

December 2006

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Individual Infusion of Information Systems: The Role of Adaptation and Individual Cognitions

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ABSTRACT

Information system (IS) infusion denotes the degree to which an IS is fully integrated into an organization's or individual's work practices, and the degree to which the full potential of the IS is being exploited. Most infusion research has focused on broad antecedents of the construct at an organizational level. The current study examines infusion at an individual level. Specifically, it examines how the adaptation process impacts individual-level IS infusion. Based on theories of adaptation and cognition, a theoretical model of IS adaptation and infusion is developed. The model will be tested using a multi-method field study at a large health care provider firm. This research will contribute to theoretical understanding of the influence of the IS adaptation process on IS infusion and provide insight for managers who are interested in fostering IS infusion in their organizations.

Keywords

Infusion, adaptation, field study, IS use

INTRODUCTION

Today's organizations rely increasingly on information systems (IS) to support business processes and gain competitive advantage. However, despite prodigious investment in these systems, their purported benefits often lag behind expectations or fail to materialize at all (Adam and O'Doherty, 2003; Bingi, Sharma and Godla, 1999; Davenport, Harris and Cantrell, 2004). One important factor behind this trend is that IS is often not fully integrated, or infused, into the work practices of individuals within the organization. Thus, desired benefits of the IS are limited as individuals engage in superficial use of IS or fail to use it at all (Jaspersen, Carter and Zmud, 2005; Mabert, Soni and Venkataramanan, 2001; Rigby, Reichheld and Scheffer, 2002; Robey, Ross and Boudreau, 2002).

There is a long tradition of research into the factors that influence individual adoption of information technology (Davis, Bagozzi and Warshaw, 1989; Taylor and Todd, 1995; Venkatesh and Morris, 2000). However, the pressing need for organizations to understand the factors behind IS infusion is prompting researchers to look beyond technology adoption frameworks to the factors that prompt individuals to not only adopt, but to infuse IS in their work practices (Chang and Lung, 2002; Winston and Dologite, 1999). Although the concept of IS infusion has been present in the literature for some time, our understanding of how IS is infused at an individual level is still relatively nascent (Chin and Marcolin, 2001). To address this gap in the literature, the current study examines the infusion of IS at an individual level. Building on theories of IS acceptance and adaptation, and recent conceptualizations of post-adoptive behavior, a theoretical model of individual IS infusion is proposed.

BACKGROUND AND THEORETICAL MODEL

Infusion is perhaps best recognized as the final stage in Cooper and Zmud's (1990) stage model of technology implementation in organizations. In that model, infusion is defined as "increased organizational effectiveness...obtained by using the IT application to its fullest potential" (Cooper et al., 1990 p. 124-125) We draw from this definition with slight modification to reflect the individual-level focus of this research. Infusion represents the extent to which an information system is used completely and effectively and improves the individual's performance.

Infusion is an outcome in an overall process that encompasses pre-adoptive, adoptive, and post-adoptive user behaviors. Literature that focuses explicitly on infusion suggests that IS infusion is predicated upon both use of the IS and the degree to which individuals adapt in response to the new IS (Cooper et al., 1990; Saga and Zmud, 1994; Zmud and Apple, 1992).

Thus, to infuse an IS, the user must not only use it in her work, but must engage in adaptation behaviors that re-shape the individual-IS-work dynamic. IS implementation research corroborates this proposition, finding that adaptation efforts of individuals significantly affect the degree to which IS is successfully integrated into individual and organizational work (e.g. Leonard-Barton, 1988; Majchrzak and Cotton, 1998; Orlikowski, 2000; Orlikowski and Gash, 1994). Although IS use and adaptation behaviors are generally regarded as post-adoptive user behaviors, researchers have recognized the need for post-adoptive IS research to draw upon the rich tradition of IS adoption research in understanding post-adoptive behavior (e.g. Jaspersen et al., 2005). Given the continuous and path-dependent nature of the adoptive and post-adoptive process, it is reasonable to expect that the antecedents of adoption will continue to play a role in influencing post-adoptive behaviors.

Based on these themes, this research proposes a framework of individual-level IS infusion (see Figure 1). The dependent variable, individual-level infusion of an IS, is dependent on both use of the IS and individual adaptation behaviors. IS use and adaptation behaviors are, in turn, influenced by individual-level perceptions of the IS, labeled as 'Individual Cognitions', as mediated through behavioral intention. The framework integrates prior research in the areas of infusion (Cooper et al., 1990; Saga et al., 1994), adaptation (Beaudry and Pinsonneault, 2005), and adoption of information systems (e.g. Venkatesh, Morris, Davis and Davis, 2003), and is consistent with conceptualizations of post-adoptive behavior that have recently emerged (Boudreau and Seligman, 2005; Jaspersen et al., 2005).

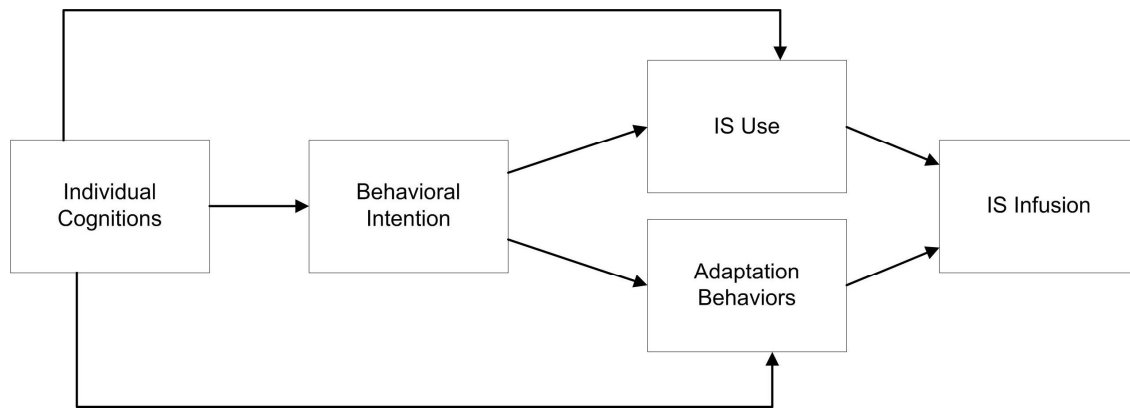


Figure 1. Research Framework

IS Infusion

Most studies of IS infusion have defined the construct at an organizational level (e.g. Cooper et al., 1990; Winston et al., 1999). Given the individual-level focus of this research, Saga and Zmud's (1994) conceptualization of extended, integrative, and emergent use behaviors is most appropriate for this context and level. Extended, integrative, and emergent use involve individuals using more IS features to accomplish a more comprehensive set of work tasks, using the IS to enhance flow linkages among work tasks, and using the IS to accomplish tasks that were not feasible or recognized prior to the introduction of the IS, respectively (Saga et al., 1994).

IS Use

IS use is defined as the extent to which the user utilizes the IS in accomplishing work tasks, and is typically measured by examining frequency, intensity, and duration of use (Jaspersen et al., 2005; Trice and Treacy, 1988). While quantitative measures alone are insufficient for capturing the complexity of post-adoptive use outcomes such as infusion (Chin et al., 2001; Lassila and Brancheau, 1999) they are likely to play a role in influencing these outcomes. For example, Saga and Zmud (1994) propose that integrative use (an infusion use behavior), is influenced by standardization of use behaviors over time. This standardization is in turn influenced by the frequency of IS use. This notion is also supported by Zmud and Apple (1992), who found that routinization of a technology was a necessary condition for its infusion.

- *H1: IS use (frequency, intensity, duration) is positively related to IS infusion*

Adaptation Behaviors

Users may engage in a wide variety of adaptation behaviors in response to the introduction of a new IS (Griffith, 1999; Pinsonneault and Rivard, 1998). Beaudry and Pinsonneault's (2005) coping model of user adaptation (CMUA) provides a framework for guiding this research. Their definition of adaptation behaviors includes "the cognitive and behavioral efforts exerted by users to manage specific consequences associated with a significant IT event that occurs in their work environment" (p. 496). Drawing on coping theory (Lazarus and Folkman, 1984), they suggest that these behaviors may be emotion-focused (geared toward changing one's internal emotional state) or problem-focused (geared toward changing the environment and focusing on the individual, the task, and/or the IS).

The concept of infusion implies that the user makes changes in her environment to fully integrate the features offered by the IS into her work routines. This suggests that adaptation efforts geared toward changing the environment (e.g. problem-focused adaptation behaviors) will have a positive impact on the degree to which the information system is infused at the individual level. However, adaptation efforts that focus solely on changing the user's internal emotional state are not likely to produce the type of IS integration that denotes infusion.

- *H2: Problem-focused adaptation behaviors will relate positively to individual-level IS infusion*
 - *H2a: Adaptation behaviors directed toward changing the work task will relate positively to individual-level IS infusion*
 - *H2b: Adaptation behaviors directed toward changing the IS will relate positively to individual-level IS infusion*
 - *H2c: Adaptation behaviors directed toward changing the individual will relate positively to individual-level IS infusion*
- *H3: Emotion-focused adaptation behaviors will relate negatively to individual-level IS infusion.*

Determinants of IS Use and Adaptation Behaviors

Pre-adoptive, adoptive, and post-adoptive behaviors are not isolated silos of activity, but rather interdependent stages in a continuous developmental process (Rogers, 1995). Emerging conceptualizations of post-adoptive behavior have acknowledged this interdependency, and have encouraged researchers to build on the insights of adoption research (e.g. Boudreau et al., 2005; e.g. Jasperson et al., 2005). Consistent with emerging recommendations, this research builds on recent adoption research to understand the factors that influence post-adoptive IS infusion. Following Jasperson, et al. (2005), we draw on the unified theory of acceptance and use of technology (UTAUT) to identify important antecedents to both IS use and adaptation behaviors (Venkatesh et al., 2003).

Behavioral Intention

UTAUT proposes that IS use behavior is determined by behavioral intention to use the IS (Ajzen, 1991; Fishbein and Ajzen, 1975; Venkatesh et al., 2003). Numerous studies of IS use have found significant relationships between behavioral intention to use and IS use (e.g. Davis et al., 1989; Taylor et al., 1995). These studies have typically measured use in terms of frequency, intensity, or duration of IS use as a whole.

- *H4: Behavioral intention to use an IS will be positively related to IS use (frequency, intensity, duration)*

While IS use is necessary for achieving IS infusion, it is not sufficient. Experience has demonstrated that even frequent, intense, or prolonged users of an IS may fall short of infusing the IS into their work practices (Jasperson et al., 2005; Robey et al., 2002). For example, users may employ a limited set of IS features, or they may avoid using the IS to support some tasks it was designed to support (Hartwick and Barki, 1994; Kay and Thomas, 1995). In such cases, the intention to use may lead to use behavior, but not necessarily to the adaptation behaviors required for IS infusion. On the other hand, those who intend to infuse the technology are more likely to engage not only in IS use, but in adaptation behaviors that promote IS infusion. This is consistent with recent conceptualizations of post-adoptive user behavior, which suggest that post-adoptive behaviors are influenced by post-adoptive intentions (Jasperson et al., 2005).

- *H5: Behavioral intention to infuse an IS will be related to adaptation behaviors*

Drawing from CMUA (Beaudry et al., 2005), emotion-focused adaptation behaviors are not likely to promote infusion because they are focused on changing an individual's emotions rather than the environment. Thus, those who intend to

infuse an IS into their work practices are more likely to engage in problem-focused adaptation behaviors which promote IS infusion.

- *H5a: Behavioral intention to infuse an IS will be positively related to problem-focused adaptation behaviors*
- *H5b: Behavioral intention to infuse an IS will be negatively related to emotion-focused adaptation behaviors*

Individual Cognitions

UTAUT posits that a collection of individual cognitions influences intention to use an IS (Venkatesh et al., 2003). An important contribution of the current study is that it goes beyond traditional technology acceptance frameworks to suggest that individual cognitions affect not only intention to use and IS use, but also intention to infuse IS and subsequent adaptation behaviors that promote IS infusion. Although such a relationship has not been directly explored in theories such as UTAUT, literature on post-adoptive behavior and adaptation suggests that these cognitions may have an important role to play. For example, Jaspersen, et al. (2005), integrate the UTAUT cognitions into their theoretical framework of post-adoptive behavior and suggest that these cognitions are those “most likely to influence post-adoptive intentions” (p. 538). Similarly, other researchers have cited several factors that may influence a users’ appraisal of an IS and consequent adaptation behaviors, including understanding of the technology, perceived task-technology fit, perceived compatibility with the users’ values, needs, and past experiences, performance expectancy, social influence, and assessment of control (Beaudry et al., 2005; Boffo and Barki, 2003). These factors correspond closely to cognitions within UTAUT’s categories of performance expectancy, effort expectancy, facilitating conditions and social influence (Venkatesh et al., 2003).

Noting the conceptual consistency across these studies, we posit that cognitions identified in UTAUT will influence not only intention to use IS, but also intention to infuse IS.

- *H6: Performance expectancy will be positively related to behavioral intention to infuse IS, moderated by gender and age*
- *H7: Effort expectancy will be positively related to behavioral intention to infuse IS, moderated by gender, age, and experience*
- *H8: Social influence will be positively related to behavioral intention to infuse IS, moderated by gender, age, voluntariness, and experience*

Consistent with UTAUT, we hypothesize that facilitating conditions will have a direct effect on adaptation behaviors, independent of intention to infuse the IS.

- *H9: Facilitating conditions will be positively related to problem-focused adaptation behaviors, moderated by age and experience*
- *H10: Facilitating conditions will be negatively related to emotion-focused adaptation behaviors, moderated by age and experience*

In addition to the above, this research also tests hypotheses postulated in the original UTAUT model, with slight variations in wording for the present research:

- *H11: Performance expectancy will be positively related to behavioral intention to use the IS, moderated by gender and age*
- *H12: Effort expectancy will be positively related to behavioral intention to use the IS, moderated by gender, age, and experience*
- *H13: Social influence will be positively related to behavioral intention to use the IS, moderated by gender, age, voluntariness, and experience*
- *H14: Facilitating conditions will be positively related to IS use, moderated by age and intention*

Expanded Research Model and Hypotheses

The final expanded research model is shown in Figure 2. For the sake of clarity, moderating variables are omitted from the model.

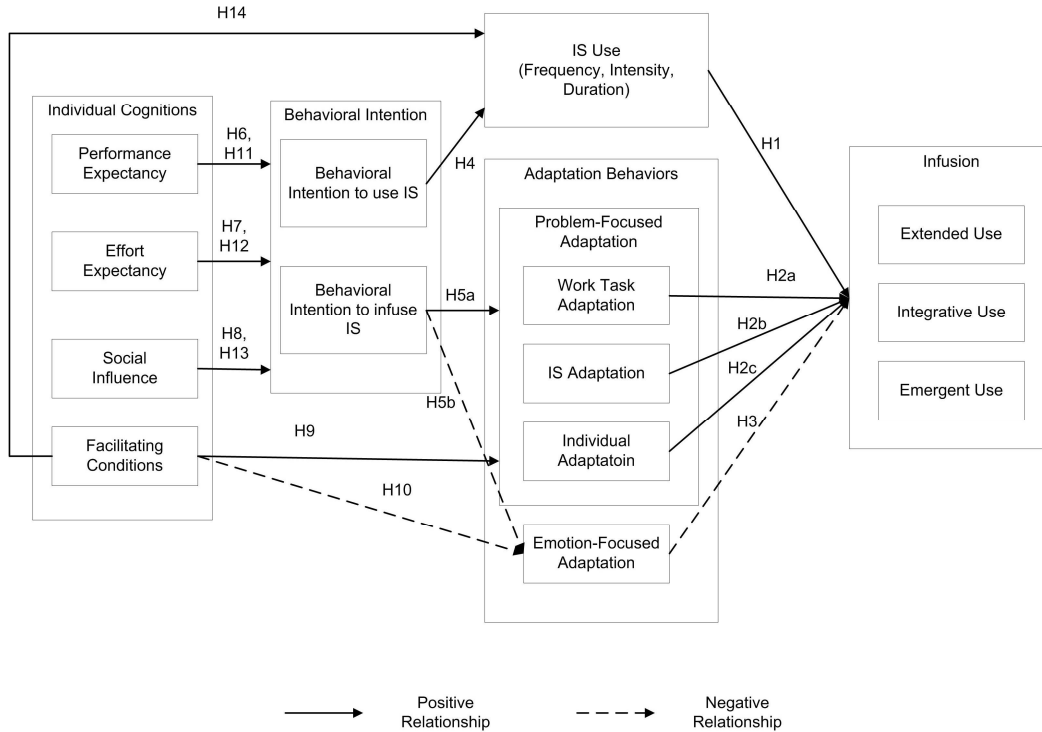


Figure 2. Expanded Research Model

RESEARCH METHOD

A multi-method field study will be employed for this research. A field study is well suited to investigating a complex behavioral phenomenon, particularly when the boundaries between the phenomenon and context are not clearly evident (Yin, 2003), as is the case for IS infusion. In accordance with recommendations of many researchers (e.g. Kaplan and Duchon, 1988; Yin, 2003), this study utilizes both qualitative interviews and a quantitative survey for data collection.

Research Site

The site for the field study is a large healthcare provider firm in the process of implementing an organization-wide electronic medical system (EMS). The firm has approximately 8 million members served by 30 medical centers and approximately 11,000 physicians distributed across six geographic regions in the United States. The EMS is a multi-billion dollar initiative geared toward improving the quality of healthcare provided to the firm’s members. Although implementation schedules varied across sites, each site has been using the EMS for at least several months, thus allowing sufficient time for infusion of the technology to occur.

Data Collection

Interviewees will consist of various healthcare workers (including physicians, nurses, and support staff) across different geographic sites. The target duration for each interview is 60 to 90 minutes. Interview questions will be based on the theoretical constructs in the model while allowing room for additional insight into participants’ experiences. Interviews are scheduled to be completed in June and July. The survey will be administered, online, to ambulatory healthcare workers across geographic regions. The survey will include items to measure the constructs identified in the theoretical model. Average completion time for the survey is 30 minutes. A sample survey has been developed by selecting items based on their prevalence in the literature and on their appropriateness for the research site. The survey is being piloted at a campus health organization, with administration in the target site scheduled for August.

EXPECTED RESULTS

This research will contribute to understanding an important theoretical and practical problem: how and why information systems are infused by individuals. By linking adaptation behaviors to infusion and individual cognitions, this research expands both IS adoption and adaptation literatures, which have not closely examined the effects of individual cognitions on adaptation behaviors or on individual IS infusion. Finally, the results of this study will provide organizations with greater insight into how they can foster infusion of the information systems in which they invest, in order to reap maximum benefits.

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