	-0.066	0.067	0.055	0.032
USE*	0.035	0.081	-0.074	0.054	**1.000**	-0.131	0.132	0.081	0.073	-0.051
BUA1	0.098	-0.046	-0.028	0.061	-0.095	**0.828**	-0.076	0.006	0.146	0.024
BUA2	0.096	-0.067	-0.082	0.160	-0.130	**0.919**	-0.014	0.158	0.111	0.064
BUA3	-0.055	-0.187	-0.046	0.022	-0.117	**0.905**	-0.026	0.094	0.132	0.036
CUA1	0.050	0.047	0.183	-0.034	0.109	0.002	**0.812**	-0.221	-0.268	-0.040
CUA2	-0.025	-0.028	0.153	-0.016	0.086	0.091	**0.851**	-0.306	-0.240	0.128
CUA3	-0.032	0.098	0.016	-0.105	0.127	-0.161	**0.811**	-0.396	-0.339	0.177
AUA1	0.136	0.034	-0.197	0.011	0.102	0.111	-0.365	**0.940**	0.446	-0.144
AUA2	-0.010	-0.032	-0.080	0.093	0.099	0.076	-0.196	**0.772**	0.249	-0.041
AUA3	0.132	0.039	-0.193	0.093	0.032	0.098	-0.402	**0.961**	0.449	-0.100
ITC2	0.009	0.170	0.014	0.032	0.067	0.087	-0.290	0.331	**0.891**	-0.278
ITC3	-0.026	0.063	0.038	0.064	0.067	0.165	-0.340	0.466	**0.941**	-0.261
PII1	0.055	-0.066	0.024	0.039	-0.041	0.059	0.097	-0.089	-0.247	**0.944**
PII2	0.014	-0.088	0.055	0.060	-0.044	0.066	0.146	-0.099	-0.308	**0.961**
PII3	0.089	0.018	0.146	-0.044	-0.064	-0.019	0.015	-0.148	-0.236	**0.796**

Notes: USE*: logged value of objective IT system use; SNS: seeking-network size; GNS: giving-network size; GNC: giving-network closure; SNC: seeking-network closure; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation; ITC: IT complexity; PII: personal innovativeness in IT

Appendix H. Common Method Bias

Table H1. Result of Common Method Bias Testing

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.970	28.360	28.360	3.970	28.360	28.360
2	2.527	18.046	46.407	2.527	18.046	46.407
3	2.186	15.615	62.021	2.186	15.615	62.021
4	1.478	10.556	72.577	1.478	10.556	72.577
5	1.037	7.406	79.984	1.037	7.406	79.984
6	.562	4.012	83.996			
7	.527	3.766	87.762			
8	.442	3.160	90.921			
9	.396	2.830	93.751			
10	.258	1.842	95.593			
11	.236	1.685	97.278			
12	.179	1.278	98.555			
13	.105	.753	99.308			
14	.097	.692	100.000			

Appendix I. Table of Inter-correlations for Supplementary Analysis

Table I1. Variables Inter-correlations for Supplementary Analysis

Var	Gender	Age	EDU	Title	CEXP	TRN	PII	ITC	SNS	GNS	SNC	GNC	BUA	CUA	AUA
Gender	**N/A**														
Age	-0.238	**N/A**													
EDU	-0.426	0.046	**N/A**												
Title	0.523	-0.288	-0.061	**N/A**											
CEXP	-0.163	-0.004	0.173	-0.094	**N/A**										
TRN	0.117	-0.017	-0.156	0.007	-0.176	**N/A**									
PII	-0.174	0.076	0.025	-0.138	0.168	0.087	**0.903**								
ITC	0.232	0.020	-0.144	0.139	-0.203	0.052	-0.292	**0.917**							
SNS	0.004	-0.006	0.075	0.071	0.160	-0.058	0.051	-0.012	**N/A**						
GNS	0.190	0.122	-0.039	0.121	-0.024	-0.040	-0.061	0.118	0.582	**N/A**					
SNC	-0.045	0.054	-0.183	-0.203	0.140	-0.177	0.067	0.030	-0.449	-0.323	**N/A**				
GNC	-0.033	-0.171	-0.146	-0.100	0.032	-0.005	0.032	0.055	-0.117	-0.279	0.135	**N/A**			
BUA	-0.197	0.154	0.223	-0.133	0.088	0.028	0.049	0.143	0.043	-0.121	-0.061	0.093	**0.885**		
CUA	-0.033	-0.103	0.045	-0.082	-0.096	-0.051	0.107	-0.347	-0.002	0.053	0.138	-0.066	-0.038	**0.825**	
AUA	0.037	0.002	-0.053	0.006	-0.239	0.197	-0.115	0.444	0.113	0.024	-0.186	0.067	0.108	-0.376	**0.895**
Scope	-0.047	-0.249	0.220	-0.038	0.099	-0.024	0.177	-0.046	-0.098	0.025	0.177	0.055	0.212	0.089	-0.148

Notes: Diagonal elements are the squared roots of AVEs of reflective variables; off-diagonal elements are correlations among latent constructs.
Cexp: computer experience; TRN: number of training sections; SNS: seeking-network size; GNS: giving-network size; GNC: giving-network closure; SNC: seeking-network closure; BUA: behavioral user adaptation; CUA: cognitive user adaptation; AUA: affective user adaptation ITC: IT complexity; PII: personal innovativeness in IT; Scope: use scope (i.e., subjective assessment of IT system use).