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Understanding User Adaptation toward a New IT System in Organizations: A Social Network Perspective

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Abstract:

Social networks can be a vital mechanism for users to adapt to changes induced by new IT systems in organizations. However, we do not adequately understand the effect of social networks on post-adoption IT use. Drawing on coping theory and the social network literature, we develop a cognitive-affective-behavioral classification of user adaptation and identify seeking-network closure and giving-network closure as key network characteristics pertinent to post-adoption IT use. Thereafter, we establish a theoretical link from seeking-network closure and giving-network closure to post-adoption IT use through the underlying mechanisms of user adaptation. We operationalize the research model using a field survey of a newly implemented electronic medical record system in a hospital in Northeast China, where we collected network data and objective system logs of 104 doctors. We found that seeking-network closure was positively associated with cognitive adaptation but negatively associated with affective adaptation and behavioral adaptation, whereas giving-network closure was negatively associated with cognitive adaptation but positively associated with affective adaptation and behavioral adaptation. Moreover, cognitive adaptation and affective adaptation were determinants of post-adoption IT use, but behavioral adaptation was not. We discuss our study's theoretical and practical contributions.

Keywords: Seeking-network Closure, Giving-network Closure, Coping Theory, User Adaptation, Post-adoption IT Use.

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1 Introduction

Enterprise-wide IT system implementation constitutes a huge financial undertaking for businesses and a thoroughly disruptive event to employees. Oftentimes, despite intensive project management and careful planning, implementation may go awry and incur huge financial losses (Sykes, 2015). According to Panorama Consulting Solutions 2015 (Panaroma Consulting Solutions, 2015), despite a US$1.7 million increase in average implementation cost, 60 percent of ERP implementations failed to realize material business benefits. Among the myriad challenges, research has identified user adaptation as a key impediment to successful IT implementation. Given its substantial implications on the profitability and sustainability of businesses, organizations should develop an improved understanding of user adaptation to IT system implementation (Maruping & Magni, 2015).

Previous research on IT system usage has primarily focused on technology-related cognitive processing (e.g., perceived ease of use and perceived usefulness) and situational factors (e.g., gender and voluntariness) and found them to be particularly important in determining users' initial adoption of technology (e.g., Venkatesh, Davis, & Morris, 2007; Venkatesh, Morris, Davis, & Davis, 2003). Increasing evidence suggests that understanding technology usage beyond initial adoption is important if not critical. In particular, extant studies suggest that an IT system's actual value can only be realized through post-adoption IT use, which is necessary for technologies to be fully integrated into actual work processes (e.g., Ahuja & Thatcher, 2005; Hsieh, Rai, & Xu, 2011; Maruping & Magni, 2015). Although these technology-related cognitive processing and situational factors are the key determinants of users' initial technology adoption (Sykes, Venkatesh, & Gosain, 2009), these factors may not be entirely relevant in explaining post-adoption IT use, which usually involves significant IT-induced changes (e.g., redesign of business processes and deployment of new system functions (Morris & Venkatesh, 2010)). Accordingly, in this paper, we first enhance existing understanding of technology adoption by developing new insights into post-adoption IT use.

Research broadly categorizes the post-adoption stage as one of the most challenging stages after a new IT system implementation (Markus & Tanis, 2000). In this stage, users usually demonstrate strong resistance to IT-induced changes and, at times, attempt to avoid the system altogether to cope with the strain that the changes produce (Sykes, Venkatesh, & Johnson, 2014). Ample IS research has focused on understanding the effectiveness of managerial interventions (e.g., user training, help desk support, and change management support) for technology usage in businesses (Sykes, 2015). Although these managerial interventions can be instrumental in nurturing initial user adoption, they may not be entirely effective in determining users' post-adoption IT use. For instance, although research has recognized formal user training as the key mechanism to help users adopt new technologies, it has largely ignored the importance of informal mechanisms (e.g., on-the-job training and social learning) in sustaining post-adoption IT use (Robey, Ross, & Boudreau, 2002). Further, extensive user training may not be economically feasible in practice (Venkatesh, Zhang, & Sykes, 2011).

Indeed, emerging evidence suggests that social networks (i.e., on which individuals develop relationships to exchange information among their peers to accomplish work-related tasks (Reagans & McEvily, 2003)) can be a vital mechanism in motivating productive post-adoption IT use (Sasidharan, Santhanam, Brass, & Sambamurthy, 2012). More importantly, the IS literature has investigated social networks by, for example, examining advice-seeking networks' effect on technology usage and advice-giving networks' effect on continued usage (Magni, Angst, & Agarwal, 2012; Sykes et al., 2009; Venkatesh & Sykes, 2013; Venkatesh et al., 2011). Enhancing the understanding of social networks, prior research has explored myriad network characteristics (e.g., seeking-network density and giving-network centrality (Sykes et al., 2009) and seeking-network closeness centrality and giving-network eigenvector centrality (Venkatesh & Sykes, 2013)). Additionally, extant research has demonstrated paradoxical empirical findings on social networks and post-adoption IT use. Researchers have predicted advice-seeking from peers to increase technology usage (Sykes et al., 2009; Venkatesh & Sykes, 2013), but emerging evidence suggests that users' advice-seeking networks may inhibit meaningful IT system usage (e.g., Venkatesh et al., 2011). As a result, our understanding of the effect of network characteristics on post-adoption IT use remains largely fragmented if not inconclusive. Accordingly, in this paper, we second elucidate the key social network characteristics that determine users' post-adoption IT use.

Finally, extant adoption research has focused on explaining usage as a form of behavioral coping, such as innovation with an IT system (Ahuja & Thatcher, 2005), technology improvement and work system coordination (Hsieh et al., 2011), and extended system feature usage (Sun, 2012). Although substantially broadening the understanding of technology usage, past works have largely assumed a monolithic perspective by focusing on the effect of behavioral coping strategy in driving technology usage. Recent research has begun to develop a multi-lithic perspective on users' technology-driven coping strategies in post-adoption IT use. In particular, in addition to behavioral coping, increasing evidence has highlighted the importance of cognitive coping (e.g., intention to and expectation to continue IT exploration (Maruping & Magni, 2015), affective coping (e.g., emotional venting and psychological distancing (Beaudry & Pinsonneault, 2010), and IS avoidance (Kane & Labianca, 2011). Accordingly, in this paper, we third investigate post-adoption IT use by proposing and empirically testing a classification of multi-lithic user-coping strategies.

Overall, we offer new insights into user post-adoption IT use by integrating coping theory with the social network literature. Additionally, by synthesizing previous research on users' technology-driven responses, we classify different types of post-adoption coping strategies. Further, we develop a theoretical framework for the antecedents and outcome effects of post-adoption responses in the context of newly implemented IT systems in organizations. Finally, we operationalized the research model using a field survey conducted in a leading children's hospital in Northeast China.

2 Theoretical Foundations

In this section, we develop our theoretical perspective on post-adoption IT use. We begin by reviewing coping theory, which serves as the overarching framework of our research model. We then examine extant research on social networks to identify the key network characteristics that determine users' post-adoption IT use. Finally, we review extant literature on post-adoption user responses to identify a classification of multi-lithic user-coping strategies.

2.1 Coping Theory

As the one most widely used theoretical frameworks in psychology, coping theory deals with adaptational acts that individuals perform in response to changes that occur in their environment (Lazarus, 1993). Coping refers to the efforts that individuals exert to manage specific external and/or internal demands that they consider taxing or as exceeding their personal resources (Lazarus & Folkman, 1984). Coping theory helps explain the way individuals rely on different resources to deal with changes in their environment (Lazarus, 1993). In particular, this theory posits that individuals cope with changes by engaging two processes; namely, the appraisal process and the response-formulation process.

In the appraisal process, individuals assess the personal implications of changes (Lazarus & Folkman, 1984). In other words, when change occurs, one first asks, "What is at stake for me in this situation?". The paramount issue involves determining the change's likely consequences (e.g., opportunity vs. threat) and its personal significance. To assess the potential consequences, individuals often rely on their ability in maximizing opportunity while reducing threat in changes. To assess a change's personal significance, individuals typically consider the level of relevance they exert over a situation and what they can do given the coping resources available to them (Lazarus & Folkman, 1984). In the response-formulation process, individuals perform different actions to deal with the situation at hand and apply three kinds of coping efforts to deal with change: cognitive coping, affective coping, and behavioral coping (Begley, 1998).

In particular, cognitive coping involves redefining the stressful change into more palatable terms, affective coping involves regulating emotional responses to the change, and behavioral coping represents the steps taken to develop plans and enact responses that directly deal with the change (Begley, 1998). From the engagement perspective of coping, cognitive coping involves efforts to mentally reclassify the change, affective coping involves regulating emotions triggered by the change, and behavioral coping involves taking up actions to transform the change itself and the individual's relationship with the change (Begley, 1998). The specific combination of cognitive, affective, and behavioral coping depends on one's appraisal process of a given situation (Lazarus & Folkman, 1984). The outcome of the evaluations helps to determine individuals' ultimate behavioral manifestation.

Researchers have applied coping theory to explain health protective behaviors (Pechmann, Zhao, Goldberg, & Reibling, 2003), consumer decision making processes (Yi & Baumgartner, 2004), and organizational change management (Sonenshein & Dholakia, 2012). Recently, researchers have introduced the theory to IS research to, for example, explain users' reactions to significant IT events (Beaudry & Pinsonneault, 2005), users' avoidance behavior to malicious IT (Liang & Xue, 2009), and socio-psychological responses to techno-changes (Kwahk, 2011). The implementation of new IT systems has the potential to dramatically change jobs and business processes (Beaudry & Pinsonneault, 2005). These changes are great challenges for users during the post-adoption stage (Morris & Venkatesh, 2010).

Therefore, coping theory serves as a useful lens to explore users' reactions to these IT-induced changes for effective post-adoption IT use.

2.2 Social Networks and Appraisal Process

2.2.1 Social Networks and IT System Use

Organizations often explicitly prescribe and implement traditional managerial interventions to facilitate IT system adoption and continued use. For example, to help overcome the lack of usage experience, organizations typically set aside explicit resources for user training to ease employees into adopting newly implemented systems. Similarly, to manage the impacts of system implementation on business processes and work habits, companies often dedicate explicit resources to change management that oversees the transformation of individuals, teams, and the entire organization. In contrast, social networks are often established without explicit prescriptions or dedication of resources. Rather, social networks form naturally as employees interact among themselves in organizational settings without explicit managerial intervention. Indeed, past research suggests that social networks are self-organizing entities that provide significant rewards for solving problems in the workplace (Sparrowe, Liden, Wayne, & Kraimer, 2001). Social networks become one of the most significant and prevalent resources for overcoming various changes that newly implemented IT systems induce (Sykes, 2015). Recently, we have seen booming research interest in examining social networks and IT system use. From thoroughly reviewing papers from leading IS journals, we summarize the key studies on network characteristics and IT system usage or outcomes of such usage in Table 1.

These studies provide a rich understanding of social networks, especially advice-seeking networks, in IT system use. In particulars, Bruque, Moyano, and Eisenberg (2008) demonstrate that tie strength and network density of an employee's informational seeking network are both positively associated with the employee's effective IT system use. Beaudry and Pinsonneault (2010) report that the amount of advice sought from peers positively affects an account manager's use of a new banking enterprise system. Sasidharan et al. (2012) show that employees' indegree centrality and betweenness centrality in information-gathering networks are positively associated with their use of a new ERP system. Sykes (2015) demonstrate that eigenvector centrality in advice-seeking networks positively affects employees' satisfaction with a newly implemented IT system. Peng and Dey (2013) reveal that a project's network centrality and network closure foster its adoption of open source software technology. Magni et al. (2012) further indicate that team advice-seeking networks influences individual employees' IT system use. However, in studying the implementation of e-healthcare systems, Venkatesh et al. (2011) found a contradictory result in advice-seeking networks and IT system use). They report that doctors' degree centrality in advice-seeking networks among peer doctors de facto has a detrimental effect on their use of e-healthcare systems (Venkatesh et al. 2011). The paradoxical finding leads one to rethink the key network characteristics that determine post-adoption IT use.

Further, advice seeking and advice giving are two fundamentally distinctive acts that exert different influences on problem solving, including the use of a new IT system (Zagenczyk & Murrell, 2009). Therefore, recent research has paid special attention to advice-seeking and advice-giving networks simultaneously in investigating IT system use. In particular, Sykes et al. (2009) found positive effects of get-help network density and give-help network centrality on the use of a newly implemented content management system. Another study on digital initiatives from Venkatesh and Sykes (2013) demonstrates the positive effects of closeness centrality in advice-seeking networks and eigenvector centrality in advice-giving networks on Internet use in an Indian village.

2.2.2 Network Characteristics and Appraisal Process

Although IS research has enriched our understanding of social networks, prior research has explored myriad network characteristics. As a result, understanding how users can benefit from advice-seeking and advice-giving networks for post-adoption IT use remains largely fragmented. The benefit of advice-seeking networks is the access to others' information (Adler & Kwon, 2002). Such an informational benefit accumulates in a user whose contacts are connected with each other in advice-seeking networks (Coleman & Coleman, 1994; Gargiulo, Ertug, & Galunic, 2009). Therefore, we adopt the network characteristic of *seeking-network closure* to explore the informational benefit that one can derive from advice-seeking networks for post-adoption IT use. According to coping theory (Lazarus & Folkman, 1984), we propose that seeking-network closure, which represents users' informational benefit, determines their beliefs about effectively using a newly implemented IT system in the appraisal process.

Conversely, advice-giving networks indicate that users influence how they deal with problems by responding to others' requests (Adler & Kwon, 2002). This influence benefit accumulates in a user whose contacts are disconnected from each other in advice-giving networks (Burt, 1992; Gargiulo et al., 2009). Accordingly, we adopt the network characteristic of *giving-network closure* to explore the influence benefit that one can derive from advice-seeking networks for post-adoption IT use. Drawing on coping theory (Lazarus & Folkman, 1984), we propose that giving-network closure, which represents users' influence benefit, determines their relevance assessment over a newly implemented IT system in the appraisal process. In summary, based on previous social network literature and coping theory, we posit that seeking-network closure and giving-network closure are two key network characteristics that affect post-adoption IT use by determining how users appraise a newly implemented IT system.

Table 1. Key Studies on Social Networks and IT System Usage

Study	Network characteristics studied	Research context	Findings
Bruque et al. (2008)	Tie strength of informational seeking network. Density of informational seeking network.	An implementation of electronic banking system.	Tie strength and density of informational network are positively associated with an employee's effective IT system use.
Sykes et al. (2009)	Get-help network density. Give-help network centrality.	An implementation of content management systems.	Get-help network density and give-help network centrality positively influence system use
Beaudry & Pinsonneault (2010)	Instrumental support seeking from peers.	An implementation of a new banking system for account managers.	An employee's instrumental support seeking from peers positively influences his/her IT system use.
Venkatesh et al. (2011)	Advice-seeking networks degree centrality.	An implementation of electronic healthcare systems.	Degree centrality among doctors has a negative effect on doctors' use of electronic healthcare systems.
Sasidharan et al. (2012)	Information-gathering networks indegree centrality. Information-gathering network betweenness centrality.	An implementation of a new ERP system.	Employees' indegree centrality and betweenness centrality in information-gathering networks are both positively related to the perceived information quality and task impact of the ERP system.
Magni et al. (2012)	Team internal density in advice-seeking networks. Team external bridging in advice-seeking networks.	An introduction of customer relationship management systems.	Team internal closure has a U-shaped relationship with individual technology use, and team external bridging is positively associated with individual technology use.
Peng & Dey (2013)	Network centrality with current adopters. Network closure with current adopters.	Open source software projects at SourceForge.	Network centrality and network closure among current adopters foster technology adoption of open source software technology.
Venkatesh & Sykes (2013)	Get-advice networks closeness centrality. Give-advice networks eigenvector centrality.	Digital initiatives in an Indian village.	Both get-advice networks closeness centrality and give-advice networks eigenvector centrality are significant determinants of system use.
Sykes (2015)	Get-advice networks eigenvector centrality.	An introduction of a new enterprise system.	An employee's eigenvector centrality in get-advice networks has a positive effect on employee's system satisfaction.

2.3 User-coping Strategies and Response-formulation Process

2.3.1 User-coping Strategies and Post-adoption Usage

User-coping strategies fundamentally focus on a key phenomenon: the ways users respond to changes that a new IT system induces (Beaudry & Pinsonneault, 2005). Extant research centers on post-adoption IT use as an outcome of behavioral coping from a monolithic perspective. For instance, Ahuja and Thatcher (2005) examine post-adoption IT use as the outcome of a user's goal of finding new uses for an existing IT system to support new tasks and enjoy the benefits of use in the workplace. Barki et al. (2007) found that all behaviors directed at changing or modifying an IT system and how it would be deployed and used in an organization are important post-adoption IT use activities. Bruque et al. (2008) focus on users' reorganization of behavioral routines and habits to effectively fit a new IT system as a process of behavioral coping. Hsieh et al. (2011) highlight the roles of technology improvement and work system coordination in driving post-adoption IT use for extracting business value from existing IT systems in organizations. In addition, Sun (2012) studied post-adoption IT use of Microsoft Office through the lens of adaptive system use behaviors, which the author conceptualized as users' revisions of which and how system features are used.

Recent research has begun developing a multi-lithic perspective on users' technology-driven coping strategies in post-adoption IT use. Maruping and Magni (2015) highlight the importance of cognitive coping and proposed intention to continue exploring and expectation to continue exploring as the two cognitive influence mechanisms for post-adoption collaborative technology use in organizations. Further, increasing evidence has emphasized the importance of affective coping. Beaudry and Pinsonneault (2010) propose emotional venting and psychological distancing as two affective ways in overcoming stressful IT events for IT use. Elie-Dit-Cosaque and Straub (2011) found that individuals adopt self-preservation to restore emotional stability and reduce the tension arising from disruptive IT events. Kane and Labianca (2011) focus on the roles of IS avoidance, a particular type of post-adoption resistance, to identify situations in which individuals avoid working with the adopted IS by suppressing emotional distress and reducing negative consequences.

In essence, the literature on post-adoption coping strategies suggests that users rely on different strategies to respond to IT-induced changes and calls for a multi-lithic perspective on users' technology-driven coping strategies. Thus, to understand the exact influences of coping strategies on post-adoption IT use, we require a classification of post-adoption coping strategies.

2.3.2 A Multi-lithic Perspective on User-coping Strategies

Beaudry and Pinsonneault (2005) define user-coping strategies as user adaptation that is similar to the concept of coping. Therefore, based on coping theory (Begley, 1998; Lazarus & Folkman, 1984), we develop a cognitive-affective-behavioral classification of user adaptation. Specifically, we focus on *cognitive adaptation*, which refers to the degree to which users focus on the positive outcome of IT system use, to reflect the importance of cognitive coping (Carver, Scheier, & Weintraub, 1989). Scholars have largely agreed that cognitive adaptation is a key way to cope with new IT system implementations (Davis, Nolen-Hoeksema, & Larson, 1998; Taylor, 1983). In particular, through cognitive adaptation, individuals can effectively focus on the positive outcomes and, thus, motivate themselves to develop plans to solve problems associated with changes (Carver et al., 1989). Likewise, in the post-adoption IT stage, cognitive adaptation helps users focus on the benefits derived through system usage (Maruping & Magni, 2015).

To reflect the importance of affective coping, we focus on affective adaptation, which we define as the degree to which users direct attention away and detach themselves from an IT system (Yi & Baumgartner, 2004). Often, users exercise affective adaptation to restore emotional stability from IT-induced changes (Beaudry & Pinsonneault, 2005). Previous research has shown that users intend to cope with the stress experienced from a new IT system by directing their attention to off-task activities (Venkatesh, 2000). Although affective adaptation helps restore emotional stability, it may impede adaptive processes and, thus, become a hindrance to resolving issues associated with IT implementation (Beaudry & Pinsonneault, 2010; Elie-Dit-Cosaque & Straub, 2011). Affective adaptation sums up the passive coping strategies, which individuals usually adapt to achieve emotional alleviation in the post-adoption stage (Kane & Labianca, 2011; Shaw & Barrett-Power, 1997).

Finally, consistent with the centrality of behavioral coping, we focus on behavioral adaptation, which we define as the degree to which users change the functions of an IT system and task procedures to fit personal preferences (Barki, Titah, & Boffo, 2007). Behavioral adaptation describes users' post-adoption behavioral responses after organizations adopt and implement an IT system (Jasperson, Carter, & Zmud, 2005). In the post-adoption stage, after users begin using an implemented IT system, they may engage with more of the functional features of the technology (Hsieh et al., 2011) and be better able to modify their tasks to fit with the technology (Beaudry & Pinsonneault, 2010) to derive benefits from using the IT system. Behavioral adaptation aims at achieving fit between an IT system and tasks, and it focuses on the task-technology adaptation (Barki et al., 2007). Behavioral coping strategies that deal directly with a new IT system produce positive effects because they directly respond to the IT system itself (Begley, 1998).

In summary, based on coping theory, we propose a cognitive-affective-behavioral classification of user adaptation for post-adoption IT use. Note that the specific response formulation of cognitive adaptation, affective adaptation, and behavioral adaptation highly depends on the appraisal process.

3 Research Model and Hypothesis Development

Our research model employs coping theory as the overarching framework to explain post-adoption IT use from the social network perspective (see Figure 1). Specifically, we examine the influences of seeking-network closure and giving-network closure on post-adoption IT use through the underlying mechanisms of the cognitive-affective-behavioral classification of user adaptation.

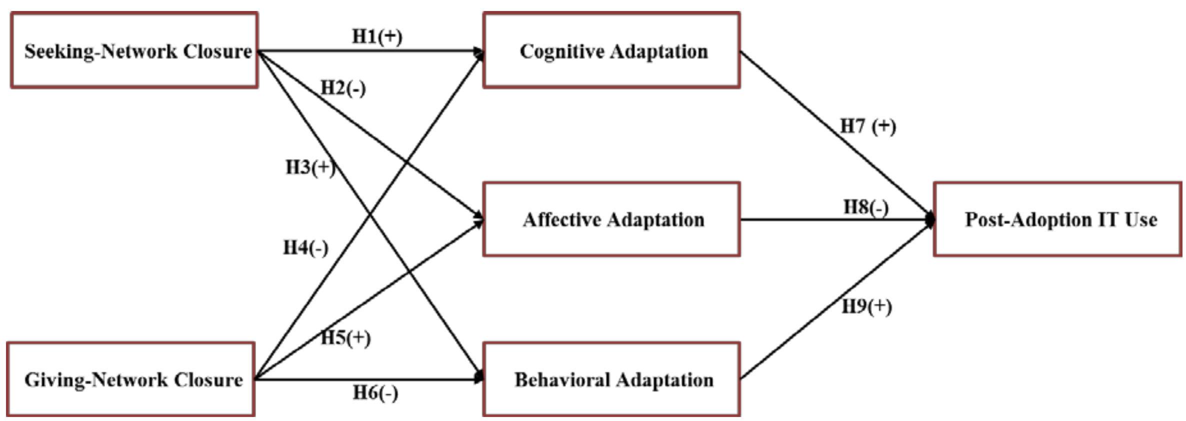

Figure 1. Research Model

3.1 Effects of Seeking-network Closure on User Adaptation

In a new IT-system implementation, seeking-network closure is likely to enhance users' beliefs about maximizing personal benefit and minimizing threats and, hence, allows them to focus on the positive outcome of IT system use (Elie-Dit-Cosaque & Straub 2011). Users' seeking-network closure reflects their informational benefit from advice-seeking networks (Coleman, 1988). Compared with users with a low degree of seeking-network closure, those with a high degree of seeking-network closure are more likely to obtain informational benefit through garnering reliable information from their peers (Reagans & McEvily 2003). This informational benefit makes users believe that they can overcome changes induced by a new IT system because they develop reliable sources to obtain system-related information to ease them through the change (Thoits, 1995). Therefore, we hypothesize:

> **H1:** Seeking-network closure is positively associated with cognitive adaptation.

Users intend to distance themselves psychologically from a new IT system if they have IT-associated knowledge barriers. However, users with a high level of seeking-network closure can appropriately seek their peers' information to overcome these IT-associated knowledge barriers (Gargiulo et al., 2009). Thus, these users are self-efficient in restoring emotional stability and are not likely to psychologically distance themselves from a new IT system (Beaudry & Pinsonneault, 2010; Yi & Baumgartner, 2004). When users believe that they can obtain reliable help in using a new IT system, they are less likely to be distressed by IT-induced changes and, hence, reduce their likelihood of affective adaptation (Lazarus & Folkman, 1984). Therefore, we hypothesize:

H2: Seeking-network closure is negatively associated with affective adaptation.

Similarly, to maximize personal benefits, users who are confident about advice made available through their social networks are likely to assume an approach orientation towards the new IT system (Lazarus & Folkman, 1984). One way to achieve this objective is by adapting the work system (e.g., modify operational procedures) and the technology (e.g., personalize the IT system and change its functionalities) (Beaudry & Pinsonneault, 2005). In addition, seeking-network closure provides relevant advice for users to become familiar with an IT system's functions (Bruque et al., 2008) and enables them to learn functions unique to the new IT system and new working procedures in that IT system (Sykes et al., 2009). Therefore, users are likely to discover new uses of existing functions or to identify needs to incorporate new functions into the IT system (Jasperson et al., 2005). Therefore, we hypothesize:

H3: Seeking-network closure is positively associated with behavioral adaptation.

3.2 Effects of Giving-network Closure on User Adaptation

Users' giving-network closure represents their influence benefit from advice-giving networks (Burt, 1992; Gargiulo et al., 2009). Compared with users with a high degree of giving-network closure, those with a low degree of giving-network closure obtain more influence benefit by giving information to other disconnected peers (Gargiulo et al., 2009). This influence benefit makes users perceive themselves to be knowledgeable and capable of the new IT system (Settoon & Mossholder, 2002) and view the new IT system as an opportunity to improve their work (Beaudry & Pinsonneault, 2005). Additionally, influential users are likely to form a positive self-sense toward the new IT system (Hobfoll, 2001). Therefore, these users are likely to think about the positive aspects of the new IT system. For instance, influential users are believed to have high autonomy over the new IT system and attempt to innovate with the new IT system to find its potential uses (Ahuja & Thatcher, 2005). Therefore, we hypothesize:

H4: Giving-network closure is negatively associated with cognitive adaptation.

Because contacts have other alternative information sources, giving-network closure reduces users' influence benefit (Gargiulo et al., 2009) and, thus, decreases their perceived relevance of the new IT system. Users may even view the new IT system as a threat to their daily work because they may repeatedly receive IT-related complains or negative IT-related queries from their connected contacts (Gargiulo et al., 2009). Thereafter, users are likely to expend efforts in handling disruptions from a self-perspective (Lazarus & Folkman, 1984). Specially, if users view the new IT system as only slightly relevant to their daily work, their efforts will mainly focus on restoring emotional stability and reducing the stress emanating from the new IT system, including keeping distance from the new IT system (Beaudry & Pinsonneault, 2005). Therefore, we hypothesize:

H5: Giving-network closure is positively associated with affective adaptation.

When influential users perceive that the new IT system is relevant to their work, these users will expend effort in adapting the work system (e.g., modify operational procedures) and the technology (e.g., personalize the IT system and change its functionalities) that directly deals with the new IT system (Beaudry & Pinsonneault, 2005). Moreover, influential users are autonomous in their daily work and receive many opportunities to respond to task demands by managing schedules or adapting an IT system to fit their circumstances (Ahuja & Thatcher, 2005). However, giving-network closure pushes users to perform work according to others' expectations (Gargiulo et al., 2009). The role overload from extra responsibilities in advice giving causes users to perceive the IT system as truly an interruption and highly irrelevant to their work to avoid extra responsibilities (Bolino & Turnley, 2005). Conversely, when users' contacts are disconnected from each other, users can avoid the concerted control from these contacts and, thus, obtain great freedom (Gargiulo et al., 2009). This freedom enables users to be influential in their work. Therefore, we hypothesize:

H6: Giving-network closure is negatively associated with behavioral adaptation.

3.3 Determinants of Post-adoption IT Use

Cognitive adaptation that deals directly with a new IT system produces positive effects because it responds to the IT system itself (Begley, 1998). It is significantly and independently associated with a positive affect toward a new IT system (Folkman & Moskowitz, 2000), which leads to one's increasingly using the new IT system. In addition, cognitive adaptation (i.e., meaning search) is closely related to the sense making of changes as threats or opportunities (Dutton & Jackson, 1987). Through meaning search with the new IT system that introduces changes to existing work procedures, users can come to view potentially adverse changes as positive and beneficial (Dutton & Jackson, 1987). Further, cognitive adaptation increases users' commitment to the new IT system, and users are likely to have high levels of engagement in the new IT system (Sonenshein & Dholakia, 2012). Therefore, we hypothesize:

H7: Cognitive adaptation is positively associated with post-adoption IT use.

Affective adaptation that focuses on emotional alleviation represents passive coping strategies (Shaw & Barrett-Power, 1997), which are considered a waste of energy (Begley, 1998). Although it minimizes the perceived negative effects of anxiety and helps to restore emotional stability by directing attention away from a new IT system (Yi & Baumgartner, 2004), affective adaptation can also be impeditive for post-adoption IT use. Affective adaptation impedes adaptive processes and resolution of problems, which are detrimental to post-adoption IT use (Beaudry & Pinsonneault, 2010). Specifically, Beaudry and Pinsonneault (2010) found that, if users psychologically distance themselves from an IT system, then they are not likely to use it. Therefore, we hypothesize:

H8: Affective adaptation is negatively associated with post-adoption IT use.

Finally, behavioral adaptation that deals directly with a new IT system produces positive effects (Begley, 1998). If users invest considerable effort in behavioral adaptation, they are motivated to use a new IT system more to realize the expected benefits from doing so (Bhattacherjee & Harris, 2009). On one hand, behavioral adaptation aims to match the working processes of a new IT system with task procedures (Goodhue & Thompson, 1995). It facilitates post-adoption IT use by improving learning domain knowledge or by facilitating the learning of the interface structure of a new IT system (Burton-Jones & Grange 2012). On the other hand, IT-induced changes result in users' decisions to match task procedures with the working processes of a new IT system (DeSanctis & Poole, 1994). Subsequently, reconstituting tasks into new structures enables users to take full advantage of a new IT system (Schmitz, Webb, & Teng, 2010). Users can use the appropriate functions of a new IT system to complete the modified tasks. Behavioral adaptation results in an enhanced fit and compatibility between a new IT system and tasks, which are positively related to post-adoption IT use (Beaudry & Pinsonneault, 2010). Therefore, we hypothesize:

H9: Behavioral adaptation is positively associated with post-adoption IT use.

4 Research Method

4.1 Research Setting

We conducted a field survey to test the research model in a leading children's hospital in Northeast China. The research setting was the implementation of an electronic medical record (EMR) system in the hospital's outpatient department. The hospital implemented the system to replace traditional paper-based medical records for outpatients. The implementation began in January, 2014, and ended by the end of February, 2014.

Conducting a field study on this particular EMR system suited our study for several reasons. First, our interviews showed that doctors viewed this implementation as a significant change in their daily work. Although they received user training before the system officially rolled out, they still faced knowledge barriers and continued to exchange EMR-related information among their peers. Second, this EMR system had a user-friendly system design (e.g., display setting) and enabled doctors to customize disease modules based on personal preferences. Third, doctors uncovered new uses (e.g., integration with other IT systems in the hospital) for the system as their usage experience increased, and, thus, they had the potential to change their routine work processes to fit the EMR system. For instance, the EMR system was linked to the prescription management system for medicine distribution, a health information system for doctors' workload management, and a financial IT system for bills payment. Finally, based on our interviews with the IT center director, doctors reacted differently to the EMR system. Several of them tried to develop disease modules in the system according to their work preferences and provided considerable feedback to the technical team for further improvement of the EMR system. Nevertheless, others complained and avoided the EMR system.

4.2 Construct Operationalization

4.2.1 Measures

Rather than using self-reported data, we used objective data to measure *post-adoption IT use* at the individual user level. Data gathered through minimally different methods often suffer from method bias, such as hypothesis guessing[1] (Straub, Limayem, & Karahanna-Evaristo, 1995). Post-adoption IT use reflects the actual number of daily interactions with the EMR system. Each interaction indicates a successful input of a patient's medical record in the EMR system. According to the instructions for using objective measurements from Magni et al. (2012), we averaged the system log data over a three-month period in order to smoothen the peaks and valleys that resulted from disruptions, such as vacations and holidays.

We obtained *network measures* using the roster-based method (Shah 1998) wherein we provided each respondent with a name list of all users of the EMR system in the outpatient department. We collected *advice-seeking networks* (i.e., interpersonal relationships for seeking IT-related information from others (Ibarra & Andrews, 1993; Sykes et al., 2009)) by asking each respondent to check the names in the user roster from whom they sought IT-related information on a typical work day in the past two months (Sasidharan et al., 2012). We collected *advice-giving networks* (i.e., interpersonal relationships for giving IT-related information to others (Ibarra & Andrews, 1993; Sykes et al., 2009)) by asking each respondent to check the names in the user roster to whom they gave IT-related information on a typical work day in the past two months (Sasidharan et al., 2012).

Unlike other measures, such as constraints or density, researche often uses betweenness centrality as a measure of structural holes and network closures (Mehra, Kilduff, & Brass, 2001). It refers to the extent to which a user falls between other pairs of users, who are themselves disconnected, on the path of any shortest distance (Scott, 2000). This measure considers both direct and indirect ties and is preferable to Burt's (1992) constraint measure that focuses primarily on direct ties. Since betweenness centrality reflects the extent of structural holes in a network, one uses the reversed value of betweenness centrality as an indicator of network closure. The existence of structural holes means the lack of network closure (Burt, 2005). Thus, we calculated betweenness centrality in both advice-seeking networks and advice-giving networks using the flow betweenness procedure in UCINET 6 (Borgatti, Everett, & Freeman, 2002). Therefore, we measured *seeking-network closure* as the reversed value of betweenness centrality in advice-seeking networks and *giving-network closure* as the reversed value of betweenness centrality in advice-giving networks.

We adapted the three-item scale from Carver et al. (1989) to measure *cognitive adaptation* (one sample question was: "I tried to see the EMR system in a different light, to make it seem to be more positive"). We measured *affective adaptation* with three items we adapted from Yi and Baumgartner (2004) (one sample question was: "I wished that the situation of using the EMR system would go away or somehow be over with"). We measured *behavioral adaptation* with three items we adapted from Barki et al. (2007) (one sample question was: "I spent efforts (in time and energy) on changing the functions of the EMR system to fit my work"). All variables are reflective, and we measured all items on a seven-point Likert scale (see Appendix A).

4.2.2 Control Variables

We included gender, age, educational level, job title, and years of computer experience to control the effects of individual differences. Although all users had the option to receive system training, it was not compulsory. Therefore, we controlled for the effects of *system training* (i.e., number of EMR system training sessions attended) (Amoako-Gyampah & Salam, 2004). *Personal innovativeness in IT* is an important individual trait in determining a user's attitude toward a new IT system, and we measured it with three items we adapted from Agarwal and Karahanna (2000).

Although we were not theoretically focused on the effects of network sizes, we need to hold the network sizes constant to obtain accurate effects of network closure. We measured *seeking-network size* as the number of direct contacts from whom the respondent sought advice (Gargiulo et al., 2009). It corresponds to the respondent's out-degree centrality in advice-seeking networks. Similarly, we measured *giving-network* size as the number of direct contacts to whom the respondent gave advice (Gargiulo et al., 2009). It also corresponds to the respondent's out-degree centrality in advice-giving networks.

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

4.3 Data Collection and Sample

We administered a paper-based survey to capture the users' social network characteristics and archival data. Following Sykes et al. (2009), we adopted a two-phase method. Given that we explore how advice-seeking and advice-giving networks at the pre-adoption stage impact user adaptation at the post-adoption stage, we needed to capture the two types of networks before collecting data on user adaptation. Research has suggested three months in between the two phases to be applicable (Sykes et al. 2009).

Specifically, we distributed the first phase of the survey immediately after the hospital implemented the EMR system at the end of February, 2014. This survey collected data on users' advice-seeking networks, advice-giving networks, demographics, and control variables. The survey was a standard socio-metric instrument that gave respondents a roster of members; the roster method is standard best practice for collecting social network data (Scott, 2000). Among the target population of 149 doctors, 115 responded. However, we omitted five incomplete responses and, thus, obtained a valid sample of 110 respondents. Note that, in studies that use primary social network data, a sample size of 110 is considered to be quite large (Borgatti & Cross, 2003).

We conducted the second phase of the survey three months later in the last week of May, 2014. This survey collected data on user adaptation. We also obtained archival system logs of three-month EMR use (i.e., March, April, and May of 2014) from the IT center. Among the 110 respondents from the first phase, 104 of them completed the second survey with qualified responses. As for the six ineligible surveys: four provided incomplete data, and we could not access the remaining two when distributing the second survey.

Table 2 (see next page) depicts demographics of the 104 respondents who engaged in both surveys. To check for non-response bias between the two phases of the surveys, we compared the demographics between respondents and non-respondents of the second phase. We detected no significant difference in terms of gender, age, education level, job title, and years of computer experience (see Appendix B for details). Therefore, we determined that non-response bias did not contaminate our dataset.

5 Data Analysis

The multistage theoretical model suggests the need for a structural equation modeling technique. We chose the partial least square (PLS) technique (SmartPLS 2.0.M3) for several reasons. First, as a second-generation structural equation modeling (SEM) technique, it can estimate the loadings (i.e., assess construct validity) and the causal relationships among constructs in the multistage models (Fornell & Bookstein, 1982). Second, in comparison with the covariance-based (CB) SEM, PLS is robust with fewer statistical identification issues. Moreover, it best suits models with relatively small samples (Hair, Ringle, & Sarstedt, 2011), which is the case in our study. Additionally, whereas CB-SEM is more appropriate for theory confirmation, PLS provides a good approximation of CB-SEM in terms of final estimates (Hair et al., 2011).

5.1 Evaluating the Measurement Model

We assessed our reflective constructs in terms of reliability, convergent validity, and discriminant validity. Factor analysis showed that the item loadings were acceptable (Kankanhalli, Tan, & Wei, 2005) (see Table C1 in Appendix C). As Table 3 shows, all Cronbach's alpha and composite reliability values exceeded the threshold of 0.70 (Chin, 1998), and all AVE values were above the recommended threshold of 0.50 (Hair et al. 1998). Thus, reliability was confirmed. In addition, item loadings were all above 0.71 and significant at the level of 0.01. Therefore, convergent validity was confirmed. The square root of the AVE (see Table 4) for each construct was greater than the correlations involving the construct, which confirmed discriminant validity (Fornell & Larcker, 1981).

Table 4 shows the descriptive statistics and inter-correlations of the studied variables. Inter-correlations were generally acceptable except for a positive correlation of 0.582 between seeking-network size and giving-network size. Although we found no high correlation among the interest variables, we were able to proceed with testing the potential multicollinearity. We found that all the variance inflation factor values (ranging from 1.009 to 1.817) were less than 3.3 (Diamantopoulos & Siguaw, 2006). Thus, multicollinearity did not pose any serious threat to the validity of our analyses (refer to Appendix D for details).

Table 2. Sample Demographics

Demographics	Category	Frequency	Percentage (%)
Gender	0: Female	65	62.50
	1: Male	39	37.50
Age	1: Less than 30 years	1	0.96
	2: 30-35 years	25	24.04
	3: 36-39 years	10	9.62
	4: 40-43 years	11	10.58
	5: 44-47 years	14	13.46
	6: 48-51 years	18	17.31
	7: 52-55 years	11	10.58
	8: More than 55 years	14	13.46
Education	1: Below bachelors	1	0.96
	2: Bachelors	74	71.15
	3: Masters	28	26.92
	4: PhD	1	0.96
Years of computer experience	1: Less than 2 years	3	2.88
	2: 2-5 years	18	17.31
	3: 6-8 years	19	18.27
	4: 9-10 years	18	17.31
	5: 11-15 years	30	28.85
	6: More than 15 years	16	15.38
Job title	1: Resident doctor	10	9.62
	2: Attending doctor	20	19.23
	3: Associate professor	23	22.12
	4: Chief professor	51	49.04
Number of training sessions	1: 1 or none	33	31.73
	2: 2	37	35.58
	3: 3	22	21.15
	4: 4	4	3.85
	5: 5	4	3.85
	6: 6	2	1.92
	7: 7 or more	2	1.92

Table 3. Convergent Validity for Reflective Constructs

Constructs	Item	Loading	T-value	Composite reliability	Cronbach's alpha	AVE
Behavioral adaptation	BAD1	0.828	30.258	0.915	0.864	0.783
	BAD2	0.919	84.409			
	BAD3	0.905	62.576			
Cognitive adaptation	CDA1	0.812	24.276	0.865	0.766	0.681
	CAD2	0.851	32.985			
	CAD3	0.811	23.140			
Affective adaptation	AAD1	0.940	19.475	0.923	0.877	0.801
	AAD2	0.772	17.631			
	AAD3	0.961	23.603			
Personal innovativeness in IT	PII1	0.944	60.304	0.930	0.890	0.816
	PII2	0.961	10.519			
	PII3	0.796	14.099			

Table 4. Descriptive Statistics and Inter-correlations of Variables

Variable	Mean	Std. dv.	Age	EDU	EXP	TRN	PII	SNS	GNS	SNC	GNC	BAD	CAD	AAD
Age	4.730	2.121	**N/A**											
EDU	2.260	0.465	0.046	**N/A**										
EXP	3.970	1.431	-0.004	0.173	**N/A**									
TRN	2.260	1.334	-0.017	-0.156	-0.176	**N/A**								
PII	4.987	1.393	0.076	0.025	0.168	0.087	**0.903**							
SNS	3.140	1.893	-0.006	0.075	0.160	-0.058	0.051	**N/A**						
GNS	3.230	2.247	0.122	-0.039	-0.024	-0.040	-0.061	0.582	**N/A**					
SNC	-5.034	10.091	0.054	-0.183	0.140	-0.177	0.067	-0.449	-0.323	**N/A**				
GNC	-4.366	8.606	-0.171	-0.146	0.032	-0.005	0.032	-0.117	-0.279	0.135	**N/A**			
BAD	3.444	1.597	0.154	0.223	0.088	0.028	0.049	0.043	-0.121	-0.061	0.093	**0.885**		
CAD	5.451	1.134	-0.103	0.045	-0.096	-0.051	0.107	-0.002	0.053	0.138	-0.066	-0.038	**0.825**	
AAD	3.082	1.372	0.002	-0.053	-0.239	0.197	-0.115	0.113	0.024	-0.186	0.067	0.108	-0.376	**0.895**
USE*	3.240	0.761	-0.135	-0.141	-0.157	0.073	-0.051	0.035	0.081	-0.074	0.054	0.131	0.132	-0.081

Note: diagonal elements are the squared roots of AVEs of reflective constructs; off-diagonal elements are correlations among latent constructs. EDU: education degree, EXP: computer experience, TRN: number of training sections, PII: personal innovativeness in IT, SNS: seeking-network size, GNS: giving-network size, GNC: giving-network closure, SNC: seeking-network closure, BAD: behavioral adaptation, CAD: cognitive adaptation, AAD: affective adaptation, USE*: logged value of post-adoption IT use.

5.2 Evaluating the Structural Model

Subsequently, we examined the structural model in terms of path significance and explanatory power using a bootstrapping procedure. Figure 2 shows the PLS results. For each dependent variable, we estimated two models: the theoretical model and the full model. Although an examination of the path coefficients of seeking-network closure and giving-network closure on user adaptation showed that the magnitudes of the paths decreased, their significance remained after we added the control variables. For brevity, the following results are based on the full model.

In cognitive adaptation, the effects of seeking-network closure ($\beta = 0.224$, $p < 0.01$) and giving-network closure ($\beta = -0.051$, $p < 0.01$) were significant. Thus, we found support for H1 and H4. In affective adaptation, seeking-network closure ($\beta = -0.184$, $p < 0.01$), and giving-network closure ($\beta = 0.096$, $p < 0.05$) were significant antecedents. Thus, we found support for H2 and H5. In behavioral adaptation, although the effects of seeking-network closure ($\beta = -0.07$, $p < 0.05$) and giving-network closure ($\beta = 0.072$, $p < 0.05$) were significant, the results were contrary to our expectations. Therefore, we did not find support for H3 and H6. In post-adoption IT use, the positive effect of cognitive adaptation ($\beta = 0.202$, $p < 0.01$) and the negative effect of affective adaptation ($\beta = -0.119$, $p < 0.01$) were significant (Figure 2). Thus, we found support for H7 and H8. However, behavioral adaptation did not significantly affect post-adoption IT use ($\beta = -0.075$, $p > 0.05$). Thus, we did not find support for H9.

Additionally, we found that neither seeking-network size ($\beta = 0.101$, $p > 0.05$) nor giving-network size ($\beta = 0.035$, $p > 0.05$) significantly affected cognitive adaptation. The effects of seeking-network size ($\beta = 0.073$, $p > 0.05$) and giving-network size ($\beta = -0.053$, $p > 0.05$) on affective adaptation were not significant. Seeking-network size had a significant positive effect ($\beta = 0.149$, $p < 0.05$) on behavioral adaptation and giving-network size had a significant negative effect ($\beta = -0.200$, $p < 0.05$) on behavioral adaptation.

The control variables present several insightful findings. We found that age ($\beta = 0.136$, $p < 0.01$) and job title ($\beta = 0.212$, $p < 0.01$) had a significant impact on post-adoption IT use. These results imply that senior doctors used the EMR system more intensively than junior doctors. Additionally, we found that educational level ($\beta = -0.044$, $p > 0.05$) had no significant influence on post-adoption IT use of the EMR system. System training ($\beta = 0.022$, $p > 0.05$) had no significant impact on post-adoption IT use. Lastly, personal innovativeness of IT ($\beta = -0.006$, $p > 0.05$) had no significant influence on post-adoption IT use.

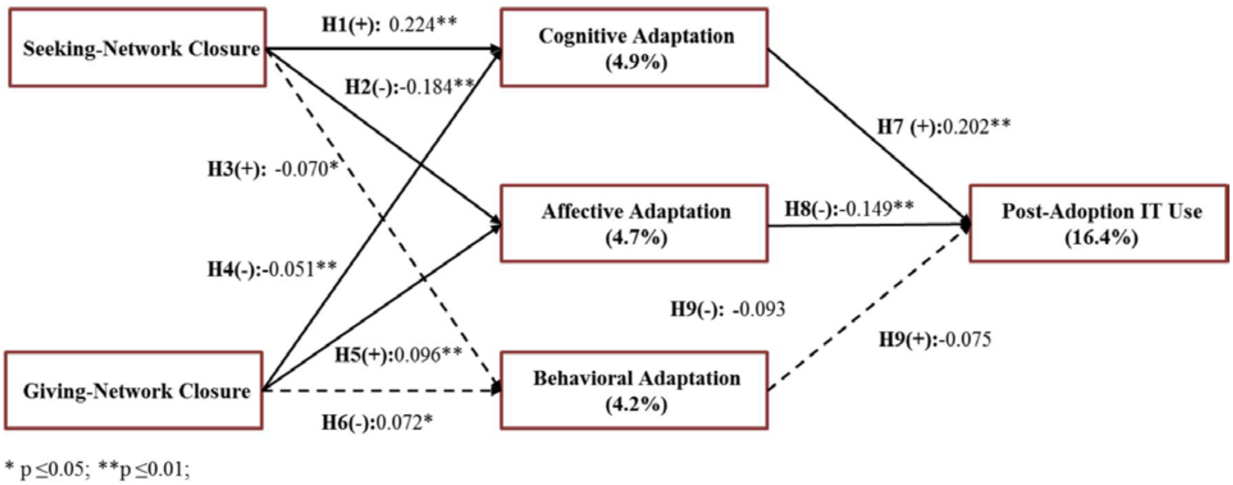

Figure 2. Model-testing Results

5.3 Common Method Bias

To assess for possible common method bias, we followed Podsakoff, MacKenzie, Lee, and Podsakoff's (2003) recommendation and conducted confirmatory factor analysis (CFA) for two models. First, we estimated a model of all the self-reported variables (i.e., behavioral adaptation, cognitive adaptation, affective adaptation, and personal innovativeness in IT). We restricted each of the 12 measurements to being an indicator of the corresponding latent factor. Fit indices of the first model ($\alpha2(48) = 75.561$) were as follows: $\alpha2/df = 1.595$, root mean square error of approximation (RMSEA) = 0.076, goodness of fit index (GFI) = 0.959. The fit index criteria for an acceptable model are as follows: below 3 for α2/df, below 0.10 for RMSEA, and above 0.90 for the GFI (Anderson & Grebing, 1988; Hair, Anderson, Tatham, & Black, 1998). Therefore, our results indicate a satisfactory model fit.

In the second model, aside from the four factors examined in the first model, we conducted CFA with one additional factor to represent the unmeasured common method. We allowed each of the 12 items to load on its corresponding theoretical factor construct and all to load on the additional method factor, which we constrained to be uncorrelated with the other four factors. The fit indices for the second model ($\alpha2(37) = 55.054$) were as follows: $\alpha2/df = 1.488$, RMSEA = 0.068, GFI = 0.974. A chi-square test comparing the two models indicated that the difference between the two models was not significant ($\alpha2(2) = 0.157$, p = n.s.), which suggests that common method bias was not a serious concern.

6 Discussion and Contributions

6.1 Key Findings

Our results supported most of the hypotheses except H3, H6, and H9. Our results provide evidence that seeking-network closure positively influences cognitive adaptation and negatively influences affective adaptation and that giving-network closure negatively affects cognitive adaptation and positively affects affective adaptation. Whereas cognitive adaptation increases post-adoption IT use, affective adaptation reduces post-adoption IT use.

However, contrary to our postulation, seeking-network closure was negatively associated with behavioral adaptation. One reason as for why is that seeking-network closure ensures informational benefit in terms of information access ability but what actually matters for behavioral adaptation is the diversity of accessed information. Information diversity is a critical determinant of the overall effectiveness of actions taken to deal with changes (Shaw & Barrett-Power, 1997). Contacts in seeking-network closure are likely to have similar information and provide users with redundant information, which reduces diversity in the obtained information (Burt, 1997). Behavioral adaptation highly depends on creative thinking in changing IT functions or task procedures, but information redundancy from seeking-network closure impedes creative thinking (Fleming, Mingo, & Chen, 2007).

Furthermore, contrary to our expectation, giving-network closure was positively associated with behavioral adaptation. One reason as for why is that the time and energy an individual user has are finite (Gargiulo et al., 2009). Social connectivity in users' advice-giving networks helps information spread among their peers, which spares focal users from repetitive and laborious IT queries. As a result, focal users may become efficient in taking on creative system use, such as changing the features of a new IT system or modifying work processes.

Finally, we found that behavioral adaptation did not affect post-adoption IT use. One reason as for why is that habit and social norms usually dominate the decision to use a new IT system instead of a better technology-task fit (TTF) from behavioral adaptation. In this research, doctors were most likely to view the use of the EMR system as mandatory. Indeed, the use of a mandatory system can be considered a situation in which social norms in using an IT system are strong and overpower other considerations, such as TTF or beliefs or affects toward a new IT system (Goodhue & Thompson, 1995). Although users invest efforts to modify system functions and task procedures to fit personal preferences because of external pressure from the management team or peer users, they may not be motivated to use the new IT system more.

6.2 Theoretical Contributions

With this study, we offer important theoretical contributions by integrating the social network literature and user adaptation research under the coping theory framework. In doing so, we provide new insights into the classification of post-adoption user-coping strategies in explaining the effects of key network characteristics on individual users' post-adoption IT use in the context of a newly implemented IT system.

6.2.1 Enriching Knowledge of Post-adoption IT Use

Despite the prevalence of post-adoption IT use in recent research, we know little about how to achieve desirable post-adoption IT use to benefit from the vast investment of new IT systems in organizations. The predictors of initial IT adoption or usage (e.g., cognitive processing, and situational factors) are not applicable or effective in explaining post-adoption IT use. The core of managing post-adoption IT use involves understanding how users respond to changes that a new IT system implementation induces. Therefore, this study contributes to the post-adoption IT use literature by building a user adaptation theory based on coping theory and the social network literature.

6.2.2 Identifying Seeking-network Closure and Giving-network Closure that Determine Users' Post-adoption IT Use

In accordance with previous research on social networks and IT system usage, this study emphasizes the important roles of social networks in sustaining post-adoption IT use given the limitations of traditional managerial interventions (e.g., user training, help desk support, and change management support). Further, this study contributes to the literature on social networks and post-adoption IT use by identifying two key network characteristics: seeking-network closure and giving-network closure. In particular, seeking-network closure reflects users' informational benefits, and giving-network closure represents users' influence benefits in promoting their post-adoption IT use. On one hand, previous research has a fragmented understanding of the effects of network characteristics on post-adoption IT use. Our identification of the two key network characteristics contributes to providing an integral perspective. On the other hand, this identification highlights the importance of disaggregating the "exchange direction" in social networks.

Note that, although seeking and giving behaviors might relate to each other somewhat in general, seeking-network closure and giving-network closure can be independent and, hence, are not at odds with one another in this study because a user can be well connected with others in advice-seeking networks and, at the same time, be well connected in advice-giving networks. For instance, average users (e.g., clerical staff) who are strongly motivated to help others can be highly active in providing advice and help (e.g., on patient registrations) to others in advice-giving networks. Since average users might only know well about a very specific scope of features (i.e., patient registration procedures), these users might encounter challenges when they deal with new tasks (e.g., deleting an existing patient record). In such a case, these users might draw on their existing network connections to seek help and, hence, contribute to the formation of their network closure in the advice-seeking networks. In essence, users impose the different roles (i.e., seeker and giver) that they play on themselves differently (Gargiulo et al., 2009). This disaggregation assists in clarifying the observed paradoxical finding on social networks and IT system use in previous literature that has conceptualized advice networks in only one way.

In addition, this paper contributes to IS research by deepening our knowledge of post-adoption IT use and by going beyond traditional attributes theories (e.g., task-technology fit) or cognition processes of IT acceptance (e.g., TRA and TAM) and the tapping of social factors (e.g., social influence, social norms, and social support). Much of this genre of literature is still in its infancy, and we need more studies to build a literature based on this research stream.

6.2.3 Developing Multi-lithic User-coping Strategies

Understanding the dynamic process of how users respond to changes that a new IT system induces can help in effectively achieving implementation success (Bruque et al., 2008). Whereas previous research has assumed a monolithic perspective of user-coping strategies, we theoretically identify and empirically demonstrate a multi-lithic perspective, including cognitive, affective, and behavioral coping strategies. To this end, we advance the post-adoption literature by classifying user-coping strategies into cognitive adaptation, affective adaptation, and behavioral adaptation. In accordance with the research appeal of Jasperson et al. (2005) to develop instrumentations to enrich the understanding on post-adoption user reactions, we empirically test the cognitive-affective-behavioral multi-lithic classification.

With this study, we also demonstrate how user-coping strategies affect post-adoption IT use in the context of a newly implemented IT system. Previous research has largely drawn attention to the importance and benefits of behavioral user-coping strategies, but we found that behavioral adaptation did not affect post-adoption IT use. In contrast, cognitive adaptation and affective adaptation were significant determinants of post-adoption IT use. Our findings are particularly worthwhile because they complement the results of the user-coping strategies literature, which shows that internal motivational drivers likely trigger post-adoption IT use (Li, Hsieh, & Rai, 2013). In addition, we contribute to coping theory by extending it to the post-adoption IT use research. Among others, coping theory serves as a new theoretical lens to examine the post-adoption IT phenomenon through two processes: appraisal process and response-formulation process. Our research design with data collected over two phases is consistent with the perspective that coping is a process and ongoing.

6.3 Practical Contributions

Our findings have practical implications for managerial interventions in two areas that support a new IT system implementation in organizations. Managers can adopt these interventions to help staff members adapt to and ensure that they more effectively use new IT systems at the post-adoption stage. Cognitive adaptation and affective adaptation serve as primary determinants of post-adoption IT use. Managers should direct their attention to increasing employees' understanding of the benefits of and decrease their psychological distancing toward new IT systems. Effective managerial strategies on cognitive adaptation and affective adaptation affect not only the effectiveness of operations that are based directly on the use of an IT system but also an organization's performance as a whole.

Another important practical implication concerns the findings on seeking-network closure and giving-network closure. Organizations widely acknowledge the importance of advice networks, but managers are not certain about how to profit from them. Whereas we found that the effect of system training on IT system use was not significant, advice-seeking networks and advice-giving networks significantly influenced users' post-adoption IT use through cognitive adaptation and affective adaptation. To better complement human resources (e.g., system training and personal capabilities), managers need to devote much attention to employees' advice networks, especially when implementing a new IT system. Corresponding to the importance of seeking-network closure, we advise organizations to attend to isolated users who may be cut off from advice-seeking networks. In particular, companies might consider hosting formal group discussions and informal socialization activities to help initialize the development of personal connectivity with the ultimate objective of cultivating personal advice-seeking networks. Furthermore, corresponding to the importance of giving-network closure, we advise organizations to pay careful attention to employees who are competent in using new IT systems and are largely disconnected in the advice-giving networks. These employees are often the key members in organizations (e.g., team leaders and department heads). These individuals are often highly knowledgeable IT system experts and invaluable to organizations, especially in the beginning stage of an IT system implementation. To help facilitate the development of interpersonal connectivity in the advice-giving networks, companies should implement mechanisms that make these employees identifiable and accessible. For example, as a formal mechanism, organizations may consider compiling an expert directory to help staff members identify and contact these employees when they need their assistance. As an informal mechanism, organizations may provide financial incentives for these expert employees to conduct IT system demonstrations to share their best practices, which can help them develop personal advice-giving networks.

Finally, our study provides practical guidelines for IS researchers. Choosing a proper way to measure networks is important to guarantee response quality. In acknowledging the benefits of capturing the richness of communication frequency in constructing networks, applying certain network analytical principles (i.e., dichotomization of ties based on certain cutoff points) in the data collection is feasible. This strategy contributes to decreasing non-responses and increasing survey quality, especially with a long list of network questions. Moreover, the operationalization of network variables contextually depends on research interests. Choosing the right network parameters to measure network constructs not only accurately captures the theoretical conceptualization of studied constructs but also facilitates the understanding of the entire network structure. For instance, using betweenness centrality to measure network closure considers both direct and indirect ties in advice networks. This use is more effective than adopting network size or network density, which only regards direct advice exchanges.

6.4 Limitations and Future Research Directions

First, the fact that we collected only social network data in a focal business unit (e.g., an outpatient department) may limit our contributions. Data on ties to the IT center and those outside the outpatient department, including across organizational boundaries and communities of practice (Sykes et al. 2014), can help deepen our understanding of the roles of advice-seeking and advice-giving networks when they solve challenges that a new IT system poses. To address this practical limitation, researchers can examine these ties by examining email or bulletin board archives (e.g., Wasko & Faraj, 2005). Future studies that incorporate these data sources will be valuable because these sources will assist in objectively constructing users' advice networks and, thus, avoid any self-report bias.

Second, we measured user adaptation three months after the IT system implementation. We encourage future studies to administrate user adaption measurements at multiple time points after implementation. By doing so, researchers might be able to uncover evidence about dynamic changes in the user adaption process. Additionally, in this study, we collected data on user adaptation and post-adoption IT use simultaneously. Although this type of data gathering strategy is fairly typical in the IS domain, one must take care in any effort to account for endogeneity and causality. To this end, we encourage future research to consider a multi-stage data gathering strategy to harness additional evidence.

Third, we primarily focused on structures of advice-seeking and advice-giving networks in the pre-adoption and post-adoption IT use stages. Currently, a research trend proposes that the use of a new IT system changes the existing advice-seeking and advice-giving networks in organizations (Leonardi, 2013). To develop our study further, one could capture the structures of both networks at certain time points after routine post-adoption IT use and quantify the effect of post-adoption IT use on changes in network structures. Doing so would contribute to the literature on the dynamics of social capital or social influence. Changes in users' attitudes (e.g., trust and perceived risks) toward a new IT system in a multiple-phase study are another potential topic for future explorations because attitudes are important antecedents of IT system use (Venkatesh et al., 2003). Further, psychology research has shown the interactions among cognition, affection, and behavior. Therefore, another valuable future research direction would be to investigate the complement or substitution among cognitive, affective, and behavioral adaptation.

Finally, we did not investigate communication media for advice seeking and advice giving. Previous research has suggested that using communication media (e.g., email, SNS) is linked to the effectiveness of transmission and processing of the exchanged advice (Dennis, Fuller, & Valacich, 2008). A potential extension is to specify advice-seeking and advice-giving networks as being online and offline to produce four different types of networks: online advice-seeking, offline advice-seeking, online advice-giving, and offline advice-giving networks. Another future extension is to consider the exact amount of advice exchanged in each type of networks. Moreover, we focused only on advice networks. Integrating other types of networks (e.g., friendship networks) can help provide further insights into user adaptation toward a new IT system. For example, friendship ties, which typically feature high levels of intimacy, trust, and social support, may also influence individuals' attitudes, perceptions, and behaviors toward a new IT system (Zagenczyk & Murrell, 2009).

7 Conclusion

In this study, we examine post-adoption IT use by integrating coping theory with the social network literature. With a new IT system, our results reveal that one can expect users whose contacts are connected with each other in advice-seeking networks and disconnected from each other in advice-giving networks to have a high level of post-adoption IT use because they focus on the system's positive outcomes and psychologically keep close to it. This study contributes to the foundation for future studies on social networks, user-coping strategies, and post-adoption IT use. By building on this study, researchers and managers alike can identify techniques to improve effective and productive post-adoption IT use by constructing informal social networks and promoting effective user-coping strategies in organizations.

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Appendix A: Constructs and Measurements

Table A1. Variables and Measurements

Variables	Items	Description	Source
Advice-seeking networks	ASN	"Please indicate these persons from whom you seek IT-related information on a typical work day"	Sasidharan et al. (2012)
Advice-giving networks	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 networks	Freeman (1979)
Giving-network size	GNS	The out-degree centrality in advice-giving networks	
Seeking-network closure	SNC	The reversed value of flow betweenness in advice- seeking networks	
Giving-network closure	GNC	The reversed value of flow betweenness in advice-giving networks.	
Behavioral adaptation (BAD)	BAD1	I spent efforts (in time and energy) on changing functions of the EMR system to fit my works	Barki et al. (2007)
	BAD2	I spent efforts (in time and energy) on changing your tasks so that they better fit the EMR system	
	BAD3	Overall, I spent efforts in recommending changes to the EMR system	
Affective adaptation (AAD)	AAD1	I wished that I could escape from the situation of using the EMR system	Yi & Baumgartner (2004)
	AAD2	I tried not to think about the situation of using the EMR system	
	AAD3	I wished that the situation of using the EMR system would go away or somehow be over with	
Cognitive adaptation (CAD)	CAD1	I tried to look for something good in using the EMR system.	Carver et al. (1989)
	CAD2	I tried to see EMR system in a different light, to make it seem to be more beneficial.	
	CAD3	I tried to learn something from the experience of using the EMR system.	
Personal innovativeness in IT(PII)	PII1	If I heard about a new information technology, I would look for ways to experiment with it.	Agarwal & Karahanna (2000)
	PII2	In general, I am hesitant to try out new information technologies.	
	PII3	I like to experiment with new information technologies.	
IT system use	USE	Average number of interactions with the EMR system every day in the past 3 months	Magni et al. (2012)

Appendix A: ANOVA Test for Non-response Bias

Table B1. Response 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			
Job title	Between groups	.451	1	.451	.422	.517
	Within groups	115.449	108	1.069		
	Total	115.900	109			

Appendix C: Principal Component Analysis

Table C1. Item Factor Loadings

	SNS	GNS	SNC	GNC	USE*	BAD	CAD	AAD	PII
SNS	1.000	0.582	-0.449	-0.117	0.035	0.043	-0.002	0.113	0.051
GNS	0.582	1.000	-0.323	-0.279	0.081	-0.121	0.053	0.024	-0.061
SNC	-0.449	-0.323	1.000	0.135	-0.074	-0.061	0.138	-0.186	0.067
GNC	-0.117	-0.279	0.135	1.000	0.054	0.093	-0.066	0.067	0.032
USE*	0.035	0.081	-0.074	0.054	1.000	-0.131	0.132	0.081	-0.051
BAD1	0.098	-0.046	-0.028	0.061	-0.095	0.828	-0.076	0.006	0.024
BAD2	0.096	-0.067	-0.082	0.160	-0.130	0.919	-0.014	0.158	0.064
BAD3	-0.055	-0.187	-0.046	0.022	-0.117	0.905	-0.026	0.094	0.036
CAD1	0.050	0.047	0.183	-0.034	0.109	0.002	0.812	-0.221	-0.040
CAD2	-0.025	-0.028	0.153	-0.016	0.086	0.091	0.851	-0.306	0.128
CAD3	-0.032	0.098	0.016	-0.105	0.127	-0.161	0.811	-0.396	0.177
AAD1	0.136	0.034	-0.197	0.011	0.102	0.111	-0.365	0.940	-0.144
AAD2	-0.010	-0.032	-0.080	0.093	0.099	0.076	-0.196	0.772	-0.041
AAD3	0.132	0.039	-0.193	0.093	0.032	0.098	-0.402	0.961	-0.100
PII1	0.055	-0.066	0.024	0.039	-0.041	0.059	0.097	-0.089	0.944
PII2	0.014	-0.088	0.055	0.060	-0.044	0.066	0.146	-0.099	0.961
PII3	0.089	0.018	0.146	-0.044	-0.064	-0.019	0.015	-0.148	0.796

Note: USE*: logged value of objective IT system use, SNS: seeking-network size, GNS: giving-network size, GNC: giving-network closure, SNC: seeking-network closure, BAD: behavioral adaptation, CAD: cognitive adaptation, AAD: affective adaptation, PII: personal innovativeness in IT.

Appendix D: Multicollinearity Testing Among Studied Variables

Table D1. 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
Educational level	0.736	1.359	0.226	6.422
Job 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 adaptation	0.991	1.009	0.156	4.873
Cognitive adaptation	0.869	1.151	0.128	5.388
Affective adaptation	0.862	1.160	0.013	16.596
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

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