

INFUSION OF INFORMATION SYSTEMS:  
THE ROLE OF ADAPTATION AND INDIVIDUAL COGNITIONS

by

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## DEDICATION

This dissertation is dedicated to my sweetheart

Amy

And to our three beautiful children

Alexis, Avery, and Carter

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## ABSTRACT

Each year, organizations invest billions of dollars in large information systems (IS) that support business processes. These systems are implemented with the hope that they will bring increased efficiency and productivity to operations, decision making, and collaboration, thus strengthening competitive advantage in an increasingly aggressive global marketplace. Unfortunately, empirical evidence demonstrates that despite prodigious investment in these systems, their purported benefits often lag behind expectations, or fail to materialize at all. While many causes may contribute to these failures, a common theme in empirical studies is that information systems are rarely infused into individuals' work practices, thus undermining their benefits to the organization. IS infusion refers to the degree to which the technology is fully integrated into an individual's or organization's work systems. Although theoretical and practical interest in IS infusion is growing, little is understood about the factors that lead to IS infusion at the individual level.

This dissertation integrates research and theory in information systems acceptance, adaptation, and infusion to develop a theoretical model of IS infusion at the individual level. To test the model, a survey instrument was developed and tested at the health care facility of a large public university. The revised survey was then deployed at a large technology firm in the northwestern United States, from which 195 individual responses were obtained. Results indicate that adaptation behaviors engaged in by IS users significantly impact the degree to which they infuse the IS in their work.

Moreover, these adaptation behaviors are shaped by cognitive appraisals of the IS, which are, in turn, influenced by key acceptance-related IS perceptions.

This study contributes to research by integrating previously disparate theories into a holistic framework of individual-level IS infusion. For practice, this research sheds light on specific factors that contribute to IS adaptation and infusion, thereby assisting IS managers to promote these outcomes within their organization.

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background and Problem

Each year, organizations invest billions of dollars in large information systems (IS) that support business processes (James and Wolf, 2000; Seddon et al., 2003; Seddon et al., 1999). These systems are implemented with the hope that they will bring increased efficiency and productivity to operations, decision making, and collaboration, thus strengthening competitive advantage in an increasingly aggressive global marketplace. Unfortunately, empirical evidence demonstrates that 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 et al., 1999; Davenport et al., 2004). While many causes may contribute to these failures, a common theme in empirical studies is that information systems are underutilized, thus undermining their benefits to the organization (Jasperson et al., 2005; Mabert et al., 2001; Rigby et al., 2002; Robey et al., 2002). If companies are to reap the benefits of their IS investments, they must ensure that their employees use IS appropriately to perform their work.

The study of how individuals adopt and use technology has flourished in the IS academic community over the past several decades. Theories of human behavior [e.g. Theory of Reasoned Action (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991) and diffusion of innovations (e.g. Innovation Diffusion Theory (Rogers, 1995))] have been marshaled to reveal a multitude of factors that influence an individual's beliefs, attitudes, intentions to adopt, and actual adoption of

information technology (e.g. Davis, 1989; Venkatesh et al., 2003). This research has largely conceptualized use intentions and behaviors as dichotomous (use vs. non-use) or measured along macro dimensions such as duration, frequency, or intensity. While this focus has yielded much insight into the adoption phenomenon, it does not adequately address the post-adoption utilization issues that plague IS implementation initiatives (Boudreau and Seligman, 2005; Jaspersen et al., 2005; Lassila and Brancheau, 1999). Moreover, the increasing complexity and organizational breadth of today's information technologies has rendered simple conceptualizations of use inadequate for current organizational needs. Recognizing these deficiencies, IS researchers are now calling for better understanding of post-adoptive utilization of information systems (Agarwal, 2000; Chin and Marcolin, 2001; DeLone and McLean, 2003).

One concept that has emerged in the literature and is relevant to post-adoptive utilization of IS is *IS infusion*, or the degree to which “the IT application is used within the organization to its fullest potential” (Cooper and Zmud, 1990, p. 125). The concept of infusion goes beyond simple quantitative, macro-level measures of use to convey the degree to which the technology is fully integrated into an organization's work systems. Thus, infusion provides a useful framework for understanding the deeper post-adoptive utilization issues of interest to both organizations and researchers. However, although the concept has been present in the literature for some time, our understanding of the factors that lead to infusion of technology in organizations is limited. Most studies of infusion have examined its broad organizational antecedents rather than focusing on the individual-level processes by which it is attained (Chang and Lung, 2002; Eder and

Igbaria, 2001; Jones et al., 2002; Winston and Dologite, 1999). More research is needed that explores these processes and elucidates “what constitutes IT usage and the pattern of IT infusion itself” (Chin and Marcolin, 2001, p. 10)

At an individual level, infusion is not likely to occur unless the user of the technology proactively engages in changing work habits, routines, and the technology itself to achieve higher levels of productivity. IS implementation research has generally observed that the most successful IS implementations are those in which the users of the technology adapt in order to take full advantage of an IS’s features (Chin and Marcolin, 2001; Jaspersen et al., 2005; Leonard-Barton, 1988; Orlikowski, 1996; Tyre and Orlikowski, 1994; 1996). Researchers have studied IS adaptation for several years, examining such aspects as temporal patterns of adaptation (e.g. Tyre and Orlikowski, 1994), adaptation behaviors (e.g. Beaudry and Pinsonneault, 2005b), and structural and performance impacts of adaptation (e.g. DeSanctis and Poole, 1994; Majchrzak et al., 2000). A particularly promising approach for understanding individual adaptation processes has recently been proposed by Beaudry and Pinsonneault (2005b), who draw on coping theory as a theoretical mechanism for understanding users’ affective and adaptive reactions to new workplace IS. Despite its established presence in the research literature, however, individual-level adaptation has not been closely examined in terms of its relationship to IS infusion, which embodies the richer conceptualization of use that researchers are now beginning to seek. Greater insight into IS infusion will require going beyond models of technology acceptance to explore how individual adaptation affects post-adoptive use behaviors. As Agarwal (2000) observes, “technology acceptance

outcomes need to be extended to more formally include the notions of adaptation, reinvention, and learning” (p. 102).

## **1.2 Research Question and Objectives**

In light of these observations, this dissertation draws upon recent research in technology acceptance, use, and adaptation, together with research on coping behavior, to examine the following research question: *How do individual-level IS cognitions and adaptation processes affect the post-adoptive infusion of an information system?* This question is addressed in the following manner. First, extant literature in the areas of IS infusion, use, and adaptation is reviewed and synthesized. Relevant research on individual coping is also reviewed. Based on this literature, a theoretical model of individual IS infusion is then developed. The model is tested by analyzing data collected at two research sites (a pilot site and a primary site) that have recently implemented large-scale, enterprise information systems. Semi-structured interviews with IS users and administrators at each of these sites provide a preliminary means of assessing the terminology and relationships expressed in the model. Based on these interviews and a review of the literature, a survey is developed and deployed to test proposed relationships in the model.

## **1.3 Importance of the Research**

This research offers both theoretical and practical contributions. From a theoretical perspective, the current study incorporates concepts from research in technology acceptance and use with those of coping and adaptation to provide an integrated theoretical model for understanding 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. In addition, this research builds on the work of Zmud and his colleagues (e.g. Cooper and Zmud, 1990; Saga and Zmud, 1994) by operationalizing and testing the concept of IS infusion, and upon the work of Beaudry and Pinsonneault (2005b) by applying additional concepts from coping theory to better understand how IS infusion is realized. Finally, this research tests a recent comprehensive model of technology acceptance proposed by Venkatesh et al. (2003) and integrates it into a larger framework of individual-level post-adoptive IS adaptation and use.

For practice, this study provides managers with insight into the factors that influence how and why infusion occurs (or fails to occur). As established above, IS practitioners have a vested interest in ensuring that IS is used fully and appropriately within their organizations. Results from this study can be used to inform the design of ongoing training and user intervention programs that foster higher levels of infusion among IS users, ultimately helping organizations reap more benefit from their IS investments.

#### **1.4 Guide to the Dissertation**

This dissertation is organized into 6 chapters. Chapter 2 summarizes the literature on IS use, infusion and adaptation and provides an overview of relevant literature on coping.

Chapter 3 draws on the literature review to define the research constructs and develop the theoretical model and research hypotheses to be tested.

Chapter 4 details the research methodology employed for this study, including a description of the research sites, participants, independent and dependent variables, measures, procedures used for the pilot study, and tests of the measurement model using pilot study data.

Chapter 5 outlines the data analysis procedures used and presents the results of the primary data analysis. The results of this analysis are used to support or refute the research hypotheses and provide the evidence for interpretation of the study's findings.

Chapter 6 concludes the thesis by discussing implications and contributions of the research to theory and practice, outlining the study's strengths and limitations, and suggesting directions for future research.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This research builds on literature from a variety of domains within and outside of IS research. Salient IS research themes include IS acceptance and use, infusion, and IS user adaptation. In addition, this research draws on general and IS-specific theories of individual coping as a theoretical foundation for examining user adaptation behaviors.

The chapter is organized as follows. First, extant literature on IS use is discussed, followed by a definition of the infusion concept and a discussion of its origins in the IS literature. Studies examining antecedents of infusion are then presented, together with an overview of infusion measures in the literature. Next, relevant literature on IS acceptance and IS adaptation is reviewed, followed by an overview of general and IS-specific coping research. The chapter concludes with a summary of the relevant themes identified in the research literature.

#### **2.1 IS Use and Infusion**

##### *2.1.1 IS Use*

Information system use is one of the most central and frequently studied constructs in the IS literature (Szanja, 1993; Trice and Treacy, 1988). DeLone and McLean (1992) note that “the use of an information system has often been the MIS success measure of choice in MIS empirical research”, and that use is “...one of the most frequently reported measures of IS success...” (p. 66). According to a review by Burton-Jones and Straub (2006), IS use is a central component of several sub-streams of IS research, including IS success (e.g. Goodhue, 1995; Lucas and Spitler, 1999), IS for

decision making (e.g. Szanja, 1993; Yuthas and Young, 1998), IS acceptance (e.g. Straub et al., 1995; Venkatesh and Davis, 2000), and IS implementation (e.g. Ginzberg, 1981; Hartwick and Barki, 1994). As an additional indicator of the significance of the use construct in IS research, Boffo and Barki (2003) noted that *MIS Quarterly* and *Information Systems Research*, two leading journals in the MIS field, together published 38 papers dealing with some aspect of IS use over the last decade, attesting “to the importance of the construct of IS use in our field” (p. 1).

Given that benefits derived from an IS depend on how it is used, the attention devoted to the use construct in the literature is not surprising. However, despite its prevalence in the literature, the IS use construct has not been well theorized (Boffo and Barki, 2003; Boudreau and Seligman, 2005; Burton-Jones and Straub, 2006; Chin and Marcolin, 2001). Most of the extant research has examined use from a quantitative perspective, operationalizing the construct as the frequency, intensity, or duration of use behaviors (e.g. Adams et al., 1992; Compeau and Higgins, 1995; Igbaria et al., 1997; Parthasarathy and Bhattacharjee, 1998; Taylor and Todd, 1995b; Venkatesh and Morris, 2000). For instance, use studies have commonly included self-report use measures such as “On average, how much time do you spend on the system every day?” (Venkatesh and Davis, 2000), or “My company uses [system] very frequently” (Gefen, 2000). These types of measures indicate the overall degree to which the IS is used and are often interpreted as denoting acceptance or success of an IS.

Despite the prevalence of quantitative use measures in the literature, increased quantity of use does not necessarily imply increased individual or organizational benefit.

While quantitative use measures may be useful as high-level surrogates for IS acceptance and success, researchers are now calling for a richer understanding of “what constitutes IT usage and the pattern of IT infusion itself” (Chin and Marcolin, 2001, p. 10). This shift in perspective is motivated in part by the increasing complexity of today’s organizational IS, which has resulted in increased user discretion over *how*, as opposed to *whether* or *how often*, an IS is used. For instance, an organization may adopt and mandate the use of a feature-rich enterprise resource planning (ERP) system to integrate business functions and support transactions with customers and suppliers. Notwithstanding organizational mandate, however, users may still exhibit wide variance in terms of the types of IS features that they use and the way they use them to complete their tasks (Boudreau and Seligman, 2005; De Sousa, 2005; Jaspersen et al., 2005). Hence, increased research attention must be devoted to understanding factors that shape quality or type of use, particularly with regard to complex, mandated organizational IS (Barki et al., 2005; Cooper and Zmud, 1990; Saga and Zmud, 1994).

In spite of limited research examining use quality, scholars have recognized that use of technology is likely to occur at various levels, with some types of use constituting “deeper” use than others. Both organization-level and individual-level research have offered various labels for these use levels. At an individual level, Hall and Loucks (1977) describe a progression of seven use stages beginning from nonuse and orientation and proceeding to integration and renewal. A similar progression is proposed by de Sousa (2005), who suggests that users progress from basic and exploratory use to non-routine and finally deep levels of use. Jaspersen et al. (2005) identify feature adoption,

feature use, and feature extension as a series of use behaviors that may be exhibited by users of IT in organizational contexts. These studies all underscore the fundamental premise that users progress through various levels of use as they gain more experience using an information technology.

At the organizational level, researchers have observed similar progressions of use levels. Drawing on punctuated equilibrium theory, Lassila and Brancheau (1999) propose four organizational equilibrium states of technology adoption characterized by levels of technology use: low-integration, standard adoption, expanding, and high-integration. Each successive state involves increasing incorporation of a technology's features to redefine and extend both work tasks and technology. In a similar vein, Orlikowski (2000) proposes three types of "technology enactment" that reflect the degree to which processes, technology, and social structures are changed as a result of the technology's use. The types of enactment are inertia (technology is used within the existing way of doing things), application (technology is used to augment or refine the existing way of doing things), and change (technology is used to substantially alter the existing way of doing things). Frameworks such as these have begun to lay the groundwork for exploring "what constitutes IT usage and the pattern of IT diffusion and infusion itself" (Chin and Marcolin, 2001, p. 10).

### *2.1.2 Infusion: Definitions and Origin*

IS infusion has been defined in the literature as "increased organizational effectiveness ... obtained by using the IT application to its fullest potential" (Cooper and Zmud, 1990, pp. 124-125). Others have defined infusion as "the degree of [technology]

integration with existing business processes” (Eder and Igarria, 2001, p. 234), “embedding an IT application deeply and comprehensively within an individual’s or organizations work systems” (Saga and Zmud, 1994, p. 79), and “the extent to which an innovation is used completely and effectively and improves the organization’s performance” (Wynekoop, 1991, p. 21). The common themes underlying these definitions are that, 1) technology may be integrated at various levels by both organizations and individuals, and, 2) that organizational and individual benefits derived from technology are contingent upon the level of this integration.

Although the concepts behind infusion have been present in the literature over the past several decades, the term *infusion* originated in research of the late 1980s (e.g. Kwon and Zmud, 1987; Sullivan, 1985), and became widely recognized as the last stage in the six-stage technology implementation model proposed by Cooper and Zmud (1990). According to this organization-level model, IT implementation activities proceed through initiation, adoption, adaptation, acceptance, routinization, and finally infusion. The model is founded Lewin’s (1952) framework of change, with initiation associated with Lewin’s unfreezing stage, adoption and adaptation associated with Lewin’s change stage, and acceptance, routinization, and infusion associated with Lewin’s refreezing stage.

Cooper and Zmud’s (1990) implementation model provides a useful framework for implementation research, but definitions of the model’s stages remain somewhat “broad” and “ambiguous” (Saga and Zmud, 1994, p. 68). Recognizing this deficiency, Saga and Zmud (1994) draw upon existing empirical research to further theorize and define the post-adoptive stages associated with Lewin’s (1952) refreezing state

(acceptance, routinization, and infusion). Specifically, they propose three types of individual use behavior that characterize infusion: extended use, integrative use, and emergent use. Extended use refers to “using more of the technology’s features in order to accommodate a more comprehensive set of work tasks” (p. 80). Integrative use involves “using the technology to establish or enhance flow linkages among a set of work tasks” (p. 80). Finally, emergent use refers to “using the technology in order to accomplish tasks that were not feasible or recognized prior to the application of the technology to the work system” (p. 80). According to Saga and Zmud (1994), these types of use represent the “means by which infusion is realized” (p. 80).

### *2.1.3 Infusion Research: Theoretical and Empirical Studies*

Research has examined infusion from both a theoretical and empirical perspective. Early theoretical work drawing from prior IT implementation literature has suggested that infusion occurs via standardization of IT use in the workplace and reconceptualization of business processes (Saga and Zmud, 1994). Other theoretical studies have proposed a wider range of factors impacting organizational-level infusion. For example, based on an extensive review of IT implementation literature, Winston and Dologite (1999) proposed a series of 11 infusion determinants in small business contexts. These determinants included organizational factors (structure, IT experience), end-user factors (experience, training, involvement, incentives) owner factors (knowledge, strategy, involvement) and extra-organizational situations (strategic alliances, IT consultants). Although targeted toward small businesses, the 11-factor model was not tested empirically.

Empirical studies have approached infusion from two broad perspectives. The first perspective, herein termed infusion via organizational technology configuration, defines and examines infusion in terms of subsets of IT features that have been implemented by an organization as a whole. Studies adopting this perspective examine socio-technical structures and technology configurations that denote IS infusion (Lassila and Brancheau, 1999). For example, Cooper and Zmud (1990), in their study of Material Requirements Planning systems, used a pre-existing schema that had been institutionalized in practice for defining levels of MRP use. This schema identified five classes of MRP use in terms of the types of functions the system was used to perform, as well as the performance outcomes that emerged. Each class included progressively more MRP use and performance outcomes, with the top three classes representing levels of infusion. In a similar vein, Zmud and Apple (1992) assessed infusion of supermarket scanners by identifying “a succession of technological configurations of the new work reality” (p. 150). Each successive configuration represented higher levels of use and deeper embedding of the technology in the organization. Eder and Igarria (2001) employed a cross-sectional survey to study the diffusion and infusion of intranet technology in several organizations. Building on Zmud and Apple (1992) and levels of intranet deployment defined by the Gartner Group, they asked respondents to identify “the highest level of intranet application that each department was using” (p. 238). As in prior studies, each successive level of use represented deeper infusion of the technology in the organization.

Studies adopting the organizational technology configuration perspective have identified a wide range of factors affecting organizational level technology infusion. For example, Cooper and Zmud (1990) hypothesized a mediating role of compatibility and technology complexity between task and technology characteristics and IT adoption and infusion. In their study of material requirements planning technology, they found no significant relationships between these antecedents and IT infusion, prompting them to suggest that “political and learning models are likely to be more appropriate” for studying later phases of IT implementation (p. 134). Zmud and Apple (1992) investigated the relationship between technology routinization and infusion in a study of electronic scanners in supermarket chains. They found that routinization was a necessary, but not sufficient, condition for infusion and that both constructs correlated highly with the more traditional innovation measures of earliness of adoption and diffusion. In their study of infusion of intranet technology across several organizations, Eder and Igbaria (2001) found that infusion was positively related to various organizational factors such as earliness of adoption, top management support, IT infrastructure, and technology diffusion. Similarly, Chang and Lung (2002) found significant relationships between organizational change factors such as centralization of structures, skill variety, task identity, and the feedback of the task on the infusion of advanced manufacturing technologies in 50 manufacturing companies.

The second perspective for studying infusion is termed infusion via individual-level technology use. Studies adopting this perspective conceptualize and measure infusion as the degree to which individual technology users employ the full range of

features offered by the technology, or the degree to which they use the technology to its fullest extent. Studies that have adopted this perspective are few. One such study was conducted by Jones et al. (2002), who examined individual-level infusion of sales force automation (SFA) technology in a large financial services company. They developed a four-item, self-reported scale of infusion that assessed “the extent to which the salesperson uses SFA to its fullest extent to enhance their productivity” (p. 147). Items were measured on a 7-point Likert scale, which exhibited a high composite reliability (0.93). The results of the study suggested that while user attitudes had a significant effect on intention to adopt technology, other determinants such as facilitating conditions and personal innovativeness factored more prominently in determining the technology’s infusion.

#### *2.1.4 Summary: IS Use and Infusion*

The studies reviewed in this section clearly demonstrate the breadth of factors influencing technology infusion, and highlight the fact that these factors are likely to differ from those associated with initial adoption of technology. Because of their predominant organizational focus, however, these studies tend to neglect the individual level processes by which infusion is realized. Understanding these processes is critical because organizational infusion of an IS can only be achieved as individuals infuse the technology into their own work practices. Theoretical studies have suggested that infusion occurs as IS use becomes frequent and routinized, and as IS-enabled work processes are re-conceptualized and adapted in response to it (Saga and Zmud, 1994). Accordingly, the following sections review research on IS acceptance and use and IS

adaptation, with particular emphasis on recent theoretical developments from which this study draws.

## **2.2 IS Acceptance and Use**

### *2.2.1 Overview*

An IS cannot be infused unless it is first accepted and used by users. Hence, understanding factors that promote or impede IS acceptance and use is particularly relevant to this research. IS acceptance research, described as one of the most mature sub-disciplines within the IS field (e.g. Hu et al., 1999), generally examines factors that promote or impede individuals' acceptance and subsequent use of IS in the workplace (e.g. Davis, 1989; Taylor and Todd, 1995b; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000) and in other contexts (e.g. Brown and Venkatesh, 2005; Brown et al., 2006; Venkatesh and Brown, 2001). Drawing on the fields of psychology and sociology, this body of work has produced a number of theoretical models for explaining IS adoption and initial use. Table 2.1 summarizes these models, their referent theories or studies, the antecedents to IS use they include, and a sample of IS studies that have employed each model. The fundamental concept underlying the majority of these models is that user perceptions about an IS influence behavioral intention to use the IS, which, in turn, drives actual IS use behavior.

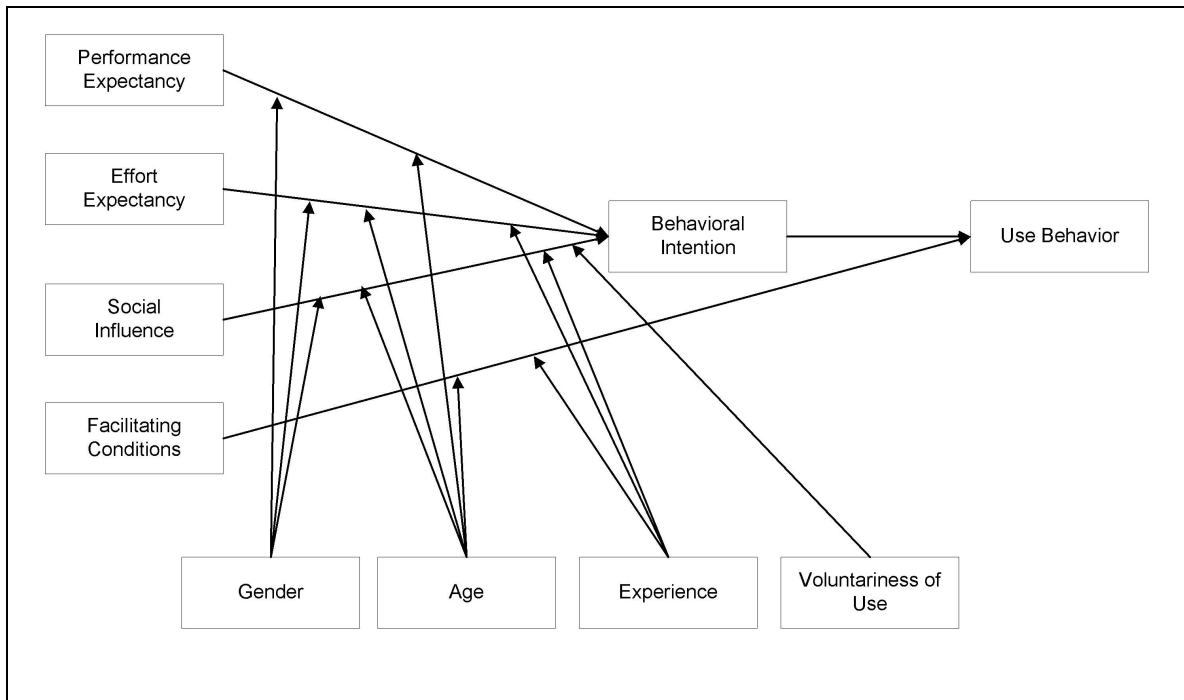
**Table 2.1 - Summary of Key IS Acceptance Models**

<b>Model</b>	<b>Referent Theories/Studies</b>	<b>Key Constructs Affecting Use</b>	<b>Sample IS Studies</b>
Theory of Reasoned Action (TRA)	(Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975)	Attitude toward behavior, Subjective norm	(Davis et al., 1989)
Technology Acceptance Model (TAM) and TAM2	TRA (Fishbein and Ajzen, 1975)	Perceived usefulness, Perceived ease of use, Subjective norm (TAM2 only)	(Al-Gahtani, 2001; Brown et al., 2002; Chau, 1996; Davis, 1989; Dishaw and Strong, 1999; Gefen and Straub, 2000; Hu et al., 1999; Karahanna and Straub, 1999; Malhotra and Galletta, 1999; Mathieson et al., 2001; Szajna, 1994; Venkatesh, 2000; Venkatesh and Davis, 2000)
Theory of Planned Behavior (TPB & DTPB)	(Ajzen, 1991)	Attitude toward behavior, Subjective norm, Perceived behavioral control	(Harrison et al., 1997; Mathieson, 1991; Morris and Venkatesh, 2000; Taylor and Todd, 1995b)
Motivational Model (MM)	Motivational theory (Deci, 1971; 1975; Deci and Ryan, 1985)	Extrinsic motivation, Intrinsic motivation	(Davis et al., 1992; Venkatesh, 1999; Venkatesh and Speier, 1999)
Model of PC Utilization (MPCU)	Triandis' (1977) Theory of Human Behavior	Job-fit, Complexity, Long-term consequences, Affect towards use, Social factors, Facilitating conditions	(Thompson et al., 1991)
Innovation Diffusion Theory (IDT)	(Rogers, 1995)	Relative advantage, Ease of use, Image, Visibility, Compatibility, Result demonstrability, Voluntariness	(Agarwal and Prasad, 1997; Agarwal and Prasad, 1998b; Karahanna et al., 1999; Moore et al., 1991; Moore and Benbasat, 1991; Moore and Benbasat, 1996; Plouffe et al., 2001)
Social Cognitive Theory (SCT)	(Bandura, 1986)	Performance expectations, Personal expectations, Self-efficacy, Affect, Anxiety	(Compeau et al., 1999; Compeau and Higgins, 1995)
Model of Adoption of Technology in Households (MATH)	TPB (Ajzen, 1991), Household lifecycle theory (Gilly and Ennis, 1982; Schaninger and Danko, 1993)	Attitudinal beliefs, Control beliefs, Normative beliefs	(Brown and Venkatesh, 2005; Brown et al., 2006; Venkatesh and Brown, 2001)

The purview of IS acceptance models has typically been restricted to measuring use/non use immediately following adoption or, in some cases, merely intention to use (e.g. Agarwal and Karahanna, 2000; Agarwal and Prasad, 1998a; Bhattacharjee, 2001; Venkatesh, 2000). While certainly appropriate for capturing pre-adoption and adoptive behaviors, this perspective yields limited insight into the complexities of post-adoptive behaviors (Barki et al., 2005; Chin and Marcolin, 2001; Jasperson et al., 2005). Nevertheless, it would be unwise to dismiss key adoption determinants as irrelevant to post-adoptive behavior. 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 post-adoption researchers to build on the insights of adoption research. For example, Jasperson et al. (2005), argue that “the cumulative tradition of research on technology acceptance and initial use should enrich our understanding of individual post-adoptive behaviors” (p. 527). They develop a conceptual model of post-adoptive behavior that incorporates findings from adoption research into the larger perspective of post-adoptive activities. In a similar vein, Boudreau and Seligman (2005) draw from case study data to develop a theoretical model of quality of use of a complex technology that includes many of the important belief constructs found in models of technology acceptance. These studies emphasize that adoption research should inform our understanding of post-adoptive behavior.

### *2.2.2 Unified Theory of Acceptance and Use of Technology (UTAUT)*

Although IS acceptance models share the common objective of predicting IS use, they differ in the antecedents to IS use that they include. This divergence poses a challenge for researchers and practitioners who must “pick and choose constructs across models, or choose a favored model and largely ignore the contributions from alternative models” (Venkatesh et al., 2003, p. 426). Recognizing this problem, Venkatesh et al. (2003), proposed the Unified Theory of Technology Acceptance (UTAUT) as a holistic framework for explaining IS acceptance and use. UTAUT (shown in Figure 2.1) synthesizes and distills key IS use antecedents identified in several IS acceptance models into a set of four key IS perceptions: performance expectancy, effort expectancy, social influence, and facilitating conditions (see Table 2.2 for definitions and root constructs). According to UTAUT, performance expectancy, effort expectancy, and social influence impact a user’s intention to use the IS, which, together with facilitating conditions, determines actual use behavior. These relationships are moderated by gender, age, and experience of the user as well as the voluntariness of IS use.



**Figure 2.1 - UTAUT Model (Venkatesh et al., 2003)**

**Table 2.2 - UTAUT Perceptions**

Perception	Definition	Root Constructs
Performance Expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance	Perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations
Effort Expectancy	The degree of ease associated with use of the system	Perceived ease of use, complexity, ease of use
Social Influence	The degree to which an individual perceives that important others believe he or she should use the new system	Subjective norm, social factors, image
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system	Perceived behavioral control, facilitating conditions, compatibility

To validate the UTAUT model, Venkatesh et al. (2003) collected survey data from four companies in the entertainment, telecom services, banking and public administration industries. IS use was voluntary in two of the companies and mandatory in the other two. As a cross-validation sample, additional data were collected from a financial services firm and a retail electronics firm, one of which mandated IS use. Data analysis generally supported the relationships posited by the model, particularly for direct effects performance expectancy as a key antecedent of intention to use the technology and moderated effects of effort expectancy, social influence, and facilitating conditions on intention to use and use behavior.

Since Venkatesh et al. (2003), UTAUT has received relatively little empirical validation. However, a few studies have employed the model to examine acceptance phenomena in various contexts, including adoption of tablet PCs by business faculty (Anderson et al., 2006), buyer/seller adoption of business-to-business electronic marketplaces (Shan et al., 2006), and adoption of mobile communication technology by physicians (Shengnan et al., 2006). These studies have generally supported UTAUT relationships, although there is some variation in the relative effect of each IS perception. For instance, Anderson et al. (2006) found that performance expectancy and voluntariness had the greatest impact on faculty adoption of tablet PCs, while Shan et al. (2006) found that performance expectancy, social influence, and facilitating conditions each played a comparable role in determining supplier adoption of electronic marketplaces. Thus, while UTAUT seems a comprehensive and promising foundation

for explaining IS acceptance, more work is needed to explore and validate UTAUT relationships in additional contexts.

### *2.2.3 Summary: IS Acceptance and Use*

IS acceptance research has addressed a multitude of factors that impact initial acceptance and use of IS. A plethora of theoretical models have been proposed and empirically tested, and the field has moved toward integration of these perspectives via the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). However, with few exceptions (e.g. Bhattacharjee, 2001; Karahanna et al., 1999), IS acceptance research has focused primarily on the initial adoption decision and early use behaviors. Moreover, studies that do examine prolonged use behavior continue to operationalize the construct in terms of overall quantity of IS use as opposed to quality of use (e.g. infusion). Because today's organizations rely increasingly on deep and sustained use of complex IS, increased attention is now turning to issues that affect these outcomes (Boudreau and Seligman, 2005; Jaspersen et al., 2005). The next section reviews the literature on IS adaptation, a growing body of research suggesting that user adaptation to a new workplace IS critically impacts its degree of integration and, consequently, the degree to which it provides individual and organizational benefit.

## **2.3 IS Adaptation**

### *2.3.1 Overview*

The IS adaptation process has been the subject of several studies over the past few years. Theories such as punctuated-equilibrium (Lassila and Brancheau, 1999; Orlikowski, 1996), adaptive structuration (DeSanctis and Poole, 1994), and situated

change (Orlikowski, 1996) have been applied to better understand how technologies “not only adapt to existing organizational and industrial arrangements, but ... also transform the structure and practices of these environments” (Van De Ven, 1986, p. 591). Some research has investigated the degree to which a technology is changed during its adoption and implementation, (Clark, 1987; Ives and Olson, 1984; Leonard-Barton, 1988; Rice and Rogers, 1980). Other studies have focused on how users’ perceptions and attitudes (e.g. Majchrzak et al., 2000), and the work system and organizational structure (e.g. Sokol, 1994; Tyre and Orlikowski, 1996) are adapted by the IT implementation.

In the late 1980s, Leonard-Barton (1988) observed that, up to that time, most studies of adaptation had focused exclusively on either how the technology could be adjusted to its environment or how the environment is shaped by the technology, prompting her to combine the two perspectives and propose a process of “mutual adaptation” (p. 253). Later studies have advanced the common theme that the adaptation process occurs as a process of reciprocal adjustment among three components: the user, the technology, and the work task (Beaudry and Pinsonneault, 2005b; Orlikowski, 1996). When a new IT system is introduced users may engage in adaptation behaviors targeted at each of these dimensions. For example, users may adapt the work task by modifying work routines and procedures. The IT system may also be adapted to better fit the needs of users in particular situations. Finally, users may engage in behaviors directed at adapting themselves, such as attending training sessions or seeking additional knowledge through support documentation.

While users may engage in any combination of the above adaptation behaviors, the determinants of these behaviors and their effects on IT use are not well understood. As Leonard-Barton (1988) points out, “adaptation does not necessarily occur in equal proportions to both technology and organization” (p. 253). In some cases, users may tend toward changing the technology to fit their current work tasks, while in other situations they may change work tasks to fit the new technology. Studies of adaptation, while generally agreeing that adaptation involves the adjustment of several structures (e.g. task, system, self), have not reached consensus on the nature of this adaptation (Majchrzak et al., 2000) or how different types of adaptation affect subsequent use of information systems.

### *2.3.2 Preconditions of Adaptation*

In addition to understanding how adaptation behaviors affect subsequent use, organizations have a strong incentive to better understand what factors influence user adaptation behaviors. Adaptive structuration theory (DeSanctis and Poole, 1994) suggests that adaptive behaviors are not deterministic, but instead are constrained by existing contextual structures (e.g. work tasks, technology) in the environment. The adaptation process, according to this theory, consists of modification and reshaping of these structures through a series of actions termed appropriations, which serve to form new patterns of interaction and purpose in using the technology. In a similar vein, Leonard-Barton’s (1988) misalignment model of user adaptation posits that adaptation is driven by misalignments in the technology, the user organization infrastructure (delivery system), and the job performance criteria (value). The adaptation process consists of a

series of adaptive iterations aimed at incrementally rectifying these misalignments. In both of these models, environmental structures are both constraints to and targets of the adaptation process.

Although adaptation models generally agree that the adaptation process involves the modification of various structures, there is little insight regarding how adaptation occurs in terms of which structures are modified. Majchrzak et al. (2000) observes that modification of structures during adaptation may not depend on the structures themselves as much as how malleable the structures are in a given context. Based on their study of a virtual team using a collaborative technology, they proposed that the malleability of structures is an important factor mediating the influence of structures on appropriation (adaptation) activities.

Other studies of adaptation shed additional light on factors that may influence user's adaptation behaviors. Orlikowski and Gash (1994) argue that understanding how individuals interpret a technology is important in understanding how they interact with it. They proposed the notion of "technological frames" as "cognitive structures or mental frames that are held by individuals" (p. 178). Using this lens, Boffo and Barki (2003) propose two dimensions that are salient in determining technological frames and consequent adaptation behaviors: Power and Compatibility. Power reflects "how powerful (or powerless) an individual feels with respect to an IS which has been implemented in his or her organization" (p. 7). Compatibility reflects "how compatible an individual perceives an IS to be with the tasks he or she needs to accomplish in her job" (p. 8). Boffo and Barki argue that adaptation behaviors (termed *adaptive use* and

*learning use* in their work) will be influenced by the degree to which users feel they possess power and the degree to which users feel the new IT is compatible with their work.

### *2.3.3 Summary: IS Adaptation*

In summary, research on IS adaptation has demonstrated that modification of the user, the IS, and the work context are key factors governing the successful implementation and integration of IS into an organization's work systems. However, this body of research has not produced a comprehensive theoretical framework for understanding patterns of individual adaptation behaviors and how these behaviors impact subsequent IS use. Recently, coping theory has emerged as a promising foundation for understanding users' varied post-adoptive reactions to an IS (Beaudry and Pinsonneault, 2005b). Coping theory provides a general framework for understanding how individuals respond to disruptive events in their environment (Beaudry and Pinsonneault, 2005b; Lazarus and Folkman, 1984), and has recently been adopted by IS researchers seeking to understand users' reactions to new workplace IS. The next section presents an overview of general coping literature, with particular emphasis on the most prevalent model of coping behavior, the transactional coping model. This review is followed by a summary of coping research in the IS domain, specifically Beaudry and Pinsonneault's (2005b) Coping Model of User Adaptation.

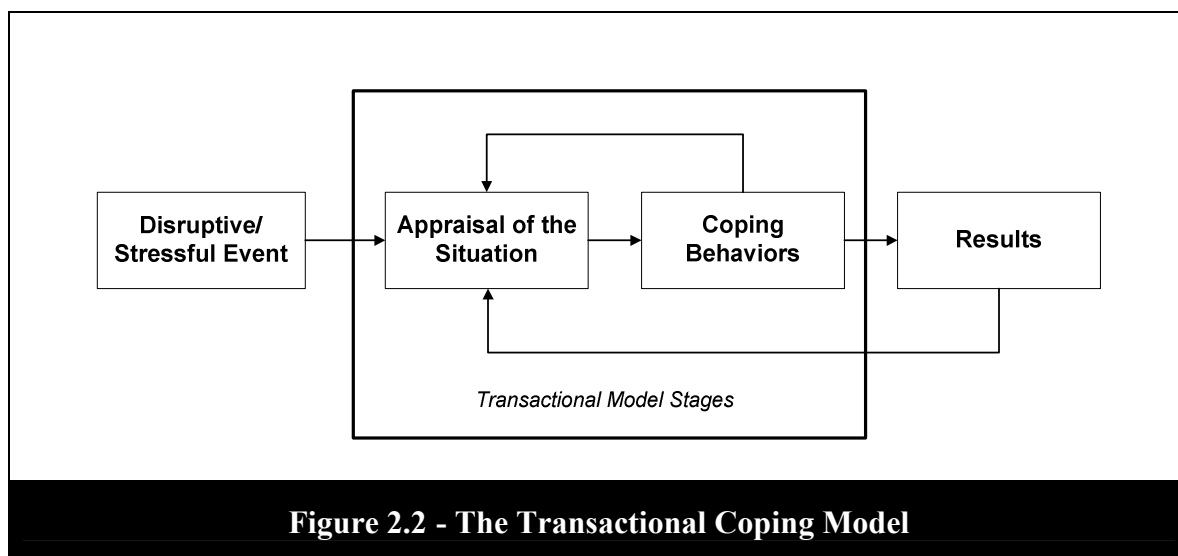
## **2.4 Coping**

### *2.4.1 General Coping Research*

Coping has been defined as “the cognitive and behavioral efforts to manage specific internal or external demands that are appraised as taxing or exceeding the resources of the person.” (Lazarus and Folkman, 1984, p. 141). The study of coping has produced a voluminous literature in psychology over the past several decades. Drawing from early Freudian work on psychological defense, research on human adaptive responses to stress began to coalesce under the term “coping” in the 1960s , most notably with Lazarus’s (1966) seminal work *Psychological Stress and the Coping Process* (Parker and Endler, 1996). Since that time, an immense proliferation of coping research has theoretically and empirically examined the adaptive mechanisms individuals employ in response to stressful situations. A recent study reported in excess of 17,000 published articles in response to a Social Citation Index search on “coping” (Duhachek, 2005). A detailed exposition of this literature is beyond the scope of the present study; however, excellent reviews can be found from Folkman (1992) and Skinner et al. (2003)

The most predominant and widely accepted theory of coping is the transactional model (Folkman and Lazarus, 1985; Lazarus and Folkman, 1984) that describes coping as an evolving process of cognitive appraisal of a situation followed by behaviors aimed at handling the situation and/or reducing stress. The transactional model adopts a situational view of coping, arguing that coping responses change “over time and in accordance with the situational contexts in which [they] occur” (Lazarus, 1993, p. 235).

The transactional model identifies two primary stages of the coping process, which are identified in Figure 2.2 and discussed further in the following paragraphs.



**Figure 2.2 - The Transactional Coping Model**

As shown in Figure 2.2, the coping process begins when a person confronts or becomes aware of a potentially disruptive or stressful event. According to the transactional model, an individual first evaluates the potential consequences of the situation through a process of cognitive appraisal. Appraisal is defined as “the process of categorizing an encounter, and its various facets, with respect to its significance for well-being” (Lazarus and Folkman, 1984, p. 31). Appraisal is central to coping because it is during this process that the individual assesses what is at stake in the situation and what can be done about it. Appraisal influences coping responses which, in turn, influence situational outcomes (Kessler, 1998; Lazarus and Folkman, 1984; McRae, 1984).

Appraisal is divided into two conceptual subprocesses termed primary and secondary appraisal. Table 2.3 summarizes these subprocesses and their potential outcomes. During primary appraisal, the individual assesses what is personally at stake

in the situation. Three general primary appraisal outcomes are identified by the transactional model: irrelevant, benign/positive, and stress (Lazarus and Folkman, 1984). Irrelevant appraisals occur when the individual has no investment in the outcomes of the situation. For example, modification to an organization's management structure may be appraised as irrelevant by an individual whose job stakes are not affected by the change. Benign/positive appraisals occur when the individual evaluates the situation as positive or conducive to enhanced well-being. A more streamlined management structure, for example, may be appraised as benign/positive by an individual whose job autonomy will be enhanced by the change. Stress appraisals occur when the situation is perceived to harm, threaten or challenge the individual's well being. A stressful situation is appraised as harmful if it has already resulted in damage or loss, or as a threat if it seems likely to do so. Conversely, a stressful situation may be appraised as a challenge if the individual evaluates the situation as an opportunity for gain or growth.

While primary appraisal addresses what is at stake in a situation, secondary appraisal concerns what coping options are available to respond to the situation. Secondary appraisal involves an assessment of personal, social, psychological, emotional, and physical resources that can be applied to the problem. Because the evaluation of these resources will determine the coping options available to the individual, secondary appraisal is a key factor in determining coping behaviors (Lazarus and Folkman, 1984). Coping researchers have generally assessed secondary appraisal outcomes by asking individuals to identify an event as one that they (a) could change or do something about, (b) had to accept or get used to, (c) needed to know more about before they could act, or

(d) had to hold themselves back from doing what they wanted to do (Coyne et al., 1981; Folkman et al., 1986a; Lazarus and Folkman, 1984; Parkes, 1984).

<b>Table 2.3 - Cognitive Appraisals</b>			
<b>Type</b>	<b>Summary Question</b>	<b>Outcomes</b>	
Primary Appraisal	What is at stake for me in this situation?	<b>Irrelevant:</b> Situation carries no implication for the person's well-being	
		<b>Benign/positive:</b> Situation construed as positive; preserves or enhances person's well-being	
		<b>Stress</b>	<b>Harm:</b> Situation has resulted in some damage or loss to the person
			<b>Threat:</b> Situation involves harm/loss that has not yet taken place, but is anticipated
			<b>Challenge:</b> Situation is regarded as an opportunity for gain or growth
Secondary Appraisal	What can I do about it?	Can change or do something about Have to accept or get used to Need to know more before acting Have to hold back from doing what is wanted	

Following appraisal, the individual engages in coping behaviors to deal with the situation. Coping behaviors include both cognitive and behavioral efforts to manage the stressful event and its effect on the individual. The transactional model categorizes both cognitive and behavioral coping behaviors as problem-focused or emotion-focused. Problem-focused coping behaviors aim to manage the disruptive event by altering external aspects of the situation such as environmental pressures or constraints, barriers, resources, or procedures (Lazarus and Folkman, 1984). Problem-focused behaviors may also be directed toward the self through such acts as developing new standards of behavior, shifting aspirations, or learning new skills and procedures (Lazarus and

Folkman, 1984). Emotion-focused coping, on the other hand, focuses on the self but does not alter external elements. Instead, emotion-focused behaviors are directed toward reducing emotional distress and restoring or maintaining a sense of internal equilibrium. Emotion-focused coping efforts may include such behavior as avoidance, minimization of perceived consequences, distancing, or wishful thinking (Lazarus and Folkman, 1984).

As noted earlier, the combination of problem- and emotion-focused coping efforts employed by an individual depends on the appraisal of the situation. Beaudry and Pinsonneault (2005b) observe that “Individuals tend to choose the coping strategy that promises the greater chance of success and the restoration of a sense of well being” (p. 496). Coping research has suggested that individuals tend to employ problem-focused adaptation behaviors when they appraise the event in a positive light (primary appraisal) and/or when they feel they have control over the situation (secondary appraisal) (Lazarus and Folkman, 1984). Conversely, when a situation is perceived as negative or outside of the person’s control, emotion-focused efforts tend to be more prevalent (Lazarus and Folkman, 1984).

The categorization of coping behaviors as problem- or emotion-focused is not the only extant categorization of coping behaviors. Coping researchers have proposed several other categorization systems derived from either a conceptual, top-down approach (e.g. Lazarus and Folkman, 1984; Moos and Billings, 1982), or an empirical, bottom-up approach (e.g. Aldwin and Revenson, 1987; Parkes, 1984). These schemes exhibit wide variety in the number of categories identified, ranging from two or three categories to several dozen (Skinner et al., 2003). Some of the more common of these include

approach vs. avoidance (Roth and Cohen, 1986), behavioral vs. cognitive (Latack and Havlovic, 1992), control vs. escape (Latack and Havlovic, 1992), and engagement vs. disengagement (Compas et al., 2001) to name a few. The number and breadth of these frameworks attest to the maturity of coping research as well as a theoretical divergence in the field. Nevertheless, despite some criticisms (Lazarus, 1996; Skinner et al., 2003), the emotion- and problem-focused distinction remains the most common and widely accepted framework for understanding coping behaviors (Hunter and Boyle, 2004; Moos and Billings, 1982).

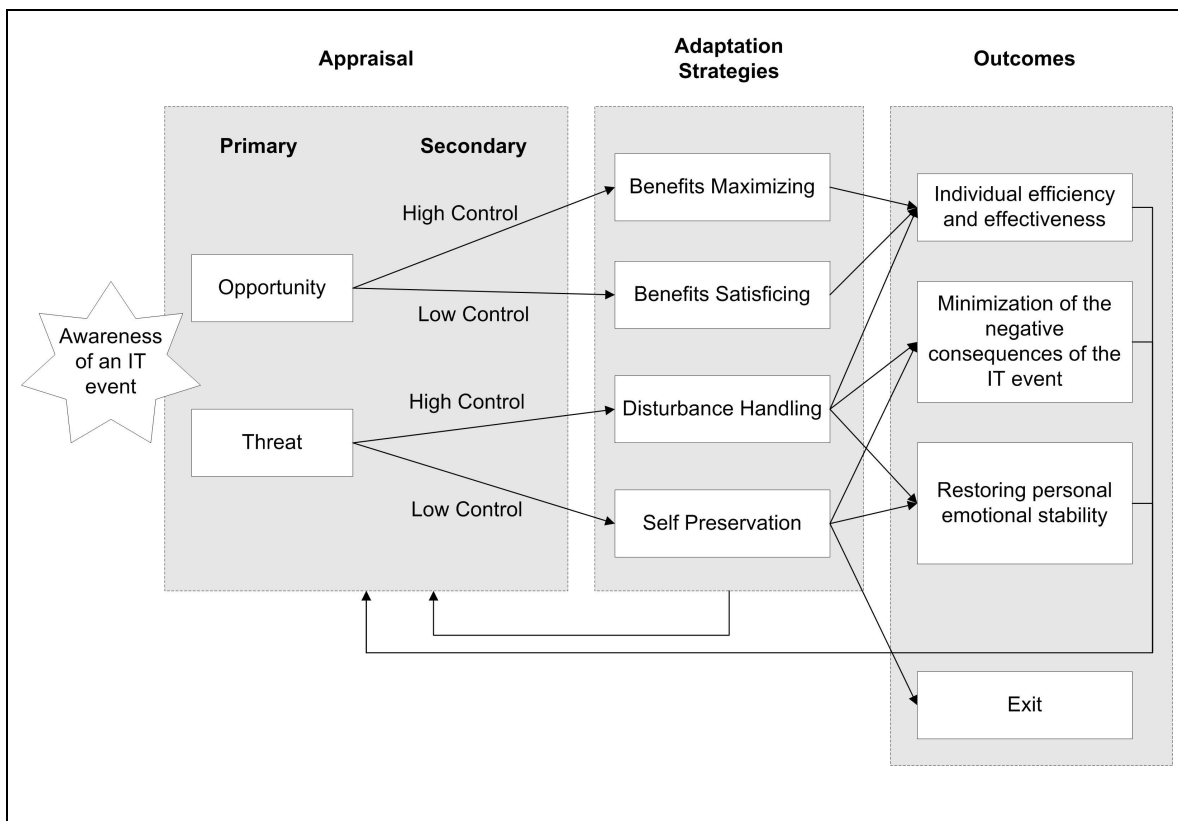
#### *2.4.2 IS-Specific Coping Research*

End users can react to a new information system in many different ways. For instance, if an individual does not foresee a significant personal impact from the introduction of an IS, she may deem it largely irrelevant to her personal well-being. If she believes that the IS offers benefits such as improved work effectiveness or efficiency, or if there is considerable social support for the IS, the user is likely to perceive it positively (Davis, 1989; Moore and Benbasat, 1991; Taylor and Todd, 1995a; Taylor and Todd, 1995b; Venkatesh et al., 2003). Conversely, a belief that the IS will hamper productivity or be difficult to use will likely induce a stress reaction to the IS. These reactions can produce various patterns of IS use behaviors. For example, an individual who feels threatened by a new workplace IS and sees limited options for responding positively may learn only basic IS functions and, consequently, engage in superficial or perfunctory use that produces minimal performance benefits. In contrast, an individual who perceives the IS as a challenge and feels empowered to respond positively will be

more likely to adapt her work procedures in order to take full advantage of the IS's capabilities. Research has suggested that these types of affective reactions to an IS more strongly determine post-adoptive behaviors than do mere cognitive beliefs (Bhattacharjee, 2001) or intention to use the IS, particularly in mandated use contexts involving complex systems (Brown et al., 2002). However, until recently an integrated theoretical foundation for understanding these types of reactions had not emerged in the IS literature.

Building on key concepts from the technology acceptance and adaptation literatures, Beaudry and Pinsonneault (2005b) recently proposed the Coping Model of User Adaptation (CMUA) to explain how IS users "restore emotional stability, modify their tasks, reinvent and adapt the technology, or even resist it" (p. 494). CMUA (shown in Figure 2.3) posits that the adaptation process occurs as users cope with the occurrence of an "IT event" in their work environment (Beaudry and Pinsonneault, 2005b). CMUA involves 3 stages. First, the user engages in primary appraisal as she assesses whether the IT event constitutes an opportunity or a threat. Second, during secondary appraisal the user assesses her degree of control over her environment. Finally, based on the primary and secondary appraisals, the user engages in various adaptation behaviors to deal with the IT event. Adaptation behaviors may be problem-focused or emotion focused. Problem-focused adaptation behaviors are oriented toward modifying any of three contextual elements: the IS-enabled work task, the individual, or the IS itself. Emotion-focused adaptation behaviors, on the other hand, focus only on the self, and aim to restore

internal emotional stability rather than to alter the external situation. Table 2.4 provides examples of problem- and emotion-focused adaptation behaviors in an IS context.



**Figure 2.3 - The Coping Model of User Adaptation (CMUA), adapted from Beaudry and Pinsonneault (2005b)**

<b>Table 2.4 - Types of Adaptation Behaviors</b>	
<b>Type of Adaptation</b>	<b>Example Behaviors</b>
Work Task	Modifying operational procedures; Streamlining work tasks
IT System	Modifying, adding, deleting screens; Personalizing the IT; Changing functionalities during implementation
Self (problem focused)	Attending training; Seeking help from colleagues; Spending time practicing using the system
Self (emotion focused)	Minimizing perceived negative consequences; Making positive comparisons with others; Engaging in selective attention, avoidance, or distancing (reducing involvement in work)

CMUA identifies four high-level coping strategies that are based upon primary and secondary appraisal outcomes and characterized by various combinations of problem- and emotion-focused adaptation behaviors. These strategies are termed benefits maximizing, benefits satisficing, disturbance handling, and self-preservation. The first two strategies, benefits maximizing and benefits satisficing, occur when the individual views the IS as an opportunity. If such an individual has control over her work environment, she is likely to engage in problem-focused adaptation behaviors that allow her to derive maximum advantage from the capabilities offered by the IS (benefits maximizing). On the other hand, if the individual has little control over her work environment, both problem- and emotion-focused adaptation behaviors are likely to be limited. In this case, the user employs a benefits satisficing strategy by passively accepting the benefits offered by the IS without proactively adapting to it.

The next two adaptation strategies, disturbance handling and self preservation, occur when the individual views the IS as a threat. If such an individual retains a high degree of control over her work environment, she will likely engage in problem-focused adaptation behaviors to mitigate the potential harm deriving from the IS. In addition, she is likely to engage in emotion-focused adaptation behaviors to minimize perceived negative consequences and restore emotional stability. CMUA terms this strategy disturbance handling. If, on the other hand, the individual has limited control over her work environment, she must rely solely on emotion-focused adaptation behaviors since she can do very little to alter her environment. CMUA labels this strategy as self-preservation.

CMUA asserts that the specific combinations of problem- and emotion-focused adaptation behaviors employed by an individual will impact individual-level outcomes, including individual efficiency and effectiveness, minimization of the perceived negative consequences of the IT event, and restoration of personal emotional stability. Adaptation strategies that involve problem-focused behaviors are likely to result in improved efficiency and effectiveness in using the IS to perform work tasks, while adaptation strategies that involve emotion-focused behaviors are likely to result in minimization of the negative consequences of the IS and restored emotional stability. In extreme cases when a user feels severely threatened by an IS and completely unable to cope, she may withdraw from the situation entirely by, for example, requesting a transfer, quitting a job, or retiring (Begley, 1998).

The current research adopts CMUA as a useful lens for understanding user reactions to a new workplace IS and builds upon it in two ways. First, the current research empirically examines key aspects of CMUA, which, owing to its nascence in the literature, has not yet undergone empirical validation. Although Beaudry and Pinsonneault (2005b) illustrate the tenets of the model using qualitative case evidence from two IS implementations in North American banks, they note the need for further testing, in particular with “large scale studies involving numerous users” (p. 519). Second, this research examines antecedents to IS appraisal and additional consequences (e.g. infusion) resulting from various types of adaptation behaviors, thus expanding the scope of CMUA and positioning it within a larger nomological network linking key IS

perceptions to IS use behavior. These contributions are detailed further in the following chapter.

#### *2.4.3 Summary: Coping*

In summary, coping theory provides a useful lens for understanding user responses to a new IS, which can often be perceived as disruptive or stressful. Drawing on principles from the transactional coping model and CMUA, this research argues that user appraisal of a workplace IS can determine the way the user adapts to it and, consequently, the degree to which it is infused in the user's work processes.

### **2.5 Chapter Summary**

The IS literature clearly highlights IS use, adaptation, and infusion as important phenomena in IS implementation contexts. Long term viability of an organizational IS critically depends on how well individual users adapt to it and how deeply they infuse it in their work practices. However, a cohesive theoretical framework for describing how IS use and individual adaptation behaviors lead to (or detract from) individual-level IS infusion has not yet emerged. Drawing on themes from the literature reviewed in this chapter, the next chapter develops a theoretical model of individual-level IS infusion, and presents research hypotheses to be tested.

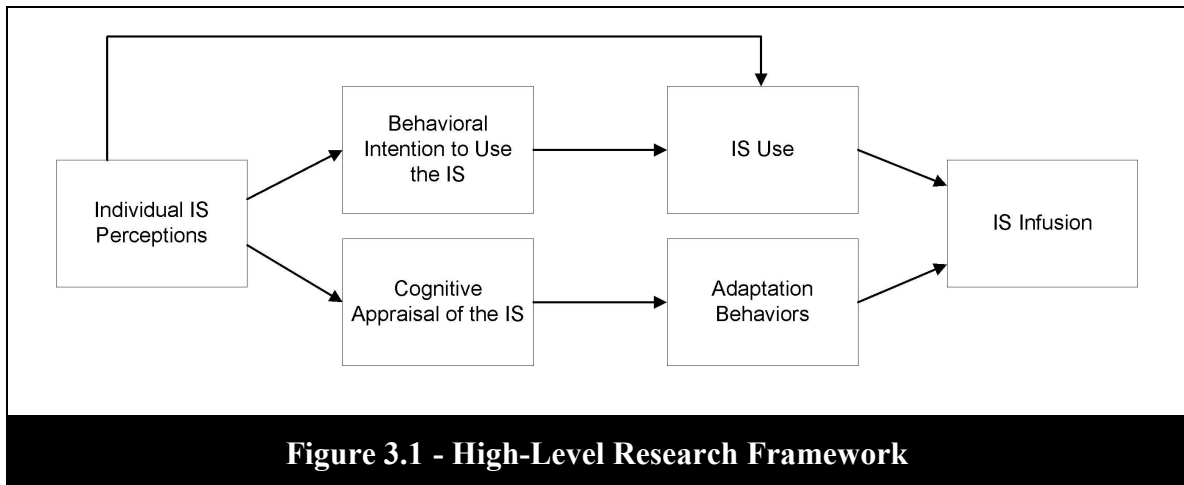
## **CHAPTER 3**

### **RESEARCH MODEL**

This chapter presents the theoretical model to be investigated in this research. The chapter is organized as follows. First, the high level research framework is presented. Each of the framework's constructs is then elaborated to form the testable research model, and hypothesized relationships between the constructs are developed. Table 3.1 summarizes these hypotheses.

#### **3.1 High-Level Research Framework**

Drawing from research discussed in the previous chapter, Figure 3.1 depicts the high-level research framework to be tested. The dependent variable of the framework is infusion of an information system at the individual level. This infusion is dependent on both use of the IS and adaptation behaviors engaged in by the individual. Consistent with IS acceptance and coping theories, IS use is determined by behavioral intention to use the IS, while adaptation behaviors are influenced by cognitive appraisal of the IS. Behavioral intention and IS appraisal are, in turn, shaped by key individual IS perceptions. The framework integrates prior research in the areas of infusion (Cooper and Zmud, 1990; Saga and Zmud, 1994), adaptation (Beaudry and Pinsonneault, 2005b), and adoption of information systems (e.g. Venkatesh et al., 2003), and is consistent with emergent conceptualizations of post-adoptive behavior (Boudreau and Seligman, 2005; Jaspersen et al., 2005).



## 3.2 Construct and Hypothesis Development

### 3.2.1 IS Infusion

As noted in the previous chapter, most studies of IS infusion have defined the construct at an organizational level (e.g. Cooper and Zmud, 1990; Winston and Dologite, 1999). Since the present unit of analysis is the individual, this study adopts a definition of infusion integrated from prior research with slight modification to emphasize the individual as the unit of analysis. IS infusion is defined herein as the extent to which an information system is fully embedded in an individual's work system, and is used completely and effectively in order to improve the individual's performance (Cooper and Zmud, 1990; Saga and Zmud, 1994; Sullivan, 1985; Wynekoop and Senn, 1992). This definition highlights both the depth of use that characterizes infused systems and the performance benefits that are expected to accrue from such infusion.

Because of the individual-level focus of this study, the measure of IS infusion should focus on individual use behaviors. Saga and Zmud's (1994) conceptualization of extended, integrative, and emergent use behaviors is well established in the literature and

seems appropriate for measuring individual-level infusion. As noted in the previous chapter, extended use refers to “using more of the technology’s features in order to accommodate a more comprehensive set of work tasks” (p. 80), integrative use involves “using the technology to establish or enhance flow linkages among a set of work tasks” (p. 80), and emergent use refers to “using the technology in order to accomplish tasks that were not feasible or recognized prior to the application of the technology to the work system” (p. 80). According to Saga and Zmud, each or any of these behaviors represents a pathway to a higher level of IS use, and thus a means through which infusion is realized.

### *3.2.2 IS Use*

IS use is defined as the extent to which the user utilizes the IS in accomplishing work tasks. IS use has been a central and recurrent theme in many studies, and has typically been defined in terms of frequency, intensity, and duration of use (Barki et al., 2005; Burton-Jones and Straub, 2006; Jaspersen et al., 2005; Trice and Treacy, 1988; Venkatesh et al., 2003). While these quantitative measures alone are insufficient for capturing the complexity of post-adoptive use outcomes such as infusion (Chin and Marcolin, 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 routinization of use behaviors over time, or the degree to which the use of the IS has become standardized and is perceived as normal by users. Routinization 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 electronic scanner

technology was a necessary condition for its infusion. Based on these observations, the following are hypothesized:

*H1a: Frequency of IS use will be positively related to routinization of IS use*

*H1b: Routinization of IS use will be positively related to IS infusion*

### 3.2.3 Adaptation Behaviors

Users may engage in a wide variety of adaptation behaviors in response to the introduction of a new information system (Griffith, 1999; Pinsonneault and Rivard, 1998). CMUA (Beaudry and Pinsonneault, 2005b) provides a theoretical basis for understanding how users adapt to new information systems, and therefore constitutes a useful framework for guiding this research. As in CMUA, adaptation behaviors are defined herein as “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).

Based on their review of the IS adaptation literature, Beaudry and Pinsonneault (2005b) assert that adaptation behaviors can be targeted toward any of three dimensions of the IS implementation context: the user, the technology (information system) and the work system (work processes). Framing these dimensions in terms of coping theory, Beaudry and Pinsonneault propose a typology of adaptation behaviors, which, at a broad level, includes problem-focused behaviors and emotion-focused behaviors.

#### 3.2.3.1 Problem-Focused Adaptation Behaviors

Problem-focused adaptation behaviors are “directed at managing or altering the problem causing the distress” (Lazarus and Folkman, 1984, p. 150) and focus on altering the external environment. Beaudry and Pinsonneault (2005b) describe how problem-

focused adaptation behaviors in response to a new workplace IS may alter the work task, the user, or the IS itself:

Problem-focused adaptation aims at managing the issues associated with the IT event directly by (1) adapting one's self such as adjusting personal habits to fit the requirements of the technology (Orlikowski, 1996; Tyre and Orlikowski, 1994), learning new skills (Tyre and Orlikowski, 1994), and adjusting work commitment (Majchrzak and Cotton, 1998); (2) adapting the work by modifying procedures and routines (Sokol, 1994; Tyre and Orlikowski, 1996); and/or (3) adapting the technology by changing its functionalities and features (Clark, 1987; Leonard-Barton, 1988; Rice and Rogers, 1980) (p. 500).

CMUA (Beaudry and Pinsonneault, 2005b) posits that problem-focused adaptation behaviors will result in increased individual efficiency and effectiveness. Qualitative data from interviews with nine bank account managers provided some support for this proposition. However, Beaudry and Pinsonneault (2005b) did not examine infusion of the new information system and, thus, did not shed light on the role of infusion as an antecedent to these outcomes or as a consequence of adaptation behaviors.

The concept of infusion implies that the user of the information system 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 work task, IS, or the user herself (e.g. problem-focused adaptation behaviors) should have a positive impact on the degree to which the information system is infused at the individual level. In other words, users who respond to the "IT event" by actively adapting themselves, their work processes, and the IS itself should be more likely to reach higher levels of infusion than those who fail to so adapt. This notion is endorsed by Saga and Zmud (1994), who identify reconceptualization of work processes as a key infusion enabler,

noting that “in order to fully leverage an organization’s IT investments, core work processes must be reengineered to account for increasing technological capabilities” (p. 79). Corroborating this perspective, the growing body of IS adaptation literature has demonstrated that progressively higher levels of IS integration occur as individuals and organizations modify their environments to take advantage of the IS’s capabilities (Lassila and Brancheau, 1999; Majchrzak et al., 2000; Orlikowski, 2000; Orlikowski and Gash, 1994). This literature prompts the following hypothesized relationship between problem-focused adaptation and infusion:

*H2: Problem-focused adaptation behaviors directed toward changing the work task, the IS, and the individual will relate positively to individual-level IS infusion*

### 3.2.3.2 Emotion-Focused Adaptation Behaviors

Emotion-focused adaptation behaviors are “directed at regulating emotional response to the problem” (Lazarus and Folkman, 1984). Unlike problem-focused adaptation behaviors, emotion-focused behaviors are directed toward the inner self, and do not directly alter external aspects of the situation. Coping studies exhibit substantial variance in the number and types of emotion-focused adaptation behaviors they identify. However, a synthesis of this literature (Hunter and Boyle, 2004; Skinner et al., 2003) reveals that common emotion-focused coping behaviors include seeking social support, positive reappraisal, wishful thinking, distancing, and escape/avoidance. In the IS domain, these behaviors aim toward changing or regulating the individual’s affective response to the information system. According to Beaudry and Pinsonneault (2005b):

Emotion-focused adaptation is oriented toward one’s self and aims at changing one’s perception of the consequences of the IT event or at reducing emotional distress. Emotion-focused adaptation includes self-deception and avoidance (e.g.,

denying that the IT affects one, acting as if the IT event had not occurred; (Zuboff, 1988)), minimization of the consequences of the IT event, selective attention (e.g. removing thoughts of the event), positive comparison (e.g. comparing oneself to other users who are more badly affected by the event; (Lazarus and Folkman, 1984)), and passive acceptance (e.g. accepting the IT event as a fact of life by changing beliefs and attitudes; (Tyre and Orlikowski, 1994; 1996)) (p. 500).

Although emotion-focused adaptation behaviors do not directly alter the external environment, their effect on IS infusion is not entirely clear. In general, emotion-focused behaviors have traditionally been associated with sub-optimal coping adjustment, while problem-focused behaviors have been linked to more positive results (e.g. Carver et al., 1989; Causey and Dubow, 1992; Ebata and Moos, 1991; Endler and Parker, 1990). For example, behaviors such as avoidance or wishful thinking, while potentially helpful for regulating emotional response, are not likely to produce positive external outcomes. However, the restoration of emotional equilibrium afforded by some emotion-focused behaviors may establish a foundation for achieving positive coping results. As noted by Beaudry and Pinsonneault (2005b), “[Restoration of emotional stability] might be a required step before [an IS user] can perform problem-focused adaptation efforts which will eventually increase operational efficiency and effectiveness” (p. 518). To illustrate, seeking social support, a commonly studied emotion focused adaptation behavior, may not only promote a sense of internal well-being, but also empower the individual to respond to a stressor in productive ways (Carver et al., 1989).

To distinguish the effects of various emotion-focused adaptation behaviors on infusion, this research draws upon another well-known categorization of coping

behaviors: approach vs. avoidance.<sup>1</sup> Approach coping behaviors are oriented toward the source of stress, while avoidance coping behaviors are oriented away from it (Roth and Cohen, 1986). Ebata and Moos (1991) describe approach strategies as “cognitive attempts to change ways of thinking about the problem and behavioral attempts to resolve events by dealing directly with the problem or its aftermath” (p. 34). Approach oriented emotion-focused adaptation strategies include such acts as seeking social support from others or reappraising the stressor in a positive light. In contrast, avoidance strategies are described as “cognitive attempts to deny or minimize threat, and behavioral attempts to get away from or avoid confronting the situation...” (Ebata and Moos, 1991, p. 34), and include escape/avoidance, wishful thinking, or distancing.

Prior research has generally shown that approach-oriented coping behaviors produce better adjustment outcomes than do avoidance-oriented behaviors (Billings and Moos, 1981; Folkman and Lazarus, 1980). In the IS domain, Beaudry and Pinsonneault (2005b) make a similar argument based on their observation of users who (a) achieved increasing performance benefits of deeper use sparked by positive reappraisal of the system (approach-oriented behaviors), or (b) tried to minimize their learning and use of the IS and, consequently, engaged in superficial use yielding few performance benefits (avoidance-oriented behaviors). Correspondingly, this research posits that approach emotion-focused adaptation behaviors with respect to a new workplace IS will promote

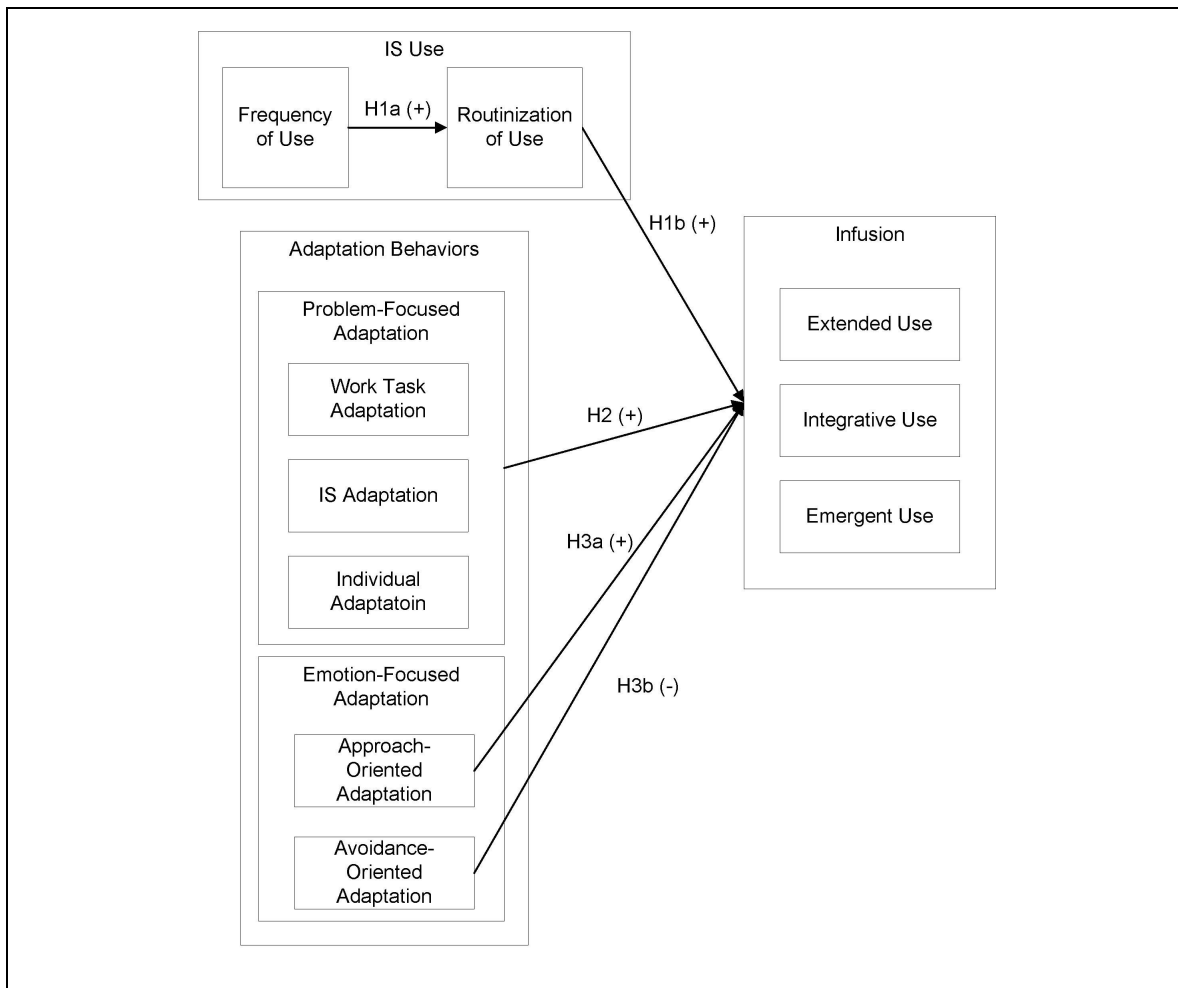
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<sup>1</sup> The approach/avoidance distinction is not necessarily confined to emotion-focused adaptation behaviors. For instance, an individual may alter the troubled person-environment relationship by engaging in active resistance or complete withdrawal from the situation. However, because this research focuses solely on approach oriented problem-focused adaptation behaviors as identified in CMUA, the distinction is invoked here only for emotion-focused behaviors.

deeper and more integrative IS use (i.e. infusion), while avoidance behaviors will inhibit this outcome.

- H3a: Approach oriented emotion-focused adaptation behaviors will relate positively to individual-level IS infusion*
- H3b: Avoidance oriented emotion-focused adaptation behaviors will relate negatively to individual-level IS infusion*

In summary, prior research suggests that infusion depends on routinization of IS and user adaptation behaviors in response to it. Hypotheses H1-H3 are depicted graphically in Figure 3.2.



**Figure 3.2 - Hypothesized Effects of IS Use and Adaptation Behaviors on Infusion**

### 3.2.4 IS Appraisal

As noted in the previous chapter, the transactional coping model defines appraisal as “the process of categorizing an encounter, and its various facets, with respect to its significance for well-being” (Lazarus and Folkman, 1984, p. 31). Appraisal is composed of two fundamental evaluations: what is at stake in the situation (primary appraisal) and what can be done in response (secondary appraisal). Primary appraisal outcomes involve assessment of the situation as benign/positive, challenging, or threatening/harmful, while secondary appraisal outcomes include assessments of control in dealing with the situation.

Both primary and secondary appraisal outcomes affect adaptation behaviors. In terms of primary appraisal, events appraised as benign/positive are more likely to prompt problem-focused adaptation over emotion-focused adaptation because there is no menace to emotional well-being. Conversely, threatening circumstances are more likely to elicit emotion-focused responses that attempt to restore internal equilibrium (Folkman et al., 1986a; Lazarus and Folkman, 1984). Beaudry and Pinsonneault (2005b) note that “when individuals appraise an IT event as a threat, their efforts will be mostly oriented toward either diminishing emotional distress associated with the event or reducing the perceived negative consequences associated with it. ... On the other hand, adaptation efforts associated with positive appraisals can lead to actions aimed at improving operational and functional efficiency and effectiveness, which are likely to positively affect user performance” (pp. 518-519). Based on these arguments, the following are hypothesized:

*H4a: Appraisal of the IS as benign/positive will be positively associated with problem-focused adaptation behaviors*

*H4b: Appraisal of the IS as threatening/harmful will be positively associated with emotion-focused adaptation behaviors*

The third type of primary appraisal outcome, challenge, denotes elements of both benign/positive and threat/harm appraisals. Similar to threat, challenge appraisals evoke feelings of stress and uncertainty; however, challenge appraisals are also characterized by positive affective reactions such as eagerness, excitement or exhilaration (Lazarus and Folkman, 1984). For example, an IS user may feel a degree of stress associated with becoming a proficient IS user while simultaneously feeling enthusiastic about its potential to enhance her job performance. In such a case, both problem- and emotion-focused behaviors are likely to be operant, with the latter being characterized by approach, rather than avoidance, behaviors. Hence, the following are hypothesized:

*H4c: Appraisal of the IS as challenging will be positively associated with problem-focused adaptation behaviors*

*H4d: Appraisal of the IS as challenging will be positively associated with approach-oriented emotion-focused adaptation behaviors*

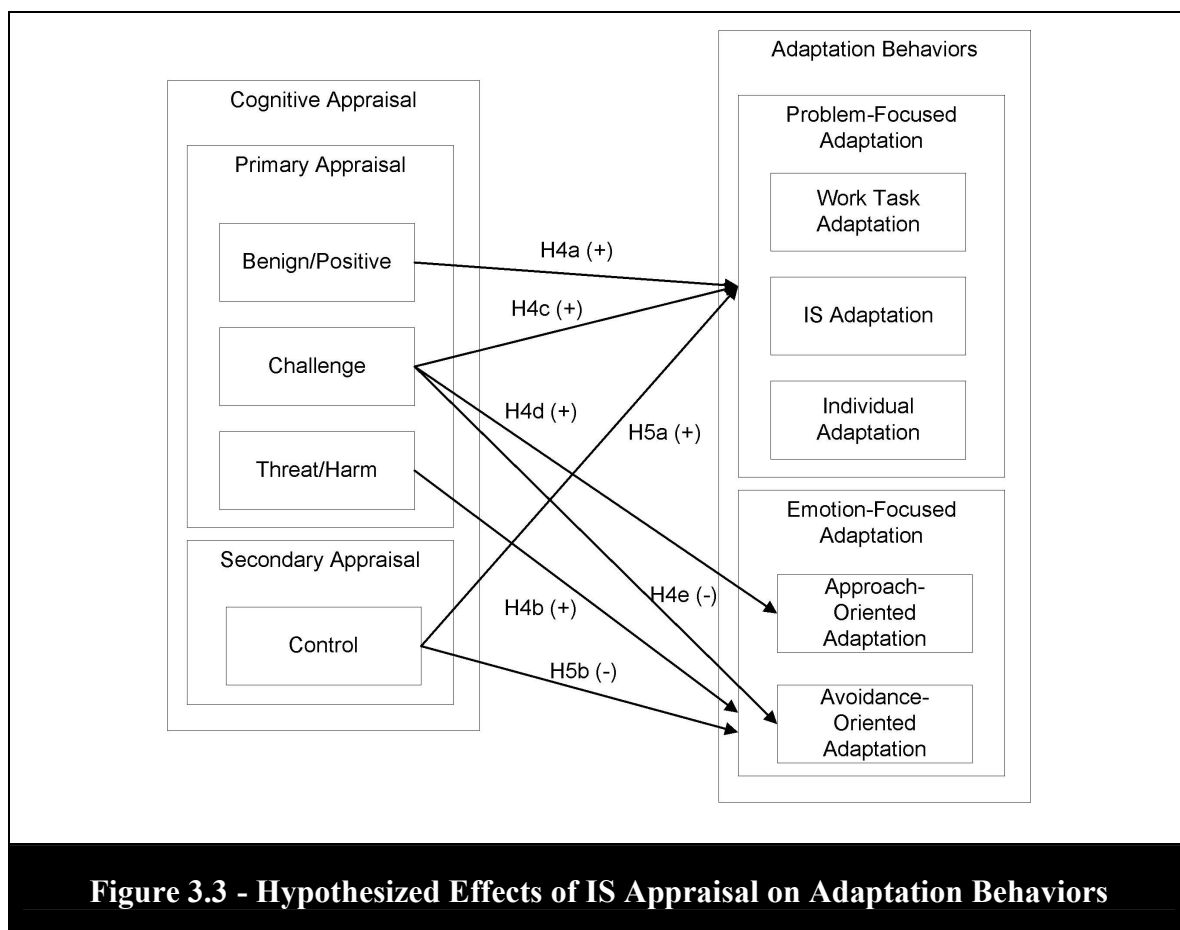
*H4e: Appraisal of the IS as challenging will be negatively associated with avoidance-oriented emotion-focused adaptation behaviors*

While primary appraisal deals with what is at stake in the situation, secondary appraisal concerns the degree of control the individual has over her environment. Coping research suggests that problem-focused adaptation efforts are most likely when an individual feels that she can do something to alter her circumstances, whereas emotion-focused adaptation efforts prevail in instances when individuals feel they have little or no control (Beaudry and Pinsonneault, 2005b; Lazarus and Folkman, 1984). This leads to the following hypotheses:

*H5a: High control appraisals with respect to an IS will be positively associated with problem-focused adaptation behaviors*

*H5b: High control appraisals with respect to an IS will be negatively associated with emotion-focused adaptation behaviors*

In summary, both primary and secondary appraisals of an IS are expected to influence individual adaptation behaviors in response to it. The hypotheses developed in this section are summarized in Figure 3.3.



### 3.2.5 IS Perceptions

Consistent with emerging recommendations of IS scholars, this research builds on recent adoption research to understand the factors that influence post-adoptive IS infusion. Following Jasperson et al. (2005), this study draws on the recent unified theory

of acceptance and use of technology (UTAUT) to identify important antecedents to both IS use and adaptation behaviors (Venkatesh et al., 2003). UTAUT posits that a collection of individual cognitions influences intention to use an IS (Venkatesh et al., 2003). The cognitions (performance expectancy, effort expectancy, social influence, and facilitating conditions) are synthesized from several theoretical models of technology acceptance that, while differing in their constructs, share the fundamental premise that reactions to using an IS will shape intention to use the IS and actual use behavior (e.g. Davis, 1989; Taylor and Todd, 1995a; Taylor and Todd, 1995b; Thompson et al., 1991). An important contribution of this research 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 appraisal of the IS and subsequent adaptation behaviors that promote or obstruct IS infusion. Although such a relationship has not been directly explored in theories such as UTAUT, the literature on post-adoptive behavior and adaptation suggests that these cognitions have an important role to play. For example, Jasperson 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). Moreover, while CMUA does not explicitly include factors that influence IS appraisal, Beaudry and Pinsonneault (2005b) suggest several factors that may contribute, such as understanding of the technology, perceived task-technology fit, and perceived compatibility with the users’ values, needs, and past experiences. These factors closely relate to cognitions within UTAUT’s categories of facilitating conditions and performance expectancy (Venkatesh et al., 2003). In addition, Beaudry and

Pinsonneault note that performance expectancy and social influence are likely to influence primary appraisal. In secondary appraisal, the user assesses “how much control they have over the IT event and what their adaptation options are given the resources available to them” (p. 499). This corresponds closely to facilitating conditions in UTAUT.

Noting the conceptual consistency across these studies, this research posits that IS perceptions identified in UTAUT will influence not only intention to use IS, but also appraisal of the IS. The following sections detail hypothesized effects of UTAUT perceptions on primary and secondary IS appraisals.

#### 3.2.5.1 Performance Expectancy

The first UTAUT perception is performance expectancy, the degree to which the individual believes that using the system will help her to attain gains in job performance (Venkatesh et al., 2003). Performance expectancy has been shown to be a key determinant in shaping an individual’s intention to use an IS, both in mandatory and voluntary settings (Agarwal and Prasad, 1998a; Brown et al., 2002; Compeau and Higgins, 1995; Davis et al., 1992). Because job security, compensation, and other benefits usually depend on satisfactory performance of job duties, the perceived impact of an IS on workplace productivity constitutes a substantial stake for a prospective user. Indeed, organizational psychology research has identified the introduction of new technology at work as a potential source of occupational stress (Arnetz, 1997; Kahn and Cooper, 1986; Korunka and Vitouch, 1999), with significant relationships existing between appraisal of the IS and performance-related professional efficacy outcomes such

as job self-confidence and goal attainment (Salanova and Schaufeli, 2000). An IS that is perceived to weaken or undermine satisfactory performance of job duties is likely to prompt negative reactions from user's whose job outcomes are contingent upon its use (Davis, 1989; Davis et al., 1989; Taylor and Todd, 1995a; Venkatesh and Davis, 2000). This observation is consistent with the findings of Beaudry and Pinsonneault (2005b), who noted that users who perceived favorably the instrumentality of the IS in performing their job duties were more inclined toward positive IS appraisals, while negative appraisals tended to emerge from those who felt their job performance was at risk. Accordingly, I postulate that when performance expectancy is low, the user is likely to judge the IS as threatening or harmful to success on the job. Conversely, when performance expectancy is high, the user is likely to view the IS in a positive light. Specifically, I hypothesize that performance expectancy of using an IS will be related to primary appraisal of the IS such that:

*H6a: Performance expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS*

*H6b: Performance expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS*

### 3.2.5.2 Social Influence

A second perception identified by UTAUT is social influence, or the degree to which an individual perceives that important others believe he or she should use the new system (Venkatesh et al., 2003). Research has shown that the impact of social influence on behavioral intention to use an IS is strongest in mandatory use settings (Hartwick and Barki, 1994), and early in the IS use period (Agarwal and Prasad, 1997; Hartwick and Barki, 1994; Karahanna et al., 1999; Venkatesh and Davis, 2000). Venkatesh and Davis

(2000) theorize that social influence occurs through the mechanisms of compliance, internalization, and identification. Compliance acts to directly change behavioral intention in response to social pressure without necessarily changing the individual's belief structure. Thus, an individual may comply with pressure to use an IS despite feeling that the IS is detrimental to success in the workplace. Internalization and identification, on the other hand, operate by modifying the individual's belief structure to fit with the beliefs of a referent other, or by enticement from potential social status gains. Because they alter IS perceptions (Venkatesh and Davis, 2000), internalization and identification are likely to influence IS appraisal. Kelman (1958) notes that internalization occurs "when an individual accepts influence because the content of the induced behavior—the ideas and actions of which it is composed—is intrinsically rewarding" (p. 53). Hence, an individual who internalizes signals from an important work referent that use of the system is beneficial should view the consequences resulting from IS use as positive, while, internalization of negative IS-related cues should produce an appraisal of the IS as threatening or harmful. In the case of identification, the individual accepts social influence not because of the intrinsic value of the behavior, but to "maintain a satisfying self-defining relationship to another person or a group... The individual actually believes in the responses which he adopts through identification... [but] he adopts the induced behavior because it is associated with the desired relationship" (Kelman, 1958, p. 53) Applying this notion to the context of IS, an individual seeking social reward from an important work referent should be more likely to appraise the IS positively if social gains or enhancements to the relationship will derive

from its use, but negatively if IS use threatens these outcomes. I therefore hypothesize that social influence (operating via internalization and identification) surrounding use of an IS will be related to primary appraisal of the IS such that:

*H7a: Social influence surrounding use of an IS will be positively related to benign/positive primary appraisal of the IS*

*H7b: Social influence surrounding use of an IS will be negatively related to threat/harm primary appraisal of the IS*

### 3.2.5.3 Effort Expectancy

Effort expectancy, the third perception identified by UTAUT, is defined as the degree of ease associated with use of the system (Venkatesh et al., 2003). Somewhat counter-intuitively, this definition means that *higher* effort expectancy results from *lower* perceived effort associated with use of the system. Effort expectancy (or a related construct) has been shown to be particularly salient prior to IS adoption and during early IS use (Davis, 1989; Thompson et al., 1991; Thompson et al., 1994), and less salient during later IS use (Karahanna et al., 1999; Venkatesh, 1999). This is expected because effort-related challenges associated with a new behavior decrease as the individual acquires more experience and expertise performing the behavior. However, in cases where mastery of a behavior requires sustained exertion, effort expectancy may be an ongoing concern. Difficulties associated with system use place increased demands on users who must use the IS to perform their jobs. Research on occupational stress has demonstrated that high job demands produce deleterious effects such as burnout, depression, and job dissatisfaction (Karasek, 1979; Karasek and Theorell, 1990; Van der Doef and Maes, 1999). IS research has confirmed these relationships, finding that high job demands associated with IS use resulted in increased work stress (Korunka et al.,

1997) and dissatisfaction (Shen and Gallivan, 2004) among IS users . In terms of appraisal, an IS user who must master an extended repertoire of IS features might feel that the required effort threatens or harms her ability to function on the job, while an individual who feels that the effort required to master the IS is within reasonable bounds should be more likely to appraise the IS as a benefit or a challenge. Supporting this notion, Boudreau and Seligman (2005) found that users' perceived ease of use of a complex workplace IS affected their satisfaction with the system and, consequently, the quality of their system use. Specifically, users who found the system prohibitively difficult to use were prone to frustration with the system that resulted in sub-optimal use outcomes. Correspondingly, I hypothesize that effort expectancy of using an IS will be related to primary appraisal of the IS such that:

*H8a: Effort expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS*

*H8b: Effort expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS*

In addition to influencing benign/positive and threat/harm IS appraisals, effort expectancy is also expected to play a role in appraising an IS as challenging. Challenge appraisals occur when an event is regarded as stressful, but also seen as an opportunity for gain or growth (Lazarus and Folkman, 1984). Hence, challenge appraisals entail a degree of difficulty or obstacle that, once overcome, produces an anticipated benefit. With respect to an IS, perceptions of difficulty are captured in the effort expectancy construct, or the degree of ease associated with use of the system (Davis, 1989; Venkatesh, 1999; Venkatesh and Morris, 2000). If effort expectancy of an IS is high (i.e., the IS is seen as easy to use), appraisal of the IS as challenging is unlikely because

there is little or no anticipated difficulty in interacting with the system. Conversely, an IS that requires greater effort to master should be appraised as more challenging than one that requires minimal effort. However, challenge appraisals also require an anticipated benefit associated with IS use. IS research has consistently shown that performance expectancy, the degree to which the individual believes that using the system will help her to attain gains in job performance, is the predominant benefit associated with use of an IS in the workplace (Agarwal and Prasad, 1998b; Compeau and Higgins, 1995; Taylor and Todd, 1995a; Thompson et al., 1991; Venkatesh et al., 2003). Thus, if performance expectancy is high, an IS that is difficult to use could still be viewed as a challenge (as opposed to simply a threat) because gains in job performance are expected to follow from its use. Under conditions of low performance expectancy, however, low effort expectancy perceptions should be less likely to yield an appraisal of the IS as challenging since little or no performance benefit from its use is anticipated. Supporting this idea, Beaudry and Pinsonneault (Beaudry and Pinsonneault, 2005b) interviewed several bank IS users who, although they were required to devote much effort to learning a new account management IS, viewed it more as a challenge than as a threat due to the performance benefits it offered (for example, see the case of “Peter”, p. 509). Consequently, the following is hypothesized:

*H8c: Effort expectancy of using an IS will be negatively related to challenge primary appraisal of the IS, moderated by performance expectancy of using the IS.*

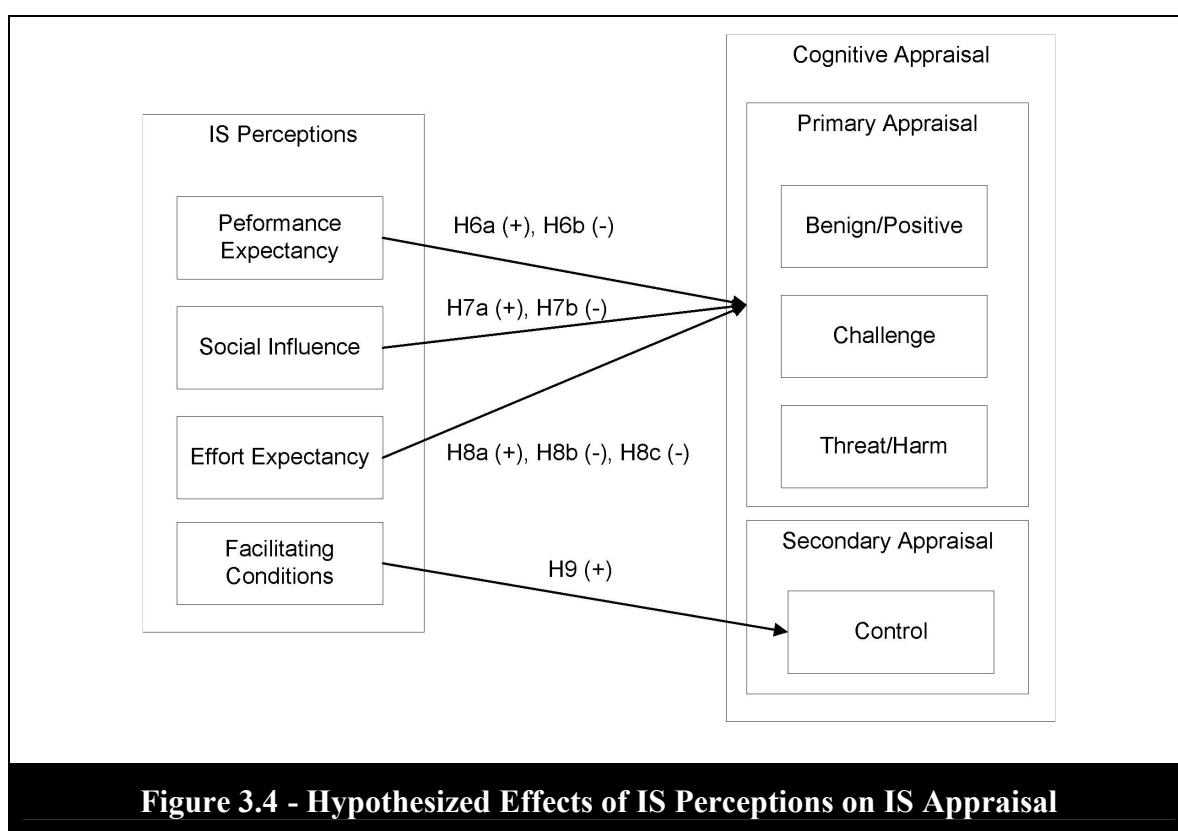
#### 3.2.5.4 Facilitating Conditions

The fourth perception identified by UTAUT is facilitating conditions. Facilitating conditions are defined as the degree to which an individual believes that organizational and technical infrastructure exists to support use of the system (Venkatesh et al., 2003). Although this definition emphasizes supporting infrastructure that is external to the user, facilitating conditions may also include enabling or constraining factors that are internal to the user, such as requisite knowledge, time, or self-efficacy (Taylor and Todd, 1995a; Taylor and Todd, 1995b; Thompson et al., 1991; Venkatesh et al., 2003).

While perceptions of performance expectancy, effort expectancy, and social influence are hypothesized to influence primary appraisal (i.e. assessment of what is at stake in the situation), facilitating conditions are closely related to the concept of secondary appraisal (i.e. assessment of what can be done about the situation). If appropriate facilitating conditions are in place, the user is likely to feel empowered in dealing with the new IS (Thompson et al., 1991; Venkatesh et al., 2003). Such empowerment could result from conditions that are external to the user (e.g. ongoing training and user support) or conditions that are internal to the user (e.g. computer self-efficacy or prior knowledge of similar information systems from which to draw) (Taylor and Todd, 1995b). If, on the other hand, the user perceives an absence of necessary facilitating conditions, she is likely to feel limited control in dealing with the situation (Triandis, 1979). Such a scenario could yield passive resignation to using the IS, or postponed action resulting from a “wait and see” attitude. Based on this logic, I hypothesize that:

*H9: Facilitating conditions surrounding use of an IS will be positively related to high control secondary appraisal of the IS*

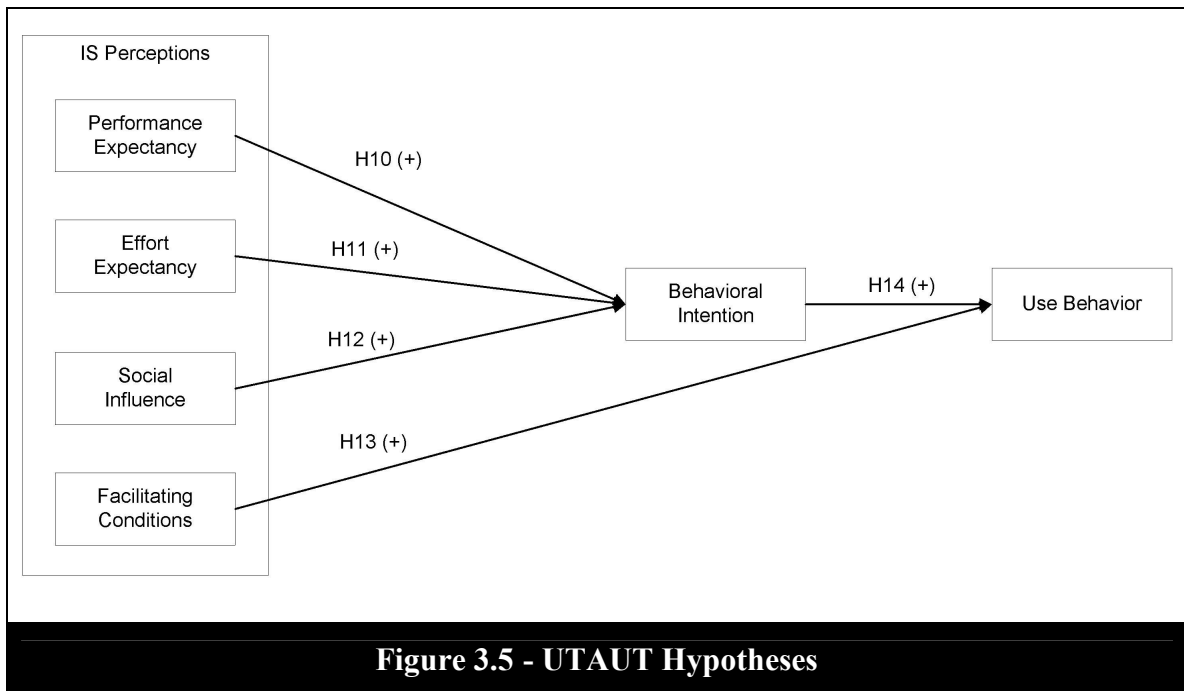
In summary, theory suggests that IS perceptions identified in UTAUT will play a role in primary and secondary appraisal of the IS. The research hypotheses developed in this section are summarized in Figure 3.4 (lower-level hypotheses are collapsed and directional signs are omitted for clarity).



### 3.2.6 UTAUT Hypotheses

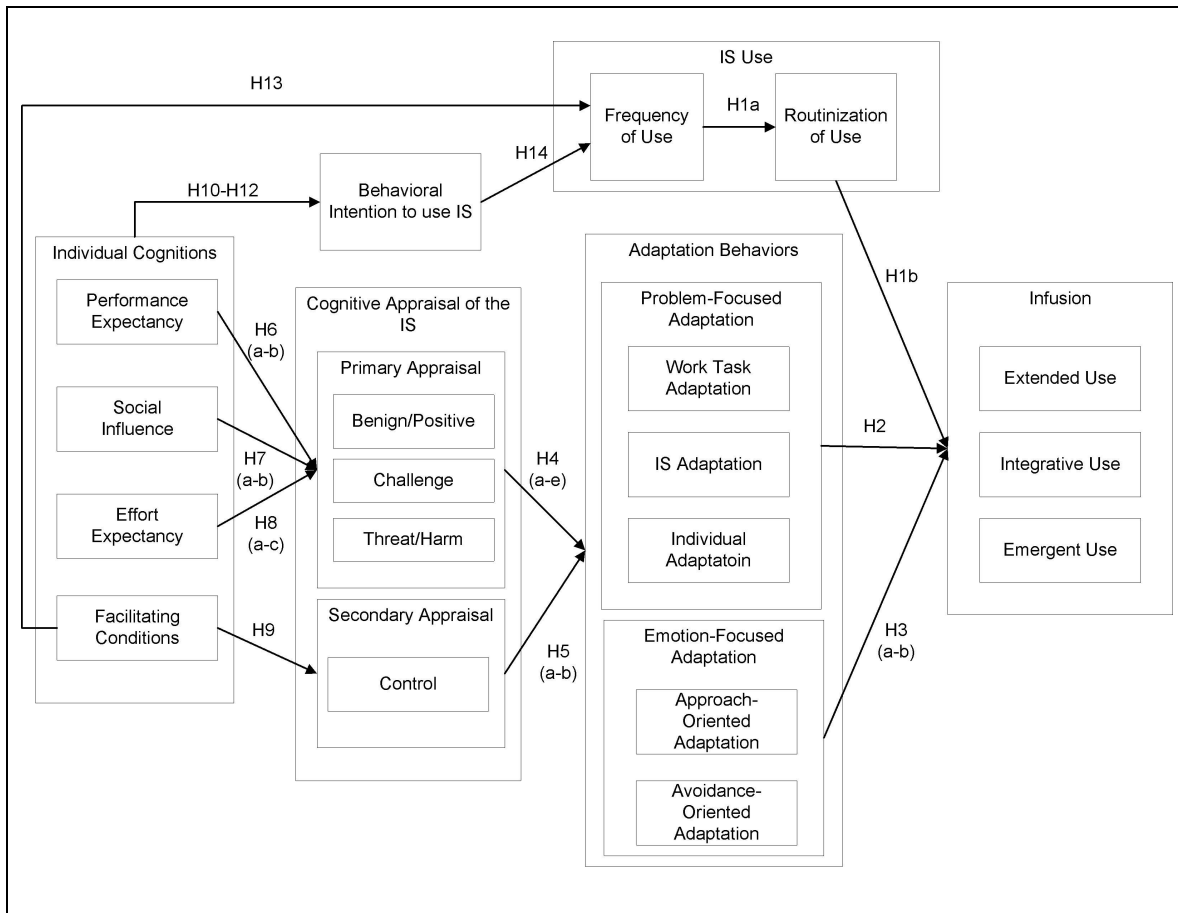
In addition to the above hypotheses, this research also tests the hypotheses postulated in the original UTAUT model, with slight variations in wording for the present research. These hypotheses are given below and depicted graphically in Figure 3.5 (excluding moderators for clarity):

- H10: Performance expectancy will be positively related to behavioral intention to use the IS, moderated by gender and age*
- H11: Effort expectancy will be positively related to behavioral intention to use the IS, moderated by gender, age, and experience*
- H12: Social influence will be positively related to behavioral intention to use the IS, moderated by gender, age, voluntariness, and experience*
- H13: Facilitating conditions will be positively related to IS use, moderated by age and intention*
- H14: Behavioral Intention to Use the IS will be positively related to IS use*



### 3.3 Expanded Research Model and Hypotheses

The final expanded research model is shown in Figure 3.6. For the sake of clarity, lower-level hypotheses are collapsed and moderating variables are omitted from the model. Table 3.1 summarizes the research hypotheses to be tested.



**Figure 3.6 - Expanded Research Model**

<b>Table 3.1 - Research Hypotheses</b>	
<b>Label</b>	<b>Hypothesis</b>
<i>H1a</i>	<i>Frequency of IS use will be positively related to routinization of IS use</i>
<i>H1b</i>	<i>Routinization of IS use will be positively related to IS infusion</i>
<i>H2</i>	<i>Problem-focused adaptation behaviors directed toward changing the work task, the IS, and the individual will relate positively to individual-level IS infusion</i>
<i>H3a</i>	<i>Approach oriented emotion-focused adaptation behaviors will relate positively to individual-level IS infusion</i>
<i>H3b</i>	<i>Avoidance oriented emotion-focused adaptation behaviors will relate negatively to individual-level IS infusion</i>
<i>H4a</i>	<i>Appraisal of the IS as benign/positive will be positively associated with problem-focused adaptation behaviors</i>
<i>H4b</i>	<i>Appraisal of the IS as threatening/harmful will be positively associated with emotion-focused adaptation behaviors</i>
<i>H4c</i>	<i>Appraisal of the IS as challenging will be positively associated with problem-focused adaptation behaviors</i>
<i>H4d</i>	<i>Appraisal of the IS as challenging will be positively associated with approach-oriented emotion-focused adaptation behaviors</i>
<i>H4e</i>	<i>Appraisal of the IS as challenging will be negatively associated with avoidance-oriented emotion-focused adaptation behaviors</i>
<i>H5a</i>	<i>High control appraisals with respect to an IS will be positively associated with problem-focused adaptation behaviors</i>
<i>H5b</i>	<i>High control appraisals with respect to an IS will be negatively associated with emotion-focused adaptation behaviors</i>
<i>H6a</i>	<i>Performance expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS</i>
<i>H6b</i>	<i>Performance expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS</i>
<i>H7a</i>	<i>Social influence surrounding use of an IS will be positively related to benign/positive primary appraisal of the IS</i>
<i>H7b</i>	<i>Social influence surrounding use of an IS will be negatively related to threat/harm primary appraisal of the IS</i>
<i>H8a</i>	<i>Effort expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS</i>
<i>H8b</i>	<i>Effort expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS</i>
<i>H8c</i>	<i>Effort expectancy of using an IS will be negatively related to challenge primary appraisal of the IS, moderated by performance expectancy of using the IS</i>

**Table 3.1 - Research Hypotheses**

<b>Label</b>	<b>Hypothesis</b>
<i>H9</i>	<i>Facilitating conditions surrounding use of an IS will be positively related to high control secondary appraisal of the IS</i>
<i>H10</i>	<i>Performance expectancy will be positively related to behavioral intention to use the IS, moderated by gender and age</i>
<i>H11</i>	<i>Effort expectancy will be positively related to behavioral intention to use the IS, moderated by gender, age, and experience</i>
<i>H12</i>	<i>Social influence will be positively related to behavioral intention to use the IS, moderated by gender, age, voluntariness, and experience</i>
<i>H13</i>	<i>Facilitating conditions will be positively related to IS use, moderated by age and experience</i>
<i>H14</i>	<i>Behavioral Intention to use the IS will be positively related to IS use</i>

## CHAPTER 4

### RESEARCH METHODOLOGY AND DATA COLLECTION

This chapter describes the research methodology employed to investigate the hypotheses developed in the previous chapter. The research design is presented, followed by a discussion of constructs and measures. Site description, data collection procedures, and measurement model results from a pilot study are described, after which a description of the primary research site and data collection procedures is provided.

#### 4.1 Research Design

A field study methodology was employed for this research. Field studies examine a phenomenon in a real-life context, and are a “well-accepted approach to studying the complex phenomena of technology implementation in an organizational setting” (Majchrzak et al., 2000, p. 575). 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). This research meets this criterion. First, IS infusion clearly depends on myriad factors in the organizational context of use. In addition, adaptation is also highly context-dependent. Second, because of the inextricable nature of infusion and adaptation from context, the boundaries between these phenomena and their context are not easily identifiable. In fact, re-shaping of the environmental context (e.g. work task and system) is expected as a *part* of the phenomenon of interest. Thus, a field study is appropriate.

Many researchers have advocated the use of both quantitative and qualitative data collection procedures in field study research (Creswell, 2003; Kaplan and Duchon, 1988;

e.g. Sieber, 1973; Yin, 2003). In accordance with this recommendation, the pilot study utilizes data from both qualitative interviews and a quantitative survey, the latter constituting the primary data source. Qualitative interviews were first conducted at the pilot site to explore adaptation and infusion in context, validate and refine the theoretical model, and refine the survey instrument. A survey was then developed and administered at the pilot site. Based on the pilot results, the survey was refined and administered at the primary research site.

#### **4.2 Constructs and Measures**

Where possible, constructs were operationalized through direct use or adaptation of items previously developed and validated in the literature. Constructs were measured using either formative or reflective scales. Reflective scales are those for which variance in observed measurement items is affected by (or reflects) variance in the underlying construct (MacCallum and Browne, 1993). Manifest variables for reflective scales are designed to tap into a singular dimension representing the latent construct of interest. The desired unidimensionality of reflective scales warrants traditional statistical tests of construct reliability (e.g. internal consistency measures such as Cronbach's alpha) and validity (e.g. exploratory and confirmatory factor analyses) to demonstrate that manifest variables converge on their intended construct and discriminate between it and other constructs. By contrast, formative scales consist of a composite of multiple observed indicator variables that represent different dimensions of the construct (MacCallum and Browne, 1993). In other words, manifest variables are said to form, rather than reflect, the latent construct. Because indicator variables of formative scales represent different

dimensions of the construct, little or no correlation may exist between these indicators (Jarvis et al., 2003). Rather, the aggregation of these indicators creates an index that defines the latent construct.

Jarvis et al. (2003) suggest four guidelines for determining whether a scale is reflective or formative. First, theoretical direction of causality should be considered to determine if the indicators cause or reflect the construct of interest. As mentioned above, formative scale indicators are conceptualized as causing the construct rather than reflecting it. Second, indicators should be assessed for their interchangeability. Reflective scale indicators are interchangeable in that they tap the same underlying construct; formative scale indicators, by contrast, can involve different themes or behaviorally distinct phenomena. Third, reflective scale indicators should covary with each other since, by definition, they measure the same underlying construct; formative scale indicators, however, may or may not covary. Finally, reflective scale indicators for a single construct should derive from the same antecedents and produce the same consequences, whereas antecedents and consequences of formative scale indicators may diverge.

Following Jarvis et al.'s (2003) guidelines, measurement scales in the present study were conceptualized as either formative or reflective (see Table 4.1 for a summary). The following sections further describe each of the constructs, their definitions and measurement scales.

<b>Table 4.1 - Formative and Reflective Measurement Scales</b>	
<b>Constructs Measured Using Reflective Scales</b>	<b>Constructs Measured Using Formative Scales</b>
Infusion Extended Use Integrative Use Emergent Use Benign/Positive Appraisal Threat/Harm Appraisal Challenge Appraisal Performance Expectancy Effort Expectancy Social Influence Facilitating Conditions Behavioral Intention to Use	IS Use Secondary Appraisal Work Adaptation System Adaptation Self Adaptation Seeking Social Support Positive Reappraisal Avoidance/Wishful Thinking Distancing

#### *4.2.1 Infusion*

Infusion measures the extent to which an information system is fully embedded in an individual's work system, and is used completely and effectively in order to improve the individual's performance (Cooper and Zmud, 1990; Saga and Zmud, 1994; Sullivan, 1985; Wynkoop and Senn, 1992). A reflective scale measuring overall infusion was developed by Jones et al. (2002) and is employed in this study. In addition to this overall measure, reflective scales were developed to assess the extended, integrative, and emergent use as defined by Saga and Zmud (1994). The items forming these scales are shown in Table 4.2.

<b>Table 4.2 - Infusion Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Infusion (INF)  <i>The extent to which an IS is used completely and effectively and improves an individual's performance</i>	(Jones et al., 2002)	<ol style="list-style-type: none"> <li>1. I am using [System] to its fullest potential for supporting my own work</li> <li>2. I am using all capabilities of [System] in the best fashion to help me on the job</li> <li>3. I doubt that there are any better ways for me to use [System] to support my work</li> <li>4. My use of [System] has been integrated and incorporated into my work at the highest level</li> </ol>
Extended Use (EXUSE)  <i>Using more of the IS's features in order to accommodate a more comprehensive set of work tasks</i>	N/A	<ol style="list-style-type: none"> <li>1. I can complete at least as many tasks with [System] as I could before I started using [System]</li> <li>2. I am using features of [System] that weren't available in the prior system(s) I used</li> <li>3. By using the features available in [System] , I am able to get more work done</li> <li>4. I am using [System] to accomplish tasks that I did manually before</li> </ol>
Integrative Use (INTUSE)  <i>Using the IS to establish or enhance flow linkages among a set of work tasks</i>	N/A	<ol style="list-style-type: none"> <li>1. The order in which I complete my tasks has changed since I started using [System]</li> <li>2. My work has become more streamlined since I started using [System]</li> <li>3. [System] makes it easier for me to manage all of the things I have to do on the job</li> <li>4. Using [System], I am better able to access information from multiple sources</li> </ol>
Emergent Use (EMUSE)  <i>Using the IS in order to accomplish tasks that were not feasible or recognized prior to the application of the IS to the work system</i>	N/A	<ol style="list-style-type: none"> <li>1. I can complete tasks with [System] that I couldn't do before</li> <li>2. I am completing more tasks with [System] than I was before it was implemented</li> <li>3. [System] has made it possible for me to do things that I couldn't do before</li> <li>4. The number of tasks I perform has increased since I started using [System]</li> </ol>

#### 4.2.2 IS Use

IS use was measured by asking respondents to rate (a) how often they used the system in a day or week (frequency), and (b) how many hours per day they used the system (duration). These items have been used in many prior IS studies (e.g. Compeau et al., 1999; Thompson et al., 1991) and have typically been treated as reflective indicators of system use. However, frequency and duration of use may or may not be correlated. For instance, a user may use the IS every day (high frequency) but for only a few minutes each day (low duration). Hence, this study conceptualizes frequency and duration as formative indicators of IS use.

<b>Table 4.3 - IS Use Scale</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
IS Use (USEFREQ, USEDUR)  <i>The frequency and duration with which an individual engages the IS in her work</i>	(Compeau et al., 1999; Thompson et al., 1991)	<ol style="list-style-type: none"> <li>1. How frequently do you use the system in your work? [Not at all – More than once a day]</li> <li>2. On average, how much time per day do you spend using the system [None – More than 8 hours]</li> </ol>

#### 4.2.3 Adaptation Behaviors

Problem- and emotion-focused adaptation constructs were assessed as composites of several potentially uncorrelated behaviors that, taken together, provide an index of a particular dimension of adaptation. For instance, a user may eliminate certain tasks performed on the job after adopting an IS, but may not significantly change her way of performing other tasks. However, each of these behaviors denotes a dimension of

adapting the individual's work task. Similarly, adaptation efforts directed at the system itself may focus on the system's interface, its underlying functionality, its hardware, or any combination of these. Although such behaviors occur independently, taken together they represent the efforts of an individual to modify a dimension of her environment (e.g. work, system, or self). In other words, adaptation behavior constructs are regarded as composites of individual acts that are directed at changing contextual elements of the user's situation. Therefore, these constructs were operationalized using formative scales.

#### 4.2.3.1 Problem-Focused Adaptation

Problem-focused adaptation scales were taken from literature on innovation diffusion (Rice and Rogers, 1980) and IS adaptation and use (Barki et al., 2005; Beaudry and Pinsonneault, 2005a). These scales were selected based on the three dimensions of problem-focused adaptation identified by Beaudry and Pinsonneault (2005b): work, system and self.

<b>Table 4.4 - Problem-Focused Adaptation Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
<p>Work Adaptation (WORKAD)</p> <p><i>Modifications made to one's working system in reaction to the introduction of the IS</i></p>	(Beaudry and Pinsonneault, 2005a)	<ol style="list-style-type: none"> <li>1. I started to do things on my job that I couldn't do before [System]</li> <li>2. I eliminated tasks that I had to do before but that were no longer required using [System]</li> <li>3. Using [System] changed my way of performing some tasks</li> </ol>
<p>System Adaptation (SYSAD)</p> <p><i>Modifications made to the IS features or functionalities in reaction to the introduction of the IS</i></p>	(Barki et al., 2005; Rice and Rogers, 1980)	<p>How much effort (in time and energy) did you spend making or recommending...</p> <ol style="list-style-type: none"> <li>1. Improvements to [System] functionalities (the way the system works)</li> <li>2. Improvements to the [System] interface (the look and feel of the system)</li> <li>3. Improvements to the [System] hardware (the actual computer equipment you use)</li> <li>4. Other modifications to [System] so that it better fit your tasks</li> </ol>
<p>Self Adaptation (SELFAD)</p> <p><i>Efforts directed toward improve one's ability, skills, and knowledge to use the IS</i></p>	(Barki et al., 2005; Rice and Rogers, 1980)	<ol style="list-style-type: none"> <li>1. I communicated with colleagues to better understand how [System] operates</li> <li>2. I communicated with IT specialists to better understand how [System] operates</li> <li>3. I researched, on my own initiative, in order to increase my knowledge and mastery of [System]</li> <li>4. I explored several information sources, on my own initiative, concerning [System]</li> <li>5. I consulted the [System] support documentation that was available to me</li> <li>6. I participated in [System] training opportunities</li> <li>7. I consulted with the [System] superuser(s) to learn more about [System]</li> </ol>

#### 4.2.3.2 Emotion-Focused Adaptation

Coping research has identified scores of adaptation behaviors that serve to regulate an individual's emotional response to a stressful encounter (see Skinner et al., 2003 for a review). Most of these derive from emotion-oriented behaviors originally identified in Lazarus' early work (e.g. Folkman, 1992; Folkman et al., 1986a; Lazarus and Folkman, 1984) based on the transactional coping model. In the interest of parsimony, four commonly cited emotion-focused behaviors were identified as relevant for this study based on their prevalence in the coping literature (Hunter and Boyle, 2004; Skinner et al., 2003) and their appearance in emerging IS coping research (Beaudry and Pinsonneault, 2005a). These included seeking social support and positive reappraisal (approach-oriented emotion-focused behaviors), and avoidance/wishful thinking and distancing (avoidance-oriented emotion-focused behaviors). Scales for each of these dimensions were adapted from Beaudry and Pinsonneault (2005a).<sup>2</sup>

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<sup>2</sup> Beaudry and Pinsonneault use different labels for these constructs. However, to maintain consistency with the majority of the coping literature, this study adopts construct labels originally used by Lazarus and colleagues. In addition, item PR4 was originally associated with items assessing distancing behavior; however, because it aligns more closely with the definition of positive reappraisal, it is included as an indicator of the this construct.

<b>Table 4.5 - Emotion-Focused Adaptation Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Seeking Social Support (SSS)  <i>Efforts to seek informational, tangible, or emotional support associated with the IS</i>	(Beaudry and Pinsonneault, 2005a)	<ol style="list-style-type: none"> <li>1. I asked for moral support from my colleagues to help me deal with [System]</li> <li>2. I talked about [System] with my spouse or family members</li> <li>3. I met with my supervisor to talk about [System]</li> </ol>
Positive Reappraisal (PR)  <i>Efforts to create or ascribe positive meaning to the IS</i>	(Beaudry and Pinsonneault, 2005a)	<ol style="list-style-type: none"> <li>1. I repeated to myself that [System] was an opportunity to learn and develop new skills</li> <li>2. I told myself that using [System] would get better over time</li> <li>3. I told myself that I had to accept [System] since there was nothing I could do about it</li> <li>4. I tried to change my mind about using [System] and have fun</li> </ol>
Avoidance/Wishful Thinking (AWT)  <i>Wishful thinking or behavioral efforts to escape or avoid the IS (contrasts with distancing, which emphasizes detachment)</i>	(Beaudry and Pinsonneault, 2005a)	<ol style="list-style-type: none"> <li>1. I considered taking a leave of absence from work for a while because of [System]</li> <li>2. I did not want to hear about [System]</li> <li>3. I did all I could to avoid using [System]</li> </ol>
Distancing (DI)  <i>Efforts to detach oneself and to minimize the significance of the IS</i>	(Beaudry and Pinsonneault, 2005a)	<ol style="list-style-type: none"> <li>1. I tried not to worry about difficulties associated with using [System]</li> <li>2. I went out to clear my mind</li> </ol>

#### *4.2.4 Appraisal*

Items measuring appraisal were adapted from the Cognitive Appraisal of Health Scale (CAHS) (Ahmad, 2004; Kessler, 1998), developed to measure appraisal of health crisis events such as illness or injury. The CAHS was chosen for this study because of its validated psychometric properties, and because many of the items in the instrument were generalizable to a non-health-related context. Drawing from the transactional model of coping (Lazarus and Folkman, 1984), CAHS improves on earlier appraisal scales (e.g. Folkman et al., 1986a; Folkman et al., 1986b) by incorporating reflective measures for each dimension of primary appraisal identified by the transactional model (i.e. benign/positive, threat, harm, challenge), as well as a formative measure of secondary appraisal developed by Lazarus and Folkman (1984). Because the CAHS was originally designed to assess appraisal of health problems, some items were less applicable to an IS context (e.g. damaging to relationships or frightening). Hence, the specific scale items used in this study were selected based on their factor loadings in earlier studies (Ahmad, 2004; Kessler, 1998), as well as their appropriateness in the context of IS.

<b>Table 4.6 - Appraisal Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Benign/Positive Appraisal (BPA)  <i>Assessment of the IS as benign or positive; preserves or enhances user's well-being</i>	(Ahmad, 2004; Kessler, 1998)	1. Using [System] is NOT stressful for me 2. I feel I have nothing to lose on my job by using [System] 3. I feel that using [System] helps to improve quality of care delivered to [Organization] patients 4. I don't think much about [System] 5. [System] doesn't affect my life
Threat/Harm Appraisal (THA)  <i>Assessment of the IS as resulting in harm/loss to the user that has taken place or is anticipated</i>	(Ahmad, 2004; Kessler, 1998)	1. Using [System] is frightening for me 2. I feel that things at [Organization] will only get worse because of [System] 3. I feel that things at [Organization] will not go well due to [System] 4. I feel I have a lot to lose on my job by using [System] 5. I worry about the negative consequences of using [System] 6. I feel that using [System] negatively affects the quality of care delivered to [Organization] patients 7. I have had to give up a great deal at work because of [System] 8. I have been harmed in some way by using [System]
Challenge Appraisal (CA)  <i>Assessment of the IS as an opportunity for gain or growth</i>	(Ahmad, 2004; Kessler, 1998)	1. I view [System] as a chance to change for the better 2. I see [System] as an opportunity to develop new skills 3. I feel that I can successfully manage the transition to [System] 4. I feel that I can control what happens to my job with regard to [System] 5. I feel that I am handling the transition to [System] very well 6. I feel that there is a lot I can do to master [System]

<b>Table 4.6 - Appraisal Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Secondary Appraisal (SA)  <i>Assessment of the individual's control over the IS and what can be done in response to it</i>	(Ahmad, 2004; Kessler, 1998; Lazarus and Folkman, 1984)	1. I feel that I cannot do my job the way I want because of [System] 2. I feel that I can do something about the transition to [System] 3. I feel that there is nothing that I need to do about the transition to [System] 4. I feel that I need to know more about [System] before I can use it appropriately 5. I feel that I have to accept [System]

#### 4.2.5 IS Perceptions and Intention to Use

Reflective scales of IS perceptions and intention to use were taken from Venkatesh et al. (2003) as well as other IS acceptance studies on which the UTAUT model is based. Items used in the original UTAUT study (Venkatesh et al., 2003) were selected across various root scales based on an empirical, rather than a theoretical, basis. To overcome this limitation and remain true to the underlying theory behind the model, this research operationalizes the UTAUT perceptions based on their primary foundational constructs in the IS literature (e.g. perceived usefulness for performance expectancy and perceived ease of use for effort expectancy). These items have been widely used and validated in IS research.

**Table 4.7 - IS Perception and Intention Scales**

<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
<p>Performance Expectancy (PE)</p> <p><i>The degree to which an individual believes that using the IS will help him or her to attain gains in job performance</i></p>	<p>(Davis, 1989; Davis et al., 1989; Venkatesh et al., 2003)</p>	<ol style="list-style-type: none"> <li>1. Using [System] in my job enables me to accomplish tasks more quickly</li> <li>2. Using [System] enhances my effectiveness on the job</li> <li>3. Using [System] in my job increases my productivity</li> <li>4. I find [System] useful in my job</li> </ol>
<p>Effort Expectancy (EE)</p> <p><i>The degree of ease associated with use of the IS</i></p>	<p>(Davis, 1989; Davis et al., 1989; Venkatesh et al., 2003)</p>	<ol style="list-style-type: none"> <li>1. It has been easy for me to become skillful at using [System]</li> <li>2. I find [System] easy to use</li> <li>3. Learning to operate [System] has been easy for me</li> <li>4. My interaction with [System] is clear and understandable</li> </ol>
<p>Social Influence (SI)</p> <p><i>The degree to which an individual perceives that important others believe he or she should use the IS</i></p>	<p>(Ajzen, 1991; Davis et al., 1989; Fishbein and Ajzen, 1975; Mathieson, 1991; Thompson et al., 1991; Venkatesh et al., 2003)</p>	<ol style="list-style-type: none"> <li>1. In general, [Organization] supports the use of [System]</li> <li>2. People who are important to me in my job think that I should use [System]</li> <li>3. The senior management of [Organization] has been helpful in the use of [System]</li> <li>4. People who influence me in my work think that I should use [System]</li> </ol>
<p>Facilitating Conditions (FC)</p> <p><i>The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the IS</i></p>	<p>(Thompson et al., 1991; Venkatesh et al., 2003)</p>	<ol style="list-style-type: none"> <li>1. Guidance in using [System] is available to me</li> <li>2. Specialized instruction concerning [System] is available to me</li> <li>3. A specific person (or group) is available for assistance with [System] difficulties</li> </ol>

**Table 4.7 - IS Perception and Intention Scales**

<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Behavioral Intention to Use (BI)  <i>An individual's consciously formulated plan to use the IS</i>	(Davis et al., 1989; Venkatesh et al., 2003)	<ol style="list-style-type: none"> <li>1. I predict that I will use (or continue to use) [System] over at least the next 6 months</li> <li>2. I intend to use (or continue to use) [System] over at least the next 6 months</li> <li>3. I plan to use (or continue to use) [System] over at least the next 6 months</li> </ol>

### 4.3 Pilot Study

A pilot study was conducted as a preliminary test of the measurement items. The pilot site, research participants, data collection procedures, and measurement model tests are described in the following sections.

#### 4.3.1 Research Site Selection

The first step in the pilot study was to identify a suitable research site. To be eligible for participation, an organization needed to have implemented a large-scale information system at least one year prior to the time of data collection. 'Large-scale' was defined as a system that encompassed several functional areas within the organization, spanned traditional organizational boundaries, and was used by the majority of employees within the organization. Requiring the system to be in use for more than one year ensured that users had sufficient time to infuse the system into their work practices.

The research site selected for the pilot study was the Campus Health Department (hereafter referred to as *CH*) of a large public university. *CH* was selected because it met the site requirements outlined above and because of proximity to the researcher and

the willingness of CH personnel to participate in the research. CH is a health care facility dedicated to promoting and preserving the health and wellness of University students, faculty, staff, and affiliates, and is organized according to the various functions and services it provides, including patient care, reception/scheduling, lab, pharmacy, radiology, and medical billing. To address various process inefficiencies and remain on the forefront of medical service technology, CH solicited proposals from various commercial vendors for the development and implementation of an integrated Electronic Medical System (EMS). The new EMS was adopted to overcome current problems of system fragmentation, difficulty of use, lack of control, and high turnaround times, and had been in use for approximately 1.5 years at the time of data collection.

#### *4.3.2 Participants*

Participants were drawn from CH employees who used the EMS system in their work. The researcher relied heavily on key contacts within the organization to identify individuals who were appropriate for the study, and who were able and willing to participate. Two groups of participants were selected: interview participants and survey participants.

##### 4.3.2.1 Interview Participants

One or two individuals from five campus health departments were invited to participate in interviews. These included two receptionists, two billing clerks, one nurse, one medical assistant, and two lab technicians. Interview participants were selected based upon their availability, their willingness to participate, and their representativeness of other CH employees as determined by the primary contact at CH.

#### 4.3.2.2 Survey Participants

All CH employees who used the EMS in their work were targeted as survey participants. Participants included individuals in the following roles: receptionist, nurse/MAs, providers (physicians), lab technicians, registration/billing clerks, pharmacists and pharmacy technicians, and medical records personnel. Excluded from participation were administrative and general clerical employees whose work did not require use of the EMS. A total of approximately 75 CH employees were invited to participate in the survey.

#### *4.3.3 Data Collection*

##### 4.3.3.1 Qualitative Data Collection

Qualitative data were collected through semi-structured interviews with representative CH employees as discussed in the previous section. Interviews took place during the month of July, 2006. Interviewees were invited to participate via personal invitation from the primary contact at CH. Interviews lasted roughly one hour and were tape recorded for thorough documentation and later transcription. The researcher followed an interview script to ensure consistency across interviews (see Appendix A); however, the exact content of the interviews varied somewhat based on issues that emerged during the process. All interviews took place at CH during work time but in a separate conference room so as to ensure confidentiality of the responses.

The primary purpose of the qualitative data was to provide a preliminary investigation of the constructs identified in the theoretical model and to provide a basis for development of the survey instrument. Participants were probed about infusion-

related phenomena to ensure that the constructs of interest were indeed relevant to the CH employees. In addition, interview responses provided a basis for ensuring that the language of the subsequent survey was appropriate and understandable.

#### 4.3.3.2 Quantitative Data Collection

The primary data for the pilot study was collected through administration of a cross-sectional EMS user survey. An original draft survey instrument was developed by the researcher based on extant items in the literature. The survey was then refined based on reviews and feedback from two CH employees who were well acquainted with the EMS and issues surrounding its use. Based on recommendations from the primary contact at CH, the survey was deployed online using a customizable survey administration tool called Question Builder ([www.questionbuilder.com](http://www.questionbuilder.com)). An online survey was deemed preferable to a paper-based survey due to ease of administration and because all targeted respondents had direct and authorized access to Internet-connected workstations to complete the survey.

Participants were initially notified of the study through an email sent by CH management in early August, 2006. The email contained the researcher's description of the study and included a link to the online survey. Incentive to participate was provided by entering each participant in a drawing for one of four gift certificates (ranging from \$50 to \$100 in value) to a popular online retailer. Approximately 25 CH employees participated during the first week. To bolster participation, the researcher made an on-site visit during mid August, 2006, during which employees were personally invited and encouraged to complete the survey. 37 additional responses were obtained after this visit,

for a total of 62 responses. Of these, 5 responses were discarded due to incompleteness, response inconsistencies, or redundancy, leaving a total of 57 usable responses. Given the original number of 75 targeted participants, this represents a response rate of 76%.

#### *4.3.4 Demographic Characteristics of Survey Participants*

Survey respondents were 85% female and ranged in age from 22 to 65 years ( $M = 46$  years). Time employed at CH ranged from 4 months to 24 years ( $M = 8.5$  years), with time in current position ranging from 4 months to 23 years ( $M = 6.3$  years). 44% of respondents had earned a bachelor's degree or higher degree. Approximately one third of respondents had been involved in at least one other technology deployment project besides EMS, either while working at CH or at another organization. Survey participants thus exhibited a wide range of demographic characteristics.

### **4.4 Measurement Model Results**

#### *4.4.1 Descriptive Statistics*

Descriptive statistics for each of the constructs measured are provided in Table 4.8. These statistics were calculated based on construct scores obtained by averaging individual item responses for each construct.

<b>Table 4.8 - Descriptive Statistics</b>				
<b>Construct</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>St. Dev</b>
Infusion	1.3	7.0	4.95	1.10
Extended Use	2.3	7.0	5.17	1.15
Integrative Use	1.5	7.0	5.18	1.23
Emergent Use	2.0	7.0	5.15	1.29
IS Use	3.0	7.0	6.52	0.99
Work Adaptation	2.0	7.0	5.04	1.31
Self Adaptation	1.9	6.0	3.94	0.82
System Adaptation	1.0	5.0	2.38	1.09
Seeking Social Support	1.0	6.0	3.25	1.11
Positive Reappraisal	1.0	6.0	3.14	1.33
Avoidance/Wishful Thinking	1.0	3.67	1.23	0.53
Distancing	1.0	5.0	2.38	1.20
Benign/Positive Appraisal	2.7	7.0	5.24	1.21
Threat/Harm Appraisal	1.0	5.3	2.52	1.22
Challenge Appraisal	3.0	7.0	5.89	0.92
Secondary Appraisal	1.0	7.0	2.57	1.34
Performance Expectancy	1.0	7.0	4.81	1.68
Effort Expectancy	1.7	7.0	5.29	1.52
Social Influence	3.3	7.0	5.54	0.99
Facilitating Conditions	1.7	7.0	5.47	1.47
Behavioral Intention to Use	4.0	7.0	6.23	0.68

#### *4.4.2 Reliability, Validity, and Instrument Refinement*

The primary purpose of the pilot study was to test and refine the survey instrument before primary data collection. Pilot evaluation of the measurement scales is discussed first for constructs measured reflectively and then for constructs measured formatively.

##### 4.4.2.1 Constructs Measured Reflectively

Validation of reflectively measured constructs focused on reliability and validity of the measurement scales. Reliability is the degree to which the construct is free from

random error (Hoyle et al., 2002), or the degree to which the measures of the construct are consistent in what they are intended to measure . Because reliability addresses conceptual consistency of several items tapping a unitary construct, it is appropriately applied to reflective, rather than formative, constructs (Petter et al., 2006). Two common means of assessing reliability include test-retest reliability, in which scores on the same measure are obtained at two points in time and then correlated, and internal consistency reliability, in which multiple concurrent measures of a single construct are correlated. Given that this study collects data at only one point in time, internal consistency was chosen as the means of assessing reliability. The most common measure of internal consistency reliability, Cronbach's alpha (Cronbach, 1951), is utilized in this study. The conventional lower bound for Cronbach's alpha is 0.70 (Nunnally, 1978); however, researchers suggest that alphas as low as 0.60 are acceptable in exploratory research (Robinson et al., 1991).

Validity refers to whether the measurement items indeed assess the latent construct of interest (Hair et al., 2005; Hoyle et al., 2002). Both convergent and discriminant validity were assessed for reflective constructs. Convergent validity refers to the overlap between alternative measures that are intended to tap the same construct, while discriminant validity refers to the divergence of measures that are intended to tap different constructs (Hoyle et al., 2002). Convergent and discriminant validities are assessed in this study via factor analyses in which the item loadings and cross loadings are examined. Manifest items that load highly on their assigned constructs and lower on

other constructs can be said to converge on the latent construct of interest while discriminating between it and other constructs.

One problem that became readily apparent from participant feedback was that the survey required an excessive amount of time to complete ( $M = 41$  minutes). This amount of time was considered burdensome by participants and had the potential of inducing fatigue. Hence, instrument refinement aimed to reduce the length of the survey while still maintaining acceptable construct and content validity. To this end, measurement of reflective constructs that had received significant prior validation in the IS literature (e.g. UTAUT constructs) were reduced to three items (and in some cases two items) wherever possible. Items that deflated construct reliability (e.g. lowered Cronbach's alpha) or decreased construct validity (e.g. cross-loaded with other constructs) were considered as leading candidates for removal from the scales. However, because the small sample size of the pilot data could produce factor structures that are context-specific, scale refinement did not proceed solely on the basis of empirical considerations. As noted by Bagozzi (1980), construct validity encompasses issues of both observational and *theoretical* meaningfulness—that is, measures must be true to the underlying definition and spirit of the constructs they are designed to measure. Thus, the primary consideration in the refinement process was the preservation of theoretical meaningfulness of the constructs, with the preliminary results from the pilot data providing supplemental guidance.

Sample size of the pilot data ( $N=57$ ) precluded a comprehensive factor analysis of all constructs in the model. Hence, independent factor analyses were conducted on four conceptual sub-groupings of constructs: IS perceptions and intentions (e.g. UTAUT

constructs), Primary IS appraisals, and infusion. The following sections present reliability and validity analyses for these groupings and discuss changes made to the survey instrument in preparation for primary data collection.

#### 4.4.2.1.1 IS Perceptions and Intention Scales

Table 4.9 and Table 4.10 present reliability and validity analyses for the IS perception and intention scales. These scales measure performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), social influence (SI), and behavioral intention to use the IS (BIU).

<b>Table 4.9 - Reliability Analysis for IS Perceptions and Intention Scales</b>		
<b>Construct</b>	<b>Number of Items</b>	<b>Cronbach's alpha</b>
Performance Expectancy (PE)	4	0.91
Effort Expectancy (EE)	4	0.93
Social Influence (SI)	4	0.66
Facilitating Conditions (FC)	3	0.89
Behavioral Intention to Use (BIU)	3	0.91

**Table 4.10 - Factor Analysis for IS Perceptions and Intention Scales**

	Component				
	1	2	3	4	5
PE1	.236	.102	<b>.906</b>	.178	-.009
PE2	.226	.183	<b>.871</b>	.299	.068
PE3	.175	.105	<b>.916</b>	.269	.021
PE4	.269	<b>.664</b>	.332	.315	.095
EE1	.233	.132	.285	<b>.851</b>	.040
EE2	.417	.282	.331	<b>.616</b>	.060
EE3	.352	.143	.315	<b>.800</b>	-.048
EE4	.481	.210	.417	<b>.641</b>	-.078
SI1	.413	.264	-.055	.439	<b>.655</b>
SI2	-.103	<b>.731</b>	.121	-.072	.199
SI3	<b>.742</b>	.218	.292	.198	.104
SI4	-.051	.344	.066	-.152	<b>.861</b>
FC1	<b>.905</b>	.047	.164	.277	.041
FC2	<b>.850</b>	.170	.143	.185	-.072
FC3	<b>.809</b>	-.032	.184	.251	.133
BIU1	.185	<b>.893</b>	.112	.173	.077
BIU2	.023	<b>.880</b>	.015	.256	.041
BIU3	.342	<b>.736</b>	.067	.073	.336

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

All IS perception and intention scales exhibit strong reliability, with the exception of social influence, for which alpha is lower (0.66) but still considered acceptable. With regard to validity, effort expectancy, facilitating conditions, and behavioral intention to use display clean factor loadings on their assigned constructs, while social influence and performance expectancy scales exhibit some cross-loadings. In the case of performance expectancy, PE4 asks how useful the system is perceived to be, while PE1-PE3 address speed, effectiveness, and efficiency gained by using the system. The divergence of factor loadings may have occurred because, for this population, the concept of usefulness was not equated with these performance gains in the minds of respondents. However, small

sample size may have resulted in a context-specific structure that lacks generalizability to other contexts. In light of this observation and because performance expectancy draws heavily from perceived usefulness as a foundational construct, PE4 was retained as a core theoretical item to the construct.

In the case of social influence, the four measures employed derive from two root constructs: subjective norm (Ajzen, 1991; Davis et al., 1989; Taylor and Todd, 1995a; Taylor and Todd, 1995b), and social factors (Thompson et al., 1991). Social factors (measured in SI1 and SI3) refer to the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others in specific social situations (Venkatesh et al., 2003). Conversely, subjective norm (measured SI2 and SI4) refers to the person's perception that most people who are important to him think he should or should not perform the behavior in question (Venkatesh et al., 2003). Because subjective norm corresponds more closely with the definition of social influence adopted in this study, and because many IS studies have used SI2 and SI4 as measures of this construct (e.g. Karahanna et al., 1999; Taylor and Todd, 1995b; Venkatesh and Davis, 2000), SI1 and SI3 were removed from the survey instrument.

To reduce survey length, performance expectancy and effort expectancy scales were reduced to three items each. PE1 (Using [System] in my job enables me to accomplish tasks more quickly) was removed from the performance expectancy scale despite its high loading because performing tasks quickly (as opposed to efficiently or productively) was thought less likely to capture the underlying usefulness-oriented spirit

of the construct. EE1 (It has been easy for me to become skillful at using [System]) was removed from the effort expectancy scale for similar reasons. Scales measuring facilitating conditions and behavioral intention to use demonstrated strong reliability and validity and were already three items in length; hence, these scales were left unchanged.

#### 4.4.2.1.2 Primary IS Appraisal Scales

IS appraisals included primary appraisal (judging the IS as benign/positive, threatening/harmful, or challenging), and secondary appraisal (assessing the degree of control one has over use of the IS in her job). Secondary appraisal was measured via a five-item formative index; hence, primary appraisal is the focus of this section. Table 4.11 and Table 4.12 display the results of reliability and factor analyses for the original primary appraisal scales.

<b>Table 4.11 - Reliability Analysis for Primary Appraisal Scales</b>		
<b>Construct</b>	<b>Number of Items</b>	<b>Cronbach's alpha</b>
Benign/Positive Appraisal (BPA)	5	0.54
Threat/Harm Appraisal (THA)	8	0.89
Challenge Appraisal (CA)	6	0.73

<b>Table 4.12 - Factor Analysis of Primary Appraisal Scales</b>			
	Component		
	1	2	3
THA1	<b>.734</b>	.170	-.036
THA2	<b>.671</b>	-.297	.276
THA3	<b>.711</b>	-.311	.131
THA4	<b>.792</b>	-.242	.137
THA5	<b>.821</b>	-.114	-.001
THA6	<b>.860</b>	-.037	.049
THA7	<b>.527</b>	-.337	-.266
THA8	<b>.642</b>	-.236	.059
BPA1	<b>-.680</b>	.331	.386
BPA2	<b>-.608</b>	.259	.230
BPA3	<b>-.636</b>	.048	.030
BPA4	.114	-.410	<b>.714</b>
BPA5	.186	.052	<b>.733</b>
CA1	<b>-.698</b>	.317	-.186
CA2	-.270	<b>.737</b>	-.182
CA3	<b>-.697</b>	.427	-.204
CA4	-.325	.192	<b>.390</b>
CA5	<b>-.544</b>	.445	.016
CA6	-.026	<b>.776</b>	.116

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

Threat/harm appraisal items exhibited strong reliability and a cohesive factor structure; however, two items were removed from the scale in the interest of reducing the length of the instrument. THA1 (Using [System] is frightening for me) was found to deflate alpha, and was of questionable applicability in an IS context. THA2 (I feel that things at [organization] would only get worse because of [system]) was considered a loaded question in that it implied an already negative state of affairs at the company. Moreover, THA2 was considered conceptually equivalent to THA3 (I feel that things at

[organization] would not go well due to [system]). THA1 and THA2 were therefore removed from the scale.

In the case of benign/positive appraisal, two items, BPA4 (I don't think much about [System]) and BPA5 ([System] doesn't affect my life), were found to deflate Cronbach's alpha (alpha = 0.67 without these items) and load poorly with other benign/positive measures. Because these items focused on the degree to which the user thought about the system in general and how much the system affected his/her life, it is likely that they did not tap the core theoretical meaning of the construct. Hence, BPA4 and BPA5 were removed from the scale. Of the remaining items in this scale, BPA1 and BPA2 were oriented toward viewing the IS as benign (e.g. not worrying about the IS or having nothing to lose as a result of the IS), while BPA3 focused on the potential positive outcomes resulting from the IS (e.g. improving the quality of care delivered to patients). Capturing this positive dimension was considered important to remain faithful to the construct definition; however the language of BPA3, focusing on quality of patient care, was deemed too specific to the context of the pilot site. This item was therefore reworded to reflect positive assessment of the IS in more generalizable language. A supplemental item was also added to further capture the positive dimension of benign/positive appraisal. The revised benign/positive appraisal scale is shown in Table 4.13.

<b>Table 4.13 - Revised Benign/Positive Appraisal Scale</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Item(s)</b>
Benign/Positive Appraisal (BPA)  <i>Assessment of the IS as benign or positive; preserves or enhances user's well-being</i>	(Ahmad, 2004; Kessler, 1998)	<ol style="list-style-type: none"> <li>1. Using [System] is NOT stressful for me</li> <li>2. I feel I have nothing to lose on my job by using [System]</li> <li>3. I view using [system] as a positive aspect of my job</li> <li>4. I feel that using [system] is beneficial to me in my job</li> </ol>

Items measuring challenge appraisal demonstrated acceptable reliability, but factor structure was problematic. This may have occurred in part due to the dual nature of challenge appraisals, which involve simultaneous stressful and positive reactions to the IS. To improve the performance of this scale for primary data collection, two changes were made. First CA4, assessing the degree to which the user felt a sense of control over how the system would affect his/her job, was removed due to deflation of alpha and conceptual overlap with the notion of secondary appraisal. Second, CA5 (being able to handle the transition to the system) was removed from the scale due to its redundancy with CA3 (being able to manage the transition to the system).

#### 4.4.2.1.3 Infusion Scales

Scales measuring infusion included a general 4-item scale developed by Jones et al. (2002), as well as scales assessing extended, integrative, and emergent use as defined by Saga and Zmud (1994). Reliability and factor analyses for these scales are shown in Table 4.14 and Table 4.15.

**Table 4.14 - Reliability Analysis for Infusion Scales**

<b>Construct</b>	<b>Number of Items</b>	<b>Cronbach's alpha</b>
Infusion (INF)	4	0.83
Extended Use (EXUSE)	4	0.70
Integrative Use (INTUSE)	4	0.81
Emergent Use (EMUSE)	4	0.72

**Table 4.15 - Factor Analysis for Infusion Scales**

	Component			
	1	2	3	4
EMUSE1	<b>.823</b>	.152	.132	.159
EMUSE2	<b>.753</b>	.213	.315	.256
EMUSE3	<b>.871</b>	-.199	-.027	.063
EMUSE4	.181	.301	-.159	<b>.704</b>
EXUSE1	<b>.647</b>	.236	.394	-.021
EXUSE2	.412	-.040	.361	<b>.596</b>
EXUSE3	<b>.867</b>	.332	.196	-.061
EXUSE4	.010	-.087	.411	<b>.735</b>
INTUSE1	<b>.778</b>	.040	-.088	.384
INTUSE2	<b>.628</b>	.253	.417	.248
INTUSE3	<b>.810</b>	.373	.264	.069
INTUSE4	.250	.182	<b>.802</b>	.093
INF1	.219	<b>.765</b>	.384	-.075
INF2	.284	<b>.857</b>	.018	.018
INF3	-.010	<b>.736</b>	.137	.155
INF4	.152	.513	<b>.698</b>	.285

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

All infusion scales demonstrated adequate reliability as shown in Table 4.14. However, Table 4.15 reveals that these scales may lack convergent and discriminant validity. In the case of emergent use and integrative use, the fourth item for each of these scales failed to load with its other three items and was found to deflate Cronbach's alpha. Hence, EMUSE4 (The number of tasks I perform has increased since I started using [System]) and INTUSE4 (Using [System], I am better able to access information from

multiple sources) were removed from their respective scales. The extended use scale presented a more difficult case, with EXUSE1 and EXUSE3 loading together and EXUSE2 and EXUSE4 loading together on a separate construct. Of these four items, only EXUSE4 was found to deflate Cronbach's alpha. Moreover, this item showed less conceptual congruity (as reflected in its low loading on factor 1) with EXUSE1 and EXUSE3 than did EXUSE2, which loads more evenly on factors 1 and 4. Hence, EXUSE4 was removed from the scale while EXUSE2 was retained.

For the overall infusion scale, although INF4 loaded highest on factor 3, it also loaded relatively highly with INF1-INF3 on factor 2. Given the small sample size of the current analysis and the previous validation of this scale by Jones et al. (2002), all items in this scale were retained for the primary data collection.

Notably, the factor analysis reveals that items measuring extended, integrative, and emergent use tended to load on the same factor. Lack of discrimination among these scales might be explained by the significant conceptual similarity between the constructs as defined by Saga and Zmud (1994). For instance, both extended and emergent use deal with using the IS in a way that enhances the tasks performed in the course of one's job. This type of use may, in turn, relate closely to using the IS to enhance flow linkages among work tasks, the concept underlying integrative use. Of greater concern, however, is whether these behaviors indeed capture the notion of infusion as defined herein and in prior literature (Cooper and Zmud, 1990; Saga and Zmud, 1994). The divergence of loadings between these scales and that of the overall infusion measure indicates that extended, integrative, and emergent use behaviors may be psychometrically distinct from

infusion, i.e. using the technology to its fullest potential to enhance performance.

However, given the preliminary nature of this analysis, each of the refined scales was retained for primary data collection.

#### 4.4.2.2 Constructs Measured Formatively

Constructs measured with formative scales included IS use, secondary appraisal, and problem- and emotion-focused adaptation behaviors. Validation of formative scales differs from validation of reflective scales due to the fundamental difference in the nature of formative and reflective measurement. Because reflective scales are composed of items that are intended to be unidimensional and interchangeable, assessment of internal consistency reliability in terms of Cronbach's alpha and convergent and discriminant validity in the form of factor analysis is appropriate. However, formative scale indicators need not correlate with each other, rendering application of these analyses to formative scales inappropriate (Bollen and Lennox, 1991; Rossiter, 2002).

Because formative scales tap distinct dimensions of the target construct, of primary concern is the content validity of the scales, or the degree to which the items capture the full domain of the construct (Straub et al., 2004). Unlike convergent and discriminant validity, content validity is difficult to establish with post hoc statistical tests because content validity is threatened by underspecification of the construct as opposed to misspecification. Researchers have therefore recommended that content validity be established *a priori* through careful consideration of the construct's theory base and examination of extant literature that has measured the construct of interest (Petter et al.,

2006). To this end, formative scales used in this study were drawn from scales established in prior IS and coping research.

After the pilot study, formative scales were re-examined and some were enhanced in order to further promote content validity. The following sections outline these enhancements.

#### 4.4.2.2.1 IS Use Scale

An additional item reflecting intensity of IS use was added to current IS use items measuring frequency and duration of use. Intensity of use has been measured in prior IS studies (e.g. Venkatesh and Agarwal, 2006) and represents an additional dimension of the extent to which the IS is employed in an individual's work. The revised IS use scale is shown in Table 4.16.

<b>Table 4.16 - Revised IS Use Scale</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Item(s)</b>
IS Use (USEFREQ, USEDUR, USEINT)  <i>The frequency, duration, and intensity with which an individual engages the IS in her work</i>	(Compeau et al., 1999; Thompson et al., 1991; Venkatesh and Agarwal, 2006)	<ol style="list-style-type: none"> <li>1. How frequently do you use the system in your work? [Not at all – More than once a day]</li> <li>2. On average, how much time per day do you spend using the system [None – More than 8 hours]</li> <li>3. I would rate the intensity of my job-related the system use to be... [Extremely light – Extremely heavy]</li> </ol>

#### 4.4.2.2.2 Emotion-Focused Adaptation Scales

Beaudry and Pinsonneault's (2005a) original emotion-focused adaptation scales measuring constructs labeled herein as seeking social support (SSS), avoidance/wishful

thinking (AWT), and distancing (DI) were enhanced with additional items based on Lazarus and Folkman's Ways of Coping Questionnaire (Folkman and Lazarus, 1988; Lazarus and Folkman, 1984). The revised scales are shown in Table 4.17. Items SSS4 and SSS5 were added to the seeking social support scale to capture more generalized support seeking activities that were directed at other sources aside from one's colleagues, family members, or supervisor. Items AWT4-AWT6 were added to the avoidance/wishful thinking scale to better capture the wishful thinking dimension of this construct. Finally, the distancing scale (originally composed of two items) was altered in two ways. First, item DI2 (I went out to clear my mind) was removed from the scale based on feedback from survey participants and poor face validity. Second, because only one item remained in this scale, three additional distancing items were added from Folkman and Lazarus (1988) (coded DI2, DI3, and DI4) to increase its content validity. These items emphasize psychological detachment from the IS as described in the definition of the distancing construct.

<b>Table 4.17 - Revised Emotion-Focused Adaptation Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Seeking Social Support (SSS)  <i>Efforts to seek informational, tangible, or emotional support associated with the IS</i>	(Folkman and Lazarus, 1988; Lazarus and Folkman, 1984)	1. I asked for moral support from my colleagues to help me deal with [System] 2. I talked about [System] with my spouse or family members 3. I met with my supervisor to talk about [System] 4. I talked to someone about how I felt about [System] 5. I asked someone I looked up to for advice about dealing with [System]
Avoidance/Wishful Thinking (AWT)  <i>Wishful thinking or behavioral efforts to escape or avoid the IS (contrasts with distancing, which emphasizes detachment)</i>	(Folkman and Lazarus, 1988; Lazarus and Folkman, 1984)	1. I considered taking a leave of absence from work for a while because of [System] 2. I did not want to hear about [System] 3. I did all I could to avoid using [System] 4. I wished that [System] would somehow go away or be replaced 5. I wished that I didn't have to use [System] 6. I wished that I could change the way I felt about [System]
Distancing (DI)  <i>Efforts to detach oneself and to minimize the significance of the IS</i>	(Folkman and Lazarus, 1988; Lazarus and Folkman, 1984)	1. I tried not to worry about difficulties associated with using [System] 2. I made light of having to use [System]; I refused to get too serious about it 3. I tried to go on with my work as if [System] wasn't there at all 4. I tried not to think too much about using [System]

#### 4.4.2.3 Additional Constructs

##### 4.4.2.3.1 Routinization of IS use

Routinization of IS use, or the degree to which the use of the IS has become standardized and is perceived as normal by IS users, was not directly measured in the pilot study; rather, routinization was assumed to derive directly from the frequency and

duration of IS use over time (Saga and Zmud, 1994). However, frequent or prolonged use does not guarantee that use will be standardized or perceived as normal, much as rare or short periods of use do not necessarily preclude this outcome. Hence, an explicit scale for routinization of IS use from Schwarz (2003) was included in the primary data collection instrument.

<b>Table 4.18 - Routinization of IS Use Scale</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Routinization of IS Use (ROUT)  <i>The degree to which the use of the IS has become standardized and is perceived as normal by users.</i>	(Schwarz, 2003)	1. My use of [System] has been incorporated into my regular work schedule 2. My use of [System] is integrated as part of my normal work routine 3. My use of [System] fits right into the way I work 4. My use of [System] is now a normal part of my work

## **4.5 Primary Study**

### *4.5.1 Research Site Selection*

The primary data for this study was collected at a large electronics supplier company in the northwestern United States. This company was selected due to its willingness to participate in the study, and because it had recently implemented a large scale information system used by many of its approximately 2,000 employees. Because of confidentiality concerns, the company elected not to reveal any identifying characteristics about itself or the sample of survey respondents. Hence this information is not provided here.

#### *4.5.2 Data Collection*

Data collection at the primary research site proceeded as follows. An email was sent by company management informing employees of the purpose of the study and requesting participation. Approximately 250 participants were solicited. A paper copy of the survey was then distributed to each employee's mailbox or work station (see Appendix B). Employees were given three weeks to complete and turn in the survey, during which time two reminder emails were sent by company management. After the three week period, surveys were collected and results were tabulated. Responses were then released to the researcher in anonymous form. A total of 195 responses were obtained, constituting a response rate of roughly 78% of those solicited for participation.

#### **4.6 Chapter Summary**

This chapter described theoretical constructs and measurement scales, pilot study procedures, refinement of the survey instrument, and procedures for primary data collection. Analysis of the primary data and testing of research hypotheses are presented in the following chapter.

## CHAPTER 5

### DATA ANALYSIS

This chapter presents the data analysis conducted to test the research hypotheses. The chapter is organized as follows: First, alterations to the survey instrument made by the participating organization are described. Descriptive statistics of the research constructs are then summarized. The results of the Partial Least Squares analysis used for testing the research hypotheses and model are presented and summarized.

#### 5.1 Alterations to Survey Instrument

All questions identified in Chapter 4 were included in the original survey; however, the participating company elected to remove 20 questions due to survey length and perceived sensitivity of responses. In addition, one item was added to the two-item social influence scale. Table 5.1 and Table 5.2 list items removed from and added to the survey, respectively, by the participating organization.

<b>Table 5.1 - Items Removed from Survey</b>		
<b>Construct</b>	<b>Item Code</b>	<b>Item</b>
Infusion	INF4	My use of [System] has been integrated and incorporated into my work at the highest level
Routinization	ROUT4	My use of [System] is now a normal part of my work
Distancing	DI4	I tried not to think too much about using [System]
Avoidance/Wishful Thinking	AWT1	I considered taking a leave of absence from work for a while because of [System]
	AWT2	I did not want to hear about [System]
	AWT3	I did all I could to avoid using [System]
Positive Reappraisal	PR4	I tried to change my mind about using [System] and have fun

<b>Table 5.1 - Items Removed from Survey</b>		
<b>Construct</b>	<b>Item Code</b>	<b>Item</b>
Seeking Social Support	SSS4	I talked to someone about how I felt about [System]
	SSS5	I asked someone I looked up to for advice about dealing with [System]
System Adaptation	SYSAD4	How much effort (in time and energy) did you spend making or recommending other modifications to [System] so that it better fit your tasks
Self Adaptation	SELFAD4	I explored several information sources, on my own initiative, concerning [System]
	SELFAD5	I consulted [System] support documentation that was available to me
	SELFAD6	I participated in [System] training opportunities
	SELFAD7	I consulted with system superuser(s) to learn more about [System]
Secondary Appraisal	SA4	I feel that I need to know more about [System] before I can use it appropriately
	SA5	I feel that I have to accept [System]
Challenge Appraisal	CA4	I feel that there is a lot I can do to master [System]
Threat/Harm Appraisal	THA4	I have had to give up a great deal at work because of [System]
	THA5	I have been harmed in some way by using [System]
Benign/Positive Appraisal	BPA4	I feel that using [System] is beneficial to me in my job

<b>Table 5.2 - Items Added to Survey</b>		
<b>Construct</b>	<b>Item Code</b>	<b>Item</b>
Social Influence	SI3	My supervisor is very supportive of the use of [System] for my job

Although changes to the survey were implemented unilaterally without input from the researcher, a post-hoc examination revealed that the spirit of the constructs was in most cases preserved by remaining scale items. One exception was the secondary appraisal scale, taken from coping research of Lazarus and Folkman (1984). Secondary appraisal refers to an individual's assessment of control over the situation, and was originally measured using a 5-item formative scale. However, the scale was reduced to 3 items by the participating organization, resulting in the elimination of two key dimensions of the construct. Because this reduction was deemed an unacceptable threat to content validity, two supplemental reflective constructs measured in the survey were adopted as surrogates for the original secondary appraisal scale: perceived behavioral control and power. Originating from the theory of planned behavior (Ajzen, 1991), perceived behavioral control (PBC) reflects the degree to which the individual perceives that he/she has the skills, opportunities, and resources to engage in a particular behavior (Ajzen, 1991; Brown et al., 2002; Taylor and Todd, 1995b). Although PBC has been conceptually related to facilitating conditions, PBC reflects a more general assessment of control over use of the IS, as opposed to perceptions of specific organizational infrastructure to support its use. In a similar vein, power reflects the degree to which the individual perceives having control over how the IS affects his/her job. Use of these scales is consistent with prior coping research that has operationalized secondary appraisal as perceived control over events (Affleck et al., 1987; Burns and Egan, 1994; Jenkins and Pargament, 1988). PBC and power scales were drawn from previously validated scales, and are shown in Table 5.3.

<b>Table 5.3 - PBC and Power Scales</b>		
<b>Construct &amp; Definition</b>	<b>Measurement Source(s)</b>	<b>Items</b>
Perceived Behavioral Control (PBC)  <i>The extent to which an individual feels control over using the IS</i>	(Taylor and Todd, 1995a; Taylor and Todd, 1995b)	1. I have control over how I use [System] 2. I have the resources necessary to use [System] 3. I have the knowledge necessary to use [System]
Power (POW)  <i>The degree to which an individual perceives having control over how the IS affects his/her job</i>	(Ashford et al., 1989)*	1. I have control over how [System] affects my job 2. I can determine how [System] affects my work situation 3. I understand [System] well enough to be able to manage its impact on my job

\* In their investigation of job insecurity, Ashford et al. (1989) actually define the construct as *powerlessness* as opposed to power. For this study, the valence of the construct was reversed and items were adapted to an IS context.

## 5.2 Sample Characteristics and Descriptive Statistics

Due to perceived sensitivity of responses and anonymity concerns, demographic data of survey respondents was not released by the participating company; therefore, descriptive statistics of the sample population cannot be reported here. Table 5.4 indicates the original number of items, the revised number of items, and descriptive statistics for each construct in the model.

<b>Table 5.4 - Descriptive Statistics</b>						
<b>Construct</b>	<b>Original Number of Items</b>	<b>Number of Items Released</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>St. Dev</b>
Infusion	4	3	1.0	5.7	3.06	1.05
Extended Use	3	3	1.0	6.0	3.10	1.01
Integrative Use	3	3	1.3	7.0	4.02	1.32
Emergent Use	3	3	2.0	7.0	4.70	1.09
Routinization	4	3	1.3	7.0	3.98	1.05
IS Use	3	3	1.0	6.0	2.89	0.94
Work Adaptation	3	3	1.0	6.7	2.48	0.95
Self Adaptation	7	3	5.0	7.0	6.06	0.52
System Adaptation	3	3	1.0	5.3	3.11	1.07
Seeking Social Support	5	3	1.0	7.0	4.04	1.33
Positive Reappraisal	4	3	1.3	7.0	3.99	1.20
Avoidance/Wishful Thinking	6	3	1.0	6.7	3.73	1.64
Distancing	4	3	1.0	6.7	4.09	1.18
Benign/Positive Appraisal	4	3	1.0	7.0	3.73	1.23
Threat/Harm Appraisal	5	3	1.0	5.7	3.47	0.95
Challenge Appraisal	4	3	1.0	5.3	2.79	1.12
Perceived Behavioral Control	3	3	1.0	6.3	2.99	0.85
Power	3	3	1.0	4.7	2.39	0.90
Performance Expectancy	3	3	1.0	5.7	2.32	0.87
Effort Expectancy	3	3	1.0	6.0	3.27	1.04
Social Influence	3	3	1.0	6.0	2.99	0.99
Facilitating Conditions	3	3	1.0	6.3	2.04	1.08
Behavioral Intention to Use	3	3	1	6.3	3.02	1.08

### 5.3 Measurement Model Results

As in the pilot study, reliability and validity tests were conducted for each reflective construct in the model using the primary data set. Table 5.5 shows Cronbach's alpha coefficients for all reflective constructs. All alpha values are well above the

commonly accepted lower bound of 0.70 (Nunnally, 1978), indicating that the measurement scales exhibit strong reliability.

<b>Construct</b>	<b>Cronbach's alpha</b>
Infusion (INF)	0.84
Extended Use (EXUSE)	0.85
Integrative Use (INTUSE)	0.89
Emergent Use (EMUSE)	0.86
Routinization (ROUT)	0.83
Benign/Positive Appraisal (BPA)	0.89
Threat/Harm Appraisal (THA)	0.80
Challenge Appraisal (CA)	0.88
Perceived Behavioral Control (PBC)	0.75
Power (POW)	0.83
Performance Expectancy (PE)	0.79
Effort Expectancy (EE)	0.82
Social Influence (SI)	0.82
Facilitating Conditions (FC)	0.91
Behavioral Intention to Use (BIU) <sup>3</sup>	0.84

To test for convergent and discriminant validity, a principal components analysis using varimax rotation was conducted. The larger sample size of the primary data (N = 195) allowed for all reflective constructs to be included in a single analysis. Results, shown in Table 5.6, demonstrate that measurement scales load highly on their expected

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<sup>3</sup> Survey participants were asked to report behavioral intention to use the IS at two points in time: when the IS was first implemented (BIU-Initial) and at present (BIU-Current). To maintain temporal consistency with IS perceptions, BIU-Initial was originally planned for inclusion in the analysis. However, it was found that the scale for this construct yielded a negative Cronbach's alpha due to negative covariance among the items. This result likely occurred due to the distorted distribution of the construct, which was centralized very close to the maximum value (m = 6.7) and exhibited very low variability (s.d. = 0.20). Due to the unsuitable nature of this scale, BIU-Current was adopted as a second-best proxy for BIU-Initial. This substitution was deemed acceptable because (a) BIU-Current preserves temporal sequence with current IS use behavior, and (b) BIU is implicated only in the UTAUT portion of the overall theoretical model.

factors and lowly on all other factors, confirming strong convergent and discriminant validity of measurement scales.

Table 5.6 - Factor Analysis for Reflective Scales

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EE1	<b>0.842</b>	-0.085	0.070	0.048	0.038	-0.032	0.098	0.061	-0.152	-0.020	0.005	-0.015	0.052	-0.087	0.042
EE2	<b>0.880</b>	-0.080	0.020	-0.032	-0.047	-0.024	0.040	0.010	-0.112	-0.004	-0.113	0.051	0.002	-0.004	-0.007
EE3	<b>0.821</b>	0.000	-0.018	-0.009	-0.039	-0.100	-0.015	-0.045	0.060	0.033	0.028	0.017	0.021	0.021	-0.046
PE1	0.015	<b>0.849</b>	0.083	-0.023	0.133	-0.054	0.121	-0.102	-0.127	-0.009	-0.071	-0.016	0.047	-0.010	0.047
PE2	-0.123	<b>0.847</b>	0.071	-0.092	0.050	0.074	0.029	-0.061	-0.138	-0.010	0.067	-0.039	0.023	-0.026	0.044
PE3	-0.061	<b>0.758</b>	0.083	0.032	-0.008	-0.044	-0.019	0.118	0.026	-0.135	-0.047	-0.006	-0.131	-0.100	0.086
SI1	-0.007	0.070	<b>0.891</b>	0.025	-0.008	0.097	0.036	-0.037	-0.003	-0.034	0.016	0.090	0.078	0.012	-0.020
SI2	0.048	0.140	<b>0.874</b>	-0.033	-0.031	0.044	0.004	-0.063	-0.037	-0.058	-0.055	0.047	-0.042	0.000	-0.069
SI3	0.025	0.018	<b>0.779</b>	0.113	-0.010	0.020	0.019	-0.046	-0.060	0.076	0.046	-0.040	-0.051	-0.061	0.141
FC1	-0.002	-0.066	0.027	<b>0.930</b>	-0.030	0.026	-0.053	0.007	-0.069	-0.058	0.024	0.027	-0.036	0.067	0.013
FC2	-0.051	-0.012	0.001	<b>0.933</b>	-0.048	0.032	-0.008	-0.028	-0.017	-0.046	0.038	0.063	-0.048	0.094	0.005
FC3	0.056	-0.001	0.081	<b>0.858</b>	-0.066	0.032	0.077	-0.038	-0.063	0.049	-0.026	0.093	0.069	-0.029	-0.049
BIU1	-0.079	-0.026	-0.010	-0.012	<b>0.895</b>	0.015	-0.042	-0.004	0.012	0.009	-0.042	0.029	0.014	-0.005	0.017
BIU2	0.057	0.041	-0.013	-0.042	<b>0.892</b>	-0.043	-0.032	-0.028	0.064	-0.022	-0.034	0.097	0.026	0.044	-0.006
BIU3	-0.029	0.151	-0.026	-0.087	<b>0.798</b>	0.012	0.009	0.068	-0.098	0.037	0.001	0.111	-0.025	0.020	-0.042
BPA1	-0.113	-0.029	0.034	0.071	-0.010	<b>0.900</b>	0.097	0.021	-0.025	0.056	0.021	0.041	0.002	0.015	0.004
BPA2	-0.040	-0.040	-0.001	0.037	0.002	<b>0.911</b>	0.047	0.037	0.045	-0.056	0.033	0.065	0.084	-0.007	0.022
BPA3	-0.013	0.046	0.130	-0.016	-0.008	<b>0.868</b>	-0.002	0.083	0.021	-0.008	0.015	-0.005	0.051	0.027	0.078
THA1	0.120	0.138	0.057	-0.015	0.007	0.028	<b>0.859</b>	-0.049	-0.015	0.063	-0.014	0.052	0.021	0.059	0.022
THA2	0.053	0.030	-0.064	0.058	-0.027	0.036	<b>0.870</b>	0.004	0.026	0.023	0.056	0.054	0.055	0.073	-0.009
THA3	-0.053	-0.042	0.067	-0.028	-0.045	0.073	<b>0.782</b>	-0.002	0.097	-0.130	-0.048	-0.019	-0.054	-0.015	0.102
CA1	0.011	0.011	-0.041	0.004	0.019	0.095	0.006	<b>0.897</b>	0.066	0.009	-0.034	-0.050	-0.060	-0.019	-0.078
CA2	0.029	-0.019	-0.017	-0.028	0.041	0.095	-0.019	<b>0.900</b>	0.020	0.053	0.025	-0.033	-0.123	-0.006	-0.021
CA3	-0.020	-0.030	-0.087	-0.034	-0.024	-0.046	-0.034	<b>0.856</b>	0.005	0.051	0.049	0.058	-0.084	-0.073	-0.055
PBC1	-0.056	-0.052	-0.035	-0.069	0.004	0.006	-0.014	0.017	<b>0.855</b>	0.075	-0.038	0.008	-0.020	0.029	0.066
PBC2	-0.018	-0.017	-0.046	0.002	-0.001	0.097	-0.011	0.097	<b>0.851</b>	0.010	0.023	0.083	0.046	-0.064	0.016
PBC3	-0.101	-0.140	-0.016	-0.070	-0.021	-0.059	0.130	-0.024	<b>0.693</b>	-0.021	0.021	-0.016	0.021	-0.060	0.025
POW1	-0.008	-0.014	0.007	-0.051	-0.019	0.033	-0.053	0.033	-0.006	<b>0.844</b>	0.080	-0.071	0.002	-0.169	-0.021
POW2	0.045	-0.051	-0.069	-0.049	-0.045	0.062	0.060	0.017	0.025	<b>0.886</b>	0.059	-0.094	-0.088	-0.056	0.000
POW3	-0.022	-0.080	0.045	0.044	0.084	-0.098	-0.049	0.062	0.046	<b>0.809</b>	-0.058	-0.070	-0.014	-0.010	-0.044

Table 5.6 - Factor Analysis for Reflective Scales

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ROUT1	-0.018	0.037	-0.007	0.042	-0.018	-0.001	-0.003	0.003	-0.083	0.038	<b>0.880</b>	0.109	-0.020	0.050	0.015
ROUT2	0.032	0.002	0.014	0.029	-0.064	0.112	-0.036	0.031	0.074	-0.021	<b>0.860</b>	0.117	0.044	0.058	0.031
ROUT3	-0.082	-0.082	0.001	-0.036	0.004	-0.037	0.032	0.006	0.016	0.054	<b>0.840</b>	-0.018	-0.013	0.008	-0.005
INTUSE1	0.010	-0.037	0.060	0.007	0.104	0.012	0.049	0.003	-0.022	-0.114	0.055	<b>0.906</b>	-0.018	0.022	-0.014
INTUSE2	0.050	-0.041	0.016	0.033	0.122	0.059	0.043	0.016	0.015	-0.097	-0.017	<b>0.925</b>	0.028	-0.005	-0.008
INTUSE3	-0.002	0.019	0.021	0.154	0.022	0.033	-0.003	-0.045	0.089	-0.032	0.187	<b>0.833</b>	-0.006	-0.073	0.016
EXUSE1	0.109	-0.040	-0.007	0.028	-0.068	0.055	0.078	-0.069	0.028	-0.059	0.001	0.035	<b>0.896</b>	0.053	0.000
EXUSE2	0.028	-0.047	0.008	0.068	-0.003	-0.018	-0.052	-0.063	0.013	-0.019	-0.046	-0.014	<b>0.899</b>	-0.005	0.021
EXUSE3	-0.059	0.028	-0.019	-0.113	0.086	0.104	0.000	-0.136	0.009	-0.022	0.056	-0.016	<b>0.810</b>	0.065	-0.012
EMUSE1	-0.074	-0.011	0.020	0.056	0.037	0.012	0.061	-0.042	-0.042	-0.123	0.103	-0.019	0.056	<b>0.877</b>	-0.005
EMUSE2	-0.005	-0.049	-0.013	0.079	-0.037	-0.012	-0.030	-0.072	-0.093	-0.115	0.032	0.016	0.072	<b>0.878</b>	0.015
EMUSE3	0.013	-0.069	-0.055	-0.004	0.058	0.033	0.084	0.011	0.030	0.002	-0.013	-0.047	-0.013	<b>0.857</b>	0.092
INF1	0.020	0.032	-0.017	0.010	-0.049	-0.030	0.007	-0.059	0.035	-0.030	0.035	-0.017	0.052	0.039	<b>0.890</b>
INF2	-0.041	-0.001	0.032	-0.033	-0.006	0.065	0.102	-0.090	0.014	0.028	-0.050	0.046	0.009	0.062	<b>0.886</b>
INF3	0.002	0.131	0.038	-0.009	0.026	0.067	0.008	-0.003	0.058	-0.060	0.051	-0.033	-0.051	0.002	<b>0.814</b>

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

## 5.4 Hypothesis Testing

### 5.4.1 Analysis Method

Partial Least Squares (PLS) was used to test the research hypotheses. PLS is a structural equation modeling (SEM) technique that simultaneously evaluates both the measurement model (e.g. factor loadings) and the structural model (e.g. path coefficients) in a causal system of independent and dependent latent variables. Based on ordinary least squares procedures, PLS evaluates the significance of path coefficients and the resulting  $R^2$  of dependent variables in the model while seeking to maximize explained variance in dependent variables. PLS was chosen as the method of analysis for the following reasons. First, as an SEM technique, PLS is better suited for analyzing complex multivariate data sets including multiple constructs than are other “first-generation” techniques such as regression analysis (Gefen et al., 2000). Second, unlike covariance-based SEM techniques such as LISREL, PLS operates under a less stringent sample size requirement, and makes no assumptions about the underlying distribution of measured variables (Chin and Newsted, 1999). More importantly, PLS accommodates formative constructs, while covariance-based SEM techniques do not. Finally, given its objective of maximizing explained variance as opposed to model fit, PLS is better suited for predictive and theory-building applications (Chin, 1998) than are other SEM techniques.

The PLS procedure used for hypothesis testing involved both first- and second-order constructs. The research constructs identified in Chapter 4 are first-order constructs; i.e. latent constructs measured by a set of manifest variables. However,

several of the research hypotheses entail second-order constructs, or latent constructs consisting of other (first-order) latent constructs as opposed to manifest variables.

Problem-focused adaptation, for example, is a second-order construct composed of work adaptation, system adaptation, and self adaptation. Similarly, infusion is conceptualized as a second-order construct comprising integrative use, extended use, and emergent use.

Table 5.7 identifies all second-order constructs in the research model, together with their composite first-order constructs.

<b>Table 5.7 - Second-Order Constructs</b>	
<b>Second-Order Construct</b>	<b>Composite First-Order Constructs</b>
Infusion	Extended Use, Integrative Use, Emergent Use, Overall Infusion
Problem-Focused Adaptation	Work Adaptation, System Adaptation, Self Adaptation
Approach-Oriented Emotion-Focused Adaptation	Seeking Social Support, Positive Reappraisal
Avoidance-Oriented Emotion-Focused Adaptation	Avoidance/Wishful Thinking, Distancing
Secondary Appraisal	Perceived Behavioral Control, Power

The PLS software package used to conduct the data analysis was SmartPLS version 2.0.M3. At present, PLS software does not explicitly support second-order constructs. To overcome this limitation, the following procedure was utilized as outlined in prior research (e.g. Agarwal and Karahanna, 2000; Yi and Davis, 2003). For each set of first-order constructs comprising a second-order construct, a principal components analysis was conducted to compute first-order component scores for each case in the dataset. These component scores were then incorporated into the PLS analysis as

formative indicators of second-order constructs. In cases when the results of hypothesis testing were ambiguous using second-order constructs, the construct was decomposed and its constituent components were individually tested.

Hypotheses were tested by examining the sign and magnitude of PLS path coefficients, which represent the strength of relationships between constructs and can be interpreted as regression coefficients between standardized variables. Significance of path coefficients was calculated using a bootstrapping procedure with 500 subsamples. In addition to structural model parameters, measurement model statistics generated by PLS were examined as a further evaluation of scale reliability and validity. These included the composite reliability (CR) and the average variance extracted (AVE) for each construct. CR is a measure of scale reliability produced by PLS that is analogous to Cronbach's alpha (Gefen et al., 2000). AVE represents the percentage of variance that is attributable to variance of the construct, and is expressed as a ratio of the sum of variance captured by the construct and measurement variance (Gefen et al., 2000). Convergent validity is demonstrated when the AVE of a construct is greater than or equal to 0.5—i.e., that the measures contain at most 50% error variance. (Fornell and Larcker, 1981). Discriminant validity is established when the square-root of the construct's AVE exceeds its correlations with other constructs in the model (Gefen and Straub, 2005).

Due to sample size constraints, the overall research model presented in Chapter 3 was decomposed into four sub-models for hypothesis testing. The following sections present these sub-models, their measurement statistics, and the results of hypothesis tests.

### 5.4.2 Model 1: Antecedents of Infusion

The first model, antecedents of infusion, contains hypotheses H1 – H3, and is shown in Figure 5.1.

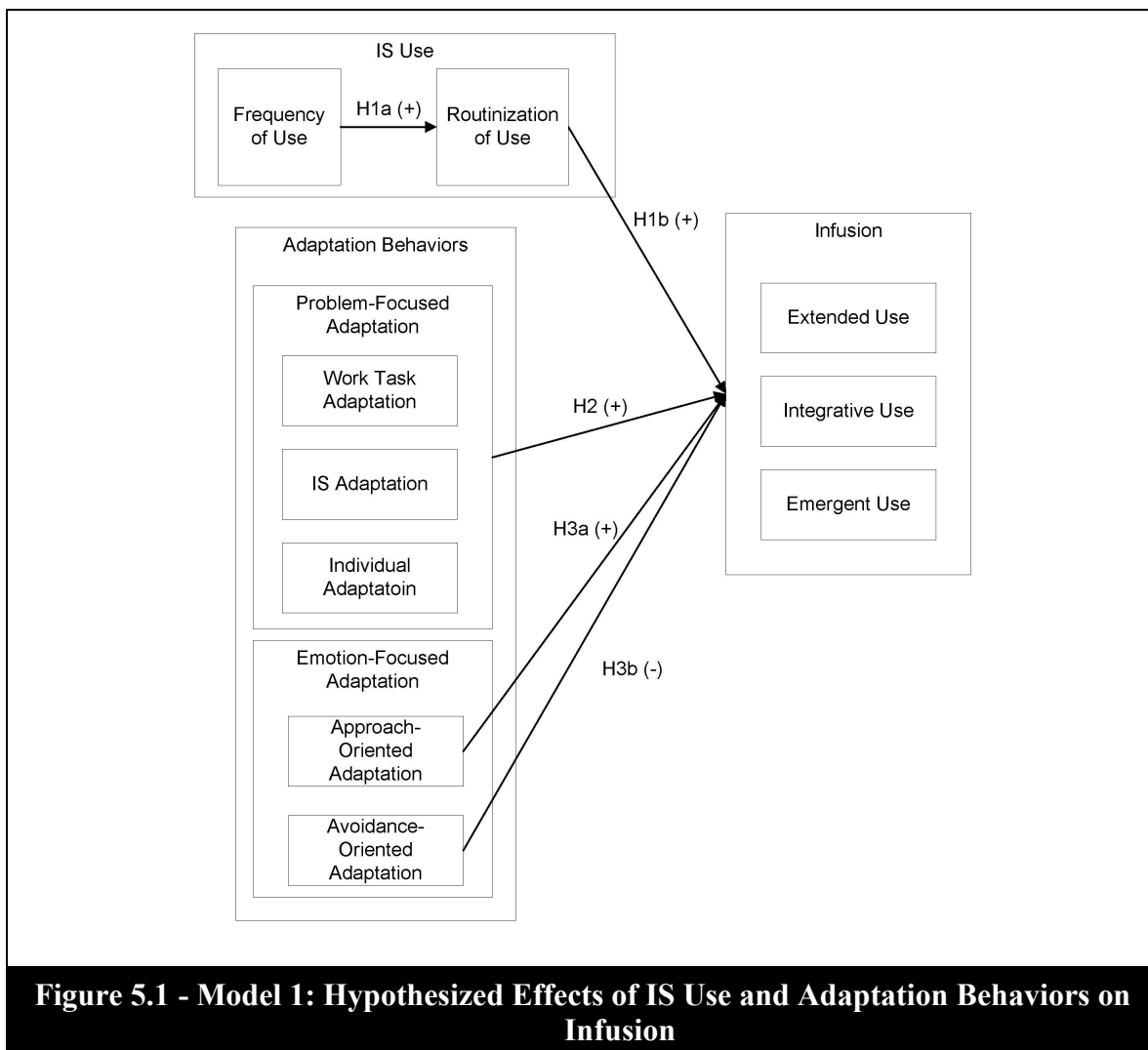


Table 5.8 shows measurement model statistics for Model 1, including CR, AVE, and inter-construct correlations. (Because CR and AVE are relevant only for reflective constructs, they are shown only for routinization in this model).

#	Construct	CR	AVE	1	2	3	4	5	6
1	EFAB-Approach	N/A	N/A	N/A					
2	EFAB-Avoidance	N/A	N/A	0.084	N/A				
3	INF	N/A	N/A	0.260	-0.076	N/A			
4	PFAB	N/A	N/A	-0.039	-0.100	-0.219	N/A		
5	ROUT	0.830	0.620	0.055	0.041	-0.003	-0.040	<b>0.787</b>	
6	USE	N/A	N/A	0.013	-0.104	0.020	0.089	-0.148	N/A

Results of structural model tests are shown in Table 5.9. Cells in the main body of the table represent hypothesized relationships between the independent variables (labeled on the right column) and dependent variables (labeled on the top row). Grayed cells represent the absence of a hypothesized relationship. The remaining cells show the PLS path coefficient and corresponding t-value (in parentheses) for each hypothesis.

	<b>Routinization</b> (R <sup>2</sup> = 0.042)	<b>Infusion</b> (R <sup>2</sup> = 0.045)
<b>IS Use (H1a +)</b>	0.204** (3.454)	
<b>Routinization (H1b +)</b>		0.047 (0.862)
<b>Problem-Focused Adaptation (H2 +)</b>		-0.031 (0.582)
<b>Approach-Oriented Emotion-Focused Adaptation (H3a +)</b>		-0.160** (2.509)
<b>Avoidance-Oriented Emotion-Focused Adaptation (H3b -)</b>		-0.128* (1.873)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

Results shown in Table 5.9 indicate that IS use (consisting of frequency, intensity, and duration of use) was positively related to routinization of IS use, as hypothesized in H1a. Contrary to expectation, neither routinization nor problem-focused adaptation was significantly related to infusion (H1b, H2). Finally, in partial support of H3, both approach- and avoidance-oriented adaptation behaviors were found to negatively affect infusion.

Approach- and avoidance-oriented emotion-focused adaptation constructs were measured formatively using factor scores for four first-order constructs: seeking social support and positive reappraisal (approach-oriented), and avoidance/wishful thinking and distancing (avoidance-oriented). For each second-order construct, the results of the initial PLS analysis showed that one of the two constituent first-order constructs exhibited a negative weight, indicating divergent effects on the dependent variable. To further examine these effects, a second PLS analysis was run using each of the first-order constructs as separate predictors of infusion. (Problem-focused adaptation was also decomposed into its constituent constructs). The results of this analysis are shown in Table 5.10.

<b>Table 5.10 - Structural Model Results for Decomposed Model 1</b>		
	<b>Routinization</b> (R <sup>2</sup> = 0.039)	<b>Infusion</b> (R <sup>2</sup> = 0.065)
<b>IS Use (H1a +)</b>	0.198** (3.374)	
<b>Routinization (H1b +)</b>		0.050 (0.974)
<b>Work Adaptation (H2 +)</b>		-0.091 (1.510)
<b>System Adaptation (H2 +)</b>		0.043 (0.702)
<b>Self Adaptation (H2 +)</b>		-0.030 (0.530)
<b>Seeking Social Support (H3a +)</b>		0.1170* (1.838)
<b>Positive Reappraisal (H3a +)</b>		-0.087 (1.496)
<b>Avoidance/Wishful Thinking (H3b -)</b>		-0.138* (2.190)
<b>Distancing (H3b -)</b>		0.032 (0.567)

\* p ≤ 0.05    \*\* p ≤ 0.01

As shown in Table 5.10, IS use again related significantly to routinization of use (H1a), but routinization did not significantly affect infusion (H1b). Also, consistent with the prior analysis, no dimension of problem-focused adaptation (work, system, self) was found to significantly affect infusion (H2). For approach-oriented emotion-focused adaptation, seeking social support contributed positively to infusion, while positive reappraisal had no significant effect (H3a). For avoidance-oriented emotion-focused

adaptation, avoidance/wishful thinking negatively influenced infusion, while distancing had no significant effect (H3b).

Hypothesis testing results are summarized in Table 5.11.

<b>Table 5.11 - Model 1 Hypothesis Test Results</b>		
<b>Label</b>	<b>Hypothesis</b>	<b>Results</b>
H1a	Frequency of IS use will be positively related to routinization of IS use	Supported
H1b	Routinization of IS use will be positively related to IS infusion	Not Supported (NS)
H2	Problem-focused adaptation behaviors directed toward changing the work task, the IS, and the individual will relate positively to individual-level IS infusion	Not Supported (NS)
H3a	Approach oriented emotion-focused adaptation behaviors will relate positively to individual-level IS infusion	Partially Supported ( <i>Seeking social support positively related; Positive reappraisal NS</i> )
H3b	Avoidance oriented emotion-focused adaptation behaviors will relate negatively to individual-level IS infusion	Partially Supported ( <i>Avoidance/wishful thinking negatively related; Distancing NS</i> )

#### 5.4.3 Model 2: Antecedents of Adaptation Behaviors

Model 2 encompasses antecedents of adaptation behaviors, and comprises hypotheses H4 – H5. This model is shown in Figure 5.2

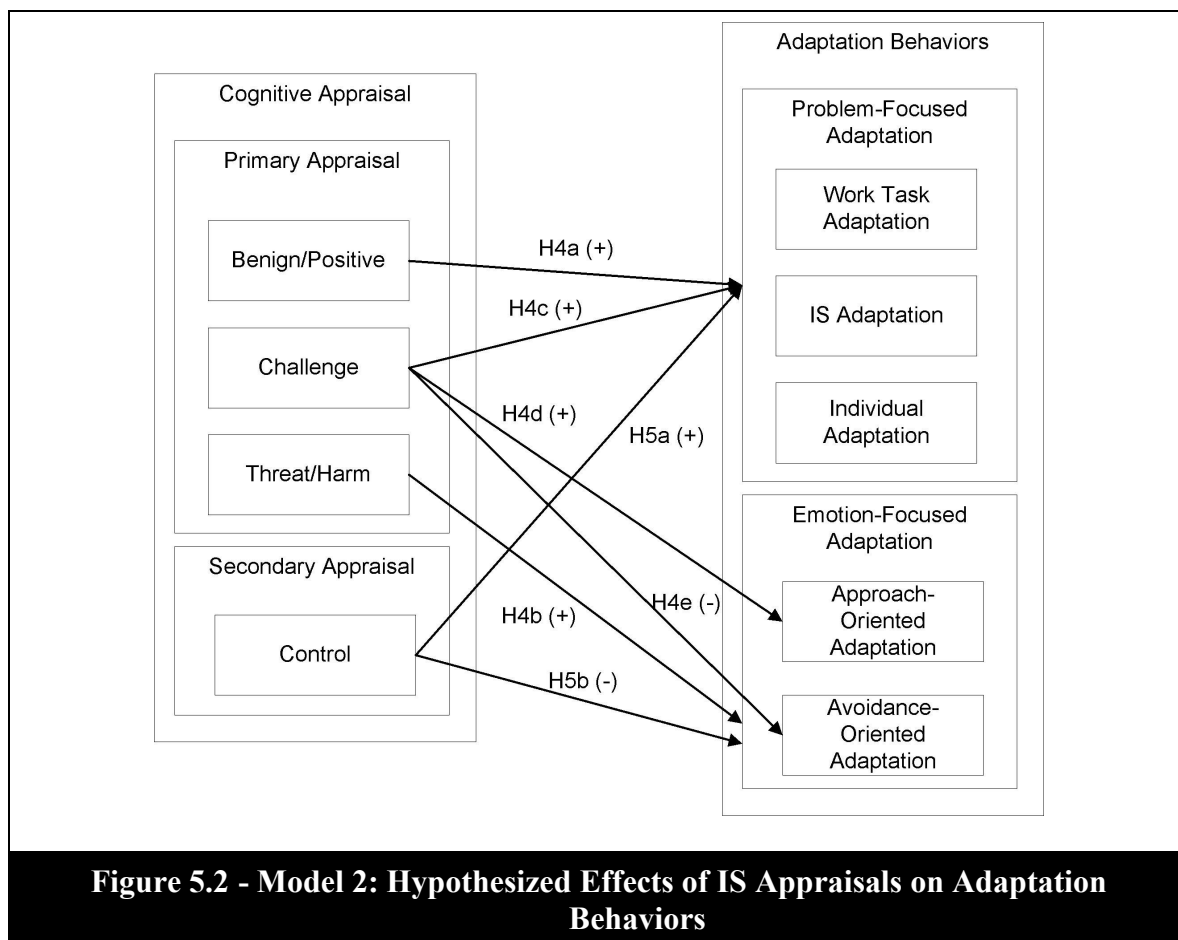


Table 5.12 shows measurement model statistics for Model 2, including CR and AVE for reflective constructs and inter-construct correlations.

<b>Table 5.12 - CR, AVE, and Inter-Construct Correlations for Model 2</b>										
#	Construct	CR	AVE	1	2	3	4	5	6	7
1	BPA	0.929	0.814	<b>0.902</b>						
2	CA	0.925	0.803	0.092	<b>0.896</b>					
3	EFAB-Approach	N/A	N/A	-0.122	-0.085	N/A				
4	EFAB-Avoidance	N/A	N/A	-0.088	-0.142	-0.066	N/A			
5	PFAB	N/A	N/A	0.200	-0.016	0.143	0.111	N/A		
6	SA	N/A	N/A	0.033	0.029	0.017	0.077	0.135	N/A	
7	THA	0.886	0.722	0.118	-0.026	-0.211	-0.160	0.132	0.064	<b>0.941</b>

Results of structural model tests are shown in Table 5.13. As hypothesized by H4a, benign/positive IS appraisals positively predicted problem-focused adaptation. H4b was not supported, with threat/harm appraisals exhibiting significant *negative* relationships to emotion-focused adaptation behaviors. Challenge appraisals did not significantly predict problem-focused or approach-oriented emotion-focused adaptation (H4c and H4d), but were negatively related to avoidance-oriented emotion-focused adaptation as hypothesized in H4e. Finally, secondary appraisal positively predicted problem-focused adaptation behaviors, supporting H5a, but failed to significantly predict emotion focused adaptation behaviors (H5b).

<b>Table 5.13 - Structural Model Results for Model 2</b>			
	<b>Problem-Focused Adaptation (R<sup>2</sup>= 0.058)</b>	<b>Approach- Oriented Emotion- Focused Adaptation (R<sup>2</sup>= 0.054)</b>	<b>Avoidance- Oriented Emotion- Focused Adaptation (R<sup>2</sup>= 0.055)</b>
<b>Benign/Positive Appraisal (H4a +)</b>	0.199** (2.614)		
<b>Threat/Harm Appraisal (H4b +)</b>		-0.215** (2.622)	-0.169* (2.041)
<b>Challenge Appraisal (H4c +, H4d +, H4e -)</b>	-0.038 (0.500)	-0.092 (1.151)	-0.149* (1.900)
<b>Secondary Appraisal (H5a +, H5b, -)</b>	0.129* (1.675)	0.034 (0.553)	0.092 (1.196)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

As in Model 1, first-order formative components of second-order constructs exhibited both positive and negative weights, indicating that individual first-order constructs may exhibit divergent effects. To examine these effects, three separate PLS analyses were run examining each decomposed adaptation behavior construct. In addition, secondary appraisal was decomposed into its constituent constructs of perceived behavioral control and power. Results of these are shown in Table 5.14 (problem-focused adaptation) and Table 5.15 (emotion-focused adaptation).

<b>Table 5.14 - Structural Model Results for Model 2, Decomposed Problem-Focused Adaptation</b>			
	<b>Work Adaptation</b> (R <sup>2</sup> = 0.016)	<b>System Adaptation</b> (R <sup>2</sup> = 0.030)	<b>Self Adaptation</b> (R <sup>2</sup> = 0.061)
<b>Benign/Positive Appraisal (H4a +)</b>	-0.067 (1.140)	-0.044 (0.795)	0.164* (2.259)
<b>Challenge Appraisal (H4c +)</b>	-0.021 (0.285)	0.115* (1.738)	-0.035 (0.492)
<b>Perceived Behavioral Control (H5a +)</b>	-0.083 (1.201)	0.031 (0.518)	0.151* (2.038)
<b>Power (H5a +)</b>	-0.053 (0.927)	0.105 (1.562)	-0.091 (1.438)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

<b>Table 5.15 - Structural Model Results for Model 2, Decomposed Emotion-Focused Adaptation</b>				
	<b>Seeking Social Support</b> (R <sup>2</sup> = 0.056)	<b>Positive Reappraisal</b> (R <sup>2</sup> = 0.110)	<b>Avoidance/Wishful Thinking</b> (R <sup>2</sup> = 0.050)	<b>Distancing</b> (R <sup>2</sup> = 0.052)
<b>Threat/Harm Appraisal (H4b +)</b>	-0.186** (3.119)	0.115* (1.880)	-0.088 (1.312)	-0.147* (2.168)
<b>Challenge Appraisal (H4d +, H4e -)</b>	-0.134* (2.080)	-0.109* (1.676)	-0.144* (2.306)	-0.058 (0.946)
<b>Perceived Behavioral Control (H5b -)</b>	0.035 (0.634)	0.106 (1.578)	0.055 (0.803)	0.083 (1.176)
<b>Power (H5b -)</b>	0.055 (1.006)	-0.263** (3.459)	-0.137* (2.064)	0.152* (2.227)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

Results shown in Table 5.14 provide partial support for Hypotheses H4a, H4c, and H5a. Specifically, benign/positive appraisal and perceived behavioral control (secondary appraisal) positively influenced self adaptation, while challenge appraisal positively influenced system adaptation. All other relationships in the model were non-significant.

Results shown in Table 5.15 provide mixed support for hypotheses H4b, H4d, H4e, and H5b. Consistent with H4b, threat/harm appraisal positively predicted positive reappraisal; however, significant *negative* relationships were observed between this construct and adaptation behaviors of seeking social support and distancing. Challenge appraisal was negatively related to seeking social support, positive reappraisal, and avoidance/wishful thinking, refuting H4d but providing partial support for H4e. Finally,

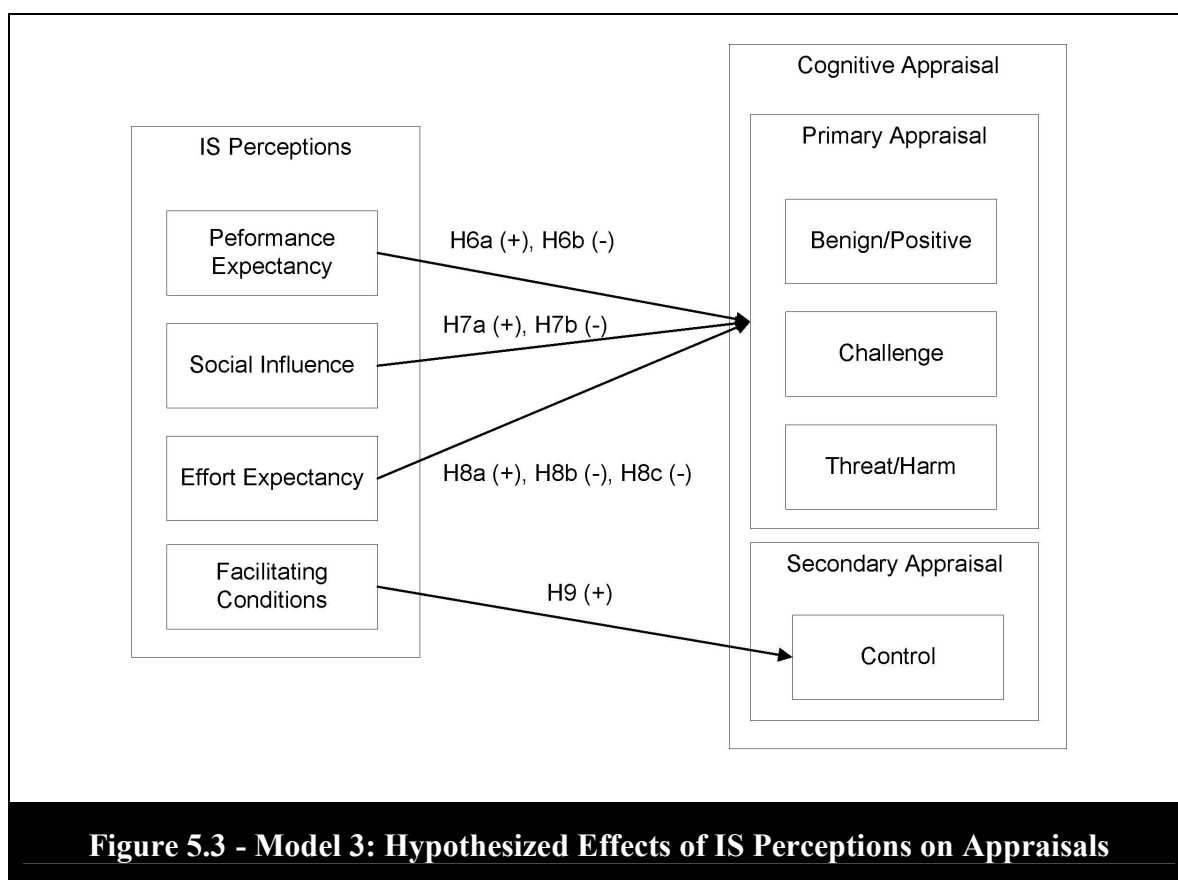
the power dimension of secondary appraisal negatively influenced positive reappraisal and avoidance/wishful thinking, but positively influenced distancing, thus providing mixed support for H5b.

Table 5.16 summarizes hypothesis testing results for model 2.

<b>Table 5.16 - Model 2 Hypothesis Test Results</b>		
H4a	Appraisal of the IS as benign/positive will be positively associated with problem-focused adaptation behaviors	Partially Supported <i>(Self adaptation positively related; work and system adaptation NS)</i>
H4b	Appraisal of the IS as threatening/harmful will be positively associated with emotion-focused adaptation behaviors	Partially Supported <i>(Positive reappraisal positively related; seeking social support and distancing negatively related; avoidance/wishful thinking NS)</i>
H4c	Appraisal of the IS as challenging will be positively associated with problem-focused adaptation behaviors	Partially Supported <i>(System adaptation positively related; work and self adaptation NS)</i>
H4d	Appraisal of the IS as challenging will be positively associated with approach-oriented emotion-focused adaptation behaviors	Not Supported <i>(Significant in opposite direction)</i>
H4e	Appraisal of the IS as challenging will be negatively associated with avoidance-oriented emotion-focused adaptation behaviors	Partially Supported <i>(Avoidance/wishful thinking negatively related; distancing NS)</i>
H5a	High control appraisals with respect to an IS will be positively associated with problem-focused adaptation behaviors	Partially Supported <i>(Perceived behavioral control positively related to self adaptation; all other relationships NS)</i>
H5b	High control appraisals with respect to an IS will be negatively associated with emotion-focused adaptation behaviors	Partially Supported <i>(Power negatively related to positive reappraisal and avoidance/wishful thinking, but positively related to distancing; all other relationships NS)</i>

#### 5.4.4 Model 3: Antecedents of Appraisals

Model 3, shown in Figure 5.3, includes antecedents of IS appraisals, and comprises Hypotheses H6 – H9.



Because hypothesized antecedents to primary and secondary appraisals are independent, two separate analyses were conducted: one to test H6 – H8, and the other to test H9. Table 5.17 shows measurement model statistics for the first sub-model (primary appraisal), including CR, AVE, and inter-construct correlations.

#	Construct	CR	AVE	1	2	3	4	5	6	7
1	BPA	0.930	0.816	<b>0.903</b>						
2	CA	0.925	0.804	0.096	<b>0.897</b>					
3	EE	0.895	0.740	-0.123	-0.003	<b>0.860</b>				
4	EExPE	0.806	0.342	0.052	-0.130	0.082	<b>0.585</b>			
5	PE	0.796	0.593	0.012	-0.128	-0.093	0.022	<b>0.770</b>		
6	SI	0.888	0.727	0.118	-0.110	0.044	-0.025	0.156	<b>0.853</b>	
7	THA	0.844	0.651	0.081	-0.052	0.102	0.018	0.168	0.083	<b>0.807</b>

The moderating impact of performance expectancy on the hypothesized relationship between effort expectancy and challenge appraisal (H8c) is represented by the EExPE construct in Table 5.17, and was constructed following the procedure outlined in Chin et al. (1996). According to this procedure, a new set of indicators is constructed by calculating all possible products of the standardized indicators of the independent and moderating constructs (performance expectancy and effort expectancy in this case). This new set of indicators is then assigned to a new moderating latent variable, which is included in the structural model as an additional predictor of the dependent variable (i.e. challenge appraisal). Using a bootstrapping resampling procedure, the significance of the path coefficient between this variable and the dependent variable is then assessed to determine whether the moderating effect is significant.

Results of structural model tests for H6 – H8 are shown in Table 5.18. Contrary to expectation, performance expectancy and effort expectancy related *positively* to threat/harm appraisal and *negatively* to benign/positive appraisal (only effort expectancy was a significant predictor of benign/positive). Thus, hypotheses H6a, H6b, H8a, and

H8b are not supported. Social influence related positively to benign/positive appraisal, but did not significantly predict threat/harm appraisal, supporting H7a but failing to support H7b. Finally, with regard to H8c, the direct effect of effort expectancy on challenge appraisal was non-significant; however, the moderating variable of effort expectancy x performance expectancy was significant in the negative direction as hypothesized in H8c. The negative path coefficient can be interpreted as follows: For a single standard deviation *increase* in performance expectancy, the effect of effort expectancy on challenge appraisal *decreases* by 0.127 (Chin et al., 1996). Thus, when performance expectancy is high, lower effort expectancy (meaning that the IS is difficult to use) is associated with higher challenge appraisals. Conversely, when performance expectancy is low, low effort expectancy is associated with lower challenge appraisals.

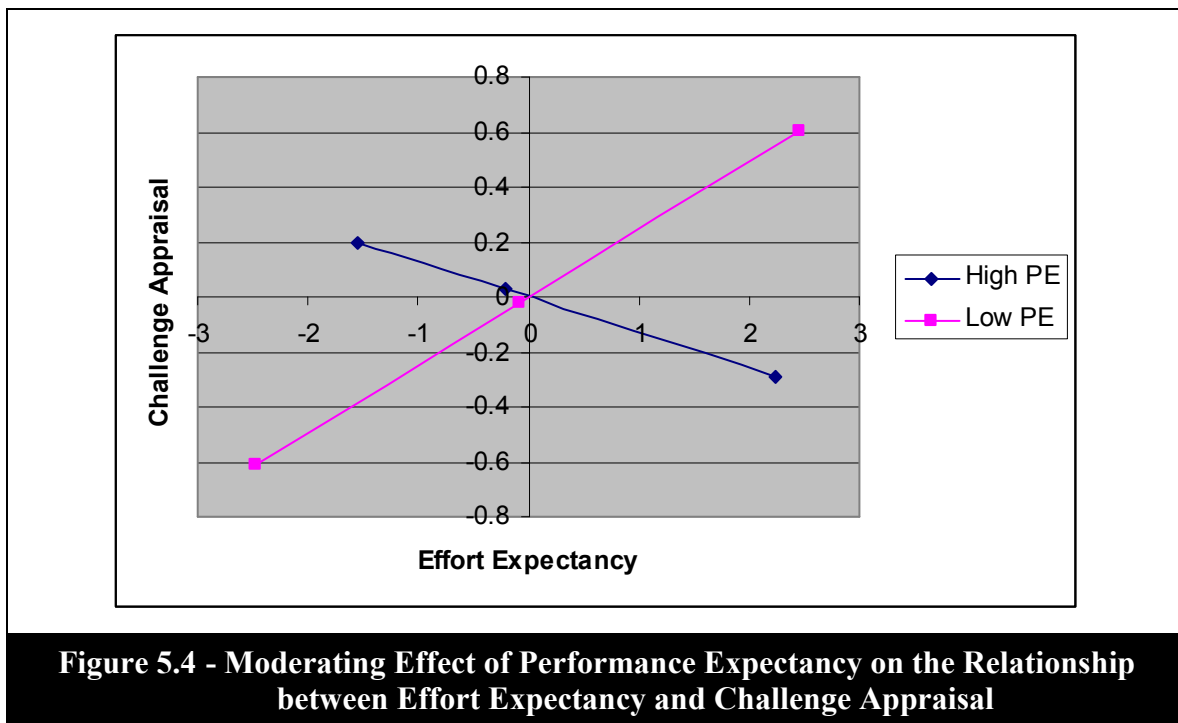
<b>Table 5.18 - Structural Model Results for Model 3, Primary Appraisals</b>			
	<b>Benign/Positive Appraisal (R<sup>2</sup>= 0.031)</b>	<b>Threat/Harm Appraisal (R<sup>2</sup>= 0.045)</b>	<b>Challenge Appraisal (R<sup>2</sup>= 0.033)</b>
<b>Performance Expectancy (H6a +, H6b -)</b>	-0.020 (0.401)	0.170** (2.45)	
<b>Social Influence (H7a +, H7b -)</b>	0.127* (1.959)	0.051 (0.808)	
<b>Effort Expectancy (H8a +, H8b -, H8c -)</b>	-0.131* (2.053)	0.115* (1.702)	-0.005 (0.096)
<b>Effort Expectancy x Performance Expectancy (H8c -)</b>			-0.127* (2.309)

\* p ≤ 0.05    \*\* p ≤ 0.01

To further illustrate the interaction effect of performance and effort expectancies on challenge appraisal, simple effects of effort expectancy on challenge appraisal were examined at high and low levels of performance expectancy. Drawing from the procedure recommended by Aiken and West (1991) and Cohen et al. (2003), two PLS analyses were conducted: one for all cases containing a performance expectancy rating greater than or equal to one standard deviation above the mean ( $N = 30$ ), and another for such cases rating performance expectancy one standard deviation below the mean ( $N = 34$ ; summated PE scales were utilized to identify the appropriate cases). The resulting path coefficients for each model are shown in Table 5.19, and the moderating effect is depicted graphically in Figure 5.4.

<b>Table 5.19 - Simple Effects of EE on CA for High and Low Values of PE</b>		
	<b>High PE</b>	<b>Low PE</b>
<b>EE → CA Path Coefficient</b>	-0.129** (2.790)	0.246** (4.681)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$



As Figure 5.4 shows, individuals with high IS performance expectancy are more likely to view the IS as a challenge when ease of IS use is perceived as low. In contrast, individuals with low performance expectancy are more likely to view the IS as a challenge when ease of IS use is perceived as high.

The second component of Model 3 includes facilitating conditions as a predictor of secondary appraisal (H9). Because the PLS software employed did not allow the simultaneous analysis of disconnected models, a separate analysis was conducted to test H9. Table 5.20 and Table 5.21 show measurement model and structural model statistics for this analysis.

<b>Table 5.20 - CR, AVE, and Inter-Construct Correlations for Model 3, Secondary Appraisals</b>						
#	Construct	CR	AVE	1	2	3
1	FC	0.928	0.812	<b>0.901</b>		
2	PBC	0.826	0.618	-0.052	<b>0.786</b>	
3	POW	0.888	0.728	-0.142	0.074	<b>0.853</b>

<b>Table 5.21 - Structural Model Results for Model 3, Secondary Appraisals</b>		
	<b>Perceived Behavioral Control</b> (R <sup>2</sup> = 0.003)	<b>Power</b> (R <sup>2</sup> = 0.020)
<b>Facilitating Conditions (H9 +)</b>	-0.052 (0.970)	-0.142** (2.798)

\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

As revealed in Table 5.21, facilitating conditions are negatively related to the power dimension of secondary appraisal, and not significantly related to the perceived behavioral control dimension of secondary appraisal. Hence, results fail to support H9.

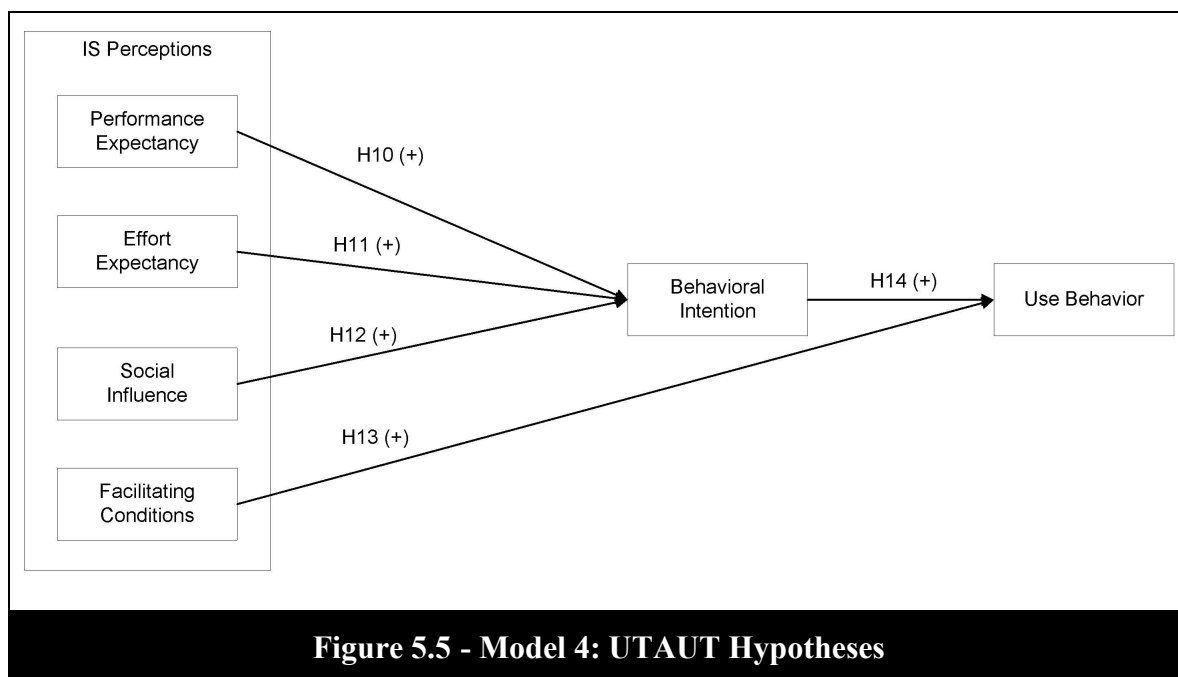
Hypothesis testing results for Model 3 are summarized in Table 5.22.

<b>Table 5.22 - Model 3 Hypothesis Test Results</b>		
H6a	Performance expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS	Not Supported (NS)
H6b	Performance expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS	Not Supported (Significant in opposite direction)
H7a	Social influence surrounding use of an IS will be positively related to benign/positive primary appraisal of the IS	Supported
H7b	Social influence surrounding use of an IS will be negatively related to threat/harm primary appraisal of the IS	Not Supported (NS)
H8a	Effort expectancy of using an IS will be positively related to benign/positive primary appraisal of the IS	Not Supported (Significant in opposite direction)
H8b	Effort expectancy of using an IS will be negatively related to threat/harm primary appraisal of the IS	Not Supported (Significant in opposite direction)
H8c	Effort expectancy of using an IS will be negatively related to challenge primary appraisal of the IS, moderated by performance expectancy of using the IS.	Supported
H9	Facilitating conditions surrounding use of an IS will be positively related to high control secondary appraisal of the IS	Not Supported (Perceived behavioral control NS; Power significant in opposite direction)

#### 5.4.5 Model 4: UTAUT

Hypotheses H10 – H14 are taken from the UTAUT model (Venkatesh et al., 2003), and are shown in Figure 5.5. As formulated in Venkatesh et al. (2003) and in Chapter 3 of this study, these hypotheses include moderating effects of various demographic variables, including age, gender, and experience. However, because these

variables were withheld by the organization participating in this study, only main effects of each IS perception are tested here.



**Figure 5.5 - Model 4: UTAUT Hypotheses**

Table 5.23 and Table 5.24 show measurement and structural statistics, respectively, for the UTAUT model.

<b>Table 5.23 - CR, AVE, and Inter-Construct Correlations for UTAUT Model</b>									
#	Construct	CR	AVE	1	2	3	4	5	6
1	BIU	0.906	0.763	<b>0.873</b>					
2	EE	0.875	0.703	-0.059	<b>0.838</b>				
3	FC	0.913	0.778	0.092	0.003	<b>0.882</b>			
4	PE	0.859	0.677	0.151	-0.103	0.048	<b>0.823</b>		
5	SI	0.879	0.709	-0.058	0.045	-0.065	0.168	<b>0.842</b>	
6	USE	N/A	N/A	0.134	0.085	0.073	-0.002	0.014	<b>N/A</b>

<b>Table 5.24 - Structural Model Results for UTAUT Model</b>		
	<b>Behavioral Intention to Use the IS (R<sup>2</sup>= 0.032)</b>	<b>IS Use (R<sup>2</sup>= 0.022)</b>
<b>Performance Expectancy (H10 +)</b>	0.161** (2.800)	
<b>Effort Expectancy (H11 +)</b>	-0.039 (0.801)	
<b>Social Influence (H12 +)</b>	-0.084 (1.466)	
<b>Facilitating Conditions (H13 +)</b>		0.061 (0.903)
<b>Behavioral Intention to Use the IS (H14 +)</b>		0.128* (1.672)

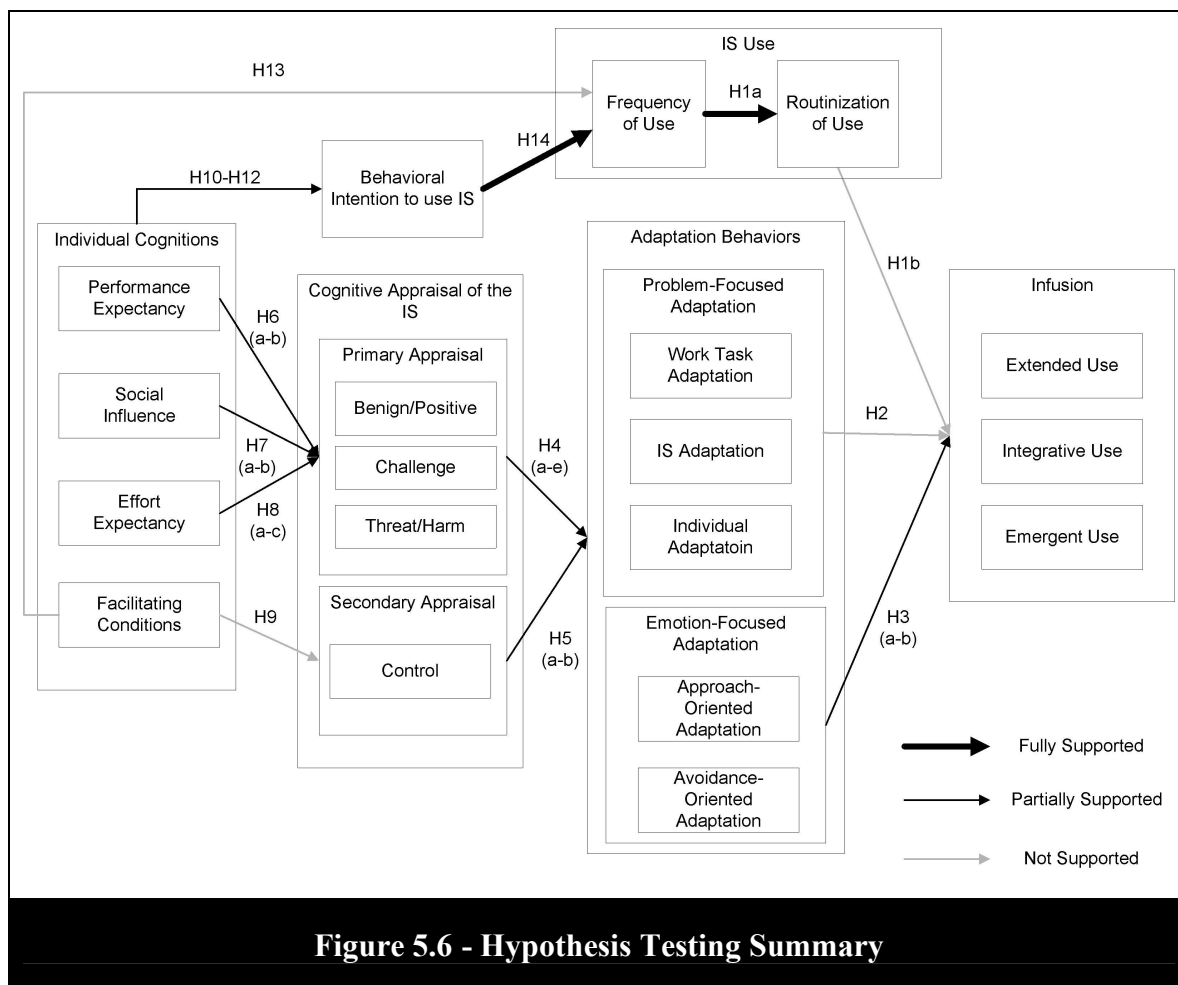
\*  $p \leq 0.05$     \*\*  $p \leq 0.01$

As evidenced in Table 5.24, performance expectancy was positively related to behavioral intention to use the IS, supporting H10. However, no significant relationship was found between perceptions of effort expectancy and social influence and behavioral intention; thus, results fail to support H11 and H12. H13 was also not supported: facilitating conditions were not significantly related to IS use behavior. Finally, in support of H14, behavioral intention to use the IS was positively related to IS use behavior. Results of hypothesis tests are summarized in Table 5.25.

<b>Table 5.25 - UTAUT Hypothesis Test Results</b>		
<b>Label</b>	<b>Hypothesis</b>	<b>Results</b>
H10	Performance expectancy will be positively related to behavioral intention to use the IS	Supported
H11	Effort expectancy will be positively related to behavioral intention to use the IS	Not Supported (NS)
H12	Social influence will be positively related to behavioral intention to use the IS	Not Supported (NS)
H13	Facilitating conditions will be positively related to IS use	Not Supported (NS)
H14	Behavioral Intention to use the IS will be positively related to IS use	Supported

#### *5.4.6 Hypothesis Testing Summary*

Figure 5.6 summarizes the hypothesis testing results, indicating which hypotheses (or set of hypotheses) were fully supported, partially supported, or not supported by the data analysis.



## 5.5 Chapter Summary

This chapter described changes made to the survey instrument, outlined the data analysis procedure, and presented the results of hypothesis tests. Findings from the analysis were then summarized. The following chapter discusses expected findings, unexpected findings, and implications of hypothesis testing results.

## CHAPTER 6

### DISCUSSION AND CONCLUSIONS

This chapter discusses implications of hypothesis test results and delineates contributions of this study to IS research and practice. Strengths and limitations of the study are then presented, after which directions for future research are discussed.

#### 6.1 Discussion and Implications

##### *6.1.1 Effects of IS Use and Adaptation Behaviors on Infusion*

Results from the data analysis provided mixed support for the hypothesized antecedents of infusion. Consistent with Saga and Zmud (1994) frequency of IS use was positively related to IS routinization. However, routinization was not significantly associated with IS infusion.<sup>4</sup> This finding implies that infusion, or using an IS to its fullest potential, may be less dependent on the regular and normal use of the IS than has been claimed in prior research (Saga and Zmud, 1994; Zmud and Apple, 1992). Instead, infusion may also occur in the IS user who engages in “deep” and “thorough” system use, but at irregular intervals and over varying periods of time. Although this argument may essentially rest on the semantics of “infusion” and “routinization,” it highlights the need for future research to examine the assumption that infused IS use can follow only from routinized IS use.

With respect to IS adaptation, two emotion-focused behaviors, seeking social support (approach-oriented) and avoidance/wishful thinking (avoidance-oriented), were

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<sup>4</sup> A power analysis revealed statistical power of 0.87 for detecting a small-to-medium effect ( $f^2 = .05$ ) with an alpha level of 0.05. Hence, the probability of a type II error (or failing to detect a significant effect when in fact one exists) is considered unlikely.

associated with infusion as hypothesized. Specifically, seeking social support was associated with higher infusion levels, while avoidance/wishful thinking was associated with lower infusion levels. The other two emotion-focused behaviors, positive reappraisal and distancing, were not significantly related. Although providing only partial support for the hypothesized relationships, these results suggest that emotion-focused reactions to an IS do play a role in shaping the type of post-adoptive use in which users engage. Although emotion-based IS reactions such as anxiety have received some attention in the IS literature (Compeau et al., 1999; Igarria and Iivari, 1995; Venkatesh, 2000), our understanding of how these reactions interact to shape IS use is still limited. For example, little is yet understood about how various types and thresholds of emotion-regulating responses can promote either engagement in or withdrawal from deeper IS use. The results of this study suggest that a closer examination of support-seeking and avoidance behaviors may be a promising starting point for building theory in this domain.

Interestingly, tests of Model 1 found no significant relationship between any dimension of problem-focused adaptation (work, system, self) and infusion. This observation contrasts with implications of both infusion and adaptation research (e.g. Lassila and Brancheau, 1999; Leonard-Barton, 1988; Saga and Zmud, 1994; Tyre and Orlikowski, 1994), which suggests that reconceptualizing work practices, altering system components, and adapting oneself are key antecedents to advanced system use. At least two explanations may account for the lack of significance among these variables as observed in this study. First, the system used by respondents may have necessitated little adaptation to the way things were done before the system was implemented. Supporting

this possibility, responses to a supplemental measure of the degree of job change associated with the system indicated that respondents tended to disagree with statements that the system had significantly changed their jobs ( $m = 3.18$  on a 1 – 7 scale of Strongly Disagree-Strongly Agree). Alternatively, final measurement scales could have omitted key adaptation elements that might have been operant in determining infusion levels. This is particularly true in the case of self adaptation, the scale for which was reduced from 7 items to 3 items by the participating organization, resulting in exclusion of potentially key self-adaptation behaviors such as reading support documentation and attending training. In either case, the lack of significant findings should prompt future research that more closely examines systems known to require significant job change, and that explores work, system, and self adaptation at a more granular level. Such studies can investigate whether problem-focused adaptation efforts are indeed critical to achieving infusion as suggested in prior research, or whether emotion-focused behaviors play a more central role, as implied by the findings of this study.

#### *6.1.2 Effects of IS Appraisal on Adaptation*

Nearly all hypotheses tested in Model 2 received partial support, indicating that the way an IS is appraised by a prospective user notably influences the way that the user adapts to it. Those who engaged in problem-focused self adaptation were more likely to perceive the IS as positive, and to feel that they had control over the way they used the IS in their job. Problem-focused system adaptation was also positively associated with appraisal of the IS as challenging. Appraisals did not significantly predict additional problem-focused adaptation behaviors such as adaptation of IS enabled work practices.

In their work on IS adaptation, Beaudry and Pinsonneault (2005b) identify work, system, and self as important dimensions of IS adaptation, but do not offer insight as to how these dimensions might be differentially affected by IS appraisals. The results of this study imply that adaptation behaviors directed toward each of these three contextual elements may emerge differently in response to the way the IS is appraised. For example, a plausible explanation of the results observed in this study is that viewing an IS as positive and feeling control over the way it is used is more likely to prompt a user to modify her own knowledge and routines to accommodate the features and functions offered by the IS. Conversely, perceiving the IS as a challenge may induce a user to focus her adaptation efforts on changing the IS itself—altering features and functionality so that it becomes more amenable to pre-established work practices. As these results suggest, an important avenue for future research is the dissection of problem-focused IS adaptation in order to better understand how specific adaptation patterns emerge, and how these patterns influence downstream use behaviors.

Hypotheses relating appraisals to emotion-focused adaptation behaviors also received mixed support. Based on coping theory, emotion-focused adaptation behaviors were expected to emerge more often when users felt threatened by the IS, and less often when users felt that they had control over its use and the way it affected their job. Results showed that threat/harm appraisals were indeed associated with higher levels of positive reappraisal, but were either negatively related or not related with other forms of emotion-focused adaptation. Similarly, a sense of power over how the IS affected one's job correlated negatively with positive reappraisal and avoidance behaviors, but related

*positively* to cognitive distancing from the IS. Finally, because appraisal of the IS as challenging involves both positive and stressful reactions to the IS, challenge appraisals were expected to increase the occurrence of approach-oriented emotion-focused behaviors, but decrease the occurrence of avoidance-oriented behaviors. Results partially corroborated these expectations, showing a negative relationship between challenge appraisals and avoidance/wishful thinking; however, negative relationships were also observed between challenge appraisals and approach-oriented behaviors of seeking social support and positive reappraisal.

As with problem-focused adaptation, the results of emotion-focused adaptation hypothesis tests reveal that adaptation patterns are not as clear-cut as theoretical models might predict. Both generalized and IS-specific coping theory acknowledge that adaptation patterns entail a complex network of inter-dependent behaviors that evolve over time (Beaudry and Pinsonneault, 2005b; Moos and Billings, 1982; Parkes, 1984; Skinner et al., 2003). Moreover, specific contextual elements may play a role in determining adaptive acts employed in response to a particular stressor (Folkman et al., 1986a; Lazarus and Folkman, 1984). For instance, an IS user who feels threatened by the IS may avoid support-seeking behaviors if she perceives that referent others may fail to empathize with her point of view. In a similar vein, a user who perceives that she retains control over how the IS affects her job may purposely engage in emotion-focused behaviors such as distancing as an expression of that control. The variable effects of appraisals on adaptation behaviors observed in this study highlight the complexity of

emotion-focused IS responses, and lay the groundwork for a closer examination of this phenomenon by IS researchers.

### *6.1.3 Effects of IS Perceptions on IS Appraisal*

Of eight hypotheses depicted in Model 3, two were supported. First, increased social influence supporting use of the IS was positively associated with appraisal of the IS as benign/positive. Second, effort expectancy of IS use negatively related to appraisal of the IS as challenging, moderated by the degree to which the individual anticipated performance gains from using the IS (this is discussed further below). In contrast, results for the remaining six hypotheses were either non-significant or significant in the opposite direction. Most surprisingly, the higher the anticipated performance gains and ease of IS use, the *less* likely the user was to appraise the IS as benign/positive and the *more* likely to appraise it as threatening/harmful. Moreover, higher perceived facilitating conditions related *negatively* to perceptions of power over how the IS affected one's job. These findings contradict strong theoretical and logical evidence suggesting that high performance gains and ease of use should produce *positive* affective reactions to the IS, and that the presence of facilitating conditions should foster a *greater* sense of control over how the IS is used on the job (Beaudry and Pinsonneault, 2005b; Brown et al., 2002; Karahanna et al., 1999; Thompson et al., 1991). One possible explanation for these seemingly paradoxical results is that other unexamined factors were operant in shaping the appraisal process. For instance, Beaudry and Pinsonneault (2005b) cite other potential appraisal antecedents, including task-technology fit (Dishaw and Strong, 1999; Goodhue and Thompson, 1995) and value compatibility (Moore and Benbasat, 1991), as

well as user anxiety (Venkatesh, 2000) and personal innovativeness (Agarwal and Prasad, 1998b; Lewis et al., 2003). In the interest of parsimony, this study focused on UTAUT perceptions—a strategy recommended by other researchers (e.g. Jasperson et al., 2005) given the predominance of these perceptions in the IS literature. However, the lack of supporting findings may warrant investigation of alternative determinants that better explain observed variance in IS appraisals.

One of the most interesting outcomes of Model 3 was the moderating effect of performance expectancy on the relationship between effort expectancy and challenge appraisal. IS acceptance research has generally concluded that both performance and effort expectancy should be high to ensure maximum probability that an IS will be used (Agarwal and Prasad, 1998a; Davis, 1989; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000). However, coping research suggests that because challenge appraisals entail a stress component, they produce more adaptive behaviors than mere benign/positive appraisals, which often mobilize few adaptive responses if any at all (Ashnel and Delany, 2001; Devonport and Lane, 2006; Lazarus and Folkman, 1984). The findings of this study imply that an IS is most likely to be appraised as a challenge by a prospective user when it is perceived to bring about performance enhancements *or* when it is perceived as easy to use, but not when both of these conditions are present. In view of coping theory, this suggests that if organizations desire to promote adaptive response to an IS, the best course of action may be to promote its performance benefits while still emphasizing the learning efforts that effective use of the system will require. This position is corroborated by Beaudry and Pinsonneault (2005b), who distinguish between

benefits satisficing and benefits maximizing adaptation strategies. In the former, the user sees the IS as positive but does not actively engage in efforts to adapt to the system, hence realizing minimal performance benefits from its use. In the latter, the user seeks to maximize performance benefits by proactively seeking to learn how the system can enhance work processes, even when such learning requires concerted effort. The results of the present study point to the interesting possibility that specific combinations of effort and performance expectancy may be more likely to produce challenge appraisals, which, in theory, should lead to greater maximization of IS benefits by IS users.

#### *6.1.4 UTAUT Relationships*

Data analysis provided mixed support for the UTAUT hypotheses. Consistent with the theory, higher IS performance expectancy led to increased intention to use the IS, which, in turn, was positively related to IS use behavior. However, no significant relationships were observed between effort expectancy, social influence, and intention to use, or between facilitating conditions and use behavior. At least two explanations may account for this finding. First, performance expectancy may indeed have been the sole consideration behind intention formation for IS users in the sample. This would be consistent with past acceptance research (e.g. Agarwal and Prasad, 1998b; Davis et al., 1992; Thompson et al., 1991), which has shown that performance-related assessments are consistently the strongest, if not the only, predictors of use intention, especially following the initial adoption period (Karahanna et al., 1999). Second, the original UTAUT study postulated (and verified) strong moderating effects of gender, age and experience on the model's main effects. For instance, effort expectancy was shown to be more salient for

younger women with less experience, while social influence exerted greater influence on older women with less experience (Venkatesh et al., 2003). The obligatory exclusion of these moderating variables from the present study may have precluded the possibility of detecting more granular effects. In either case, the equivocal support found for UTAUT relationships in this study should prompt further efforts toward validation and verification of this synthesizing theoretical model.

## **6.2 Contributions to Research**

This study contributes to extant IS research in several ways. First and most importantly, this study integrates previously disparate theoretical perspectives into an integrated framework for examining the IS adaptation and infusion process. The importance of IS user perceptions, the need for user adaptation, and the concept of IS infusion have been recognized as important phenomena for at least two decades; however, this study represents the first known attempt to integrate these theories into a comprehensive framework for explaining infusion at the individual level. Using this framework as a lens, the results of this study offer theoretical insight into (a) the role of adaptation behaviors as antecedents to IS infusion, (b) how IS appraisals lead to adaptation patterns, and (c) how key IS perceptions shape IS appraisals. In addition, this study provides an empirical test of the recently proposed Unified Theory of Adoption and Use of Technology (UTAUT).

*Adaptation Behaviors as Antecedents to Infusion.* In their conceptual exposition on infusion, Saga and Zmud (1994) theorize that infusion is influenced by the degree to which use of the IS is routinized and the degree to which work practices are

reconceptualized to incorporate the benefits it offers. Although these themes have reappeared in subsequent research, a direct empirical test of both of these propositions has not been conducted. This study contributes to extant infusion literature by testing elements of Saga and Zmud's theoretical framework. Results show that while adaptation behaviors appear to be important infusion antecedents, routinization may not be a necessary condition for infusion to occur.

*Influence of Appraisals on Adaptation Patterns.* User adaptation to a new workplace IS has long been a phenomenon of interest to IS researchers. Beaudry and Pinsonneault (2005b) proposed that coping theory could be a useful lens for understanding how individuals respond and adapt to a workplace IS, and offered qualitative evidence to support their Coping Model of User Adaptation. This study builds upon and extends Beaudry and Pinsonneault's work by providing a quantitative examination of key elements of CMUA. Specifically, this study provides insight as to how specific types of appraisal lead to both problem- and emotion-focused adaptation efforts, and how these efforts promote or detract from the ultimate outcome of IS infusion. Moreover, this study further integrates coping theory into the IS domain by exploring an expanded set of IS appraisal types, including appraisal of the IS as a challenge.

*Influence of IS Perceptions on Appraisals.* Numerous studies have shown that the way an IS is perceived by a prospective user influences the formation of intention to use the IS and, subsequently, whether or not the IS is used. This body of research provides a foundation for understanding initial use behavior; however, scholars and practitioners are

now calling for increased attention to *how* an IS is used after adoption, and how key IS perceptions impact this post-adoptive use (Chin and Marcolin, 2001; Jasperson et al., 2005). In response to this need, this study integrates key acceptance perceptions into a larger nomological network of IS appraisal, adaptation and infusion. Results indicate that perceptions do play a role in shaping post-adoptive appraisal of an IS, and that these perceptions can interact to form specific appraisal outcomes.

*Empirical Test of UTAUT.* Finally, this study provided an empirical test of the main-effect relationships identified in the UTAUT model of technology acceptance (Venkatesh et al., 2003). Results confirm the role of behavioral intention in influencing IS use behavior, and the effect of performance expectancy on formation of use intention. However, more work is needed to further verify the role of effort expectancy, social influence, and facilitating conditions on intention and use behavior.

### **6.3 Contributions to Practice**

For practitioners, this research offers three insights for the organization wishing to promote infusion of an IS into the work of its employees: 1) it highlights the need for organizations to focus on IS adaptation patterns as antecedents of deeper, infused IS use; 2) it provides clues as to how IS appraisals impact adaptation; and 3) it underscores the need to manage IS perceptions that have downstream effects on adaptation and use behaviors.

*IS Adaptation Patterns.* Van de Ven (1986) observes that new information technologies “not only adapt to existing organizational and industrial arrangements, but they also transform the structure and practices of these environments” (p. 591). To

maximize desired benefits from an IS, managers must develop better understanding of how these patterns of adaptation emerge among individual IS users. The results of this study suggest that managers need to be aware not only of observable, context-altering adaptation such as modification of work processes, but also less visible forms of adaptation that shape the internal disposition of the user toward the IS. Specifically, managers may seek to implement formal channels through which IS users experiencing difficulty may seek assistance and support from trusted peers or colleagues (think AA for IS users). In addition, interventions that counteract behavioral and cognitive avoidance of the IS should also help to promote deeper IS use. Such interventions may include ongoing user training programs or self-directed tutorials designed to enhance user skills and promote the integration of the IS into regular work routines.

*IS Appraisals.* Research suggests that the way an IS is appraised can affect how a user adapts to and uses the IS to support her work. This study provides insight into how certain appraisals influence specific adaptation behaviors, helping IS professionals influence the way an IS is appraised and, consequently, the way it is used. For instance, the manager desiring to stimulate changes in IS-enabled work processes (i.e. problem-focused adaptation) should ensure that (a) the IS is appraised as positive/challenging by users, and (b) supporting technical and managerial infrastructure is in place to ensure that users feel in control over how they use the IS.

*IS Perceptions.* The findings of this research suggest that social influence plays a role in influencing positive IS appraisals, and that performance and effort expectancies interact to form appraisal of the IS as challenging. Thus, focusing on management of

these perceptions should help IS practitioners transform the way an IS is appraised, adapted, and used.

#### **6.4 Strengths and Limitations**

The strengths of this study include examination of the adaptation/infusion phenomenon in a real-world context and the integration of heretofore disparate theoretical perspectives. Studying individuals' IS perceptions, adaptation behaviors, and infusion levels in an actual organization increases the richness of observed relationships and improves the external validity of the findings. Adopting a multi-theoretical lens allowed this study to incorporate key constructs within theories of IS acceptance, adaptation, and infusion to provide a more holistic perspective of post-adoptive IS use than that offered by any isolated theoretical perspective.

In addition to its strengths, this study has several limitations, including the potential for common method bias, the use of cross-sectional rather than longitudinal data, content validity of formative constructs due to withheld survey questions, low predictive validity, and threats to external validity due to a single-company sample.

*Common Method Bias.* Using a common method (i.e. survey) to assess both independent and dependent variables introduces the potential for common method bias to affect the data. Common method bias occurs when the research instrument itself affects the scores on the variables being measured, thus artificially enhancing (or diminishing) relationships between the research variables. For example, survey respondents may artificially alter their responses to items on a single survey due to naïve theories about the phenomenon being explored or because they desire to appear consistent in their responses

(Podsakoff et al., 2003). To minimize common method bias, researchers should ideally employ multiple methods of variable measurement, enabling triangulation of results and isolation of the underlying phenomenon. In this study it was not possible to employ additional measures of independent and dependent variables due to restrictions imposed by the participating organization. However, as recommended by Podsakoff et al. (2003), both procedural and statistical remedies were employed to mitigate and test for common method effects. First, items in the survey appeared in random order to minimize the effect of naïve theories and the potential effect of a consistency motif. Second, the length of the survey itself rendered these effects unlikely by making it difficult for respondents to consciously produce consistent results throughout the survey. Finally, Harman's one-factor test was performed by loading all variables into a single exploratory factor analysis to verify that a single (common method) factor did not account for the variance in the survey items.

*Cross-sectional vs. Longitudinal Data.* Due to temporal and research site restrictions, this study captures a cross-sectional snapshot of variables at a single point in time as opposed to measuring variables longitudinally at multiple points in time. Cross-sectional data is somewhat limited in terms of examining phenomena that evolve over time, such as infusion. Nevertheless, the use of cross-sectional survey data is extremely common in IS research, and has been employed by other researchers to gauge change in IS perceptions over time (e.g. Brown et al., Forthcoming).

*Content Validity of Formative Constructs.* As noted in Chapter 4, a chief concern with respect to formative scales is their content validity, or the degree to which the scale

adequately represents all aspects of the phenomenon being measured. This study endeavored to maximize content validity by developing scales based on extant theory and established measurement scales. However, because the participating organization elected to withhold responses to certain questions, content validity of some formative scales may have been diminished. Although not optimal, this circumstance constitutes a natural trade-off inherent in studying a phenomenon in a field setting: the realism afforded by the field is often tempered by the constraints imposed by the organization.

*Predictive Validity.* Although the relationships hypothesized in this study were drawn from a strong theoretical base, nearly all dependent constructs exhibited low levels of explained variance, with maximum  $R^2$  values around 0.06. Because this occurred even for well-established relationships in the literature (e.g. UTAUT), these results were likely attributable to idiosyncrasies of the sample population used in this study. Hence, until future research can validate or refute these hypotheses in alternative contexts and with a higher degree of predictive accuracy, the results must be interpreted with caution.

*External Validity.* This study collected data from individuals within a single organization; hence, generalizability of the results to other organizations with different characteristics is questionable.

## **6.5 Future Research Directions**

Future research can build upon this study in many ways, including 1) instrument and variable refinement, 2) longitudinal examination of adaptation and use, 3) methodological triangulation, 4) cross-industry validation, and 5) adoption of a micro-level perspective.

*Instrument and Variable Refinement.* This study relied primarily on measurement scales and variables developed and validated in prior research. However, some of these scales had not previously been applied in the context of IS. In particular, adapted appraisal measures based on the Cognitive Appraisal of Health Scale (Ahmad, 2004; Kessler, 1998) should be validated and refined in future IS studies. Further, as discussed above, a critical issue regarding formative adaptation behavior scales is their content validity, or the degree to which they adequately capture all relevant adaptation behaviors. One challenge in this regard is that potential adaptive acts are typically context dependent. For example, one organization may offer several types of training and support programs, while another may provide only minimal training opportunities. Nevertheless, future research should expand on the set of adaptation behaviors identified in this study in order identify other types of adaptive acts that promote IS infusion.

*Longitudinal Examination of Adaptation and Use.* IS use and adaptation behaviors change and develop over time. One of the limitations of this study was that it took a snapshot view of the IS adaptation process and its impact on use behavior. This perspective, while providing some valuable insights, needs to be supplemented by future research that examines these phenomena as they unfold over time. By collecting data on adaptation and use throughout the IS lifecycle, several questions can be addressed. For example do adaptive acts occur continuously throughout the use lifecycle, or during irregular intervals of disequilibrium as suggested by other research (e.g. Lassila and Brancheau, 1999; Tyre and Orlikowski, 1994)? Furthermore, how do ongoing reappraisals direct and re-direct adaptation strategies, and under what conditions do these

strategies change? A longitudinal perspective will help to address questions such as these and develop stronger theory for explaining how IS is perceived, adapted, and used.

*Methodological Triangulation.* This study relied primarily on self-reported survey data as a means for measuring and assessing IS perception, adaptation, and use. Although practical constraints precluded our use of additional data sources, such sources would prove invaluable in expanding our understanding of how adaptation and infusion occur. For example, focused interviews and field observations of a select group of users over time could provide insight into the more nuanced facets of IS appraisal, such as what factors combine to create appraisal of the IS as challenging rather than simply positive. In addition, objective adaptation and use data could be gathered to supplement self-report measures used in this study.

*Cross-Industry Validation.* Because data for this study came from a single company, we were unable to isolate effects that may have occurred due to unique organizational characteristics. Future research should test and validate the theoretical model across organizations and industries to strengthen its theoretical and practical generalizability.

*Micro-Level Perspective.* This study attempted to provide a holistic view of IS perception, adaptation and infusion by integrating key concepts from three theoretical perspectives, thus providing a broad lens for understanding how these phenomena occur. Using this lens, future research can examine how these variables interact at a more granular level. This micro-level perspective is particularly important at the theoretical

boundaries of the model—i.e. where perceptions influence IS appraisal, and where adaptation behaviors impact infusion.

## **6.6 Conclusion**

Today's organizations rely more than ever on effective use of information systems; however, infusion of an IS into employees' work practices remains an elusive goal for many companies. This study has sought to improve both theoretical and practical understanding of the infusion phenomenon by framing it within a larger nomological network of IS perception, appraisal, and adaptation. Although many unanswered questions remain, this research takes an important step toward understanding "what constitutes IT usage and the pattern of IT infusion itself" (Chin and Marcolin, 2001, p. 10).

## APPENDIX A

### INTERVIEW SCRIPT

#### Introduction

I am going to ask you a series of questions aimed at providing me with an overview of your organization, your department (business unit), your position, and various factors associated with your perceptions of the EMS and how you are using it in your work. Everything you say will be kept confidential. In presentations of the research, your name will NEVER be used. When I provide the results of this research project, I will not refer to you or your organization by name. I would like to tape record this interview – purely for ease of transcription and accuracy of statements. Is it alright with you that I record the interview?

#### Questions

##### I. Interviewee Questions

1. What is your position in at Campus Health?
2. How long have you worked for Campus Health?
3. How long have you been using the EMS?
4. How long had you been working for Campus Health prior to the implementation of the EMS?
5. What systems did you use prior to the EMS?

##### II. Questions about Cognitions

1. How do you feel about the EMS?
2. How has the EMS affected your productivity on the job?
3. How difficult has it been for you to learn to use the EMS?
4. What has been the most difficult thing about the EMS to learn? Why?
5. What are the perceptions of your co-workers about using the EMS? Your supervisor's perceptions? Others' perceptions?
6. What types of support for using the EMS have been available to you? (e.g. training, documentation, focus groups, etc.)
7. What type of ongoing support has been available to you (e.g. post-implementation)

##### II. Questions about Adaptation Behaviors

1. How did you feel about the EMS when it was implemented? (repeat from prior section, but focus on past feelings)

2. Emotionally, how difficult was the transition to the EMS for you?
3. What types of support activities have you participated in (e.g. training, documentation, focus groups)?
4. Describe the helpfulness of the various support activities you've participated in.
5. How much have you tried on your own to improve your performance using the EMS?
6. How, if at all, have you changed your personal work habits in order to better take advantage of the EMS?
7. How, if at all, have you changed the way you accomplish your tasks in order to better take advantage of the EMS?
8. What types of changes to the EMS system itself, if any, have you suggested or implemented to improve your performance?

### III. Questions about Use

1. On average, what percentage of your time during the day is spent using the EMS directly?
2. Of all the tasks you perform in your job, roughly what percentage involve the use of the EMS?
3. How much do you rely on the EMS to get your job done?

### IV. Questions about Infusion

1. How proficient would you say you are at using the EMS? (e.g., Expert? So-so? Can barely function?)
2. To what extent do (did) your colleagues come to you for help on using the EMS?
3. To what extent do (did) you ask your colleagues for help on using the EMS?
4. Of all the EMS features that you could be using for your job, roughly what percentage would you say you are using?
5. How, if at all, has your performance improved by using features of the EMS that weren't available in your prior system?
6. To what degree are you still trying to learn about or improve your use of the EMS features?
7. How has using the EMS changed the way you interact with your co-workers?
8. What types of things do you do using the EMS that were not possible before? How helpful are these things?

### V. Wrap Up

1. What do you think Campus Health can do to improve your experience with the EMS?
2. What have been your most positive and negative experiences with the EMS?
3. Can you think of any other people I should talk with?

Thank you for your time!

**APPENDIX B**

**FINAL SURVEY FOR PRIMARY DATA COLLECTION**

**INFORMATION SYSTEM USER SURVEY**

## SUBJECT DISCLAIMER FORM

We are conducting a study to learn how people perceive and use information systems in their work, and we would really appreciate your help. You are eligible to participate in this research project because you use an information system in your work. This survey asks about your perceptions of the system, the types of activities you may have engaged in to adapt to the system, and how you are using the system in your work. Most people take about 15 minutes to complete this survey. There are no right or wrong answers; we are interested in your opinions. Your participation is completely voluntary, and you may withdraw from this survey at any time. Approximately 200 other business professionals who use information systems in their jobs are being asked to participate in this survey.

After collecting and analyzing the responses, we will analyze the data for presentation in academic journals or other scholarly publications. In this process, the confidentiality of your responses is very important to us, and we will only release aggregated data. We will NOT reveal your identity or the content of your responses to your employer or any other individual. There are no known risks or direct benefits to you as a participant. The broader benefits of this study include better insight into how information systems are used in order to 1) better support the ongoing support needs of similar system users and, 2) make improvements to future system implementations at other sites. In addition, this study will help to advance research in the area of large-scale information systems implementation and use.

The only participation cost to you is your time and you will not be compensated for your participation.

If you are willing to participate, please turn to the next page to begin the questionnaire. By completing the survey, you are giving permission for the use of the data for research purposes. On the pages that follow, please answer each question to the best of your knowledge.

Your assistance in improving our understanding of how information systems are used is greatly appreciated. If you have any questions or comments please contact us at the email addresses or phone numbers below. If you have questions about your rights as a research participant, you may call the University of Arizona Human Subjects Protection Program at (520) 626-6721 or toll free at (866) 278-1455.

Yours truly,

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 THIS STAMP MUST APPEAR ON ALL  
 DOCUMENTS USED TO CONSENT SUBJECTS.  
 DATE: 7/20/07 EXPIRATION: 7/10/07



	When I first began using the system			Now		
	Strongly Disagree	Neither Agree nor Disagree	Strongly Agree	Strongly Disagree	Neither Agree nor Disagree	Strongly Agree
I intend to use (or continue to use) the system over at least the next 6 months	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
Using the system is compulsory in my job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
Using the system enhances my effectiveness on the job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
The system provides the information I need to do my job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I plan to use (or continue to use) the system over at least the next 6 months	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
People who are important to me in my job think that I should use the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
The system provides me with information in a timely manner	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I have the resources necessary to use the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I can determine how the system affects my work situation	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I cannot do my job the way I want because of the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I view using the system as a positive aspect of my job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I need to know more about the system before I can use it appropriately	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I have a lot to lose on my job by using the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that using the system is beneficial to me in my job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I have to accept the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that things at our company will not go well due to the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I see the system as an opportunity to develop new skills	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I understand the system well enough to be able to manage its impact on my job	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
Using the system is NOT stressful for me	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I can successfully manage the transition to the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that there is nothing that I need to do about the transition to the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I view the system as a chance to change for the better	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel I have nothing to lose on my job by using the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I worry about the negative consequences of using the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that I can do something about the transition to the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I feel that there is a lot I can do to master the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I have had to give up a great deal at work because of the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		
I have been harmed in some way by using the system	1-----2-----3-----4-----5-----6-----7			1-----2-----3-----4-----5-----6-----7		

## SECTION 2: REACTIONS TO THE SYSTEM

People can react to a new information system in many different ways. In this section, please share your reactions to the system by indicating how often you responded in the following ways. When answering the questions, **please think about how you responded on average from the time the system was deployed until the present time.**

## Part A: Personal Change

Please indicate the extent to which you responded to the system in the following ways.

<i>Since the system was implemented...</i>	Never	Rarely	Occasion-ally	Some-times	Somewhat frequently	Frequently	All the time
I asked for moral support from my colleagues to help me deal with the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I talked about the system with my spouse or family members	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I met with my supervisor to talk about the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I talked to someone about how I felt about the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I asked someone I looked up to for advice about dealing with the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I repeated to myself that the system was an opportunity to learn and develop new skills	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I told myself that using the system would get better over time	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I told myself that I had to accept the system since there was nothing I could do about it	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I wished that the system would somehow go away or be replaced	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I wished that I didn't have to use the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I wished that I could change the way I felt about the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I considered taking a leave of absence from work for a while because of the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I did not want to hear about the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I did all I could to avoid using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I tried to change my mind about using the system and have fun	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I tried not to worry about difficulties associated with using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I made light of having to use the system; I refused to get too serious about it	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I tried to go on with my work as if the system wasn't there at all	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I tried not to think too much about using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I communicated with colleagues to better understand how the system operates	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I communicated with IT help desk personnel to better understand how the system operates	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I researched, on my own initiative, in order to increase my knowledge and mastery of the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I explored several information sources, on my own initiative, concerning the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I consulted the system support documentation that was available to me	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I participated in system training opportunities	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I consulted with the system superuser(s) to learn more about the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----

**Part B: Work Change**

Please indicate by circling the appropriate number the extent to which you changed the way you complete your work tasks using the system.

<i>Since the system was implemented...</i>	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
I started to do things on my job that I couldn't do before the system	1	2	3	4	5	6	7
I eliminated tasks that I had to do before but that were no longer required using the system	1	2	3	4	5	6	7
Using the system changed my way of performing some tasks	1	2	3	4	5	6	7

**Part C: System Change**

Please indicate by circling the appropriate number the degree to which you changed (or suggested changes to) the appearance or functionality of the system to make it more useful or make it better suit your needs.

<i>How much effort (in time and energy) have you spent making or recommending...</i>	None	Very little	Little	A moderate amount	More than average	Quite a bit	A great deal
Improvements to the system functionalities (the way the system works)	1	2	3	4	5	6	7
Improvements to the system interface (the look and feel of the system)	1	2	3	4	5	6	7
Improvements to the system hardware (the actual computer equipment you use)	1	2	3	4	5	6	7
Other modifications to the system so that it better fit your tasks	1	2	3	4	5	6	7

**SECTION 3: USE OF THE SYSTEM**

This section deals with how you are using the system in your work.

How frequently do you use the system in your work? (circle one)							
1	2	3	4	5	6	7	
Not at all	Less than once a week	About once a week	2 or 3 times a week	4 to 5 times a week	About once a day	More than once a day	

On average, how much time per day do you spend using the system? (circle one)

1	2	3	4	5	6	7
None	Less than 1 hour	1-2 hours	3-4 hours	5-6 hours	7-8 hours	More than 8 hours

I would rate the intensity of my job-related system use to be: (circle one)							
1	2	3	4	5	6	7	
Extremely light	Moderately light	Somewhat light	Neither light nor heavy	Somewhat heavy	Moderately heavy	Extremely heavy	

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
I am using the system to its fullest potential for supporting my own work	1	2	3	4	5	6	7
By using the features available in the system , I am able to get more work done	1	2	3	4	5	6	7
My use of the system has been incorporated into my regular work schedule	1	2	3	4	5	6	7
I am using features of the system that weren't available in the prior system(s) I used	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
The order in which I complete my tasks has changed since I started using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I am using all capabilities of the system in the best fashion to help me on the job	1-----	2-----	3-----	4-----	5-----	6-----	7-----
My use of the system is pretty much integrated as part of my normal work routine	1-----	2-----	3-----	4-----	5-----	6-----	7-----
The system has made it possible for me to do things that I couldn't do before	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I can complete at least as many tasks with the system as I could before I started using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I can complete tasks with the system that I couldn't do before	1-----	2-----	3-----	4-----	5-----	6-----	7-----
My work has become more streamlined since I started using the system	1-----	2-----	3-----	4-----	5-----	6-----	7-----
My use of the system fits right into the way I work	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I am completing more tasks with the system than I was before it was implemented	1-----	2-----	3-----	4-----	5-----	6-----	7-----
My use of the system has been integrated and incorporated into my work at the highest level	1-----	2-----	3-----	4-----	5-----	6-----	7-----
I doubt that there are any better ways for me to use the system to support my work	1-----	2-----	3-----	4-----	5-----	6-----	7-----
The system makes it easier for me to manage all of the things I have to do on the job	1-----	2-----	3-----	4-----	5-----	6-----	7-----
My use of the system is now a normal part of my work	1-----	2-----	3-----	4-----	5-----	6-----	7-----

**SECTION 4: DEMOGRAPHICS**

Please tell us about yourself. Remember that all personally identifying information will be kept strictly confidential.

Age: \_\_\_\_\_

Gender (circle one):     1. Male           2. Female

Job Title: \_\_\_\_\_

How long have you been working for your current employer? Years: \_\_\_\_\_ Months: \_\_\_\_\_

How long have you been working in your current position? Years: \_\_\_\_\_ Months: \_\_\_\_\_

How long have you been using the system referred to in this survey? Years: \_\_\_\_\_ Months: \_\_\_\_\_

Besides the system referred to, how many other system deployment projects have you been involved in...

while working at this company? \_\_\_\_\_

while working at another company or organization? \_\_\_\_\_

Education completed (circle the highest level that applies):

- |             |                            |                   |                  |                       |                |                 |       |
|-------------|----------------------------|-------------------|------------------|-----------------------|----------------|-----------------|-------|
| 1           | 2                          | 3                 | 4                | 5                     | 6              | 7               | 8     |
| High school | Some undergraduate studies | Associates degree | Bachelors degree | Some graduate courses | Masters degree | Doctoral degree | Other |

If you would like to share any additional feedback about the system or about this survey, we welcome your comments below.

***The survey is now complete. Thank you for your participation!***

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