EMERGENT USE OF ENTERPRISE SYSTEMS BY EMPLOYEES: EXPLORING THE HUMAN SIDE

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CERTIFICATE OF ORIGINALITY

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_____ (Signed)

WANG Wei (Name of Student)

To My Dear Parents, Husband

and Lovely Daughter

ABSTRACT

Modern organizations are making significant investments in enterprise systems. These systems usually embody the best practices in each industry, and provide reference models or process templates for the adopting organizations (Benders et al. 2006). Vendors make promises, and organizations act on the belief that they will benefit from the capabilities of the systems. However, these advertised benefits are equally available to competitors who also adopt the systems. ERP adoption among these competitors leads to what Michael Porter termed “strategic convergence” (Porter 1985). Routine usage of these systems thus provides little comparative advantage. In this vein, the unique competitive advantages of implementing ERP can only flow from benefits beyond those originally envisioned by the vendors. Extant research on learning curves suggests that, by using technologies, workers often obtain utilities that exceed the maximum capacity indicated by technology providers (Dutton and Thomas 1984). Toward this end, an important way to derive further competitive advantage is to find new ways to creatively use the system, or emergent use. Emergent use, in this study, is defined as using a technology in an innovative manner to support an individual’s tasks and enhance his/her productivity.

Enterprise systems are often adopted at the organizational level, and employees are often obligated to use the adopted system. Under mandatory circumstances, employees still retain considerable discretion to determine whether, and to what extent, to use the system to support their tasks (Silver 1990, 1991). Meanwhile, the complexity of enterprise systems allows users to utilize them at distinct levels. A higher level of performance is usually associated with a higher level of use (Cooper

and Zmud 1990). The highest level of use, such as emergent use, can stimulate high productivity, generate high value-added goods and services, and ultimately enhance organizations' ability to compete in the knowledge-driven economy (Bhattacherjee and Premkumar 2004; DeLone and McLean 1992). However, limited theoretical explanations are available for emergent use, especially in the organizational context of mandatory usage. Therefore, this study aims to address the thorny issue of understanding exactly what it takes to foster the emergent use of enterprise systems in organizations in order to maximize the return on information systems investment.

Drawing upon the Expectation-Confirmation Model of IS continuance and organizational assimilation framework, this study proposed a research model to explore employees' emergent use, particularly when it is mandated by an organization. A field study was conducted in two large manufacturing firms using ERP systems to empirically validate the model. The results suggest that factors informed by direct experience prior to post-acceptance, specifically perceived usefulness and satisfaction, strongly affect emergent use. In contrast to the commonly accepted view of information systems implementation, the effect of general management support on emergent use at the post-acceptance stage does not get support in this study. Instead, personal traits, such as personal innovativeness with information technology, exert significant influence on emergent use. This study represents one of the few efforts to enhance our knowledge of emergent use in organizational contexts. The findings advance our knowledge of emergent use and identify key factors for managers to formulate effective interventions for planned outcomes.

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CHAPTER 1

INTRODUCTION

1.1 Motivation

Since organizations are depending more on enterprise systems to gain and sustain their competitive advantages, their investments in new information technologies (IT) have increased rapidly. Enterprise systems (ES) are often complex information systems. Complex information systems (IS) in this paper refer to large organizational information systems that integrate and streamline business processes across various functional departments or areas, such as enterprise systems (Gulla 2004; Ko et al. 2005). Enterprise resource planning (ERP) systems are typical enterprise systems. For example, organizations worldwide spent $20 billion on enterprise resource planning (ERP) system adoption and implementation in 2000 (Willcocks and Sykes 2000). Such investments increased to $26.7 billion in 2004, and are expected to rise to $37 billion in 2008 (Kawamoto 2004). It is very common for large organizations to spend more than $100 million to implement ERP systems (Robey et al. 2002; Seddon et al. 2003). Adopting and implementing enterprise systems such as ERP or customer relationship management (CRM) represent strategic decisions that demand tremendous organizational resources. However, the results of these initiatives are often rather disappointing. The Juran Institute estimates that only 10 to 15 percent of ERP implementations have a smooth introduction that delivers the anticipated benefits (Wheatley 2001). About half of the

organizations that adopted ERP systems experienced implementation failures (Adam and O'Doherty 2003; Economist 2002). It is also rare to find cases where these organizations have used their systems to the fullest potential and realized the promised return on investment.

Today's ES, which usually embody the best practices in each industry, provide reference models or process templates for the adopting organizations (Benders et al. 2006). Vendors make promises, and organizations act on the belief that they will benefit from the capabilities of the systems. However, these advertised benefits are equally available to competitors who also adopt the systems. ERP adoption among these competitors leads to what Michael Porter termed "strategic convergence" (Porter 1985). That is to say, the competitive advantages of one firm's strategic decision to implement ERP depreciate as others implement ERP as well. Routine usage of these systems thus provides little comparative advantage. In this vein, the unique competitive advantages of implementing ERP can only flow from benefits beyond those originally envisioned by the vendors. Extant research on learning curves suggests that, by using technologies, workers often obtain utilities that exceed the maximum capacity indicated by technology providers (Dutton and Thomas 1984). Toward this end, an important way to derive further competitive advantage is to find new ways to creatively use the system, or emergent use (Jasperson et al. 2005).

Enterprise systems are often adopted at the organizational level, and employees are often obligated to use the adopted system. Under these mandatory circumstances, employees still retain considerable discretion to determine whether, and to what extent, to use the ES to support their tasks (Silver 1990, 1991). In other words, they can use the system either narrowly or broadly, in ways that expand the capacities of the technologies (Carlson and Zmud 1999); and either shallowly or deeply (Chin and

Marcolin 2001), in ways that go beyond the requirements of work tasks prescribed by the managers. Creative behavior such as emergent use can stimulate high productivity, generate high value-added goods and services, and ultimately enhance organizations' ability to compete in the knowledge-driven economy (Bhattacherjee and Premkumar 2004; DeLone and McLean 1992). However, limited theoretical explanations are available for emergent use, especially in the organizational context of mandatory usage. Therefore, this dissertation aims to address the thorny issue of understanding exactly what it takes to foster the emergent use of enterprise systems in organizations in order to maximize the return on IS investment.

1.2 Research Questions and Objectives

Information system usage research has been a well-studied stream in the IS field. The reason why this research stream has been received greater attention is that system usage is the primary variable through which IS affects employees' performance (Davis 1989; Robey 1979; Swanson 1982). Theoretically grounded and empirically tested theories and models have been developed and applied in system usage research. Among the popular theories developed or applied for system usage are Diffusion of Innovation (Rogers 2003), the Theory of Reasoned Action (Fishbein and Ajzen 1975), the Technology Acceptance Model (Davis et al. 1989), and the Theory of Planned Behavior (Ajzen 1985; Taylor and Todd 1995a). These traditional adoption and acceptance models fit well for a particular range of scenarios and technologies; that is, individuals voluntarily decide whether to use a *personal and simple* technology, such as PCs or spreadsheets (e.g., Adams et al. 1992; Brancheau and Wetherbe 1990; Davis 1989; Szajna 1996). The dependent variable in these

models is not emergent use, but adoption or acceptance. Adoption refers to the decision to make use of a technology (Rogers 2003), while acceptance stands for initial technology usage after adoption (Bhattacherjee 2001).

Different from traditional individual adoption in a volitional context, organizational IS adoption typically experiences two stages: the primary adoption by a firm, division, or department and then the secondary adoption by employees. Employees' adoption (Jasperson et al. 2005) is the prerequisite for usage. Organizations often invest millions of dollars in information systems, with the expectation that their employees will appropriately utilize the system to further organizational goals. However, IS availability does not represent its utilization by organizational members (Howard and Mendelow 1991). Reviewing the related literature, we found that the majority of extant technology acceptance research focuses on acceptance or shallow usage, which represents the simple measures of whether an IT was used and the extent of its usage (Chin and Marcolin 2001). Emergent use, on the other hand, emphasizes innovative usage that actually aims to increase productivity. In essence, emergent use can be viewed as one kind of post-acceptance behaviors that involves creatively using a technology to support his or her tasks. This shift towards examining "emergent use" implies that extant adoption and acceptance models dealing with factors and processes need to be revisited. Key factors that influence an individual's behavioral attempts to use an information system to its fullest potential and even use it innovatively may differ from those for initial usage.

In addition, organizational members' use of enterprise systems is usually compulsory in organizational contexts (Nah et al. 2004; Rawstorne et al. 1998). Mandatory usage has different concern from voluntary usage. System usage is a

multidimensional construct involving acceptance and continuance, shallow and deep usage, routine and emergent use, which can be either mandated or volitional usage. In addition, continuance is not a simple extension of acceptance behaviors. Some individuals accept a system initially, but gradually lose their motivations to continue using it. Furthermore, it is impossible for individuals to achieve system effectiveness if they keep using it at a shallow level. In an organizational context, employees are often mandated to use an IS. In such a context, it is not technology usage that matters as a dependent variable, but rather how creatively and deeply the technology is used by employees. It is noteworthy that emergent use is always voluntary. After organizational members have gained experience in using a specific feature of an adopted ES, they may discover new ways to apply the feature that go beyond the delineation of the designers and implementers (Jasperson et al. 2005). Therefore, even in a mandatory context, emergent use may not be achieved via an organizational compulsoriness.

The problem of emergent use by employees falls broadly within the general area of IS implementation research. Literature reviews on IS implementation research suggest that employees' utilization of IS depends not only on their beliefs and attitudes, but also on the management strategies, policies, and actions (Ginzberg 1981; Ives and Olsen 1984; Leonard-Barton and Deschamps 1988; Lucas 1978). Although many previous studies have touched on these factors, to date, a comprehensive research framework depicting creative use of IS in a mandatory context has not been reported in the literature. The creation of this research framework will be instrumental in enhancing our understanding of how and why some information systems can be used at a higher level.

In the light of the important role that emergent use will have on organizations, the present study seeks to examine the factors affecting employees' emergent use of their information system. The primary objective of this study is not the factors affecting information systems adoption in organizations, which is the result of top or corporate decisions, but the factors affecting emergent use by employees, which depends on the users-system interaction over time. The study is designed to be of value both to business and IS managers who are interested in achieving competitive advantage with IS and to researchers investigating IS.

The present study proposes the following research question:

> *What are the cognitive perceptions, personal characteristics, and management actions that influence employees to creatively use the adopted enterprise system in a mandatory organizational context?*

There are a number of studies investigating IS implementation, IS success and effectiveness (Cooper and Zmud 1990; Grover and Goslar 1993; Sharma and Yetton 2003). A few researchers have noted that the important role of diffusion and infusion on IS success and effectiveness (Bradford 2001; Eder 1998). However, these studies have not drawn sufficient attention in the management information systems (MIS) research field. In this research, emergent use, an important post-acceptance usage behavior, refers to the extent to which an individual uses a technology in an innovative manner to support his or her task performance. This study explores the factors influencing emergent use in organizational contexts. In order to more fully

understand the issues associated with emergent use, this research has the following two objectives:

(1) To investigate a theoretically grounded model that explains emergent use;
(2) To provide insights into leverage points that managers can employ to facilitate system implementation in order to eventually enhance organizational performance.

1.3 Significance of the Study

Research on IS adoption and voluntary acceptance have been studied broadly (Davis 1989, 1993; Davis et al. 1989, 1992), whereas IS use in the mandatory context has just begun to draw IS researchers' attention (Bhattacherjee 2001; Karahanna et al. 1999; Nah et al. 2004). There is no existing holistic model that posits a set of variables that relates to emergent use of information systems. Based on the **Expectation-Confirmation Model of IS Continuance** (Bhattacherjee 2001) and the **organizational assimilation framework**, this study develops a research model that investigates the relationships among employees' characteristics, employees' perceptions about the system, and organizational actions and the effects of these factors on emergent use of IS. This empirical study has important implications with respect to investigating the determinants of emergent use in organizational contexts.

While firms have multiple objectives for installation of a system, ultimately, a commonly shared objective is for individual users to accept and faithfully use the system (Chin et al.1997; DeSanctis and Poole 1994) thus enabling the achievement

of the benefits the organization anticipated from the introduction of the technology. Several studies have suggested that most of the information system failures are due to behavioral, rather than technological, issues (Forester 1989; Regan and O'Connor 1994). Less than five percent of IS implementation failures are because of technical problems (Biggs 2000). One of the main issues in information system project failure is lack of support and commitment by users (Udo and Guimaraes 1994). Information systems do not fulfill the needs of users independently. They require people to exploit their capabilities before producing organizational benefits. Therefore, this study pays more attention to human effects from managers and employees and their impacts on employees' emergent use of IS. In this vein, the proposed model permits managers and employees to better understand and appreciate their behavioral impact.

1.4 Organization of the Study

This study is organized around a model that portrays the relationships among employees' characteristics, employees' beliefs about IS use, and organizational factors as well as the effects of these factors on employees' emergent use of IS in mandatory organizational contexts. Chapter Two provides the definition of emergent use. In order to identify the related factors to create the research model, Chapter Two also reviews the related literature, that is, individual technology acceptance research, individual post-acceptance research, and organizational adoption research. Chapter Three describes the theoretical framework for the present study and proposes several research hypotheses. Chapter Four presents the research design and methodology used to test the hypotheses, including data collection method and construct operationalization. Chapter Five reports the data analysis procedure and the research

findings. The final chapter presents the discussions, implications and conclusions of this study. It also discusses the limitations and contributions of this study.

CHAPTER 2

LITERATURE REVIEW

The research model proposed in this dissertation builds upon a large number of prior studies related to information systems adoption and usage of individuals and organizations. This chapter provides an overview of the literature related to emergent use behavior from three streams of MIS research, namely individual technology acceptance, individual technology post-acceptance and organizational adoption research. The chapter has three purposes: 1) to provide a bridge among these three research streams in terms of examining employees' emergent use issues, 2) to outline the limitations of our current knowledge in these three areas, and 3) to establish the need for a more comprehensive model of employees' emergent use for this dissertation.

Chapter 2 is organized as follows. Firstly, in order to clearly identify the research subject, it provides the definitions of information systems (IS), enterprise systems (ES) and emergent use. Secondly, employees are often mandated to use an IS in organizations, which is different from individuals in traditional technology adoption and acceptance research. Therefore, this chapter reviews the literature related to individual adoption and acceptance frameworks and examines its limitations in explaining employees' secondary adoption within organizational settings. Thirdly, because employees' emergent use is associated with post-acceptance behavior as well as organizational adoption and assimilation process, this chapter also reviews these two research streams and underscores their value in

explaining employees' emergent use. Finally, this chapter discusses the limitations of prior research and indicating how the current study can help address some of these shortcomings.

2.1 Related Concepts

2.1.1 Defining Information Systems

The study of management information systems broadly deals with understanding the design, implementation, management, and use of information technologies (IT) and information systems (IS) in organizations (Todd and Benbasat 2000). Strictly speaking, the terms "information systems" and "information technology" are not synonymous in MIS research field. Information systems are a collection of components that work together to provide information to help in the operations and management of an organization (Huff and Munro 1985; Lucas 1986; Nickerson 2001; Orlikowski and Robey 1991). Many information systems include computers. Such systems should be called computer information systems. However, people often just use the term information systems when they mean one that includes computers. Therefore, in the MIS research field, information systems refer to computer-based information systems, which are a computerized set of organized procedures that, when executed, provide information to support processes, decision making and control in an organization (Lucas 1990).

2.1.2 Defining Enterprise Systems

Enterprise systems (ES) are large-scale organizational information systems, built around packaged enterprise system software. According to Seddon et al. (2003), Enterprise system software:

- "is a set of packaged application software modules, with an integrated architecture, that can be used by organizations as their primary engine for integrating data, processes, and information technology, in real time, across internal and external value chains;
- impound deep knowledge of business practices that vendors have accumulated from implementations in a wide range of client organizations, that can exert considerable influence on the design of processes within new client organizations;
- is a generic 'semi-finished' product with tables and parameters that client organizations and their implementation partners must configure, customize, and integrate with other computer-based information systems to meet their business needs" (p.1).

Enterprise system software includes enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), product life cycle management (PLM), enterprise application integration (EAI), and data warehousing, and so forth.

2.1.3 Defining Emergent Use

From the organization assimilation perspective, Zmud and his colleagues

(Cooper and Zmud 1990; Kwon and Zmud 1987) suggested that system routinization and infusion come after the acceptance stage. While *routinization* describes the state where system use is no longer perceived as out-of-the-ordinary but actually becomes institutionalized, *infusion* refers to the process of embedding an IT application deeply and comprehensively within an individual's or organization's work systems (Cooper and Zmud 1990; Saga and Zmud 1994). It is during the infusion stage that creative use behavior will emerge (Saga and Zmud 1994). At the strategic level, emergent use surpasses routine use in that it is innovative in nature and provides competitive advantages over competitors. Thus, unlike motivation research that emphasizes sustaining behavior (Pinder 1998), emergent use focuses on exceeding the normal demands of one's tasks.

The notion of emergent use was first developed by Saga and Zmud (1994). They referred to emergent use as using an IS in order to accomplish work tasks that were not feasible or recognized prior to the application of the technology to the work system. Some researchers have realized the importance of emergent use and proposed related concepts. Focusing on post-adoptive behaviors, Jasperson et al. (2005) proposed the concept of "individual feature extension," which stands for individual discovering ways to apply features that go beyond the uses delineated by the application's designers or implementers. Nambisan et al. (1999) examined the significance of "intention to explore" to use IT efficiently. "Intention to explore" reflects a user's willingness and purpose to explore a new technology and identify its potential use. Agarwal (2000) argued that the intention to explore is similar in spirit to the concept of emergent use. Ahuja and Thatcher (2005) further introduced "trying to innovate with IT" as a means to examine IS post-acceptance use, especially in a work environment. "Trying to innovate with IT" refers to a user's

goal of finding novel uses for information technologies (Ahuja and Thatcher 2005). Conceptually speaking, the aforementioned concepts all concern using an information system innovatively. Some link technology use to task performance, while others do not. To faithfully capture emergent use in an organizational context, the system usage construct widely used in technology adoption and acceptance research needs to be carefully reconceptualized. Melone (1990) argued for a reconceptualization of the system usage construct to describe the "performance-related" usage behaviors that reflect how IT is actually used in organizations. In light of the innovative nature of emergent use and the emphasis on organizational contexts, this paper refers to *emergent use* as using a technology in an innovative manner to support an individual's task performance.

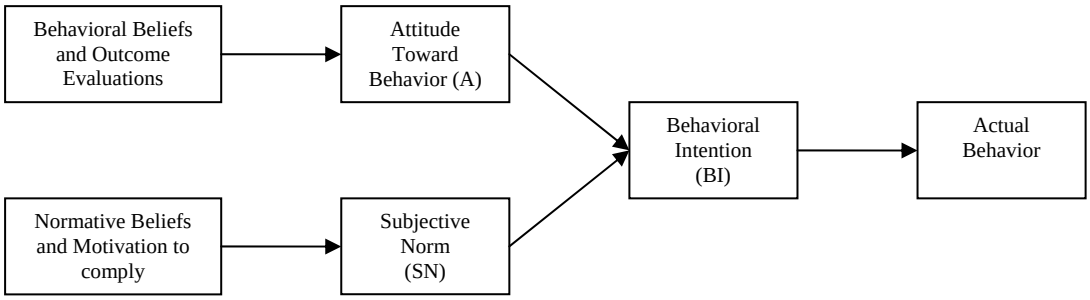
2.2 Review of Individual Technology Acceptance Research

There has been considerable research on the factors that predict whether individuals will accept and voluntarily use information systems. A number of theoretical frameworks, such as the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), the Theory of Planned Behavior (TPB) (Ajzen 1985; Taylor and Todd 1995a), the Technology Acceptance Model (TAM) (Davis et al. 1989), and Diffusion of Innovations (DOI) (Rogers 1983), have been validated for a variety of technological innovations. Although these frameworks differ in their theoretical structures, constructs and relationships posited, all of them address the common issue -- technology usage.

2.2.1 Theory of Reasoned Action

The Theory of Reasoned Action (TRA) is a widely studied social psychological model, which was intended to study consciously intended behaviors (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975).

Figure 2-1 Theory of Reasoned Action (Ajzen and Fishbein 1980)



In TRA (Figure 2-1), an individual's behavior (B) is predicted by his or her behavioral intention (BI) to perform the behavior, and BI, in turn, is jointly determined by a person's attitude (A) and subjective norm (SN). Behavioral intention is a measure of the strength of one's intention to perform a specified behavior (e.g., Fishbein and Ajzen 1975). Attitude is defined as an individual's positive or negative feelings (evaluative affect) about performing the target behavior (e.g., Fishbein and Ajzen 1975). Subjective norm refers to an individual's perception that most people who are important to him/her think he/she should or should not perform the specified behavior (e.g., Fishbein and Ajzen 1975).

According to TRA, an individual's attitude is a function of the products of the salient beliefs and outcome evaluation. Beliefs refer to the individual's subjective

probability that performing the target behavior will result in a specific consequence. Outcome evaluation means an evaluative response to that consequence.

$$A = \sum \text{Behavioral Beliefs (i)} * \text{Outcome Evaluation (i)}$$

The TRA is a general model. Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980) recommended eliciting five to nine salient beliefs through free interviews with representative members of the population of interest. The beliefs most frequently extracted from the above procedure could be used as salient beliefs.

On the other hand, the TRA theorizes that the subjective norm is a function of the products of normative belief and motivation to comply. Normative belief refers to perceived expectations of specific referent individuals or groups (Davis et al. 1989). Motivation to comply refers to an individual's willingness to comply with the expectation from the referent others (Ajzen and Fishbein 1980).

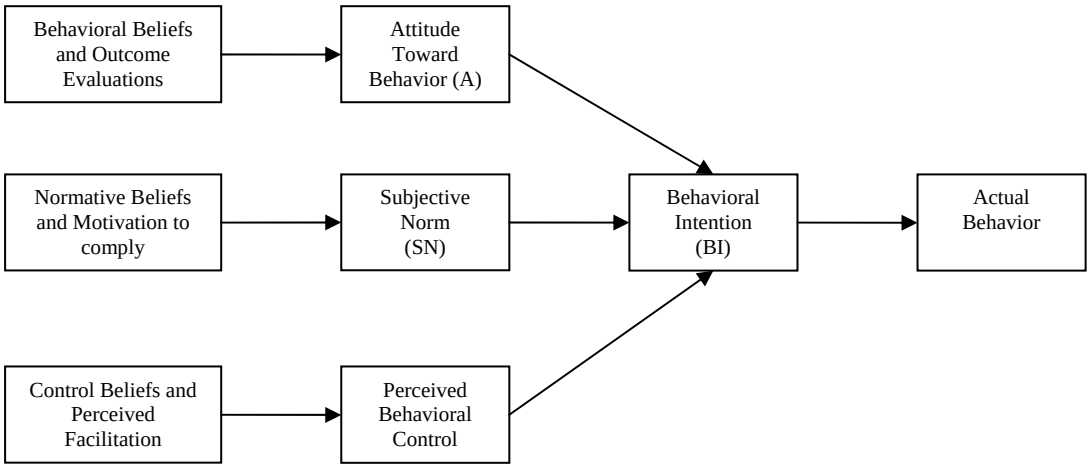
$$SN = \sum \text{Normative Belief (i)} * \text{Motivation to Comply (i)}$$

A helpful aspect of TRA from an IS perspective is the statement that any other factors can only indirectly influence behavior through attitude or subjective norm. This implies that TRA mediates the external variables on user behavior. TRA is an especially well-researched intention model that has proven successful in predicting and explaining behavior across a wide variety of domains. Therefore, TRA should be appropriate for studying the determinants of information system usage behavior as a special case.

2.2.2 Theory of Planned Behavior

TRA assumes that attitude and subjective norm fully determine behavioral intention, and behavioral intention is the only predictor of behavior. Ajzen (1985, 1991) extended TRA to develop the Theory of Planned Behavior (TPB) (Figure 2-2) in order to account for conditions where individuals do not have complete control over their behavior. The main difference between TRA and TPB is that TPB includes the key factor, perceived behavioral control (PBC), while TRA does not.

Figure 2-2 Theory of Planned Behavior (Ajzen 1985)



TRA and TPB shared the same definitions for behavioral intention, attitude, subjective norm, behavioral beliefs, outcome evaluation, normative beliefs, and motivation to comply. In TPB, perceived behavioral control (PBC) refers to the individual's perception of his/her control over performance of the specific behavior (Mathieson 1991). PBC is a function of the products of control beliefs and perceived facilitation. A control belief is a perception of the availability of skills, resources, and opportunities, while perceived facilitation is the individual's assessment of the importance of those resources to the achievement of outcomes (Mathieson 1991).

$$PBC = \sum \text{Control Belief (i)} * \text{Perceived Facilitation (i)}$$

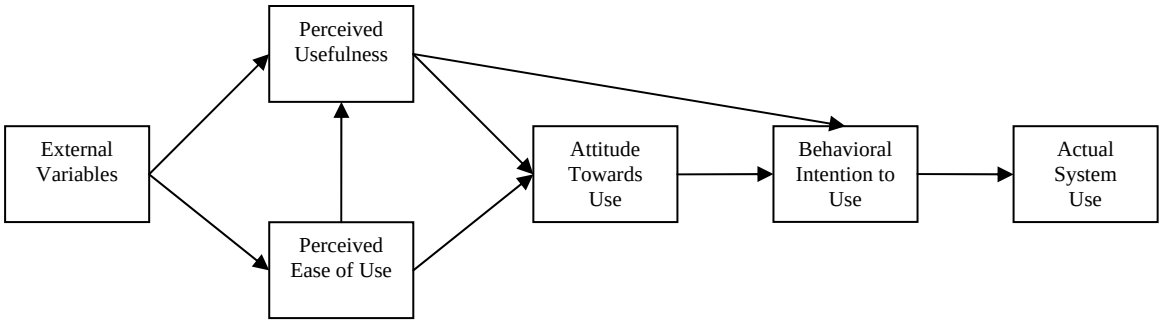
TPB suggests that A, SN and PBC have significant relationships with BI (Mathieson 1991; Taylor and Todd 1995a, Taylor and Todd 1995b). To some extent, TRA is a special case of TPB. TRA is only applied to the specific situation where individuals have completely volitional control over the necessary knowledge, skill, resource, and opportunities (Ajzen 1985), while TPB can also be applied to other situations in which individuals may not have volitional control over the necessary resources.

2.2.3 Technology Acceptance Model

Based on TRA, Davis (1989) developed the Technology Acceptance Model (TAM) (Figure 2-3) to explain individual IT adoption and usage behavior. TAM excludes the subjective norm construct in TRA because of its uncertain theoretical and psychometric status (Davis et al. 1989), and posits two perceived technology attributes—perceived usefulness (PU) and perceived ease of use (PEOU)—as the key factors affecting individual acceptance (Davis et al. 1989). PU refers to the user's perception that using the system will enhance his or her performance within an organization (Davis et al. 1989), while PEOU is defined as the degree to which the user expects that using the system will be free of effort (Davis et al. 1989). In the original TAM, behavioral intention (BI) is determined by attitude towards technology use, as well as by the direct and indirect affects of PU and PEOU. BI, in turn, directly impacts actual use of the system. In addition, TAM also proposed that

external variables indirectly influence attitude and behavioral intention via PU and PEOU.

Figure 2-3 Technology Acceptance Model (Davis 1989)



Empirical studies validated that TAM is a parsimonious and robust model when applied in a volitional context (Gefen et al. 2003; Mathieson 1991; Szajna 1994). TAM put more focuses on system characteristics (e.g., PU and PEOU), but it is limited in capturing the normative and control factors that could influence adoption and usage (Mathieson 1991). TAM was empirically proven successful in predicting about 40% of the variance in actual system use. In order to increase its explanation power, Legris et al. (2003) suggested that TAM should incorporate other components.

2.2.4 Diffusion of Innovation

Rogers (1983, 1995) developed the diffusion of innovation (DOI) theory. *Diffusion* is defined as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p. 5), while *innovation* refers to an idea, practice, or object that is perceived as new by

an individual or other adopting unit. DOI suggests that innovation adoption is a process of uncertainty reduction. During this process, individuals collect and analyze information about a new IT from the surrounding social system. After processing the collected information, they form the beliefs about using the IT. These beliefs drive individuals to accept or reject the IT.

Firstly, DOI posits that the rate of adoption is partially determined by the perceived attributes of an innovation -- innovation characteristics. After reviewing a series of diffusion studies, Rogers (2003) identifies five characteristics potentially important and showing consistent influence across diverse innovation adoption domains. These characteristics include:

- ***Relative Advantage***: the degree to which an innovation is perceived as being better than its precursor,
- ***Compatibility***: the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters,
- ***Complexity***: the degree to which an innovation is perceived as being difficult to use,
- ***Triability***: the degree to which an innovation may be experimented with before adoption, and
- ***Observability***: the degree to which the results of an innovation are observable to others (Rogers 2003).

Moore and Benbasat (1991) adopted and expanded these characteristics, and refined the constructs to be applied to the IS context. In summary, DOI research

views individuals' perceptions about these characteristics of an innovation as being important influences on acceptance behavior. Such perceptions have been used to explain both use intention (Davis et al. 1989; Mathieson 1991) as well as system usage (Davis 1993; Moore and Benbasat 1991).

Secondly, Rogers (2003) asserted that an individual's innovation decision consists of successive stages of decisions and actions. The process includes the following five stages:

- Knowledge: an individual is first exposed to and obtains some knowledge about an innovation,
- Persuasion: an individual forms an attitude toward the innovation according to the obtained knowledge,
- Decision: an individual decides whether or not she or he will accept the innovation,
- Implementation: an individual starts using or implementing the innovation, and
- Confirmation: based on the experiences derived from initial engagement, an individual decides whether to continue or discontinue the innovation.

An individual seeks information at various stages in this process in order to decrease uncertainty about an innovation's expected consequences. The decision stage leads to adoption or rejection of an innovation. Although both technology acceptance models and DOI research focus on usage behavior as the primary outcome of interest in the innovation adoption process, DOI research further distinguishes explicitly between various types of usage including initial usage and

continued usage (Rogers 2003). According to DOI, initial usage of an innovation may not be sufficient to fully derive the benefits desired from the system. Users still need to institutionalize the innovation as part of their regular work behavior. This type of usage was referred to as confirmation (Rogers 2003), routinization (Saga and Zmud 1994), continued-sustained implementation (Zaltman et al. 1973), or continuance (Bhattacherjee 2001). Individuals may be mandated to use a newly installed system in the implementation process at the early stage but the benefits from system usage may never be derived without continued and sustained usage.

Thirdly, Rogers (2003) categorized adopters into five types based on innovativeness. These five types include innovators, early adopters, early majority, late majority, and laggards. He proposed that the rate of adoption of an innovation can be represented by either a bell-shaped (frequency) curve or an S-shaped (cumulative) curve. Adopter distributions follow a bell-shaped curve over time and approach normality. However, the cumulative number of adopters approaches an S-shaped curve over time.

2.2.5 Limitations of Prior Studies

Among the above theories, DOI and TAM have received the most attention in the IS literature. These two models identify the perceived attributes of an innovation as key predictors explaining adoption. DOI identifies five perceived attributes—relative advantage, complexity, compatibility, trialability, and observability as influencing adoption behavior (Rogers 2003). TAM posits just two perceived attributes—perceived usefulness and perceived ease of use as influencing adoption (Davis et al. 1989). In addition, both of these two models put users' intention to

adopt a technology as their dependent variable, and they apply most readily to situations where the individual user can voluntarily choose whether to adopt the innovation or not. However, there is an important difference between these two models. DOI theory focuses on seeking to explain how communication channels and opinion leaders shape adoption, while TAM aims to predict technology acceptance and usage by potential adopters.

TAM was derived from TRA (Fishbein and Ajzen 1975). While TRA is a general theory of human behavior, TAM is specific to IS usage. TRA holds that individual behavior is predicted by his/her intention to perform that behavior, which in turn, is determined by a weighted combination of the person's attitude toward the behavior and his/her subjective assessment of the social acceptability of such behavior. Social acceptability or subjective norm is determined relative to the opinions of his/her referent group. Subjective norm may impact individual behavior through three mechanisms: compliance, internalization, and identification (Warshaw 1980). While the compliance mechanism causes an individual to simply alter his or her intention in response to the social pressure, the latter two mechanisms can alter an individual's belief structure, and then cause him or her to respond to potential social status gains (Venkatesh et al. 2003). Because subjective norm has a mixed effect on intention, Davis et al. (1989) modified TRA and proposed the TAM, specifically tailored to the IT usage context. TAM is parsimonious, and explains technology usage quite well (Legris et al. 2003). However, a limitation of TAM is that it assumes usage is volitional, that is, there are no barriers that would prevent an individual from using an IS if he or she chose to do so. Based on TRA, Ajzen (1991) developed TPB. TPB includes subjective norms (SN) and perceived behavior control (PBC) constructs that do not appear in TAM. TPB includes more effects that may be

important in some situations. However, TPB is less parsimonious than TAM. TAM explained 34% of the variance in usage, while TPB explained 36% (Taylor and Todd, 1995a; 1995b). The small increase in predictive power of TPB comes at the cost of the model complexity. Instead of developing TPB, other researchers have begun to extend TAM to include the extra constructs found in TPB while retaining the model's parsimony and IS focus to increase TAM's ability to predict and explain IS usage (Taylor and Todd 1995a).

Although many efforts have been made to explain individual innovation adoption, the traditional innovation adoption models have their own applicability. They are only well-suited to simple technology, individual voluntary adoption decisions, and shallow usage contexts (Gallivan 2001; Venkatesh et al. 2003). These models are not suited to the following contexts: (1) adoption that occurs within an organizational setting where users are mandated to use the innovation; (2) adoption that is subject to heavy coordination requirements or strong interdependences across multiple adopters; (3) adoption that requires extensive, specialized training to learn the principles underlying the innovation (Gallivan 2001). In addition, many of the information systems studies in the prior technology adoption research were fairly simple. Enterprise systems such as ERP or CRM in organizational settings are very complex. It is clear that such complex systems will push the limits of existing individual-level technology adoption theories. Some elements of prior research findings may work in the context of complex enterprise systems, while it is also likely that such complex systems will provide opportunity for deeper theorizing about technologies and their implementation in organizations (Boudreau and Robey 2005). The complexity and malleability of these enterprise systems permit users to utilize the systems at different levels of sophistication (Moore 2002). Given that the

technology acceptance models and diffusion of innovation research focus on usage or sustained usage as the dependent variables, they are limited in explaining the highly sophisticated level of usage -- emergent use.

2.3 Review of Individual Technology Post-Acceptance Research

There have been a large number of studies on information systems acceptance and use during the last decade (Ajzen 1991; Ajzen and Fishbein 1980; Davis 1989; Davis et al. 1989; Tan and Teo 2000). However, empirical research on post-acceptance behavior has just started, and needs more attention from researchers and practitioners. Kwon and Zmud (1987) suggested that research should explore the impact of contextual factors on post-adoption stages. Based on this research, some studies have articulated or tested differences across stages of the IS implementation process (Brancheau and Wetherbe 1990; Cale and Eriksen 1994; Cooper and Zmud 1990).

There are in general two research streams that studied post-acceptance behavior. One stream investigates continuance, or continued usage (e.g. Bhattacherjee 2001); the other focuses on technology usage that goes beyond simple and routinized usage, or usage behavior that is deep and complex in nature. In the following sections, we use the term *sophisticated usage* to represent this type of usage. These two kinds of usage have different focuses. Continued usage research focused on how to motivate users to keep using a technology (Bhattacherjee 2001; Parthasarathy 1995), while sophisticated usage research concentrated on how to use a technology deeply in order to enhance users' productivity (Nambisan et al. 1999;

Jasperson et al. 2005). In order to attain IS sophisticated usage, employees are first required to continue using the system. Therefore, continued usage research is the first step to understanding sophisticated usage research. Table 2-1 summarizes the most important studies of these use behaviors in voluntary and mandatory contexts.

Table 2-1 Summary on Major literature of Post-Acceptance Behavior

Authors/year	Description	Voluntary / Mandatory	IT	Independent Variables	Dependent Variables	Main Findings
Klonglan and Coward (1970)	This paper illustrated the place of symbolic adoption in the adoption process and the utility of considering symbolic adoption.	Voluntary				Symbolic adoption is presumed to lead to trial use and eventually to continued use.
Parthasarathy (1995)	This study explained why individuals stop using products and what impact their decision has on the subsequent sales/diffusion of the product. A theory of discontinuance was developed.	Voluntary	On-line services			Discontinuers share the characteristics of later adopters. On the other hand, long term adopters share the characteristics of earlier adopters.
Bhattacherjee (1998)	Drawing on principal-agent research, this paper developed and tested a model of intra-organizational IT usage that addressed how managers can influence organizational members to use a new IT.	Voluntary	Microsoft Excel's SOLVER	Outcome-based incentives, behavior-based incentives	IT usage behavior	Managers can promote IT usage within organizations by designing appropriate incentives and control structures such as monitoring and multiple-period contracts. However, the effectiveness of these structures will depend on potential users' ability to distinguish between various forms of incentives and control.
Parthasarathy and Bhattacherjee (1998)	This paper used innovation diffusion theory as a theoretical framework to examine post-adoption behavior within the context of online service use.	Voluntary	On-line service			The potential discontinuers can be discriminated from continued adopters based on their sources of influence, perceived service attributes, service utilization, and network externality during their time of initial adoption. This paper also found later adopters are more likely to discontinue.
Karahanna et al. (1999)	This paper combined innovation diffusion and attitude theories in a theoretical framework to examine differences in pre-adoption and	Voluntary	Microsoft Windows 3.1	Perceived usefulness, image, attitude toward continuing to use,	Behavioral intention to continue using	Potential adopter intention to adopt is solely determined by normative pressures, whereas user intention is solely determined by attitude. Post-

	post-adoption beliefs and attitudes.			perceived voluntariness		adoption attitude is only based on instrumentality beliefs of usefulness and perceptions of image enhancements.
Bhattacherjee (2001)	This paper examined cognitive beliefs and satisfaction influencing one's intention to continue using IS.	Voluntary	Online banking	Perceived usefulness, confirmation, satisfaction	IS continuance intention	The results suggest that users' continuance intention is determined by their satisfaction with IS use and perceived usefulness of continued IS use. User satisfaction, in turn, is influenced by their confirmation of expectation from prior IS use and perceived usefulness.
Tiwana and Bush (2005)	This paper developed a model to examine the continuance issue of the expertise-sharing networks	Voluntary	Expertise-sharing networks	Reputation, Relationship Capital, Personalization, Satisfaction	Continuance intention	The results suggest that reputation, relationships, personalization and satisfaction influence a user's intention to continue using the system. The proposed model predicted over half of the variance in continuance intention.
Auer (1998)	This study assessed the levels of skill in using microcomputer software packages and to understand the role of skills in an organizational context. A single-case study project was selected as a research approach.	Mandatory	Microcomputer software packages			The study suggests taxonomy of five classes of issues to look holistically at quality of use. The results suggest IS abilities that support work might be at an alarmingly low level although IS usage seems to be active.
Rawstorne et al. (1998)	This paper provided a theoretical framework for predicting IS use in a mandatory adoption environment.	Mandatory	Patient Care Information System (PCIS)	Subjective computer experience, objective computer experience, perceived usefulness, perceived ease of use, subjective norm, perceived behavioral control,	End-user Satisfaction	This paper created a theoretical framework, but did not validate it empirically.

				attitude toward the behavior, symbolic adoption		
Rawstorne et al. (2000)	This paper identified the relevant issues necessary for applying TAM and TPB to the prediction and explanation of mandated IS usage. It is a longitudinal study conducted in a hospital setting.	Mandatory	Patient Care Information System (PCIS)	behavioral attitude, subjective norm, perceived behavioral control, behavioral intention, perceived usefulness, perceived ease of use	Actual behavior	1. TAM and TPB could not explain multiple usage behaviors. 2. There is variance in mandated usage behavior. 3. Usage behavior could be predicted to a reasonable degree after the commencement of use.
Brown et al. (2002)	This paper investigated user acceptance of mandated technology, including the nature of mandatoriness and the implications of users' attitude in technology acceptance.	Mandatory	Computer banking system (CBS)	Perceived usefulness, ease of use, perceived behavioral control, subjective norm	Behavioral intention	1. Usefulness is the key antecedent of attitude. 2. The relationship between attitude and behavioral intention is absent.
Pozzebon (2002)	This paper combined structuration theory and behavioral-based theories in a qualitative study, and provided an ERP usage model as a tool for the investigation about relevant factors affecting the actual ERP usage in organizations.	Mandatory	ERP			This paper proposed to replace the traditional behavior intention with a new construct called symbolic adoption.
Nah et al. (2004)	To examine factors leading to the lack of end-user acceptance of ERP systems, this paper reviewed the literature on user adoption of IT in mandatory contexts, developed hypotheses to explain ERP user acceptance, and conducted a survey study to test the hypotheses.	Mandatory	ERP	Perceived ease of use, perceived usefulness, perceived fit, perceived compatibility, attitude toward system use	Symbolic adoption	Perceived compatibility and perceived ease of use have both direct and indirect effects on symbolic adoption, while perceived fit and perceived usefulness influence symbolic adoption by being fully mediated through attitude.

Ward et al. (2005)	This study examined the impact of organizational level influences on individual user attitudes toward system use over time. The study was set in the context of a major mandatory system implementation at a multi-bank holding company.	Mandatory	Computer Banking System (CBS)	Subjective norms, top management commitment, perceived benefit to organization	Attitude	Results suggest that subjective norms, top management commitment, and perceived organizational benefits are important to users at different times in the implementation process. The results also highlight that direct system experience plays a significant role in determining which factors are important and when.
Saga and Zmud (1994)	This study put forward frameworks to explore the behavior of employees in post-implementation stages.					This paper proposed that post-acceptance behavior includes routinization and infusion. The routinization construct can be captured by three dimensions: use perceived as being normal, standardized use, and administrative infrastructure development. For the infusion stage, extended use, integrative use and emergent use would be the relevant variables for measurement.
Karahanna (1999)	This study proposed symbolic adoption as a construct indicating degree of voluntary mental acceptance of the idea component of an IT innovation and examines the differences between antecedents of user intention to adopt and symbolic adoption.		Microsoft's Windows	Perceived usefulness, Perceived ease of use, Attitude toward adopting, subjective norm toward adopting, compatibility	Behavioral Intention to adopt, Symbolic Adoption	Symbolic adoption is more indicative of an individual's voluntary intention to adopt an innovation and that managing symbolic adoption is key to deriving the full benefits of an IT innovation.
Lassila and Brancheau (1999)	This study developed a framework allows for the investigation of the differences in IT utilization based on the relationship between technology and organization change.					This study suggests four "equilibrium states," corresponding to increasing levels of use of a software package. These states represent limited use, use to support existing processes, use to redesign existing work processes, and use to allow the extension of the

						capabilities of the technology and the work environment.
Nambisan et al. (1999)	Based on the ability of various mechanisms to facilitate knowledge acquisition and knowledge conversion, this paper developed taxonomy of organizational mechanisms.			Organizational mechanism	Technology cognizance, ability to explore, intention to explore	This study developed three constructs labeled "technology cognizance", "ability to explore" and "intention to explore".
Boudreau (2003)	Based on the analysis of data related to an ERP implementation within a public organization, this paper proposed a causal model to predict the quality of use.		ERP	Voluntariness, perceived ease of use, perceived experience with IT, perceived system quality, perceived dependence, formal training, informal training, extent of learning, perceived peer pressure, perceived support	Quality of use	They suggest that the inclusion of factors relating to learning allows to better understand why "quality of use" may vary among individual users. They emphasize factors affecting formal and informal training, and their impact on the extent of learning.
Bhattacherjee and Premkumar (2004)	This paper elaborated how users' beliefs and attitudes change during the course of their IT usage, defining emergent constructs driving such change, and proposed a temporal model of belief and attitude change.		Computer-based training system, rapid application development software	Beliefs, Attitude, Disconfirmation, Satisfaction	Continuance Intention	This study reports that emergent factors such as disconfirmation and satisfaction are critical to understanding changes in IT users' beliefs and attitudes and recommends that they be included in future process models of IT usage.
Ahuja and Thatcher (2005)	Grounded in the theory of trying, this study examined the influence of the work environment and gender on trying to innovate with information technology. The study extended the innovation diffusion literature by offering a theory-driven explanation for examining "trying to innovate with IT" and a			Autonomy, overload, autonomy/overload interaction, gender	Trying to innovate	Results provide evidence that overload and autonomy are antecedents to trying to innovate with information technology. Further, findings confirm that autonomy interacts with overload to determine trying to innovate with IT and that these relationships vary by gender.

	parsimonious measure for this construct.					
Jasperson et al. (2005)	This study offered a comprehensive research model of post-adoptive IT use behaviors and proposed some factors that influence users to continuously exploit and extend the functionality built into IT applications.	Voluntary and mandatory				If the interventions occur to disrupt the formation of the deep, non-reflective mental scripts, post-adoptive behaviors become habitualized over time. Where these habitual behaviors lead to satisfactory outcomes and where the work context is stable, such behaviors might be regarded as appropriate.

2.3.1Continued Usage Research

Studies on IS usage in voluntary contexts are based on the important assumption that IS users have a choice about the extent to which they use a system (Ajzen 1985, 1991; Ajzen and Fishbein 1980; Bandura 1986; Davis 1989). Such an assumption is appropriate in a controlled laboratory where system usage is under volitional control (Bhattacherjee 1998) or in organizations that endorse a policy of voluntary system usage during a certain system trial period (Rawstorne et al. 1998). During this period, employees are encouraged to adopt and use the system, but there is no overt pressure to do so. Following this assumption, some researchers have started to shift their focus from system acceptance to continued usage. In continued usage research, individuals possess the power to continue or discontinue using an IS. There are two primary schools of thought that focus on psychological motivations leading a user to continue to use an IS.

2.3.1.1 Continuance: An Extension of Acceptance Behavior

Some prior IT adoption studies have implicitly assumed that the processes of adoption decision would be similar to those of continued usage decision (Mathieson 1991; Taylor and Todd 1995b). Therefore, the first school of thought employs existing IT adoption perspectives to explore the continued usage behavior (Karahanna et al. 1999; Parthasarathy and Bhattacherjee 1998). This school employs the same set of motivations or beliefs to explain both the continuance and acceptance decisions, implicitly viewing continuance as an extension of acceptance behavior.

Based on this assumption, many authors have studied different aspects of individual reactions to IT from various theoretical perspectives, including Technology of Acceptance (TAM), Theory of Planned Theory (TPB), Diffusion of Innovation (DOI) and Social Cognitive Theory (SCT) (Compeau and Higgins 1995a, 1995b; Davis et al. 1989; Rogers 2003; Taylor and Todd 1995a, 1995b). In each of the above theories, usage behavior is predicted by a set of beliefs about the IT and a set of affective responses to the behavior. The beliefs and affective responses are represented by the perceived characteristics of an innovation in DOI, by perceived usefulness (PU) and perceived ease of use (PEOU), by perceived behavior control in TPB, and by outcome expectations and self-efficacy in SCT. This school assumes that the beliefs about the technology and affective responses to the behavior can explain acceptance and continuance as well.

Parthasarathy and Bhattacherjee (1998) examined the post-adoption behavior within the context of online service use. In their research, post-adoption behavior refers to continued adoption or discontinuance. Innovation diffusion theory was used as a theoretical framework to extend information technology adoption research to the case of post-adoption behavior. Their results suggested that the adopters' sources of influence, perceived service attributes, service utilization and network externality at the initial adoption stage can influence continued adoption.

Karahanna et al. (1999) investigated the antecedents of post-adoption, which described users using Windows 3.1. They found that perceived usefulness and image, and top management support, supervisor and peer usage are important factors. They also found that subjective norms alone can induce initial adoption while continued usage decisions, when non-mandated, are based solely on attitudinal considerations.

This study indicates that continued usage under a volitional basis can be explained using traditional adoption models, such as DOI and TRA.

2.3.1.2 Continuance: Not an Extension of Acceptance Behavior

Technology adoption and continuance intention are distinct because continuance is an *ex post* reconfirmation of the initial adoption decision (Tiwana and Bush 2005). Initial adoption does not guarantee continued use. Theoretical models such as TAM that focus on the initial adoption of the systems do not sufficiently explain how their usage can be sustained in the more advanced post-implementation stages of adoption. Therefore, unlike the first school of thought, whose foci are exclusively on beliefs about the IT and the initial acceptance, the second school builds a new perspective to explain continued IT usage behavior. This school includes other beliefs that might influence users' subsequent continuance decisions but not their prior acceptance. This school tries to seek theoretical support from Expectancy Disconfirmation Theory (EDT) (Oliver 1980; Oliver and Shapiro 1993). EDC suggests that individual users always re-assess their earlier acceptance decision and decide whether to continue or discontinue using the IT during the post-acceptance stage. Prior perceived confirmation and user satisfaction with prior use are two fundamental constructs in EDC.

Parthasarathy (1995) noted the importance of discontinuance in understanding why individuals stop using a product and what impact it has on the subsequent sales/diffusion of the product. Based on diffusion theory, he developed a theory of discontinuance. In this study, adopters are categorized as either earlier or later. Parthasarathy and Bhattacherjee (1998) extended the models of Diffusion of

Innovations (DOI) and Expectation Disconfirmation Theory (EDT) (Oliver 1980) to further examine the differences between earlier and later adopters. Based on EDT, they distinguished discontinuers from continuing adopters. Earlier adopters are expected to have realistic expectation about using a new service because they have less opportunity for dissatisfaction, while later adopters may have unrealistically high expectation because later adopters expect the technology to be more mature. These two studies showed that earlier adopters are more likely to continue online services than later adopters. Their studies enhance our understanding with respect to the behavior of discontinued usage during different stages of adoption, by pointing out that earlier adopters are more likely to continue to use the new service compared with later adopters.

Bhattacherjee (2001) created a model of IS continuance based on ECT (Oliver 1980), which is adapted from the consumer behavior literature. His study is one of the earliest to conceptualize and test a theoretical model of IS continuance, which takes into account the distinctions between acceptance and continued usage behaviors. Bhattacherjee's study has some similarity to Davis et al.'s formulation of TAM because it adapts ECT from the consumer behavior literature to propose the IS continuance model, just as the study of Davis et al adapted the theory of reasoned action from the social psychology literature to develop their IS acceptance model. He found that users' continuance intention is determined by their satisfaction with IS use and perceived usefulness of continued IS use. He further suggested that one's disconfirmation and dissatisfaction with IS use may lead to its eventual discontinuance, despite positive perceptions of pre-acceptance variables. This study validated that ECT can be applied to study continued usage under a voluntary basis.

Previous studies have found that user beliefs and attitudes are key perceptions driving IT usage (Ajzen 1985; Davis et al. 1989). As users gain first-hand experience with IT usage, their beliefs and attitudes may change with time, and in turn influence their subsequent IT usage. Bhattacherjee and Premkumar (2004) elaborated how users' beliefs and attitudes change during the course of their IT usage, and proposed a temporal model of belief and attitude change based on the IS continuance model (Bhattacherjee 2001). They found that disconfirmation and satisfaction are critical to understanding changes in IT users' beliefs and attitudes and recommended that they be included in future process models of IT usage.

2.3.2 Sophisticated Usage Research

Although some progress has been made in continued usage research in a voluntary context, how to apply these outcomes in a real world situation is still a problem. Firstly, continued usage is important to system implementation, but it is not sufficient for employees to achieve system effectiveness. Similar to motivation research, continued usage research only focuses on the factors needed to make employees keep using a technology. It does not pay attention to the behavior that actually is meant to increase individual productivity. Secondly, it is apparent that mandated usage is very common in organizational contexts. Mandatory usage often leads to user resistance. Zuboff (1988) argued even though employees may use the system, their job satisfaction, feelings toward their supervisors, and loyalty toward the organization can be severely and negatively affected. A further motivation for understanding mandated use lies in the desire to minimize sabotage and unfaithful appropriation of IS. Therefore, some researchers gradually shifted their focus from

voluntary to mandatory basis in recent years (Nah et al. 2004; Rawstorne et al., 1998, 2000). In mandatory environments, sophisticated usage has received the attention of IS researchers.

Some researchers have attempted to effectively conceptualize and operationalize the system usage variable. In a mandatory environment, the traditional notion of system usage is not appropriate as a dependent variable. Since employees must use the system to perform their job functions, there are no alternatives to actual use. A better dependent variable may be specific usage behaviors for which there is likely to be variance in mandatory contexts (Rawstorne et al. 2000). To date, research efforts directed towards the creation of a richer conceptualization of system usage have begun (Agarwal 2000). Notable steps in this direction have been taken by Saga and Zmud (1994), who suggested that there are many kinds of usage behaviors and outcomes.

Saga and Zmud (1994) put forward frameworks to explore the behaviors of employees in post-implementation stages. In their view, post-acceptance behavior includes routinization and infusion. In their routinization model, they suggested that the construct of routinization can be captured by three dimensions: use perceived as being normal, standardized use, and administrative infrastructure development. The first dimension, *use perceived as being normal*, means the technology's use as a 'normal' organizational activity. The second dimension, *standardized use*, is the extent to which usage is governed by some rules or structures and shows certain kinds of patterns. The third dimension to measure routinization is *administrative infrastructure development*, which is related to formal rules or policies. For the infusion stage, extended use, integrative use and emergent use would be the relevant variables for measurement. *Extended use* refers to using more of the technology's

features in order to accommodate a more comprehensive set of work tasks. *Integrative use* means using the technology in order to establish or enhance work flow linkages among a set of work tasks. *Emergent use* refers to using the technology in order to accomplish work tasks that are not feasible or recognized prior to the application of the technology to the work system. This study defines the ways to measure extant technology usage in an organization and provides the definitions of these constructs. However, the measurements of these theoretical constructs require valid and reliable scales that have not yet been developed.

Based on the Saga and Zmud's (1994) study, Ahuja and Thatcher (2005) extended the innovation diffusion literature by providing a theory-driven explanation for *trying to innovate with IT*. Considering their interest in linking the work environment to innovation with IT, their study focused on identifying and developing an appropriate predictor of *emergent use of IT*. Drawing on the Theory of Reasoned Action, they argued that work environment impediments make intentions inadequate for examining post-adoption IT use. Instead of examining intentions, they introduced the goal-based construct of *trying to innovate with IT* as an appropriate dependent variable to study post-adoption IT use. Grounded in the theory of trying to innovate, this study explored the influence of the work environment and gender on trying to innovate with IT. This study highlighted that trying to innovate with IT is an important dependent variable in exploring post-adoption IT use. However, this study employed student subjects as the data sample. Although it is consistent with other TAM studies in IS research (Agarwal and Karahanna 2000), future research should be conducted to replicate this study in different organizational contexts to identify the boundary conditions for proposed models.

From the perspective of the relationship between technology and organization change, Lassila and Brancheau (1999) proposed a framework to investigate the differences in technology utilization. They suggested four "equilibrium states," corresponding to different levels of use of an ERP system. These states represent *limited use* (low-integration), *use to support existing processes* (standard adoption), *use to redesign existing work processes* (expanding), and *use to allow the extension of the capabilities of the technology and the work environment* (high-integration). Low-integration and standard adoption can be categorized into adoptive states, while expanding and high-integration can be categorized into adaptive states. Adoptive states indicate incremental change with no change to deep structure within an organization; adaptive states indicate a change to deep structure within an organization. The progression towards higher levels of use reflects increasing comfort with the technology, as well as increasing control over the technology and related work processes. The infusion stage in the study of Saga and Zmud (1994) may occur in expanding and high-integration states. Expanding states are characterized by use of the IT beyond its basic capabilities through user modifications to work processes and procedures that enable effective assimilation. High-integration states are characterized by use that extends both the capabilities of the technology and the work environment. High-integration use involves a dynamic workplace where the technology and the associated rules and resources in an organization are continually adopted and adapted to enhance effectiveness. Because users had more freedom to adjust both software features and the organizational processes in expanding and high-integration utilization states, they could realize greater benefits than those in standard adoption and low-integration utilization states (Lassila and Brancheau 1999).

In order to encourage users to expand their use of installed IT-enabled work systems, Jasperson et al. (2005) explored the phenomenon of post-adoptive behavior and suggested that the post-adoption stage is the phase during which benefits from the investment begin to accrue. Post-adoptive behavior includes three levels: *individual feature adoption decision, individual feature use,* and *individual feature extension*. After an individual user commits to using an IT application installed in his/her organization, he/she goes into the post-adoptive behavior stage. During this stage, the individual user can actively choose to explore, use and possibly extend one or more of the application's features. They proposed an important concept, *individual feature extension,* to explain some organizations successfully realize expectations regarding IS implementation, while others do not. In their study, *individual feature extension* refers to users discovering ways to apply the feature that go beyond the uses delineated by the application's designers or implementers.

Rawstorne et al. (2000) conducted a single-site, single-technology, longitudinal study to identify the relevant issues necessary for applying the Theory of Acceptance Model and the Theory of Planned Behavior to the prediction and explanation of mandated system usage. How to create a dependent variable for prediction in contexts of mandatory use is a difficult problem because everyone certainly will use the system in a mandatory context. Therefore, a specific usage behavior was selected as the dependent variable. In their research of Patient Care Information System (PCIS), special usage behavior is measured by *updating the care plans as changes occurred, using the care plans for planning care delivery, and using the care plans as an educational tool for students and new graduates.* These three distinct usage behaviors related to nurses' use of the Nursing Care Plans (NCP) in PCIS. An NCP is a plan of action for a patient's care based on diagnostic classifications. A

computerized NCP draws upon stored electronic information to develop a plan of care for each patient.

Auer (1998) and Boudreau (2003) offered additional insights about what allows one to progress towards a more sophisticated level of use, which is different from the above studies that explore and measure specific usage behavior in the post-adoption stages. They found that post-implementation studies have concentrated more on usage and user satisfaction rather than the abilities required to use IS in an organizational context. In order to address the issue of the skills to use IS, Auer (1998) proposed a new concept *quality of IS use*. *Quality of use* is defined as the ability one has to correctly exploit the appropriate capabilities of software in the most relevant circumstances (Boudreau 2003). In an attempt to capture the extent of use, Boudreau (2003) proposed a causal model that identifies key factors leading to the quality of use. He suggested that formal training, informal training, and extent of learning can influence the quality of use. These studies suggest employees' skills and knowledge, together with organizational routines and norms direct employees' actions, resulting in cumulative IS utilization to support organizational goals. However, the operationalization of the construct of *quality of use* has not yet developed in this study. In addition, these studies used a case study approach, so their generalizability is somewhat limited.

In an organizational context, employees usually use systems to do their tasks. How to stimulate employees to use these systems in an effective way is an important issue. Based on agency theory from the microeconomics literature (Arrow 1985; Sappington 1991), Bhattacherjee (1998) developed and applied the principal agent model to explain employees' behavior of deep usage in an organizational context. He found that managerial influences, using different incentives and control structures,

can drive employees to use the systems in better and more effective ways. Since the related data are not easily collected from the field, this study employs a laboratory experiment, which limits the application of the study.

Ward et al. (2005) noted that prior research on technology acceptance has largely focused on volitional systems and on individuals, rather than organizational factors that could influence technology acceptance and use. In their study, user attitude was a dependent variable. They examined the impact of organizational level influences on individual user attitudes toward system use over time. The results suggested that subjective norms, top management commitment, and perceived organizational benefits are important to users at different times during the implementation process. This study highlighted the importance of establishing positive attitudes early in the implementation process and continuing to portray the system positively even after it has been implemented.

Nambisan et al. (1999) underscored the importance of creating new knowledge for deploying IS within an organization. They proposed three key antecedents of user propensity to innovate in IT. These three variables are "technology cognizance", "ability to explore a technology," and "intention to explore a technology." *Technology cognizance* relates to a user's knowledge about the capabilities of a technology, its features, potential use, and cost and benefits (Rogers 1995). Cognizance represents knowledge about "facts" in the domain of information technology. *Ability to explore* refers to a user's perceived competence in marshalling the cognitive and physical resources required for technology exploration. It involves reconfiguring, by combining different features of one or more technologies and integrating them with accumulated business knowledge. *Intention to explore* reflects a user's willingness to and purpose for finding new ways of applying information

technology to work tasks. This construct is intended to span the conceptual domain of discovery and learning. Clearly, all three elements are important for the creation of new technology knowledge, which contributes to effective system usage.

In summary, researchers have proposed and explored various types of post-adoptive usage behaviors. Some researchers put their focuses on examining the process of post-adoption and try to clearly describe the different types of post-adoptive usage behaviors, while other researchers paid attention to identifying the determinants of post-adoptive usage behaviors. These alternative perspectives constitute valuable efforts. However, they have not developed consistent specific usage constructs in the post-adoption stage. The emergent use issue has not been directly touched in these studies.

2.4 Review of Organizational Adoption Research

Adoption is defined as the "decision to make full use of an innovation" (Rogers 1983, p.21). An organization adoption process includes primary adoption by management and secondary adoption by employees (Leonard-Barton 1987). Organizational primary adoption refers to the organizational decision to invest in an information system, while employee's or "secondary" adoption refers to individual-level decisions regarding IS usage. In other words, organizational adoption involves a two-part decision process in which a formal decision to make an IS innovation available to the organization or department as a whole is then followed by employees' decisions about whether and how to actually use the IS innovation. Mandatory usage often occurs in an organization when an end user is forced to utilize the IS in a way that replaces at least one previous work practice. There is a

growing literature stream focusing on organizational adoption and implementation research. Organizational adoption focuses on identifying factors influencing top managers to make a decision to invest in an IS. IS implementation research is concerned with putting an IS to effective use in an organization. Factors research and stage research streams have received widespread attention. Factors research attempts to identify factors (e.g., individual and organizational) potentially related to the dependent variable (Fuerst and Cheney 1982; Ives and Olson 1984). Stage research is concerned with identifying the sequence of stages unfolding over time during organizational implementation or diffusion of information systems (Cooper and Zmud 1990).

Based on factors research, some researchers have conducted organizational adoption studies in an attempt to identify factors that can potentially impact IS usage. The identified factors can be grouped into five broad classes: individual, organizational, technological, task-related, and environmental (Kwon and Zmud 1987). However, in these studies, a single respondent is asked to complete a survey indicating whether his or her organization has adopted an innovation or not. These key informants are senior managers. Many innovation studies have been conducted to explain organizational adoption and acceptance behavior using this approach. However, this line of research has been questioned because conclusions were only based on senior managers' response, which may differ from those of employees at lower levels. Therefore, the validity of these studies for understanding organizational innovation adoption behavior has been challenged in the IS research field (Gallivan 2001).

There is another research stream that has focused on stage research models as a way of better understanding organizational implementation of IS innovations. Stage

models conceptualize IS implementation or diffusion as a sequence of stages, each of which must be attended in order to achieve implementation success. Table 2-2 depicts some of the widely cited stage models in the IS implementation/diffusion literature.

Table 2-2 Stage Models of IS Implementation (Modified from Bhattacherjee (1996))

Author	Stage Model
Sorensen and Zand (1975)	Unfreezing-Moving-Refreezing
Zmud (1982)	Initiation-Adoption-Implementation
Kwon and Zmud (1987)	Initation-Adoption-Adaptation-Acceptance-Use/performance/satisfaction-Incorporation
Cooper and Zmud (1990)	Initiation-Adoption-Adaptation-Acceptance-Routinization-Infusion

One well-known model describing technology implementation in organizations was proposed by Cooper and Zmud (1990). They suggested that organizational adoption and implementation experiences six stages: initiation, adoption, adaptation, acceptance, routinization and infusion. In the initiation stage, an organization first feels the need for a new IS. This need is developed from a need-pull or technology-pull or a combination of both (Zmud 1984). The adoption stage represents the organization's acquisition of an IS and allocation of resources necessary to implement it. In the adaptation stage, the IS is tailored to the specific needs of the organization and organizational procedures are modified to accommodate the IS. The acceptance stage represents organizational members' commitment to use the IS. In the routinization stage, the IS ceases to be a new entity and becomes a part of the routine activities of the users. In the infusion stage, the IS is used to its fullest potential. Of the six stages in the implementation process, though the first three

stages may indirectly impact individual users' motivation to utilize IS, the final three stages directly focus on this issue. The last two stages belong to post-acceptance behavior. Saga and Zmud (1994) clearly described change processes that are very useful for understanding the various stages of technology assimilation. Therefore, their stage model will be applied to create the new framework of emergent use for this study.

2.5 Summary

This chapter reviewed prior research in individual technology acceptance, individual technology post-acceptance and organizational adoption. Although most studies in these three areas have been conducted from different perspectives, they all focus on system adoption and usage. Rooted in the expectancy theory traditions of social psychology, individual technology acceptance research aims to explain why individuals want to adopt and use an IS. The dependent variable is either intention to use or simple use, but not emergent use in the post-acceptance stage.

On the other hand, individual technology post-acceptance research focuses on continued use or sophisticated usage. The aim of continued use research is to examine the factors to motivate users to keep using an IS. The dependent variable is continuance intention or continuance use behavior. Similar to individual technology acceptance, the continuance use behavior is at the same usage level with initial use, and the research context is often voluntary. Alternatively, sophisticated usage research focuses on how to motivate users to deeply use an IS in order to enhance their performance. This line of research has identified various types of post-acceptance usage behaviors (e.g., routinization, extended use, emergent use).

However, to date, little effort has been devoted toward developing a comprehensive model to explain these types of usage.

In addition, employees are often mandated to use the enterprise system installed in their organization. Organizational adoption research provides a useful insight to understand employees' emergent use within organizational settings. The IS implementation stage research models depict the assimilation process of IS into an organization. These stage models can help us better understand how to motivate an individual user to enter a sophisticated usage state. Therefore, the stage models can greatly facilitate our research model development.

CHAPTER 3

THEORETICAL FOUNDATIONS AND RESEARCH HYPOTHESES

The focus of this study is post-acceptance behaviors, particularly IS emergent use within mandatory organizational settings. Emergent use occurs at the post-acceptance stage and is critical to system effectiveness (Saga and Zmud 1994; Zhu and Kraemer 2005). To attain IS emergent use, it is necessary for users to achieve sustained usage, and then gradually go into an infusion stage to explore and find how to creatively use the system. In this vein, the author proposes a research model that synthesizes the **IS continuance model** and the **organizational assimilation framework**. While the IS continuance model taps into the aspect of sustained usage, the organizational assimilation framework captures the extent to which individuals use enterprise systems.

This chapter is divided into four sections. The first section describes the theoretical foundations. Based on the theoretical foundations and previous literature, the second section proposes the research model. The third section develops the research hypotheses. The last section summarizes the research hypotheses.

3.1 Theoretical Foundations

This section presents the theoretical basis for this study. The organizational assimilation framework is incorporated into the IS continuance model to develop an

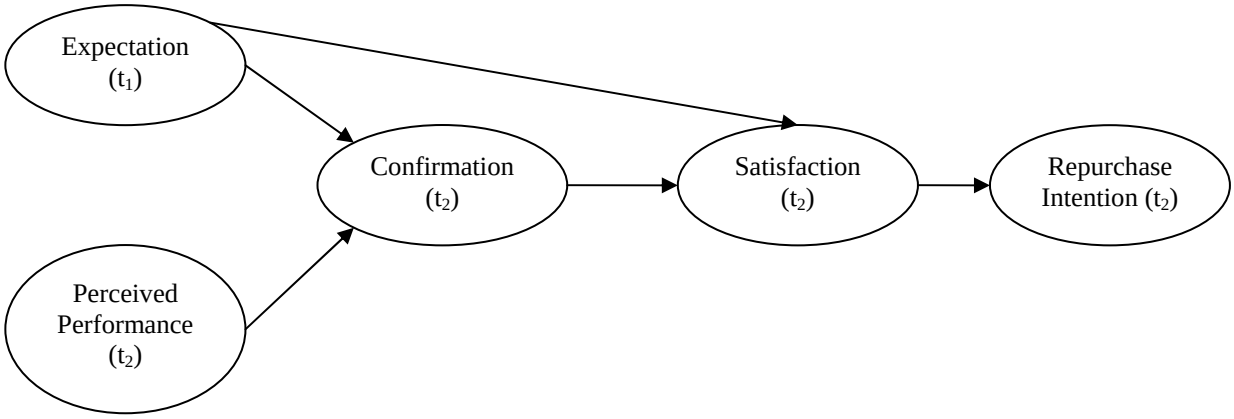
emergent use model of enterprise systems. This section firstly introduces the IS continuance model and underscores its value in developing an emergent use model, and then illustrates the organizational diffusion and assimilation framework and concludes with its importance as a theoretical basis to the current study.

3.1.1 IS Continuance Model

From the individual perspective, Bhattacherjee (2001) developed the IS continuance model, which is well suited for explaining the post-acceptance behaviors. Bhattacherjee's IS continuance model was established based on Expectancy Disconfirmation Theory (EDT) or Disconfirmation of Expectation Theory[1], which is widely used in the consumer behavior literature to study consumer satisfaction, post-purchase behavior, and service marketing in general (Anderson and Sullivan 1993; Oliver 1993; Patterson et al. 1997). EDT (Figure 3-1) suggests that consumers' intention to repurchase a product or continue service use is determined primarily by their satisfaction with prior use of the product or service. Satisfaction, in turn, is determined by consumers' pre-consumption expectation and post-consumption disconfirmation. In EDT, satisfaction is regarded as the key construct to build a loyal base of long-term consumers. In addition, given that expectation provides the baseline for consumers to form evaluative judgments about the product or service, EDT also theorizes expectation as an additional determinant of satisfaction.

[1] In the consumer behavior research, "disconfirmation" and "confirmation" are interchangeably used (Anderson and Sullivan 1993; Oliver 1980, 1993)

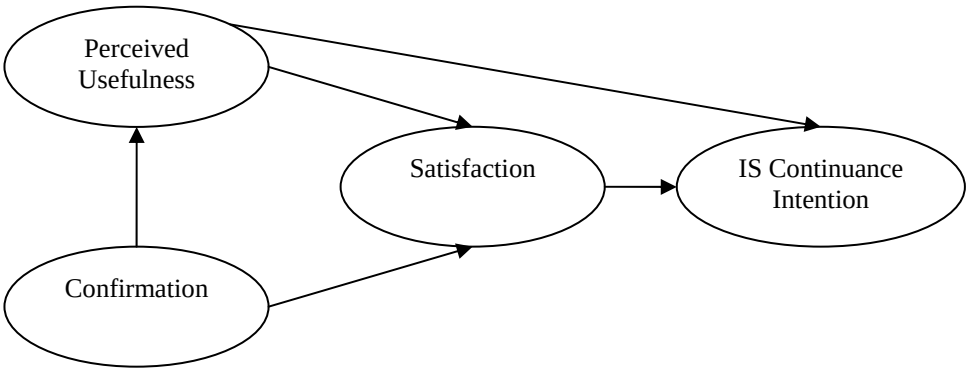
Figure 3-1 Expectation-Confirmation Theory



Note: t_1 = pre-consumption variable; t_2 = post-consumption variable

IS continuance intention is similar to consumers' repurchase decision. There are three similarities between these two decisions: 1) they follow an initial decision (acceptance or purchase), 2) they are affected by the initial use experience, and 3) they can potentially lead to ex post reversal of the initial decision. By drawing on EDT, Bhattacherjee (2001) developed the Expectation-Confirmation Model of continued use specifically tailored to information system research, which is called the IS continuance model (Figure 3-2). The IS continuance model is rooted in the expectancy-confirmation paradigm. Continuance intention was defined as an individual users' intention to continue using an adopted system (Bhattacherjee 2001). The IS continuance model predicts users' intentions to continue using an IT based on user satisfaction with the IT, extent of user confirmation, and post-adoption expectation. Bhattacherjee (2001) suggested that technology adoption and continuance intention are temporally and conceptually distinct constructs. The psychological motivations for predicting the continuance intention were formed after the initial acceptance of a system. Therefore, continuance is an *ex post* reconfirmation of the initial adoption decision.

Figure 3-2 The Post-Acceptance Model of IS Continuance (Bhattacherjee 2001)



The IS continuance model posits that a user's intention to continue use is determined primarily by his or her satisfaction with previous usage. User satisfaction, in turn, is informed by perceived usefulness and confirmation of expectation following actual use. The model also posits that perceived usefulness is expected to directly influence IS continuance intention. In addition, the extent of users' confirmation of expectation is positively associated with their perceived usefulness of IS use. This model proposed that perceived usefulness and confirmation of expectation are two important beliefs influencing users to continue using a system. Bhattacherjee's study drew attention to the substantive differences between acceptance and continuance behavior, and theorized and validated one of the earliest theoretical models of IS continuance.

In spite of its structural adaptation from the expectation-confirmation paradigm, the IS continuance model (Bhattacherjee 2001) has some differences from the traditional expectation-confirmation model. Hong et al. (2006) summarized three differences. First, the IS continuance model focuses only on post-acceptance expectations. In the expectation-confirmation paradigm, a consumer's expectation is

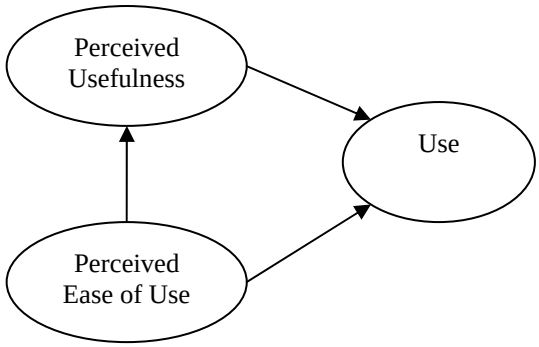
a pre-purchase expectation, which is regarded as a frame of reference to determine the level of disconfirmation and satisfaction in the post-purchase stage. As users gain experiences from using an IS, they will adjust their expectations toward using the IS. It should be noted that the pre-acceptance expectation might be different from the post-acceptance expectation. Pre-acceptance expectation is often based on information from mass media sources, while post-acceptance expectation is adjusted by users' direct experience from using an IS. Post-acceptance expectation was found to be the major determinant of user satisfaction (LaTour and Peat 1980). Given its important role to user satisfaction, the IS continuance model amended EDT to include post-acceptance expectation.

Second, post-adoption expectation is represented by perceived usefulness in IS continuance model. Expectation is defined as individual beliefs or sum of beliefs about the levels of attributes possessed by a product (Bearden and Teel 1983; Churchill and Surprenant, 1982; Oliver and Linda 1981). In the IS continuance model, Bhattacherjee (2001) used perceived usefulness as the measure of expectation because perceived usefulness is the most consistent and salient cognitive belief to user intention to use an IS over time (Davie et al. 1989; Karahanna et al. 1999).

Third, perceived performance is not included in Bhattacherjee's IS continuance model. The IS continuance model assumed that the effect of perceived performance is already captured by the construct of confirmation (Bhattacherjee 2001). In EDT, perceived performance is an antecedent of the confirmation construct and has no direct relationship with other constructs. The exclusion of perceived performance in the IS continuance model indicated that the effect of perceived performance is totally mediated by confirmation (Bhattacherjee 2001).

In sum, the IS continuance model is a newly developed model. In order to determine its generalizability, the model needs further empirical validation across different technologies and settings. In addition, since emergent use occurs at the post-acceptance stage, specifically the infusion stage (Saga and Zmud 1994), the IS continuance model may serve as an ideal theoretical foundation. However, we employed emergent use, instead of continuance intention, as the key dependent variable. This is justified by the following rationales. First, employees' system usage is usually compulsory in organizations. Some researchers have indicated that behavioral intention may not fully account for behavior if the behavior is mandated (Nah et al. 2004; Rawstorne et al. 1998). Second, in the traditional adoption and acceptance research, some researchers propose a more parsimonious version of TAM, ignoring the mediating constructs (i.e., Attitude and Behavior Intention), and measuring only the direct effect of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) on use behavior (e.g., Igbaria et al. 1997; Lucas and Spitler 1999). Davis et al. (1989) suggested that without the mediating attitude construct, the exploratory power of the model is equally good and the model is more parsimonious. In addition, in this simplified TAM (Figure 3-3), use, rather than intention to use is the focal point. According to Mathur (1998), intention reflects a state of mind that drives one to take action. The intention construct is only applied to a voluntary usage context (Ajzen 1985; Davis et al. 1989). In order to decrease the limitation of the intention construct, some researchers (e.g., Igbaria et al. 1997; Lucas and Spitler 1999) directly put their focus on use.

Figure 3-3 The Parsimonious TAM (Igbaria et al. 1997; Lucas and Spitler 1999)



Third, it is not continuance intention but emergent use that is the phenomenon of interest. Although continuance intention may help explain "continued" usage, it may not necessarily explain the creative and explorative use behavior.

3.1.2 Organizational Diffusion and Assimilation Framework

From the organizational point of view, the organizational diffusion and assimilation framework also sheds light into the emergent use phenomenon. Organizational diffusion and assimilation research represents a key area of investigation in the IS field. Prior studies on innovation diffusion show that an innovation must be integrated or ingrained into the organizational value chain before it can generate significant business value (DeLone and McLean 1992; Sethi and King 1994). An organizational adoption of an innovation is not typically a binary event but rather one stage in a process that unfolds over time. Process research is different from variance research in that variance research speculates about the processes connecting antecedents with outcomes, while process explains how change emerges and develops over time. In process research on information systems, implementation is most commonly depicted as the three-stage sequence: initiation,

adoption, and implementation (Thompson 1969).

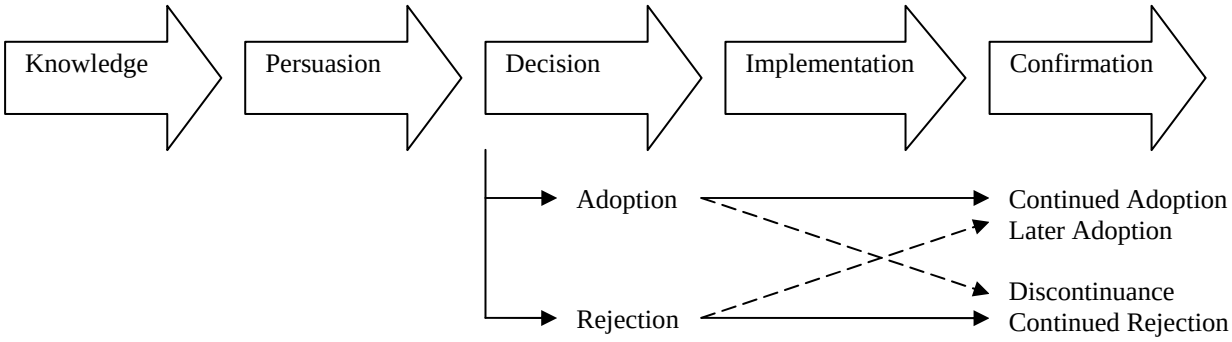
Diffusion is the process by which a technology spreads across a population of organizations (Fichman 2000), while assimilation denotes a series of stages to describe how deeply an information system penetrates the adopting firm (Gallivan 2001; Zhu et al. forthcoming). Rogers (2003) provides a useful summary of early research on organizational diffusion and realizes the potential relevance of such factors as individual characteristics and organizational structure. Kwon and Zmud (1987) and Cooper and Zmud (1990) developed more comprehensive frameworks for studying organizational adoption and diffusion. Rogers' model was the first process model of organizational adoption and implementation, while the six-stage assimilation model proposed by Cooper and Zmud (1990) was a widely used model describing technology implementation process within organizations. Cooper and Zmud's six-stage model has been praised as "an example of good definitions which serve as a model for adequate construct definition" (Prescott and Conger 1995, p. 34).

3.1.2.1 Rogers's Innovation-Decision Process

The study of innovation diffusion has a long history. Based on a synthesis of over 3000 previous studies of adoption and diffusion, Rogers (2003) proposed the innovation diffusion theory. In his theory, Rogers suggested that an individual's decision about an innovation is not instant. Rather, it experiences a five-stage adoption decision process, which consists of knowledge, persuasion, decision, implementation, and confirmation (Figure 3-4). This decision process experiences a series of choices and actions over time through which adopters evaluate an innovation and decide whether or not to incorporate the innovation into ongoing

practice. During the final confirmation stage, adopters reevaluate their earlier acceptance decision and decide whether or not to continue or discontinue using an IS innovation.

Figure 3-4 Rogers's Model of Five Stages in the Innovation-Decision Process



The innovation-decision process is essentially an information-seeking and information-processing activity to help individuals reduce uncertainty about an innovation. The process begins with the knowledge stage. When an individual is exposed to an innovation's existence and gains an understanding of how it functions, the related knowledge about this innovation is developed in the individual's mind. There are three types of knowledge relevant to an innovation: *awareness-knowledge, how-to knowledge,* and *principles-knowledge. Awareness-knowledge* means information that an innovation exists, *how-to knowledge* consists of information necessary to use an innovation properly, and *principles-knowledge* refers to information dealing with the functioning principles underlying how an innovation works (Rogers 2003). However, knowing about an innovation does not necessarily lead to adoption because an individual may not regard the innovation as relevant to his/her situation.

The second stage in the innovation-decision process is the persuasion stage. At this stage, individuals form their attitude toward an innovation. Since innovations

involve some degree of uncertainty, individuals tend to seek innovation evaluation information from their near peers. The evaluation information is based on the peers' personal experience with adoption of the new idea; it is, therefore, more convincing to most individuals. However, the formation of a positive or negative attitude toward an innovation does not always lead directly or indirectly to an adoption or rejection decision.

The choice to adopt or reject an innovation takes place at the decision stage. *Adoption* refers to "a decision to make full use of an innovation as the best course of action available" (Rogers 2003, p. 177), while *rejection* is "a decision not to adopt an innovation" (Rogers 2003, p. 177). A small-scale trial plays an important role in determining the decision to adopt. If individuals feel that an innovation is useful, they are more likely to move to an adoption decision. Similarly, rejection may occur at this stage, even after a prior decision to adopt. There are two types of rejection: active rejection and passive rejection. *Active rejection* refers to deciding not to adopt an innovation after trial usage, while *passive rejection* means never really considering the use of an innovation (Rogers 2003).

The knowledge, persuasion, and decision stages represent mental exercise of thinking and decision-making. It is at the implementation stage that an individual puts an innovation to use. At this stage, an individual keeps to seek the answers to the questions like "How do I use the innovation?" and "What operational problems am I likely to encounter, and how can I solve them?" (Rogers 2003, p. 179). The implementation stage ends when the new idea becomes institutionalized as a regularized part of an adopter's ongoing operations.

At the confirmation stage, individuals seek to reinforce the adoption decision or reverse the decision if exposed to contradictory messages of the innovation

(Rogers 2003). According to Festinger (1957), when an individual feels a state of internal disequilibrium, he or she will modify his or her knowledge, attitude, or actions to reduce or eliminate this uncomfortable state. If an individual originally decided to reject the innovation, he or she may obtain some pro-innovation messages, causing dissonance that can be reduced by adopting the innovation. On the other hand, as an adopter knows more about an innovation in the implementation stage, if he or she feels uncomfortable about the earlier adoption, discontinuance may occur. *Discontinuance* is a decision to reject an innovation after having previously adopted it. There are two types of discontinuance: (1) replacement, and (2) disenchantment discontinuance. Replacement discontinuance refers to a decision to adopt a superior innovation by rejecting the previous one. Disenchantment discontinuance means a decision to reject an innovation because of dissatisfaction with its performance.

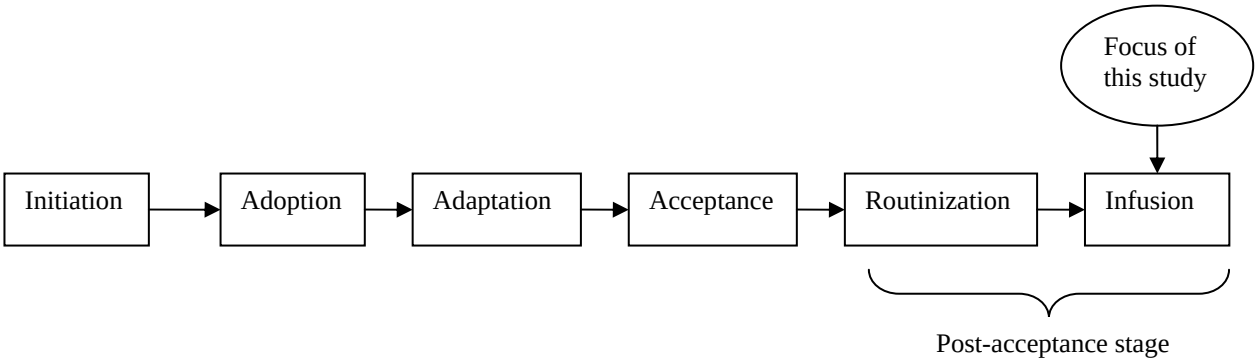
The innovation-decision process experiences these five stages: an individual passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the innovation, and to confirmation of this decision. The factors that are important to adopters may be different across the five stages. For example, mass media channels are more important at the knowledge stage, while interpersonal channels are more important at the persuasion stage (Rogers 2003). Therefore, appropriate deployment of communication channels in different stages will facilitate the diffusion process.

3.1.2.2 Cooper and Zmud's Assimilation Framework

Cooper and Zmud (1990) proposed that an IS assimilation into an organization experiences six stages: initiation, adoption, adaptation, acceptance, routinization, and

infusion (Figure 3-5).

Figure 3-5 Six-stage Assimilation Framework (Cooper and Zmud 1990)



Cooper and Zmud's assimilation framework was based on Lewin's (1952) 3-stage change model and incorporated some of the post-adoption behaviors developed by Zmud and Apple (1992). Lewin's change model includes unfreezing, change, and refreezing stages. Here, initiation is associated with Lewin's unfreezing stage; adoption and adaptation are associated with Lewin's change stage; and acceptance, routinization, and infusion are associated with Lewin's refreezing stage. Six stages are presented as follows:

- Initiation, where a match is found between organizational problems and IT solutions,
- Adoption, where a decision is reached to invest resources to implement IT,
- Adaptation, where IT is modified to fit between organizational procedures, organizational members and IT applications,
- Acceptance, where IT application is encouraged to use in organizational work,
- Routinization, where IT application is no longer perceived as new or out of the ordinary,

- Infusion, where IT application is deeply embedded within the organization's work processes (Cooper and Zmud 1990; Saga and Zmud 1994).

In these six assimilation stages, the last three stages refer to different levels of implementation activities. *Acceptance* reflects users' commitment to use the system. *Routinization* describes the state where system use is no longer perceived as out-of-the-ordinary but actually becomes institutionalized. *Infusion* refers to the process of embedding an IT application deeply and comprehensively within an individual's or organization's work systems (Cooper and Zmud 1990; Saga and Zmud 1994). Routinization and infusion, which follow the acceptance stage, can be called the post-acceptance stage. To achieve higher levels of use, an individual user keeps updating his/her understanding of the adopted IS and its application to a target task through the following ways: (1) continued interaction with the IS, (2) information received from others, and (3) the necessity to coordinate interdependent work tasks with other users (Saga and Zmud 1994). In addition, Saga and Zmud (1994) proposed that emergent use occurs at the infusion stage, which is the focus of this study. Infusion is the ultimate end-state for IS implementation, the state in which an information system is utilized to its maximal value. For simple technologies that can be utilized in a limited number of ways, usage time or frequency as a dependent variable might be suitable. However, for complex enterprise systems, more sophisticated use behaviors would be of greater value (Agarwal 2000). The sophisticated use behaviors can be represented by the following three variables:

- Extended use, where an individual uses more of the technology's features to accommodate a more comprehensive set of work tasks,

- Integrative use, where an individual uses the technology to establish or enhance work flow linkages between different tasks, and
- Emergent use, where an individual uses the technology to accomplish work tasks that were not feasible or recognized prior to the application of the technology to the work system (Saga and Zmud 1994).

Conceptually speaking, the aforementioned concepts generally concern three aspects of system use: (1) using more of the system's functions, (2) using the system to link different work tasks, and (3) using the system innovatively. By using more of the technology (i.e., extended use) or using the system to link different work tasks (i.e., integrative use), users are empowered to acquire more experience and knowledge about the system. This higher level of experience and knowledge then enhances users' capacities for utilizing the system more creatively. Therefore, emergent use is believed to subsequently arise after extended use and integrative use.

Even though stage models offer more description than explanation (Robey et al. 2002), organizational diffusion and assimilation research indicates that it is not IS use or user adoption that matters as the outcome of interest, but rather how extensively the IS is used and how deeply IS usage changes organizational processes, structures and culture (Cooper and Zmud 1990; Saga and Zmud 1994). Diffusion and Assimilation can be divided into two dimensions: breadth and depth of technology use. Breadth of use refers to the number of adopters within a firm; depth of use describes how extensively the IS innovation is used and its level of impact within the firm (Gallivan 2001). Emergent use is the highest level in depth of use. Given the strength of Cooper and Zmud's six-stage model in terms of describing change processes, their model is very useful to understanding the usage behaviors at various

stages of IS assimilation during an organization, including emergent use in the infusion stage.

3.1.2.3 Gallivan's Organizational Assimilation Framework

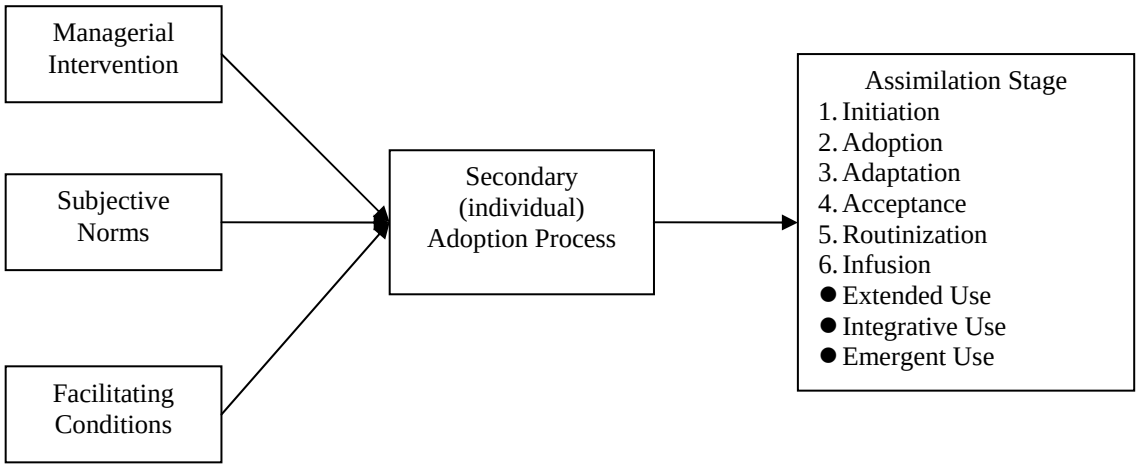
The organizational IS adoption process includes the primary adoption decision at the organizational level and secondary (individual) adoption at the employee level. Although primary adoption must occur to trigger secondary adoption, secondary adoption and organizational assimilation are more complex and are neglected by many researchers who have studied primary adoption (Gallivan 2001).

Given the strengths of the process and stage research model in describing IS implementation in an organization, Gallivan (2001) integrated Cooper and Zmud's six-stage assimilation framework with some constructs from traditional individual adoption research to propose a new framework (Figure 3-6). Based on the Theory of Planned Behavior (Ajzen 1985; Taylor and Todd 1995), Gallivan (2001) identified constructs that mediate between organizational and employees' adoption: managerial interventions, subjective norms, and facilitating conditions. Managerial interventions describe the actions taken and resources made available by managers to expedite secondary adoption. Subjective norms describe individuals' beliefs about the expectations of relevant others regarding their own secondary adoption behavior. Facilitating conditions, a broad category that captures other factors that can allow implementation to occur, include individual attributes, innovation attributes and organizational attributes.

Given that employees' secondary adoption is often mandated by senior managers (Gallivan 2001; Jasperson et al. 2005), employees are obligated to use the

adopted IS. That is, employees often directly go into the assimilation stage by spanning the secondary adoption process. Therefore, the secondary (individual) adoption process may not mediate the effects of managerial intervention, subjective norms and facilitating conditions on the behaviors at the assimilation stage.

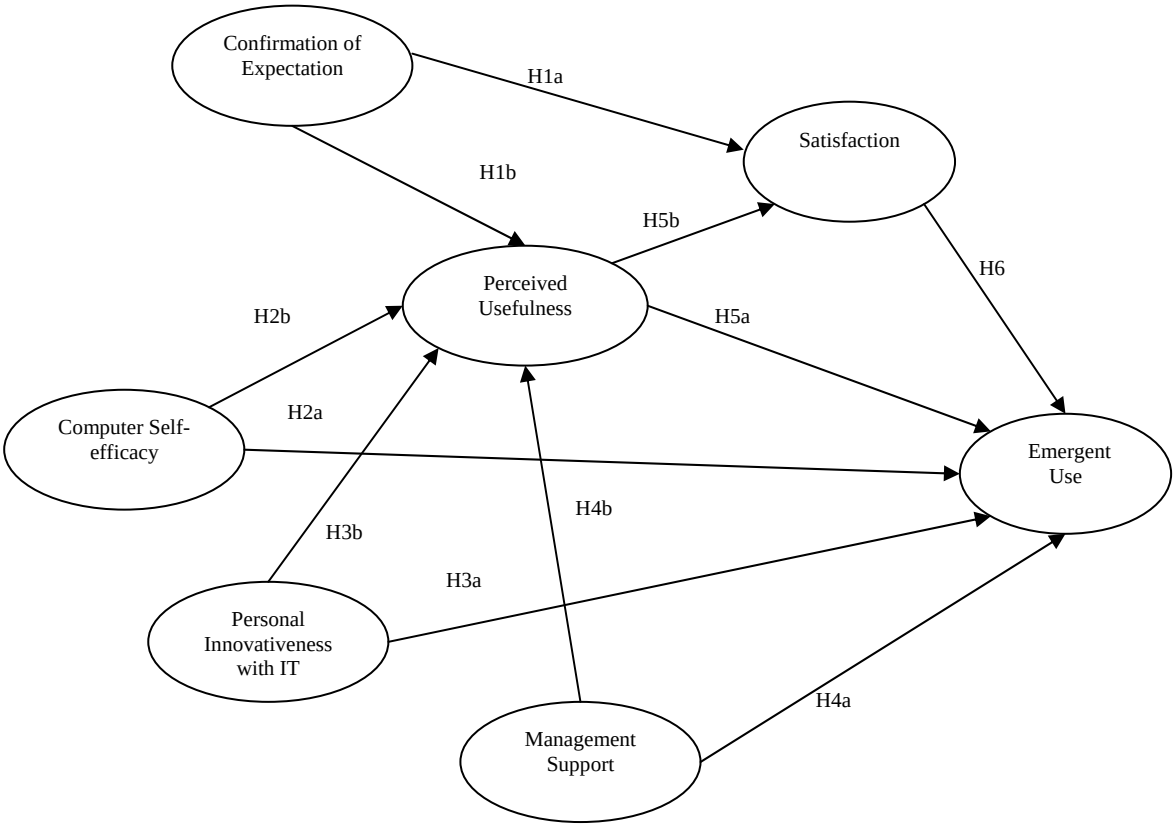
Figure 3-6 Organizational Assimilation Framework (Adapted from Gallivan 2001)



3.2 Research Model

Given the strength of organizational diffusion and assimilation model in explaining information system implementation process, this study incorporates Cooper and Zmud's organizational assimilation model with Bhattacherjee's IS continuance model to form a new framework to explain ES emergent use. As illustrated in Figure 3-7, the research model of employees' emergent use derives directly from the IS continuance model and organizational diffusion and assimilation framework.

Figure 3-7 ES Emergent Use Research Model from Employees' Perspective



Based on the IS continuance model (Bhattacherjee 2001), ES emergent use is affected by perceived usefulness and satisfaction with ES use. Confirmation of employees' expectations about the enterprise system impacts emergent use indirectly through perceived usefulness and satisfaction. Perceived usefulness also indirectly influences emergent use via satisfaction.

On the other hand, organizational adoption typically experiences two stages: primary adoption by a firm, division, or department and the secondary adoption by employees. Even though employees' system use is often mandated, the complexity and malleability of enterprise systems allows the employee users to use the systems at different levels of sophistication (Moore 2002). Higher level of system use can

lead to better organization performance (Cooper and Zmud 1990). Therefore, it is at the highest level of system use that an organization is able to fully leverage its ES investment (Saga and Zmud 1994). Cooper and Zmud (1990) introduced a six-stage model of IS implementation process. The last three stages, that is, *acceptance, routinization* and *infusion*, refer to different levels of implementation activities. Through the direct experience and learning processes accumulated in prior stages, employees have the abilities to use the system to its full potential at the infusion stage. Toward this end, researchers have also proposed a variety of concepts to depict the possible use behaviors that go beyond routine and standardized use, including the concept of *emergent use*.

Based on the Theory of Planned Behavior (Ajzen 1985; Taylor and Todd 1995), Gallivan (2001) proposed that the assimilation process can be influenced by managerial interventions, subjective norms, and facilitating conditions. In organizational contexts, employees' secondary adoption is often mandated by senior managers (Gallivan 2001; Jasperson et al. 2005). In addition, information systems within organizations are usually complicated and interdependent among employees (Pozzebon 2002). Specialized training to learn the principles of the system is required (Lippert and Forman 2005). Management support is included to reflect these organizational dynamics. Meanwhile, employees' emergent use may also be associated with facilitation conditions, such as individual attributes (Gallivan 2001). The research model captures these individual attributes by incorporating computer self-efficacy and personal IT innovativeness concepts. Prior research suggests that subjective norms can induce the initial adoption (Karahanna et al. 1999); however this effect will attenuate over time (Venkatesh et al. 2003). In addition, given the inconsistent effect of subjective norms in IT adoption and acceptance research, this

study does not include this construct in the research model.

3.3 Research Hypotheses

The presented research model rests on the combination of the post-acceptance model of IS continuance and the organizational assimilation framework. The IS continuance model suggests that post-acceptance behavior is influenced by attitudinal considerations and perceived usefulness. The organizational assimilation framework, on the other hand, proposes that employees' secondary adoption is influenced by managerial interventions and other influences from employees themselves. These important factors aid the development of the following hypotheses.

Disconfirmation of Expectation Theory posits that user satisfaction is influenced by expectation of an IS and confirmation of expectation following actual use. This indicates that confirmation of expectation and perceived usefulness are two important cognitive beliefs at the post-acceptance stage (Bhattacherjee 2001). Expectation provides the baseline level against which users can assess the confirmation of their expectation to determine their satisfaction. As a new construct in IS research, confirmation is the extent to which expectation is confirmed (Bhattacherjee 2001). Conversely, disconfirmation occurs when actual performance is lower than expected performance (Szajna and Scamell 1993). Confirmation is positively related to satisfaction with ES use because it implies realization of the expected benefits of ES use. This leads to the first research hypothesis:

H1a: Confirmation of expectation has a positive effect on satisfaction.

Additionally, just as perceived ease of use can influence perceived usefulness in IS acceptance contexts, confirmation can also affect perceived usefulness at the post-acceptance stage (Bhattacherjee 2001). During the acceptance stage, since users have little information about the new system, they are unsure what to expect from system usage. Under this circumstance, they may have low initial usefulness perceptions of the system (Bhattacherjee 2001). These low initial usefulness perceptions are easily confirmed after direct interaction with the system. Such perceptions may be adjusted higher as they become more knowledgeable about the system. Nonetheless, users may experience cognitive dissonance or psychological tension if their actual usage is not what they expected it to be. Users often have the tendency to adjust their perceptions to be consistent with reality. In other words, confirmation can elevate perceived usefulness. The above discussion leads to the following research hypothesis:

H1b: Confirmation of expectation has a positive effect on perceived usefulness.

In addition, the most immediate influences on individual cognitive interpretations and performance of using information systems are individual-related factors (Lewis et al. 2003). Among these factors, computer self-efficacy (CSE) and personal innovativeness with IT (PIIT) are the two constructs that have received consistent support as important predictors (Agarwal and Prasad 1998; Compeau and Higgins 1995a).

Self-efficacy is defined as beliefs about one's ability to perform a specific behavior (Bandura 1977). From the perspective of social learning theory, computer

self-efficacy can be viewed as an important antecedent to ES use to the extent that it fosters both the adoption of a new behavior and its maintenance (Compeau and Higgins 1995a). The inclusion of computer self-efficacy is pivotal to the recognition that ES adoption and implementation is not just about convincing people of the benefits to be derived from using ES, but also about having the requisite skills and confidence. Newly introduced enterprise systems are often based on complex technologies that pose a high knowledge burden and are difficult for end users to grasp (Attewell 1992; Fichman 1992; Gattiker and Goodhue 2005). In such cases, the end users' confidence in their ability to learn and use enterprise systems may be critical to emergent use and successful implementation. Furthermore, Compeau and Higgins (1995b) argued that computer self-efficacy influences outcome expectation, such as perceived usefulness, suggesting that individuals with higher confidence levels may be more capable of appreciating the benefits of usage. Based on the above discussion, we state the following hypotheses:

H2a: Computer self-efficacy has a positive effect on emergent use.

H2b: Computer self-efficacy has a positive effect on perceived usefulness.

Personal innovativeness with IT denotes the degree to which an individual is willing to try out any new IT (Agarwal and Prasad 1998). It is treated as an individual propensity associated with more positive beliefs about technology use. Individuals with higher personal IT innovativeness may develop more positive perceptions about IS innovations (Agarwal and Prasad 1998). Earlier diffusion research identified individuals as innovative if they are early to adopt an innovation (Rogers 2003). Thus, people with higher IT innovativeness are supposed to be more

innovative in the domain of information technologies (Lewis et al. 2003). In addition, personal innovativeness with IT could potentially affect how individuals respond to IS innovations (Agarwal and Prasad 1998). Personal innovativeness with IT also characterizes the risk-taking propensity that exists in innovators. Rogers (2003) suggested that innovators are able and willing to cope with higher levels of uncertainty. They may have the tendency to explore more new ways of using IT, rather than relying on standardized routines. As a result, individuals who are more innovative toward IT may be more likely to creatively use an enterprise system to enhance their job performance.

Personal innovativeness with IT helps us to further understand the mechanism that forms perceptions and the role that individual disposition plays in the implementation process (Agarwal and Prasad 1998). IT innovators are more likely to embrace IS innovations, explore the system, and appreciate the usefulness of the system than those who are less innovative. Thus, the following hypotheses are proposed:

H3a: Personal innovativeness with IT has a positive effect on emergent use.

H3b: Personal innovativeness with IT has a positive effect on perceived usefulness.

In organizational contexts, employees rarely have complete autonomy regarding the adoption and use of an enterprise system. Management can encourage employees to use the system explicitly through preferences and mandates, or implicitly through reward systems and incentives. Management support refers to the ways organizations encourage system usage and the degree to which they provide

necessary resources to facilitate system implementation. Management support includes management encouragement (Igbaria 1990) and such activities as mandating usage, offering training, and providing expert support when needed (Gallivan 2001). These activities bear important implications for the secondary adoption, as substantial resources are required for not only to develop the ES applications and infrastructures, but also to support end uses during the implementation.

Support and supervision of end users during the implementation process may contribute significantly to implementation success (Bhattacherjee 2001). During this process, managers need to work closely with end users to mandate, negotiate, persuade, motivate, and support their adoption and usage. In addition, management support is crucial for changing existing routines and processes that are essential for successful implementation in organizations (Purvis et al. 2001). Emergent use is the highest level of use, which requires employee users to explore new ways of using the system. During this exploring process, employee users may encounter many kinds of difficulties. Management support may contribute to overcoming these difficulties. Hence, management support appears to be a facilitating condition for emergent use. We therefore expect that:

H4a: Management support has a positive effect on emergent use.

Meanwhile, perceived usefulness also plays an important role throughout the implementation process ((Bhattacherjee 2001; Davis et al. 1989). Organizational interventions, such as user training and technical support, are instrumental in understanding the system and facilitating users to develop realistic expectations for

implementation success (Davis et al. 1989; Ives and Olson 1984; Lucas et al. 1990). High levels of training and technical support can promote favorable beliefs about the system among employees (Igbaria and Chakrabarti 1990; Lucas 1978). Moreover, management support reflects the formal stance of an organization toward ES usage, providing clues about the plausible consequences of using the system. Such a signal may also foster positive outcome evaluations. Based on this, the following hypothesis is proposed:

H4b: Management support has a positive effect on perceived usefulness.

Technology acceptance research has shown that perceived usefulness is the salient belief influencing individuals to accept an enterprise system. Perceived usefulness captures the instrumentality of ES use. Previous studies have also revealed that perceived usefulness impacts individuals' affect substantively across innovation stages (Davis et al. 1989; Karahanna et al. 1999). While attitude and satisfaction both represent individual affects, satisfaction can be conceived as a post-acceptance affect (Bhattacherjee 2001; Bhattacherjee and Premkumar 2004). Moreover, as perceived usefulness influences attitude affect during acceptance, perceived usefulness is expected to be the salient ex post expectation that influences satisfaction affect at the post acceptance stage (Bhattacherjee 2001). Thus, we propose the following hypothesis:

H5a: Perceived usefulness has a positive effect on satisfaction.

Perceived usefulness at the acceptance stage directly motivates usage intentions

because of its high instrumental consideration. Perceived usefulness at the acceptance stage is typically based on others' opinions or information disseminated through the mass media or social networks (Bhattacherjee 2001). At the post-acceptance stage, perceived usefulness is formed mostly through users' first-hand experiences and is, therefore, more reliable (Bhattacherjee 2001). In addition, in organizational contexts, employees' secondary adoption and usage are often obligatory. Employees' system usage may be mandated by the organization through rewarding incentives or punishment threats. To receive more rewards, staying at the routine usage may not be enough. Employees are more likely to explore how to use the system in a sophisticated and efficient way to enhance their performance. Thus, perceived usefulness at the post-acceptance stage may also motivate employees' emergent use. Based on the above discussion, the following hypothesis is presented:

H5b: Perceived usefulness has a positive effect on emergent use.

Satisfaction is defined as a post-acceptance affect with the prior usage of a system (Bhattacherjee 2001), that is, satisfaction is an experience-based affect (Oliver 1980). In organizational contexts, employees often have no choice about using the installed system. However, they can decide the extent to use. If employees are satisfied with their direct interaction with the system, they are more likely to embrace it and attempt to use it at the highest level, where creative use and efficient use most probably happen. The IS literature has also consistently supported the strong association between user satisfaction and usage behavior (Bhattacherjee 2001; DeLone and McLean 1992, 2003; Seddon 1997). This leads to the following hypothesis:

H6: Satisfaction has a positive effect on emergent use.

3.4 Summary of Research Hypotheses

The research model presented in Figure 3-7 was formulated based on the hypotheses derived from the literature in the previous chapter. This model showed the hypothesized relationship among the variables. A summary of the research hypotheses in this study is as follows:

H1a: Confirmation of expectation has a positive effect on satisfaction.

H1b: Confirmation of expectation has a positive effect on perceived usefulness.

H2a: Computer self-efficacy has a positive effect on emergent use.

H2b: Computer self-efficacy has a positive effect on perceived usefulness.

H3a: Personal innovativeness with IT has a positive effect on emergent use.

H3b: Personal innovativeness with IT has a positive effect on perceived usefulness.

H4a: Management support has a positive effect on emergent use.

H4b: Management support has a positive effect on perceived usefulness.

H5a: Perceived usefulness has a positive effect on satisfaction.

H5b: Perceived usefulness has a positive effect on emergent use.

H6: Satisfaction has a positive effect on emergent use.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

This chapter discusses the research methodology employed in this dissertation. The chapter begins with a discussion of the research design. This is followed by a description of information system selection, research site, sampling strategy, measures, and concludes with a discussion of the data collection.

4.1 Research Design

The research was conducted as a cross-sectional field study within two large manufacturing firms using enterprise systems via survey questionnaires. Surveys were used as information gathering techniques to record responses as data to be used for analysis (Small 1993). The reasons why an on-site field survey was chosen as the primary method of data collection are as follows:

- The experience of Chinese researchers suggests a very low response rate for mail survey research (Siu 1996). Chinese are believed to be much more willing to participate in face-to-face data collection efforts rather than via an impersonal approach.
- The field survey method may greatly enhance the validity of the sample data.

Given the objective of this study is to understand emergent use of enterprise information systems in an organizational context, a field study was employed to increase the external validity of the study (Cook and Campbell 1979). The observed relationships from a field study are more likely to be generalizable to the population of employee users in organizations.

4.2 Information System Selection

Information systems are general concepts. Different industries and organizations use different systems, and different systems provide different functions. Many prior technology adoption studies used simple information systems or information technologies as their target. These simple technologies include word processors, spreadsheet, email, voice mail, and graphing software. More recently, researchers have examined complex information systems in organizational contexts. Enterprise systems are typical complex information systems, such as the enterprise resource planning (ERP) systems. Given our research attention on emergent use of complex information systems in organizational contexts, we focus the investigation on the usage of ERP systems.

An ERP system can be viewed as an enterprise-wide information system that integrates major processes such as financial administration, human resource management, manufacturing, and supply chain management. ERP systems can help organizations incorporate their complete range of business activities into a single information technology infrastructure (Daveport 2000) so that various departments within an organization can share information and communicate with each other.

Because an ERP system covers a wide variety of a company's internal and external operations, its successful deployment and effective use are critical to organizational performance.

ERP implementation is time-consuming and expensive. According to Bingi et al. (1999), the average time for a typical ERP system implementation is 14 months, and on average nearly 150 individuals are needed to work on the implementation team at one time or another. Although there is no acknowledged time span in implementing an ERP system, the above information from Bingi et al. (1999) indicates that ERP implementation is costly in time spent. In addition, an ERP system implementation can cost from US$2 million dollars for a small organization with little customization to over US$1 billion for a large organization with complex processes. It is very common for large organizations to spend more than US$100 million to implement ERP systems (Robey et al. 2002; Seddon et al. 2003). The time and expenditure involved mostly depend on the number of modules being implemented, the scope of the implementation, and the extent to the customization (Bingi et al. 1999).

Since an ERP system is process-based, rather than function-based, ERP implementation necessitates significant organizational changes (Hammer and Stanton 1999). Furthermore, ERP vendors and consulting firms claimed that ERP systems possess the best practice and the system implementation does not need to make extensive adaptation (Bancroft et al. 1998). However, the reality is that ERP does not provide models for every process of every industry. Most firms have to add new functionality to ERP systems for the optimal use in a specific organization (Swan et al. 1999). ERP implementations are both complex and challenging (Gattiker and Goodhue 2005). The complexity of ERP systems suggests that

knowledge learned in simple technology implementation environments may not be readily applied to the ERP contexts (Amoako-Gyampah and Salam 2004). Unlike traditional and simple information systems, ERP systems are sophisticated and represent a completely different class of IT application. Therefore, ERP systems are appropriate target enterprise systems in this study.

4.3 Research Site

Before gathering the data from employee users of an ERP system, the research had to identify appropriate organizations to serve as the sample. Three major considerations determined the research sites for this study.

- **Large Organization in Manufacturing Industry**

Due to statistical power considerations, the investigated organizations should have a large number of end-users in the population for the study, suggesting large organizations as the target for data collection. In addition, the author does not put her focus on small and medium enterprises (SMEs) because SMEs tend to not have enough resources to install and implement ERP systems. Next, given that 75 percent of the manufacturing organizations have adopted ERP systems (Scott and Shepherd 2002) and that ERP systems have been widely used in the Chinese manufacturing industry, this paper focused on large manufacturing organizations in China. A large organization in this study refers to an organization that has more than 500 full-time-equivalent employees in the manufacturing industry (Blaxter 2006).

- **Post-Acceptance Stage**

Given the emphasis of this study on employees' emergent use, this research directly targeted usage behavior at the post-acceptance stage. To accomplish this, the scope of this study was confined to organizations with ERP systems that were initially adopted by senior management and then diffused and infused throughout the organization. Specifically, the ERP system should be installed and used in the enterprises for more than one year. Based on the study conducted by Boudreau (2003), an ERP system installed in an organization is usually not being used to its full potential for 15 months following its implementation. Because there is no general information about the time frame to attain emergent use, it would seem reasonable that one year may be an appropriate time period for an enterprise to progress to the post-acceptance stage.

- **Mandatory Usage Context**

A mandatory usage context is the third consideration. A mandatory usage context in this study is defined as one in which users are required to use a specific information system in order to keep and perform their jobs (Brown et al. 2002). IS adoption within organizations includes two stages: the primary adoption by a firm, division, or department and the secondary adoption by employees. Mandatory use is quite common for employees in organizational context. For example, ERP usage is characterized as mandatory for its employee users (Pozzebon 2002).

4.4 Sampling Strategy

The unit of analysis is an employee user of the ERP system in the organization because the focus on this study is employee users' IS emergent use.

Sample constituency is an important consideration in IS research on mandatory use. Studies which have acknowledged a mandatory component to IS use have tended to include quite a heterogeneous sample of individuals from many organizations and occupying different positions (Hartwick and Barki 1994; Moore and Benbasat 1991). In order to investigate the determinants of emergent use in mandatory contexts, it is important to conduct research in the context in which system usage has been mandated with respect to all research participants.

4.5 Measures

The research model has seven constructs or latent variables. Latent variables are variables that cannot be measured directly, but can be measured by linking it to a set of items that can be measured directly. All of the latent variables in this study were operationalized using multi-item scales. These measures were adapted from established scales used in prior research to represent the latent constructs used in the research model developed in this research. Appendix A lists the questionnaire items and sources.

Confirmation of expectation was measured using three indicators adapted from Bhattacherjee (2001): (1) "My experience with using the ERP system was better than what I expected." (2) "The service level provided by the ERP system was better than

what I expected." (3) "Overall, most of my expectation from using the ERP system was confirmed."

Satisfaction was measured using Bhattacherjee's overall satisfaction scale. This scale captured respondents' satisfaction levels along seven-point scales anchored between four semantic differential adjective pairs: "very dissatisfied / very satisfied," "very displeased / very pleased," "very frustrated / very contented," and "absolutely terrible / absolutely delighted."

The measurement of perceived usefulness follows the questionnaire developed by Davis et al. (1989) with minor revisions in order to suit this study. The measure consists of four items: (1) "Using the ERP system improves my job performance." (2) "Using the ERP system in my job increases my productivity." (3) "Using the ERP system enhances my effectiveness in my job." (4) "Overall, I find the ERP system useful to my job."

Personal innovativeness with IT was operationalized by using the rigorously developed and validated scales described by Agarwal and Prasad (1998). The measure consists of four items: (1) "If I heard about a new information technology, I would look for ways to experiment with it." (2) "Among my peers, I am usually the first to try out new information technologies." (3) "In general, I am hesitant to try out new information technologies." (4) "I like to experiment with new information technologies."

Computer self-efficacy refers to a judgment of one's capability to use a computer. It is not concerned with what one has done in the past, but rather with judgments of what could be done in the future. It is based on the measurement developed by Compeau and Higgins (1995b), which includes ten items: "I could complete the job using the software package…" (1) "… if there was no one around

to tell me what to do as I go." (2) "…if I had never used a package like it before." (3) "…if I had only the software manuals for reference." (4) "…if I had seen someone else using it before trying it myself." (5) "…if I could call someone for help if I got stuck." (6) "…if someone else had helped me get started." (7) "…if I had a lot of time to complete the job for which the software was provided." (8) "…if I had just the built-in help facility for assistance." (9) "…if someone showed me how to do it first." (10) "…if I had used similar packages before this one to do the same job." Following Gallivan et al. (2005), a portion of these ten items developed for computer self-efficacy were adapted to control the length of the instrument. The measure in this study consists of the following six items: "I could complete the job using the software package..." (1) "…if there was no one around to tell me what to do as I go." (2) "…if I had only the software manuals for reference. (3) "…if I had seen someone else using it before trying it myself." (4) "…if I could call someone for help if I got stuck." (5) "…if someone else had helped me get started." (6) "…if I had a lot of time to complete the job for which the software was provided."

Management support was measured using the scales adapted from Igbaria (1990). Similarly, the author adapted the original items to suit this study to measure the construct of management support. The measures comprise the following items: (1) "Training courses are readily available for employees to improve themselves in using the ERP system." (2) "A central support (e.g. information center) is available to help with problems." (3) "There is always a person in the organization to whom employees can turn for help in solving problems with using the ERP system." (4) "Upper management has provided adequate financial and other resources to the ERP system implementation effort." (5) "Management is really keen to see that their employees are happy with using the ERP system." (6) "Management has not

provided most of the necessary help and resources to get the employees to use the ERP system quickly."

Emergent use refers to using a technology in an innovative manner to support an individual's tasks performance. Although the notion of emergent use was discussed in extant literature, no established measurement was available. Two related concepts, "Trying to innovate with IT" (Ahuja and Thatcher 2005) and "Intention to Explore" (Karahanna and Agarwal 2006; Nambisan et al. 1999), capture individual intention to use IS innovatively. "Trying to innovate with IT" was measured in the following items: (1) "I try to find new uses of IT." (2) "I try to use IT in novel ways". "Intention to explore" was captured by these three items: (1) "I often experiment with new features of Access." (2) "I try to find new uses of Access." (3) "I try to use Access in novel ways". The original items in these two related constructs only focus on innovatively using an IS but do not link usage to support work performance. To measure the connection between IS usage and work tasks, three items were therefore adapted from the constructs of "Trying to innovate with IT" and "Intention to Explore" for the construct of emergent use, with emphasis on actual innovative usage behavior that supports individual task performance. The measures include the following items: (1) I often experiment with new features of this ERP system to support my work. (2) I have found new uses of this ERP system to enhance my productivity. (3) I have used this ERP system in novel ways to help my work.

Among these seven constructs, computer self-efficacy used eleven-point scale, with "not at all confident" at one end and "totally confident" at the other. Satisfaction construct used a seven-point scale anchored between semantic differential adjective pairs. The remaining five constructs used seven-point Likert-

type scale, with “strongly disagree” at one end and “strongly agree” at the other. The use of the scales in this study allowed the respondents to complete the survey instrument quickly while allowing sufficient variability to differentiate their answers. To ensure desired balance and randomness in the questionnaire, some items were reverse coded and the questions were randomly arranged. In doing so, monotonous responses to multiple items of a particular construct would be decreased.

4.6 Data Collection

The data collection method employed in this study was survey questionnaires. The data collection process includes three steps: (1) the questionnaire’s translation into Chinese and then its back-translation into English, (2) the pilot study, and (3) the field survey.

4.6.1 Questionnaire Translation and Back-Translation

The construct measures in this study were adapted from established scales in prior research, which were originally operationalized in English. Given that this study was conducted in China context, the conventional method of questionnaire translation and back-translation (Brislin et al. 1973) was applied to translate the measures into Chinese. The original questionnaire was firstly translated into Chinese and then the translated version was translated back into English to ensure accuracy of translation. Back translation is most commonly used and recommended as a way to assess the translation work (Brislin 1986; Werner and Campbell 1970). In survey

research and in translation studies, *back translation* refers to the translation of a translation back into the source language (Harkness and Schoua-Glusberg 1998). The purpose of back translation is to compare or contrast the back translation with the source text, usually with a view to assess the quality of a translation. In this study, the translators were professionals in the practice with a college degree in translation.

The basic steps are as follows:

- An original English questionnaire was first translated into Chinese by the first translator,
- The Chinese version questionnaire was translated back into English by the second translator, who was unfamiliar with the original English version questionnaire,
- The original English version questionnaire was compared to the translated English version questionnaire,
- On the basis of differences or similarities between the two English version questionnaires, conclusions were drawn about the equivalence of original English questionnaire and translated Chinese questionnaire. If the translated English version questionnaire is inconsistent with the original English version, modifications should be made based on the original one.

4.6.2 Pilot Study

The purpose of the pilot study was to test the reliabilities and validities of the constructs as well as the procedures through which the questionnaire was to be administered (Straub 1989). In addition, the pilot study helps ensure that the

questions in the instrument were properly interpreted and the survey format was in order.

Although the question items were developed and validated in previous studies, their validity and reliability cannot be automatically guaranteed satisfactory. In order to clarify questions and to insure that the items included are aligned with the proposed constructs in the research model, a pilot study was deemed necessary. The pilot study represented a preliminary round of data collection. The organizations in the pilot study did not participate in the large-scale survey. The pilot study in this study involves two procedures:

- First, one large organization in Guangzhou was contacted in order to conduct the pilot study. The translated version was pre-tested with eighteen employees who were asked to comment on any item that they find ambiguous or difficult to understand. In addition, four professors in MIS field at universities in China were interviewed in order to gather comments of the research model and survey instrument, including the wording and sequence of the question items in the instrument. This procedure resulted in discarding or modifying a few items to focus more on the related constructs.
- Second, another three organizations, two of which are located in Guangzhou city, and one of which is located in Zhuhai city of the Guangdong Province, were contacted. Seventy-nine employees in these three organizations were asked to fill in the questionnaires in the subsequent pilot study. This study followed the pretest procedures conducted by Gefen et al. (2003). The convergent validity of each scale was verified with a principal components factor analysis (PCA). A separate PCA was run for each construct. A single

eigen-value above one for each construct verified the convergent validity of each scale. Due to the small sample size, discriminant validity could not be assessed at this stage (Hair et al. 1998). The instrument's reliability was evaluated using Cronbach's alpha (Nunnally and Bernstein 1994), which is commonly used measure of reliability for a set of construct indicators. The construct alpha values in the pilot study range from 0.786 to 0.970 (see Table 4-1). All the cronbach alpha values are greater than the cited minimums of 0.60 (Nunnally 1967) or 0.70 (Nunnally 1978; Nunnally and Bernstein 1994). Therefore, the measures used in this study appeared to exhibit an acceptable level of reliability.

Table 4-1 Construct Reliability

Constructs	Number of Items	Cronbach's Alpha
Confirmation of Expectation	3	0.909
Computer Self-Efficacy	6	0.878
Personal Innovativeness with IT	4	0.787
Management Support	6	0.786
Perceived Usefulness	4	0.942
Satisfaction	4	0.970
Emergent Use	3	0.884

4.6.3 Field Survey

The large-scale survey was a second and the main round of data collection. With the cooperation of a famous vendor of ERP systems in Guangzhou, ten large organizations using the same well-known ERP system were invited to participate in

this study. As mentioned before, the involved organizations had to meet the following selection criterion: 1) be a manufacturing firm with more than 500 full-time-equivalent employees; 2) the ERP systems should be installed and used in the enterprise for more than one year, and 3) the ERP system usage was mandated.

Personal visits and telephone calls were made to the CEOs to request their permission to conduct a survey on the ERP system project in their businesses. At the same time, a cover letter, which explained the purpose of the research and ensured the necessary confidentiality, was sent to the CEOs. If the CEOs agreed, they were asked to introduce the author to the manager in charge of the ERP system project or CIO. Subsequently, the author directly contacted CIOs to solicit their support. Out of ten organizations, two organizations were selected to take part in this study. Both firms had implemented ERP systems for more than one year and were recognized for their successful implementation by the vendor.

These two firms are manufactures. They are located in the Guangzhou city, the capital of Guangdong province and the center of the greater Pearl River Delta region – the regional powerhouse of the Chinese economy (Enright et al. 2005). Individual income in the Guangzhou city is also among the highest in China. In 2005, the GDP of Guangdong province reached a record high of US$ 265 billion and surpassed the GDPs of Singapore and Hong Kong ("GD's GDP" 2006). In addition, these two firms use the same ERP system, which is a widely used system provided by a top-ranking vendor in the world.

Established in 1985, company A is one of the top brewing businesses in China. This company has its annual revenues of appropriately US$393 million and employs a total of 2800 employees. Under the high levels of competition and pressure from the industry, the company turned to IT to attain its advantage in the market. In order

to improve the flow of information within the company and coordinate production, inventory management, and sales processes to improve efficiency and cut costs, the company established an integrated ERP system to capture and store information for use across the whole organization. In 1999, the firm made decision to adopt the ERP system; in 2002, sixteen modules were deployed; and in 2004, the ERP system has been updated and optimized. By the time of data collection, the firm had used the ERP system for more than two years.

Company B was established in 1982, which is a large machine manufacturer in China. It has its annual revenues of US$35 million and employs more than 1000 employees. In 2002, the company adopted the ERP project. In 2003, twelve models in the ERP system, consisting of applications for functional management, sales and distribution, and process-manufacturing, came into operation. Similar to Company A, Company B had also used the ERP system for more than two years when the author collected the data.

The unit of analysis is at the end users of an ERP system within organizations. In order to try to reduce the chance that CIOs would select their “favorite” end users, CIOs are also encouraged to randomly select 450 employees from different departments in their organization to participate in this research. With the assistance of these CIOs, 230 employees in one organization and 220 employees in another were randomly selected from different departments to participate in the research. The questionnaires, including the cover letter stating the study purpose and the intended data usage, were administered to employee users of the ERP system. The respondents were asked to return the completed questionnaires to their CIO. To minimize potential biases, the respondents were assured that their responses and identity would remain confidential, and that only aggregate information would be

published. As a further safeguard, they could return the questionnaires in individually sealed envelopes or send their questionnaires directly to the author. Respondents completed and returned the questionnaire within two-week response period. The author received these questionnaires from the CIOs at a later time. There are no questionnaires individually sent to the author.

CHAPTER 5

DATA ANALYSIS AND RESULTS

This chapter presents the data analysis performed in this dissertation. The first section presents the profiles of the respondents, followed by a summary of descriptive statistics. Next, the third section introduces the data analysis method. In addition, because the data were collected from two different firms, Appendix B describes the data pooling procedures.

Two-step data analysis was conducted in this dissertation to first assess the measurement model and then test the hypotheses by fitting the structural model (Anderson and Gerbing 1988). Covariance-based structural equation modeling (SEM) was chosen to analyze the data in this study, given its increasing popularity in the behavioral science and its apparent strength over traditional regression-based analysis (Gefen et al. 2000). SEM is a multivariate technique that combines aspects of multiple regression and factor analysis to estimate a series of interrelated dependence relationships simultaneously (Hair et al. 1998). In the first phase, SEM assesses *the measurement model* to measure the loadings of observed items (measurements) on their expected latent variables (constructs). In the second phase, SEM assesses *the structural model* to test the assumed causation among a set of dependent and independent constructs. SEM emphasizes the overall variance-covariance matrix and the overall model fit (Teo et al. 2003). In addition, SEM can provide fuller information about the extent to which the research model is supported by the data (Gefen et al. 2000).

5.1 Demographic Characteristics of the Sample

230 employees in firm one and 220 employees in firm two were selected to participate in this study. Of the 450 questionnaires distributed, 401 were returned. After excluding sixteen incomplete responses, 385 surveys were usable for analysis, resulting in an effective response rate of 85.6 percent. Table 5-1 presents the demographic characteristics of the survey sample.

Table 5-1 Sample Demographics

ERP Employee Users	Category	Percentage
Education	Junior High School or lower	3.5 %
	Senior High School	16.9%
	College	36.1%
	Bachelor's	34.7%
	Master's	6.6%
	Doctorate or above	2.2%
Age	18-22 years old	14.3%
	23-29 years old	31.5%
	30-39 years old	35.1%
	40-49 years old	14.6%
	50 years old or older	4.5%
Gender	Male	41.8%
	Female	58.2%
Working Department	Finance	10.7%
	Marketing	27.2%
	Production	27.2%
	Human Resources Management	11.5%
	Others	23.4%

Respondents represented a number of different departments, ranging from marketing (27.2%), production (27.2%), Human Resources Management (11.5%),

finance (10.7%), and others (23.4%). Of the respondents, 41.8% were male and 58.2% were female. Although our sample included a diversity of educational levels that ranged from less than junior high school through doctorates, the average educational level was very high. More than two-thirds of respondents (70.8%) had some college-level education or had received a bachelor degree, and almost half of the respondents (40.5%) had a bachelor's degree or above. Table 5-1 also shows that two-thirds of the respondents (66.6%) ranged from 23 to 39 years old, 14.6% of the respondents were in their forties, 14.3% of the respondents were in the 18-22 years old range, and 4.5% of the respondents were above fifty.

5.2 Descriptive Statistics

Table 5-2 presents the means and standard deviation of the research constructs in the study.

Table 5-2 Descriptive Statistics

Construct	Minimum	Maximum	Mean	Std. Dev.
Confirmation of Expectation	1	7	4.76	1.22
Computer Self-efficacy	0	10	6.46	2.02
Personal Innovativeness with IT	1	7	4.40	1.27
Management Support	1	7	5.09	1.17
Perceived Usefulness	1	7	4.84	1.25
Satisfaction	1	7	4.57	1.21
Emergent Use	1	7	4.28	1.29

Notes: All constructs except Computer Self-efficacy are seven-point scales with the anchors 1=strongly disagree, 4=Neutral, 7=Strongly agree. Computer Self-efficacy is an 11-point scale with anchors 0=Not at all confident, 10=Very Confident.

5.3 Measurement Model

The measurement model was evaluated prior to the structural model, in terms of construct reliability, unidimensionality, convergent validity, and discriminant validity. Confirmatory factor analysis (CFA) was performed by using AMOS 5.0 to check the validity of the measurement model. Successive runs of confirmatory factor analysis and refinement were conducted iteratively in order to have a good model fit.

The initial model includes seven constructs with 30 items. In the measurement model, the ratio of the χ^2 to the degree of freedom (2.52), the Adjusted Goodness of Fit (AGFI) index (0.79), Root Mean Square Error of Approximation (RMSEA) index (0.063), and Comparative Fit Index (CFI) (0.87), the standardized Root Mean Square Residual (SRMR) index (0.058), Goodness of Fit Index (GFI) (0.82), Tucker-Lewis Index (TLI) (0.85) tell researchers that it is not reasonable to conclude that the data fits the model very well.

The measurement model in the CFA could be revised by dropping items that had low loading or shared high residual variance with other items (Gefen et al. 2000). Table 5-3 shows the standardized loadings and reliabilities in the initial measurement model. The initial evaluation process revealed some problems with the measurement model. Firstly, the first item, CSE1, in the computer self-efficacy construct, and the fourth item, PU4, in the perceived usefulness construct, have high cross-loadings. Secondly, in Personal Innovativeness with IT (PIIT) and Management Support (MS) constructs, there were two very low loadings, PIIT3 (0.13) and MS6 (0.17), which were reverse coding in the distributed questionnaire. In addition, the reliability of the PIIT construct seemed to be relatively low (the Cronbach's alpha=0.59), which was lower than the criterion 0.70 for confirmatory research (Nunnally 1978; Nunnally

and Bernstein 1994; Peter 1979).

Table 5-3 Standardized Loadings and Reliabilities in the Initial Measurement Model

Latent Construct	Indicator	Standard Loading	Cronbach's Alpha
Confirmation of Expectation (COE)	COE1	0.76 ***	0.77
	COE2	0.78 ***	
	COE3	0.64 ***	
Computer Self-Efficacy (CSE)	CSE1	**0.73 ***** (high cross-loading)	0.90
	CSE2	0.83 ***	
	CSE3	0.76 ***	
	CSE4	0.84 ***	
	CSE5	0.80 ***	
	CSE6	0.74 ***	
Personal Innovativeness with IT (PIIT)	PIIT1	0.85 ***	**0.59**
	PIIT2	0.54 ***	
	PIIT3	**0.13 **** (low loading)	
	PIIT4	0.57 ***	
Management Support (MS)	MS1	0.58 ***	0.78
	MS2	0.82 ***	
	MS3	0.69 ***	
	MS4	0.77 ***	
	MS5	0.70 ***	
	MS6	**0.17 ***** (low loading)	
Perceived Usefulness (PU)	PU1	0.79 ***	0.81
	PU2	0.74 ***	
	PU3	0.80 ***	
	PU4	**0.57 ***** (high cross-loading)	
Satisfaction (SAT)	SAT1	0.78 ***	0.87
	SAT2	0.85 ***	
	SAT3	0.82 ***	
	SAT4	0.69 ***	
Emergent Use (EU)	EU1	0.80 ***	0.82
	EU2	0.77 ***	
	EU3	0.79 ***	

* p< 0.10; ** p< 0.05; *** p< 0.01.

Given the unacceptable model fit in the initial model, as well as high cross loading, low item loading and construct reliability, the model was then refined iteratively by eliminating items, one at a time (Gefen et al. 2000). After dropping items, the final model with twenty-six items showed significant improvement (Table 5-4). This model was achieved by eliminating one item in Perceived IT

Innovativeness, and one item in Management Support with low loadings, one item in Computer Self-efficacy, and one item in Perceived Usefulness with high cross loadings. It was noted that every item dropped was carefully read to verify that its residual variance also made sense from a theoretical perspective. Except for the Goodness of Fit Index (GFI), which was close to the criterion of 0.90, all indices, particularly the important robust indices of Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), were above their criterion levels. GFI can be brought to 0.90 by dropping additional items. However, in order to keep content validity, the author decided to stop dropping items at this stage. It is common that Structural Equation Modeling models seldom have excellent fit values in all the indices (Gefen et al. 2003). These indices jointly suggest acceptable measurement model fit.

Table 5-4 Goodness of Fit for the Measurement Model

Goodness of Fit Indices	Initial Model	Revised Model	Desired Levels
χ^2 /df	2.52	2.26	< 3.0
CFI	0.87	0.93	> 0.90
TLI	0.85	0.91	> 0.90
RMSEA	0.063	0.057	0.05-0.08
Standardized RMR	0.058	0.045	< 0.05
GFI	0.82	0.88	> 0.90
AGFI	0.79	0.85	> 0.80
Number of Latent Variables	7	7	
Total Number of Items	30	26	

After dropping items, construct reliability, unidimensionality, convergent validity, and discriminant validity were examined.

5.3.1 Construct Reliability

Construct reliability means the extent to which a variable is consistent with what it intended to measure. Operationally, reliability is defined as the internal consistency of a scale, which assesses the degree to which the items are homogeneous. The internal reliability was assessed by calculating the values of Cronbach's alpha and composite reliabilities. Composite reliability was calculated using the following formula:

$$\rho = \left(\sum \lambda_i\right)^2 / \left(\left(\sum \lambda_i\right)^2 + \sum \theta_i\right)$$

Where λ_i refers to the *i*th factor loading and θ_i to the *i*th error variance. The coefficient has a similar interpretation as Cronbach's Alpha, except that it takes into account the actual factor loadings instead of assuming that each item is equally weighted in determining the composite.

Table 5-5 Assessment of Construct Consistency

Dimensions	Number of Items	Cronbach's Alpha	Composite Reliability
Confirmation of Expectation	3	0.77	0.87
Computer Self-Efficacy	5	0.90	0.92
Personal Innovativeness with IT	3	0.73	0.84
Management Support	5	0.85	0.89
Perceived Usefulness	3	0.83	0.89
Satisfaction	4	0.87	0.91
Emergent Use	3	0.82	0.90

Table 5-5 shows the values of Cronbach's alpha and composite reliabilities, which were within the commonly accepted range greater than 0.70 (Nunnally 1994), thereby suggesting an adequate level of internal reliability.

5.3.2 Unidimensionality

Similar to the concept of reliability, unidimensionality means a set of indicators that has only one underlying trait or concept in common (Hair et al. 1998). In other words, the items should load only on their respective constructs without having parallel correlational patterns (Segars 1997). In the measurement model, the average variance extracted (AVE) for each construct was higher than 0.50 (Fornel and Larcker 1981). This suggests that construct items explain more variance than the error terms. Given that AVE was higher than 0.50 and composite reliabilities were higher than 0.70 (Segars 1997), unidimensionality was supported (Table 5-6).

Table 5-6 Assessment of Unidimensionality

Dimensions	Composite Reliability	Average Variance Extracted (AVE)
Confirmation of Expectation	0.87	0.68
Computer Self-Efficacy	0.92	0.71
Personal Innovativeness with IT	0.84	0.63
Management Support	0.89	0.61
Perceived Usefulness	0.89	0.74
Satisfaction	0.91	0.71
Emergent Use	0.90	0.75

5.3.3 Convergent Validity

Convergent validity assesses the extent to which different indicators for the measure refer to the same conceptual construct. There is no generally accepted level of item loadings. For example, some researchers (Hair et al. 1998; Segars 1997; Thompson et al. 1995) suggested that item loadings should be above 0.707 to show

that over half the variance is captured by the latent construct. Fornell (1982) recommended a minimum loading of 0.70, which means the item explains almost 50 percent of the variance in the construct. Whereas Falk and Miller (1992) recommended a loading should be at least 0.55 which explains at least 30 percent of the variance in the construct. In order to capture more of the construct, some researchers used 0.45 or 0.40 as the criterion of minimum item loading (Agarwal and Prasad 1999; Chang and King 2005). In this study, the author used the criterion of Chang and King (2005) -- the cutoff value of 0.45. As shown in Table 5-7, all the item loadings are greater than 0.45. In addition, the item loading should be statistically significant (Hair et al. 1992). Table 5-7 showed that all estimated standard loadings in the revised model are significant ($p < 0.01$), suggesting good convergent validity.

Table 5-7 Standardized Loadings and Reliabilities in the Revised Measurement Model

Latent Construct	Indicator	Standardized Loading
Confirmation of Expectation (COE)	COE1	0.76 ***
	COE2	0.78 ***
	COE3	0.64 ***
Computer Self-Efficacy (CSE)	CSE2	0.81***
	CSE3	0.74 ***
	CSE4	0.86 ***
	CSE5	0.82 ***
	CSE6	0.75 ***
Personal Innovativeness with IT (PIIT)	PIIT1	0.89 ***
	PIIT2	0.54 ***
	PIIT4	0.57 ***
Management Support (MS)	MS1	0.59 ***
	MS2	0.80 ***
	MS3	0.71 ***
	MS4	0.74 ***
	MS5	0.71 ***
Perceived Usefulness (PU)	PU1	0.80 ***
	PU2	0.74 ***
	PU3	0.80 ***
Satisfaction (SAT)	SAT1	0.81 ***
	SAT2	0.84 ***
	SAT3	0.81 ***
	SAT4	0.73 ***
Emergent Use (EU)	EU1	0.80 ***
	EU2	0.77 ***
	EU3	0.79 ***

* p< 0.10; ** p< 0.05; *** p< 0.01.

In addition, as recommended by Bollen (1989), several fit indicators in CFA were utilized to assess convergent validity. As shown in Table 5-4, GFI and AGFI were 0.88 and 0.85, respectively. The Root Mean Square Error of Approximation (RMSEA) was 0.057, where values below 0.8 are considered acceptable (Browne and Cudek 1993). The Standardized Root Mean Square Residual (SRMR) for the model was 0.045, where values below 0.05 deemed satisfactory (Bollen 1989). Collectively these data provide strong support for the convergent validity of the measure.

5.3.4 Discriminant Validity

Discriminant validity is the degree to which items differentiate between constructs, or measure different constructs. Discriminant validity can be assessed by comparing the shared variance between constructs with the average variance extracted from the individual constructs. Higher average variance extracted from the individual constructs than the shared variances between constructs suggests discriminant validity (Fornel and Larcker 1981). In the measurement model, the square root of AVE of a construct is higher than its correlations with other constructs. The results in Table 5-8 suggest good discriminant validity.

Table 5-8 Comparison of Square Root of AVE and Correlations

Variables	COE	CSE	PIIT	MS	PU	SAT	EU
COE	**0.82**						
CSE	0.39	**0.84**					
PIIT	0.33	0.58	**0.79**				
MS	0.52	0.59	0.51	**0.78**			
PU	0.56	0.51	0.48	0.64	**0.86**		
SAT	0.61	0.33	0.35	0.45	0.57	**0.84**	
EU	0.48	0.48	0.49	0.53	0.62	0.56	**0.87**

1. COE=Confirmation of Expectation; CSE=Computer Self-efficacy; PIIT=Personal Innovativeness with IT; MS=Management Support; PU=Perceived Usefulness; SAT=Satisfaction; EU=Emergent Use
2. Diagonals represent the square root of average variance extracted.
3. Off diagonal elements are the correlations among constructs.
4. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

5.4 Structural Model

Following the establishment of the measurement model, the author proceeded

to examine the structural model using AMOS 5.0. The structural model tested in the dissertation is shown in Figure 5-1. The overall fit and the explanatory power of the research were examined. In addition, the significance of the individual paths specified by the model was also evaluated. The overall goodness-of-fit was examined using the following six common model fit measures (see Table 5-9): chi-square/degree of freedom, GFI, AGFI, CFI, SRMR and RMSEA. The ratio of χ^2 to the degree of freedom (2.24) is within the acceptable limit. Except for GFI (0.88), which is slightly lower than the commonly cited threshold, all other indexes are within accepted thresholds: CFI at 0.93, TLI at 0.92, AGFI at 0.85, SRMR at 0.046, and RMSEA at 0.057. These results collectively suggest a good fit between the structural model and data.

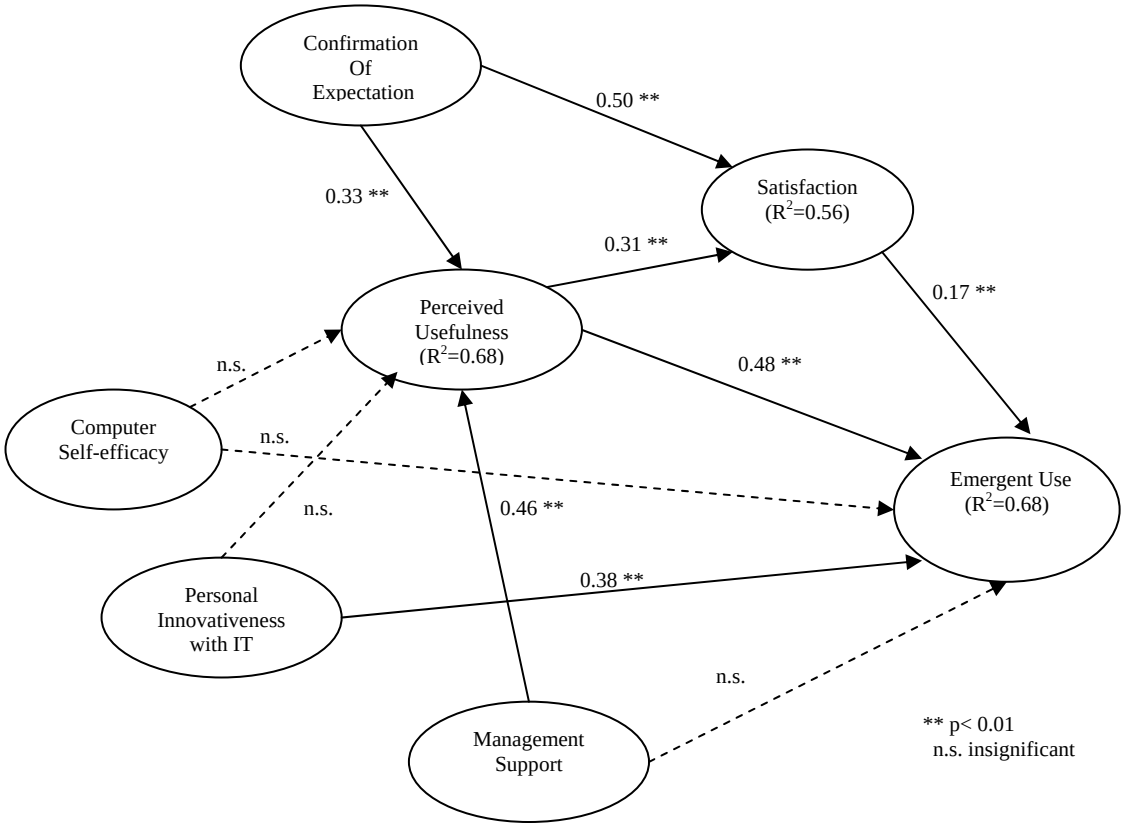
Table 5-9 Fit Indices of Structural Model

Goodness of Fit Indices	Structural Model	Desired Levels
χ^2 /df	2.24	< 3.0
CFI	0.93	> 0.90
TLI	0.92	> 0.90
RMSEA	0.057	0.05-0.08
Standardized RMR	0.046	< 0.05
GFI	0.88	> 0.90
AGFI	0.85	> 0.80
Number of Latent Variables	7	
Total Number of Items	26	

The explanatory power of the research model was evaluated by examining the portion of variance explained. Figure 5-1 illustrates the path coefficients and explanatory power for the resulting model. The results suggested that the model was able to explain 68 percent of the variance in employee users' emergent use of IS.

Furthermore, 56 percent of the observed variance in satisfaction, and 68 percent of the variance in perceived usefulness have been explained in this model.

Figure 5-1 Structural Model



Emergent use was predicted by perceived usefulness (β=0.48), personal innovativeness with IT (β=0.38), and user satisfaction (β=0.17). In addition to its direct effect, perceived usefulness also indirectly influenced emergent use (β=0.053)[2] via user satisfaction. Meanwhile, perceived usefulness was affected by confirmation of expectation (β=0.33) and management support (β=0.46). These two

[2] If an antecedent (e.g., Perceive Usefulness) influenced Emergent Use through a mediating factor (Satisfaction), its overall impact on Emergent Use was calculated as the cross-product of its impact on the mediator ($\beta_{(\text{Perceived Usefulness} \rightarrow \text{Satisfaction})}$) and the impact of the mediator on Emergent Use ($\beta_{(\text{Satisfaction} \rightarrow \text{Emergent Use})}$).

factors jointly accounted for 68% of the variance in perceived usefulness. Satisfaction was affected by confirmation of expectation (β=0.50) and perceived usefulness (β=0.31), which collectively explained 56% of the variance in satisfaction. Confirmation of expectation also indirectly influenced satisfaction (β=0.09) via perceived usefulness. As a result, seven of the eleven hypotheses were supported.

Table 5-10 shows the hypotheses test results. The results provide strong support for hypotheses 1a, 1b and 5b, which were essentially drawn from the specification of the IS continuance model (Bhattacherjee 2001). Hypotheses 2a and 2b were not supported, that is, computer self-efficacy did not exhibit significant influence on perceived usefulness and emergent use. Hypothesis 3a was supported, which posited that perceived innovativeness with IT would influence emergent use. However, hypothesis 3b was not supported, which means personal innovativeness with IT did not affect perceived usefulness. Hypothesis 4b was supported, that is, management support exhibited significant effect on perceived usefulness; while hypothesis 4a was not supported, which means management support did not exhibit significant effect on emergent use. Hypotheses 5a and 6 were strongly supported, which posited that perceived usefulness and satisfaction would influence emergent use. As summarized in Table 5-10, seven out of eleven postulated paths were of statistical significance at the 0.01 level.

Table 5-10 Summary of Hypothesis Tests

Hypothesis	Supported?	Significance Level
H1a: COE → SAT Confirmation of expectation has a positive effect on satisfaction.	**Yes**	P < 0.01
H1b: COE → PU Confirmation of expectation has a positive effect on perceived usefulness.	**Yes**	P < 0.01
H2a: CSE → EU Computer self-efficacy has a positive effect on emergent use.	No	insignificant
H2b: CSE → PU Computer self-efficacy has a positive effect on perceived usefulness.	No	insignificant
H3a: PIIT → EU Personal innovativeness with IT has a positive effect on emergent use.	**Yes**	P < 0.01
H3b: PIIT → PU Personal innovativeness with IT has a positive effect on perceived usefulness.	No	insignificant
H4a: MS → EU Management support has a positive effect on emergent use.	No	insignificant
H4b: MS → PU Management support has a positive effect on perceived usefulness.	**Yes**	P < 0.01
H5a: PU → EU Perceived usefulness has a positive effect on satisfaction.	**Yes**	P < 0.01
H5b: PU → SAT Perceived usefulness has a positive effect on emergent use.	**Yes**	P < 0.01
H6: SAT → EU Satisfaction has a positive effect on emergent use.	**Yes**	P < 0.01

There is a need to consider the issues of control variables and common method

bias. To fully account for the differences among employee users, three control variables were included in the research model. These control variables are age, gender and educational level. The author selected these particular variables because of their potential impact on information system usage as suggested by the literature (Gefen and Straub 1997; Igbaria 1990). The author examined the structural model with control variables using AMOS 5.0. The results show that age, gender and educational level did not exhibit significant influence on emergent use. The results with control variables were similar to those without control variables, with no significant differences in findings on the hypotheses.

In addition, there is potential for common method bias because independent and dependent variables were obtained from the same source and were measured in the same context. The author took several steps to address the potential threat of common method bias. First, the instrument contains different scale formats to reduce the scale commonality (Podsakoff et al. 2003). After data collection, the author performed the Harmon one-factor test recommended by Podsakoff and Organ (1986). A factor analysis combining independent and dependent variables revealed no sign of a single-factor accounting for the majority of variance. Next, following Podsakoff et al. (2003), the author added in the AMOS model a common method factor, which was formed reflectively by indicators of all constructs. With this common method factor included, the results of the structural model remained similar to the results without the factor, with one exception: the path from Management Support to Emergent Use becomes significant when the common method factor is included. This raises a question about the reliability of our original findings on Management Support and Emergent Use, but other than that the findings suggest that common method bias was not a significant issue in the study.

CHAPTER 6

DISCUSSIONS AND CONCLUSION

This study examined the emergent use of enterprise systems by employee users in an organizational context. The study was guided by the IS continuance model and organizational assimilation framework, combined into the theoretical model presented in Figure 3-7. The model was examined using responses from 385 employee users in two Chinese manufacturing firms. The results obtained from the structural equation modeling suggested that the research model exhibited a satisfactory overall fit to the collected data and was capable of providing a reasonable explanation of employee users' emergent use of enterprise systems. Seven out of the eleven hypotheses specified by the model were supported.

This chapter presents the discussions, limitations and implications of the findings of this study. First, it presents the detailed discussion of each individual path in the research model. Second, it provides the strengths of this study. Third, it examines the potential limitations of this research and suggests some possible direction for future research. Fourth, it presents the study's theoretical and practical implications. Fifth, it explains the study's contributions to the existing system usage literature, and ends by presenting the overall conclusions of the study.

6.1 Discussions

6.1.1 Perceived Usefulness

The results revealed that users' emergent use of information systems in organizations is determined by their risk-taking propensity in IT (i.e., personal innovativeness with IT) and the two important determinants at the post-acceptance stage (i.e., perceived usefulness and satisfaction) suggested by the IS continuance model (Bhattacherjee 2001).

Among the aforementioned factors, perceived usefulness was the most powerful determinant for ES emergent use by employee users in organizational contexts. In addition to its strong direct effect on emergent use, perceived usefulness also exhibited a considerable indirect effect on emergent use via satisfaction. Meanwhile, emergent use often occurs at the infusion stage during the post-acceptance stage. Different from extant research, this study focuses on infusion stage in a mandatory context. Prior research in voluntary settings has shown that perceived usefulness is a stronger predictor of behavioral intention than attitude affect at the acceptance stage; whereas satisfaction affect is a more powerful determinant of continuance intention than perceived usefulness at the post-acceptance stage (Bhattacherjee 2001). Findings across these studies suggest that perceived usefulness consistently influences IS usage behaviors; yet its strength in relation to other affective determinants may fluctuate across temporal stages and contexts. The effect of perceived usefulness on users' intention and behavior in both acceptance and post-acceptance attests to the robustness of this association across different IS implementation stages.

Moreover, the strong relationship between perceived usefulness and emergent use implies a critical role for users' tendency to take a tool-oriented view of information technologies. In organizational contexts, users appear to be pragmatic in evaluating and selecting technologies. They are more likely to pay attention to

practical utility rather than technological novelty. Users are more likely to creatively use an IS when they think the system can provide considerable or desirable utilities. In this light, if enterprise systems demonstrate satisfactorily sufficient utilities for supporting the employees' works, employee users are more likely to use the systems innovatively. Perceived usefulness, in turn, was influenced by users' confirmation of expectation from IS use. The importance of confirmed expectation to perceived usefulness suggests that users' perception of IS instrumentality may be adjusted based on their extent of confirmation (Bhattacherjee 2001). If initial usefulness perceptions are confirmed, such perceptions may be adjusted higher. In contrast, if users can not confirm their initial usefulness, such perceptions will be adjusted lower.

6.1.2 Satisfaction

In addition to perceived usefulness, satisfaction and personal innovativeness with IT also showed significant effects on emergent use. Emergent use, as a post-acceptance behavior, is subject to the influence of experience-based factors, such as satisfaction. According to Expectation Confirmation Theory (Oliver 1980), users' pre-usage cognitions (e.g., beliefs, attitude) are generally based on second-hand information, which includes vendor claims, successful case reporting in a related industry, or other interpersonal or mass media communication. Such second-hand information may be exaggerated or misunderstood, leading to cognitions that are less reliable or stable. However, reflecting post-acceptance affect, satisfaction is the aggregate affective state resulting from users' direct experiences at prior stages. It is, therefore, more realistic, unbiased, and less susceptible to change (Bhattacherjee 2001). That is to say, satisfaction channels the impact of users' initial experiences

into emergent use. Thus, acceptance at the initial usage stage can be linked to post-acceptance emergent use via satisfaction.

Satisfaction can be explained by confirmation of expectation and perceived usefulness. Similar to the effect that perceived usefulness influences attitude affect during the acceptance stage (Davis et al. 1989), perceived usefulness also has a bearing on satisfaction affect at the post-acceptance stage. Perceived usefulness at the post-acceptance stage is based on users' experiences at the acceptance stage. The more they believe in the usefulness, the more likely they will be satisfied with the IS. The observed considerable indirect effect of perceived usefulness on emergent use suggests the importance of user satisfaction. Hence, top managers should consider formulating strategies that foster innovative usage through positive affect cultivation and solidification. Furthermore, satisfaction can be directly enhanced if users' initial usage confirms their earlier expectation of the system (i.e. confirmation of expectation). Confirmation may be positive or negative depending on whether the observed performance is above or below initial expectations. Confirmation of expectation determines user satisfaction with an IS, which then determines emergent use. Confirmation of expectation also influences satisfaction indirectly via perceived usefulness (Bhattacherjee 2001), which is consistent with prior research.

6.1.3 Personal Innovativeness with IT

Among the individual characteristics, as expected, personal innovativeness with IT exhibited a strong effect on emergent use, whereas computer self-efficacy did not have a statistically significant effect. In addition, neither personal innovativeness with IT nor computer self-efficacy exhibits a significant effect on

perceived usefulness. Personal innovativeness with IT (PIIT) and computer self-efficacy (CSE) are traditionally used as traits rather than states. In general, traits refer to comparatively stable characteristics of individuals that are relatively invariant to situational stimuli (Webster and Martocchio 1992), whereas states refer to affective or cognitive episodes that are experienced in the short run and that may fluctuate over time (Webster and Martocchio 1992).

PIIT refers to the willingness of an individual to try out any new information technology (Agarwal and Prasad 1998). PIIT is connected to the dimension of intrinsic motivation, which Malone and Lepper (1987) referred to curiosity. As a relatively stable descriptor of individuals, PIIT captures the risk-taking propensity of an individual with regard to information technology. Implementing complex innovations, such as ERP systems, is a risk-taking behavior (Gattiker and Goodhue 2005). Individuals who are more likely to experiment with new technologies tend to look for more opportunities to use the adopted IS in their organization. In other words, high levels of PIIT will lead to more instances of technology use and experimentation. Our results strongly support that users' risk-propensity in general and willingness to explore new aspects of IT in specific have very positive influences on using information systems innovatively and engaging in new ways of using these systems.

In addition, personal innovativeness with IT did not exhibit a significant effect on perceived usefulness. Since modern organizations are making significant investments in enterprise systems, the complexity of these systems make the users difficult to grasp (Ko et al. 2005). This brings high a knowledge burden to employee users. Meanwhile, the sheer complexity and malleability of these enterprise information systems permit users to utilize the systems at different levels of

sophistication (Moore 2002). If they only know some of the system features, users may use only a limited number of available features or seldom apply task-related features to relevant operations (Davenport 1998; Ross and Weill 2002). However, the difference in the willingness of an individual user to try out new IT (i.e., PIIT) did not influence the formation of his/her perception of IS instrumentality. This study focuses on the post-acceptance stage, particularly the infusion stage, which is the later state for IS implementation. At this stage, users have developed more mature perception of the system usefulness, so that the importance of PIIT on perceived usefulness may diminish.

6.1.4 Computer Self-Efficacy

Contrary to our expectation, the relationship between computer self-efficacy and perceived usefulness was not supported. This suggests that perceived instrumental outcomes are not influenced by the individual's confidence in his or her ability to engage in IS use. In contrast, Compeau and Higgins (1995b) found a positive relationship between computer self-efficacy and perceived usefulness at the acceptance stage. The positive relationship can be explained from the perspective of Social Cognitive Theory (Bandura 1978). Bandura (1978) proposed that "the outcomes one expects derive largely from judgments as to how well one can execute the requisite behavior" (p. 241). In other words, users tend to form high outcome expectations about information technologies when they feel they are capable of mastering them successfully. Conversely, when they do not feel they can handle the technology, users are more likely to develop low outcome expectations about it (Compeau and Higgins 1995b).

However, this study did not support the relationship between computer self-efficacy and perceived usefulness. A speculative explanation is that the influence of computer self-efficacy on perceived usefulness may attenuate as users gain more direct experience. Prior to post-acceptance, novice users' outcome expectations are very sensitive to the perception of their own ability. As users accumulate additional knowledge and experience about the IS and form more realistic expectations about what the system can deliver, the importance of their self-efficacy beliefs on perceived usefulness may thereby decrease at the post-acceptance stage.

Also unexpectedly, computer self-efficacy had no direct bearing on emergent use. From the social learning theory perspective, computer self-efficacy can be viewed as an antecedent to IS use (Compeau and Higgins 1995a). Some empirical research has supported this relationship during the acceptance stage (e.g., Compeau et al. 1999; Compeau and Higgins 1995b). However, its impact on emergent use during the post-acceptance stage was not detected in this research. Computer self-efficacy is a very complex concept. Marakas et al. (1998) and Agarwal et al. (2000) conceptually distinguished task-specific CSE from general CSE, and argued for their distinctive behavioral influences. Marakas et al. (1998) suggested that there are two dimensions of computer self-efficacy: at the *application environment level* and at the *application-specific level*. General computer self-efficacy refers to an individual's perceived efficacy across multiple computer application domains, while task-specific computer self-efficacy is defined as individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing (Marakas et al. 1998). General computer self-efficacy is the accumulation of all task-specific computer self-efficacy of an individual. To further understand post-adoptive emergent use that is creative in nature, alternative conceptualizations of computer

self-efficacy deserve careful attention.

6.1.5 Management Support

Consistent with prior research, management support positively affected perceived usefulness, even at the post-acceptance stage. However, different from prior studies, this study focused on the work environment and post-acceptance stage. The sample in this study was collected from organizations where usage was mandatory and post-acceptance users who had more than one year experience in using the ERP system. Given that employee users are often mandated to use the installed system in their organizations, in order to implement the system smoothly, management is more likely to provide resources and support to solve the difficulties employees encountered. In the post-acceptance stage, employee users have known more about the system, their resistance to the system has been gradually decreased. Therefore, employee users are more likely to form positive outcome expectations. In addition, to a large extent, management support reflects the formal stance of the organization toward the system usage behavior. As a result, management support can help employee users develop positive consequences of using the system. In other words, management support has a positive effect on employee' perceived usefulness.

The effect of management support on emergent use is inconclusive in this study. Without control of the common method factor, management support exerted no direct influence on emergent use. However, with control of the common method factor, the path from management support to emergent use becomes significant. Unlike typical usage such as frequency, time, and the extent of use (Chin and marcolin 2001) that can be monitored, emergent use may be difficult to mandate and

monitor. Users' perceptions and motivations of emergent use would derive internally from their experience and their innovative propensity in the IT dimension, but not from the external push, such as the encouragement and support from the management. Since management support was regarded as an indication of organization norms regarding use, employee users may use an IS, but they may be unwilling to take their time and effort to explore how to innovatively use an IS in their working environment. Therefore, although management support has been suggested as a critical success factor for ERP implementation (e.g., Somers and Nelson 2001), its direct impact on emergent use that is potentially innovative and self-determinant in nature requires further investigation.

In general, this study validated that the IS continuance model (Bhattacherjee 2001) can also be applied to explaining the emergent use issue at the infusion stage. The results suggested that users' emergent use of information systems in organizations is determined by two important determinants at the post-acceptance stage—perceived usefulness and satisfaction, which were identified by Bhattacherjee (2001). In addition, the results also identified the important role of an individual's IT risk-taking propensity in predicting his/her emergent use of enterprise systems. This enhanced our understanding that the assimilation process is influenced by individual factors.

6.2 Strengths

This study is one of the early studies to empirically investigate emergent use. The study has its strengths. First, the target organizations were selected from manufacturing industries during the same timeframe, and for the same ERP systems.

This in effect controls for other factors that may cause differences in results between these two organizations, and therefore increased our confidence in the conclusion of this study.

Second, this study builds its theoretical foundations on the IS continuance model and the organizational assimilation framework. The IS continuance model captures the aspect of continued usage, while the organizational assimilation framework help us understand how to gradually go into the infusion stage. These theories guide the present study toward a more parsimonious research model, and provide the framework within which results are interpreted and related to existing knowledge.

Third, in order to increase the external validity of the results, this study was conducted in an organizational context. Given that the purpose of this study was to capture employee users' perceptions and affect with regard to innovatively using ES, it was necessary to study this phenomenon in a natural setting.

6.3 Limitations

Certain limitations inherent in the study must be acknowledged, as is true for most empirical research. First, our sample is limited to end users with mandated usage in two organizations using a particular type of information system. Conclusions drawn in this study are based on a single technology (e.g., ERP system) and a specific user group from the manufacturing industry (i.e., employee users in large manufacturing organizations). The purpose of this study is to control the variability from the different systems; however it raises the issue of generalizability. Therefore, caution needs to be exercised when generalizing these research results to

other technologies or environments. In order to replicate the present study to examine the robustness of the findings across a wide range of information systems and samples in other organizational contexts, future research is needed to examine Emergent Use in organizations in other industries. Given that only two organizations were used in this study, more future research can be done in other organizations to validate the findings presented here.

Second, a notable weakness lies in the cross-sectional research design, where measures of all constructs in this study were collected at the same point of time, rather than with a longitudinal study. Cross-sectional studies are strong in establishing links among constructs but weak in proving causality. Hence, although the analysis of the results was described in causal terms, the causality was mainly theory-based. According to Cook and Campbell (1979), causality between two variables should meet the following three criteria:

- (1) the cause precedes the effect in time,
- (2) there is a significant correlation between the variables,
- (3) the relationship is not due to the effect of other variables on each of the proposed cause and effect.

The second criterion is met in this study. Criterion 1 and 3 can be met through a longitudinal study and an experiment study, respectively. Given that the investigated constructs are not supposed to remain unchanged over time, the cross-sectional research design may not fully capture the dynamics of the emergent use phenomenon. A longitudinal study combining qualitative and quantitative data would enable a process-orientated perspective that cannot be achieved by using a

variance-based approach, such as the one employed here. In addition, this study employs only one method for data collection and may thus be subject to the common-method bias. Since this study only used a questionnaire method to collect data, the common method bias in responses is possible. The above constraints thereby limit the extent to which causality can be inferred. To address the above issues, future research should consider employing multi-methods and longitudinal research designs.

The third limitation of this research is the self-reported measurement of the Emergent use construct. Straub et al. (1995) have shown the conceptual differences between actual use and self-reported use, as well as the impact of those differences on research findings. For example, perceived ease of use may be related more to self-reported use, as opposed to actual use (Straub et al. 1995). Therefore, caution should be exercised when interpreting the results of this research. Furthermore, it is strongly recommended that research be designed to monitor the actual innovative use, so that researchers may examine the relationships of Emergent Use with other factors in the nomological networks discussed.

Fourth, the findings provide no empirical support for the relationships from computer self-efficacy to perceived usefulness and to emergent use. Computer self-efficacy in this study was assessed at a general rather than a task-specific level. This may have weakened the relationships between computer self-efficacy, perceived usefulness, and emergent use. Future research is thus encouraged to use task-related self-efficacy to replicate this study in order to explore these relationships in a more detailed manner.

Finally, given the intricacy involved in employees' ERP usage in modern organizations, such factor as the ERP functions applied in different departments,

users' ERP experiences, and even the types of industries, may all potentially moderate the revealed findings. While the present study emphasized the key constructs in the IS continuance model (Bhattacherjee 2001), management support and two individual-related factors that have received consistent support as important predictors, future research should investigate the possible moderating impact of the related factors.

6.4 Implications for Research and Practice

Enterprise systems are becoming a core component of modern organizations. However, existing evidence shows that the functional potential of these installed ES applications is underutilized. For example, users may adopt only a limited number of available features, use these features at low levels, and seldom apply task-related features to relevant operations (Davenport 1998; Ross and Weil 2002). System underutilization may be one of the major reasons for the under-achievement of information systems initiatives (Jasperson et al. 2005). In addition, today's ES usually represent the best practices in each industry (Benders et al. 2006), that is, these systems provide reference models or process templates for the adopting organizations. The ES adoption among organizations leads to "strategic convergence" (Porter 1985), which means the advertised benefits are equally available to their competitors using the same ES. In order to derive competitive advantage from the adopted ES, organizations should not stay with routine usage, but should try to achieve emergent use. The concept of emergent use is therefore a promising avenue for studying IS post-acceptance behavior that can significantly impact organizations. Therefore, both managers and researchers need to better

understand what drives individuals to explore new ways to use the system in organizational settings if returns are to be maximized.

6.4.1 Implications for Research

From the perspective of theory advancement, this paper represents a critical contribution to the fields of IS acceptance and implementation, because it is one of the first studies that focuses specifically on emergent use. Emergent use is defined as the extent to which an individual uses a technology in an innovative manner to support his/her work tasks. It is a usage behavior that occurs at the post-acceptance stage. Unlike such related concepts as post-adoption behavior (Jasperson et al. 2005), continuance (Bhattacherjee 2001), and routinization and infusion (Saga and Zmud 1994), emergent use in this study emphasizes the close link between one's usage behavior and performance.

Drawing upon multiple research streams, including IS continuance, cognitive psychology, and IS implementation research, this paper proposes a model to understand emergent use of enterprise systems in mandatory organizational settings. The final model explained 68% of the variance in emergent use, suggesting that this model serves as an adequate conceptualization of the phenomenon of interest. The results also offered insights into key determinants of emergent use, including perceived usefulness, personal IT innovativeness, and user satisfaction.

Perceived usefulness is the most important predictor of emergent use in this study. By combining socio-psychology and technology acceptance theories, Karahanna and Straub (1999) furthered our understanding of the ways in which social contexts inform the perception of usefulness. Lewis et al. (2003) suggested

that influences emanating from the individual, institutional, and social contexts, as a whole, shape individuals' beliefs about their IS use. Even with all the insights, these studies focused on initial usage at the acceptance stage, rather than emergent use at the post-acceptance stage. Note that perceived usefulness can be dynamic rather than static across the adoption, acceptance, and post-acceptance stages. Prior research provides preliminary empirical evidence that user beliefs do change over time (Szajna and Scamell 1993; Venkatesh and Davis 2000). Bhattacherjee and Premkumar (2004) also theorized about how users' beliefs change during the course of their IS usage. In this vein, this study is an important step toward better understanding the formation of perceived usefulness at the post-acceptance stage. Given the importance of perceived usefulness for IS usage, more studies should examine the antecedents and moderators of perceived usefulness at the post-acceptance stage.

In line with the IS continuance model (Bhattacherjee 2001), user satisfaction was predicted by confirmation of expectation and perceived usefulness. Derived from the expectation-confirmation theory, these two determinants jointly explained 56% of the variance in satisfaction, a much higher percentage than the 33% in the previous study. However, satisfaction in this study was operationalized as *overall* satisfaction. Some researchers have decomposed user satisfaction into a collection of beliefs, such as satisfaction toward systems, information, or services (Wixom and Todd 2005). Understanding the differential impact between distinct types of satisfaction on emergent use will certainly advance our knowledge of the phenomenon of interest.

Personal innovativeness with IT represents the degree to which an individual is willing to try out any new IT (Agarwal and Prasad 1998). The inclusion of personal

innovativeness with IT helped us better understand post-acceptance behavior by delineating the important role of individual traits in IS emergent use. The identification of the significant behavioral impact of personal innovativeness with IT on innovative post-acceptance behavior (i.e. emergent use) is, however, not totally a surprise. Given that emergent use concerns explorative and novel ways of using IS, innovative users are understandably more inclined to demonstrate this type of behavior. The revealed relationship, to a certain extent, endorses Agarwal and Prasad's prediction of the salient influence of personal innovativeness with IT on innovative IT behaviors. Toward this end, we believe that personal innovativeness with IT deserves further attention, especially when IS research has increasingly emphasized the importance of post-acceptance behavior where individual aptitude makes a difference. Personal innovativeness with IT should also be controlled in future emergent use research.

Although employees are mandated to use the installed system, after obtaining more experience, they may find new ways to appropriate the system further than the functionalities originally specified by the designers or implementers, thereby engaging in the state of emergent use (Cooper and Zmud 1990; Jasperson et al. 2005). Even if an organization enforces IS usage, users still possess considerable control over whether they intend to explore new ways of using IS to support their tasks (Jasperson et al. 2005). In other words, emergent use might be conceptually voluntary. Hence, to stimulate emergent use post-acceptance, researchers may turn to factors associated with voluntary behavior. For instance, Malhotra and Galletta (2005) offered empirical insights about system users' commitment and how it affects volitional usage. Karahanna (1999) also proposed the concept of symbolic adoption for post-acceptance behavior. Symbolic adoption refers to the degree of voluntary

mental acceptance of the idea component of an IT innovation. Both notions shed light into the emergent use issue and should be employed in future research.

A post-hoc close examination of the concept and operationalization of the management support construct revealed an interesting observation. In most IS studies, the concept of management support refers to such activities as providing financial, personnel, educational, and technical resources. These resources are instrumental for system implementation and individual usage. However, none of the above resources directly encourage and/or stimulate exploratory and innovative behavior such as emergent use. This *typical* management support may be conceptually limited and only suitable for encouraging regular usage behavior. Creative usage at the post-acceptance stage potentially requires a whole new set of support mechanisms that are distinct from earlier stages. The author therefore urges alternative conceptualization or identification of the specific management support mechanisms that aim purposely toward facilitating emergent use. This direction represents a promising avenue for future theoretical development. Knowledge learned from efforts toward this end can greatly benefit research as well as practice.

6.4.2 Implications for Practice

From the perspective of practice, the strong association between perceived usefulness and emergent use suggests that employee users in an organizational context are fairly pragmatic. Their motivations to use an information system, to a large extent, rely on the practical utility of the system. Thus, employees are more likely to explore how to use IS when the system provides considerable or desirable utilities. In addition, the indirect effect of perceived usefulness on emergent use via

satisfaction suggests the value of satisfaction management through articulation of positive utilitarian outcomes. Managers should also seriously consider communication strategies that foster IS emergent use through favorable satisfaction affect cultivation and solidification at the post-acceptance stage.

Equally important is that users' satisfaction affect is also influenced by their experiences of IS use. Their direct experiences at earlier stages can either intensify or weaken their subsequent behavior (Hartwick and Barki 1994; Kay and Thomas 1995). In this vein, the idea of "Experience Economy," conceived by Pine and Gilmore (1999) offers a valuable perspective. These authors argued that modern business excellence rests upon an organization's capability to create favorable experiences. It is the *process* experienced by individuals that generates the most value. Therefore, fostering positive experiences of IS use is critical to achieve emergent use. Managers should pay careful attention to the factors that drive positive experiences and recognize that these factors may differ across distinctive innovation stages. Managers also should not assume that acceptance and use of vendor-specified benefits represents the organization's ultimate implementation goal, and they should so communicate this to users.

In addition, system usage can be conceptualized as the interaction of three elements: the user, the information system, and the task (Goodhue 1995). Structuration theory (Orlikowski 2000) and fit-appropriation theory (Dennis et al. 2001) both stress the ongoing interaction among these elements. First, information systems can be simple or complex. Complex systems have a variety of features and functions. While some features represent the core of the technologies, others are not defining components and their use may be optional (DeSanctis and Poole 1994; Griffith 1999). Features of a technology need to be interpreted and perhaps adapted

by users to constitute a technology-in-use (Jasperson et al. 2005). The set of technology features used by an individual can change over time. Compared to the early-adopted features, later-adopted features are typically more complex and powerful (Kay and Thomas 1995). Furthermore, task outcomes are usually determined by the specific set of features used at a particular point of time (DeSanctis and Poole 1994; Goodhue and Thompson 1995). The more freedom users have to adjust both software features and organizational processes, the greater the benefits they can realize (Lassila an Brancheau 1999). It should be noted that a simple increase in the number of features used may not necessarily lead to an increase in performance outcomes. Positive outcomes are most likely to occur when individuals intelligently apply the technology features that fit their tasks (Jasperson et al. 2005).

Second, tasks are broadly defined as the actions carried out by individuals in turning inputs into outputs. Task-technology fit theory (Goodhue and Thompson 1995) suggests that by interacting more with a system's deep structure, users are better positioned to complete each individual task, thereby increasing performance. Here, system's deep structure represents the system features that are closely related to the core aspects of the task (Burton-Jones and Straub 2006). However, these kinds of tasks vary across hierarchical levels in organizations. These tasks include activities such as executing routine transactions by clerical staff, changing business processes by mid-level managers, and making strategic decisions by higher-level executives. What then is the role of tasks in emergent use? This inquiry needs to be answered in future research.

Third, Rogers (2003) recognized the existence of the re-invention phenomenon. He refers to re-invention as the degree to which an innovation is changed or

modified by a user in the process of its adoption and implementation. Instead of simply using a technology, users are active participants in the implementation process. Information systems are not only constructed by their designers, they are also reconstructed by their users (Rogers 2003). Complex technology innovations, such as ERP systems with many potential applications, are more likely to be re-invented (Rogers 2003). In such circumstances, re-invention may be a simplification strategy. This kind of simplification is more likely to occur at the initial usage stage when a user lacks the requisite knowledge to deal with the complexity embedded in a technology. A technology has different types of features. Some features may represent the core of the technology, while others may be at the periphery (Griffith 1999). As users learn more about the technology, more features can be used at the post-acceptance stage. Since some users have gained experience in using a specific feature, they are more likely to explore new ways to apply the feature (Jasperson et al. 2005). This explorative usage behavior can be also regarded as, in spirit, a kind of re-invention. Given their high propensity to explore new functions, innovative users should thereby be positioned to play an active role in this learning process. In this vein, users with higher personal innovativeness with IT can serve as crucial change agents. Innovative users are a valuable resource to cope with potential problems in the implementation of enterprise systems. However, unlike beliefs and affects, personal innovativeness with IT is a rather stable individual characteristic that is less likely to vary across circumstances (Agarwal and Prasad 1998). In other words, personal innovativeness with IT will not be easily influenced by environmental or internal variables. It may be therefore difficult to change users' personal innovativeness with IT through organizational interventions. Instead of trying to manipulate personal innovativeness with IT, managers should focus on identifying

individuals who are innovative toward IT innovations through recruitment and selection; and then encourage these individuals to creatively use IS beyond the originally envisioned benefits.

6.5 Contribution

This dissertation contributes to the post-acceptance research and mandatory usage research by examining the determinants that affect individual employees' emergent use of enterprise systems in mandatory organizational contexts.

6.5.1 Post-Acceptance Research

Kimberly (1981) notes that most of previous studies sought to predict information systems adoption, but ignored what happened after adoption. Some researchers recognized this and gradually extended adoption research to acceptance research. Here, adoption refers to the decision to make use of a technology (Rogers 2003), while acceptance stands for initial technology usage after adoption (Bhattacherjee 2001). IS adoption and acceptance are the first step to IS effectiveness because we cannot expect efficacy and effectiveness from systems that are not adopted and accepted. However, how to use the system at the post-acceptance stage will directly affect IS effectiveness.

Some researchers have realized the importance of post-acceptance usage behaviors to IS effectiveness and success. The post-acceptance behaviors may include "incorporation" (Kwon and Zmud 1987), "routinization", "infusion" (Saga

and Zmud 1994), “continuance” (Bhattacherjee 2001), and “post-adoption behavior” (Jasperson et al. 2005). It is very common that users initially accept and use an IS, but after they have direct experience about the system, they may stop using it. Therefore, post-acceptance behaviors may not be an extension of adoption and acceptance (Bhattacherjee 2001). In order to explore post-acceptance behaviors, Bhattacherjee (2001) borrowed expectation-confirmation theory (Oliver 1980) from the consumer behavior literature to propose the IS continuance model, which identified the determinants of perceived usefulness, satisfaction, and confirmation of expectation in the post-acceptance stage.

The organizational assimilation framework suggested that emergent use is supposed to take place after employees achieve routinized use, specifically in the infusion stage. In order to have a clear understanding about how employees gradually move to the infusion stage, the organizational assimilation framework was also incorporated into the model developed in this study. Acknowledging the previously discussed conceptualization of IS implementation processes by Zmud and his colleagues, Bhattacherjee (2001) distinguished initial use during the acceptance stage from continued use at the post-acceptance stage. Conceptually speaking, the post-acceptance stage described by Bhattacherjee (2001) encompasses the routine and infusion stages mentioned by Saga and Zmud (1994). Therefore, the IS continuance model is suggested to be useful for understanding use behavior that occurs at the post-acceptance stage. Based on the above discussion, one important contribution of this study is that it combines the organizational assimilation framework with the IS continuance model to investigate the emergent use issue. The theory combination has added a detailed theoretical explanation of the process through which an employee user can achieve an emergent use state.

6.5.2 Mandatory Usage Research

The focus of this study was on emergent use within a mandatory organizational setting. A mandatory use environment is where users perceive use to be organizationally compulsory (Agarwal and Prasad 1997; Hartwick and Barki 1994). Reviewing the related mandatory use literature, Ward et al. (2005) used user attitude as a dependent variable. They examined the impact of organizational level influences on individual user attitudes toward system use over time. Meanwhile, they highlighted the importance of establishing positive attitudes early in the implementation process and continuing to portray the system positively even after it has been implemented. In addition, Karahanna (1999) and Nah et al. (2004) used symbolic adoption as a dependent variable in mandatory usage contexts. Symbolic adoption has been shown as the key antecedent of IS use that is innovative in nature (Karahanna and Agarwal 2006). Karahanna and Agarwal (2006) define symbolic adoption as "a peak motivational state reflective of a user's mental evaluation of the technology and its use as a worthwhile concept" (p. 8). It represents the key motivation for extra-role behaviors.

For the original IS continuance model (Bhattacherjee 2001), it is noted that behavior intention, rather than behavior, is the dependent variable. Nevertheless, under most circumstances, employees in organizations often have no choice but to use the installed system (Brown et al. 2002). Therefore, behavioral intention may not be adequate to explain actual use behavior in the mandatory context. The emerging literature also suggests that intention to use may not be the best predictor of actual usage at the post-acceptance stage (e.g., Jasperson et al. 2005; Kim and Malhotra

2005). Jasperson et al. (2005) noted the phenomenon of system underutilization at the post acceptance stage. These usage behaviors include using a narrow band of features, operating at low levels of feature use, and rarely initiating the available feature extensions. The usage behaviors at the post-acceptance stage might not be predicted by behavioral intention. Kim and Malhortra (2005) proposed the important effect of past use on usage behavior. Following this line of reasoning, behavior (i.e., Emergent Use) rather than behavioral intention is the focus of this study. Emergent use is the highest level of post-acceptance behaviors (Saga and Zmud 1994). Therefore, the second contribution of this study is to open a door to the knowledge in understanding the mandatory usage issue.

6.6 Conclusion

To recapitulate, system emergent use is an emerging and critical issue for firms implementing enterprise systems. Understanding emergent use permits insights into innovative IS behaviors that lead to significant benefits for organizations. Emergent use also provides explanations for the under-achievement or failure of many enterprise system initiatives. Drawing upon the insights of the individual IS continuance model and organizational assimilation framework, a model was proposed to approach this phenomenon. The model was empirically examined in two large manufacturing firms that have implemented ERP systems with mandatory usage for more than one year. The results suggest that IS emergent use is influenced by perceived usefulness, personal innovativeness with IT, and satisfaction with IS use. A good understanding of the employees' emergent use provides an immediate linkage to specific factors that managers and employees can lever to improve

performance. The concept of emergent use warrants a promising avenue for studying IS post-acceptance behavior. The current research represents an important first step toward tackling the emergent use issue in organizational contexts. It can provide an immediate linkage to specific factors that managers and employees can leverage to improve performance. Further research should be examined for different technologies in different use contexts.

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APPENDIX

APPENDIX A

Construct Measurement

Construct	Measure	Scale and Sources	Reliabilities in Original Studies
Confirmation of Expectation	COE1. My experience with using the ERP system was better than what I expected. COE2. The service level provided by the ERP system was better than what I expected. COE3. Overall, most of my expectation from using the ERP system was confirmed.	7 point scale Bhattacherjee (2001)	Cronbach's Alpha=0.82
Satisfaction	SAT1. I am very satisfied with the ERP system usage. SAT2. I am very pleased with the ERP system usage. SAT3. I am very contented with the ERP system usage. SAT4. I am absolutely delighted with the ERP system usage.	7 point scale Bhattacherjee (2001)	Cronbach's Alpha=0.87
Perceived Usefulness	PU1. Using the ERP system improves my job performance. PU2. Using the ERP system in my job increases my productivity. PU3. Using the ERP system enhances my effectiveness in my job. PU4. Overall, the ERP system is useful in my work.*	7 point scale Davis et al. (1989)	Cronbach's Alpha=0.97
Personal Innovativeness with IT	PIIT1. If I heard about a new information technology, I would look for ways to experiment with it. PIIT2. Among my peers, I am usually the first to try out new information technologies. PIIT3. In general, I am hesitant to try out new information technologies.* PIIT4. I like to experiment with new information technologies.	7 point scale Agarwal & Prasad (1998)	Cronbach's Alpha=0.84
Computer Self-efficacy	I could complete the job using the software package CSE1... if there was no one around to tell me what to do as I go.* CSE2... if I had only the software manuals for reference. CSE3... if I had seen someone else using it before trying it myself. CSE4... if I could call someone for help if I got stuck. CSE5... if someone else had helped me get started. CSE6... if I had a lot of time to complete the job for which the software was provided.	11 point scale Compeau & Higgins (1995b)	Cronbach's Alpha=0.95
Management Support	MS1. Training courses are readily available for employees to improve themselves in using the ERP system. MS2. A central support (e.g. information center) is available to help with problems. MS3. There is always a person in the organization to whom employees can turn for help in solving problems with using ERP system. MS4. Upper management has provided adequate financial and other resources to the ERP system implementation effort. MS5. Management is really keen to see that their employees are happy with using the ERP system. MS6. Management has not provided most of the necessary help and resources to get the employees to use the ERP system quickly. *	7 point scale Adapted from Igbaria (1990)	Composite reliability=0.76

Emergent Use	EU1. I often experiment with new features of this ERP system to support my work. EU2. I have found new uses of this ERP system to enhance my productivity. EU3. I have used this ERP system in novel ways to help my work.	7 point scale Adapted from Ahuja & Thatcher (2005), Karahanna & Agarwal (2006), and Nambisan et al. (1998)	Cronbach's Alpha= 0.78, 0.94, 0.93

(Notes: * dropped items)

APPENDIX B

Data Pooling Method

Since the data were collected from the two firms, data pooling issues should be considered cautiously. To further evaluate the appropriateness to pool data from two firms for analysis, the author applied multi-group measurement invariance analysis (Doll et al. 1998; Steenkamp and Baumgartner 1998) to evaluate that (1) if the measurement models are invariant between firm A and firm B, and (2) if the structural models are the same across firms.

First, the author used configural and metric invariance analyses to evaluate if the measurement models are invariant. Configural invariance denotes that the patterns of item loadings are congeneric across firms, whereas item loadings are not necessarily the same (Doll et al. 1998; Steenkamp and Baumgartner 1998). No restrictions were imposed on metrics across firms when modeling configural invariance (Doll et al. 1998). Next, metric invariance checks whether items have equal loadings between firms. Item loadings were therefore constrained to be equivalent across firms when modeling metric invariance. The change in CFI (0.007) between the two nested model is smaller than the suggested threshold 0.01 (Cheung and Rensvold 2002), supporting measurement invariance. Since these two invariance models are nested, the difference between them can be assessed through a chi-square test. Doll et al. (1998) contended that chi-square test is sensitive to sample size and recommended to evaluate the changes in RMSEA, CFI, and TLI. More recently, Cheung and Rensvold (2002) suggested evaluating the change in CFI as a relatively

more reliable examination. Specifically, invariance is supported if the change in CFI between two nested models is smaller than 0.01 (Cheng and Rensvold 2002).

Table B-1 presents the results of the measurement invariance assessment. The minimum changes in RMSEA (0), TLI (0.003), and especially CFI (0.007) collectively suggest measurement invariance between the two groups. Comparisons of path coefficients and latent construct means are thus meaningful.

Table B-1: Multi-group Measurement Invariance Analysis

Model	RMSEA	TLI	CFI
Configural Inv.	**0.050**	**0.936**	**0.948**
Metric Inv.	**0.050**	**0.933**	**0.941**

The establishment of measurement invariance suggests that employees in both firms conceive these constructs identically, thus permitting meaningful comparison of their structural models (Doll et al. 1998; Steenkamp and Baumgartner 1998). An overall comparison of the structural models across firms was subsequently performed. That is, every corresponding pair of path coefficients was constrained to be equal across firms and examined the CFI difference between that model and the one in which those paths were freely estimated. Again, the minimum changes in RMSEA (0.001), TLI (0.003), and particularly CFI (0.008), jointly suggests that the structural models are not statistically different between two firms; therefore it is appropriate to pool the data from both firms for analysis.

Table B-2: Omnibus Test

Model	RMSEA	TLI	CFI
Uncontrained	**0.050**	**0.933**	**0.941**
Constrained	**0.049**	**0.930**	**0.933**

APPENDIX C

Correlation Matrix

	COE1	COE2	COE3	PU1	PU2	PU3	SAT1	SAT2	SAT3	SAT4	PIIT1	PIIT2	PIIT4	CSE2	CSE3	CSE4	CSE5	CSE6	MS1	MS2	MS3	MS4	MS5	EU1	EU2	EU3
COE1	1.00																									
COE2	0.60	1.00																								
COE3	0.43	0.54	1.00																							
PU1	0.42	0.42	0.39	1.00																						
PU2	0.42	0.38	0.30	0.61	1.00																					
PU3	0.46	0.36	0.35	0.66	0.53	1.00																				
SAT1	0.43	0.37	0.40	0.44	0.42	0.44	1.00																			
SAT2	0.40	0.49	0.41	0.43	0.41	0.48	0.68	1.00																		
SAT3	0.44	0.45	0.40	0.41	0.43	0.42	0.65	0.68	1.00																	
SAT4	0.40	0.46	0.40	0.30	0.32	0.44	0.45	0.62	0.58	1.00																
PIIT1	0.42	0.29	0.25	0.44	0.44	0.44	0.36	0.29	0.31	0.21	1.00															
PIIT2	0.11	0.19	0.17	0.23	0.20	0.16	0.13	0.15	0.22	0.15	0.49	1.00														
PIIT4	0.18	0.18	0.12	0.30	0.33	0.34	0.24	0.24	0.23	0.20	0.48	0.40	1.00													
CSE2	0.34	0.27	0.23	0.38	0.37	0.38	0.25	0.24	0.22	0.24	0.56	0.36	0.37	1.00												
CSE3	0.36	0.30	0.21	0.37	0.37	0.34	0.28	0.27	0.28	0.23	0.51	0.37	0.35	0.65	1.00											
CSE4	0.31	0.20	0.27	0.37	0.37	0.43	0.28	0.23	0.19	0.21	0.51	0.26	0.38	0.69	0.61	1.00										
CSE5	0.32	0.25	0.24	0.33	0.42	0.42	0.29	0.24	0.21	0.22	0.51	0.27	0.31	0.62	0.59	0.74	1.00									
CSE6	0.26	0.24	0.23	0.28	0.28	0.37	0.23	0.20	0.20	0.25	0.41	0.32	0.31	0.60	0.55	0.65	0.62	1.00								
MS1	0.44	0.41	0.34	0.43	0.42	0.49	0.28	0.32	0.30	0.31	0.47	0.25	0.31	0.44	0.39	0.49	0.49	0.40	1.00							
MS2	0.40	0.33	0.32	0.49	0.49	0.58	0.34	0.31	0.30	0.27	0.55	0.24	0.39	0.47	0.38	0.54	0.54	0.40	0.67	1.00						
MS3	0.39	0.26	0.30	0.38	0.35	0.42	0.36	0.34	0.23	0.25	0.46	0.14	0.35	0.35	0.29	0.39	0.43	0.34	0.53	0.56	1.00					
MS4	0.30	0.33	0.19	0.31	0.37	0.38	0.33	0.25	0.25	0.21	0.29	0.08	0.22	0.29	0.24	0.34	0.38	0.25	0.44	0.43	0.44	1.00				
MS5	0.36	0.37	0.28	0.45	0.39	0.45	0.31	0.32	0.31	0.27	0.39	0.23	0.32	0.34	0.26	0.40	0.41	0.35	0.48	0.53	0.58	0.51	1.00			
EU1	0.53	0.37	0.31	0.50	0.50	0.52	0.44	0.36	0.37	0.32	0.61	0.25	0.34	0.49	0.43	0.44	0.40	0.39	0.47	0.50	0.35	0.29	0.40	1.00		
EU2	0.36	0.29	0.25	0.48	0.48	0.39	0.42	0.35	0.36	0.27	0.44	0.29	0.23	0.36	0.38	0.32	0.31	0.30	0.36	0.32	0.29	0.18	0.27	0.57	1.00	
EU3	0.42	0.36	0.26	0.40	0.50	0.42	0.39	0.33	0.38	0.37	0.46	0.21	0.25	0.33	0.38	0.33	0.38	0.33	0.38	0.40	0.29	0.28	0.29	0.60	0.68	1.00

APPENDIX D: Questionnaire (ENGLISH)

20 August 2005

Re: Employees' Ability, ERP Systems and Extent of Use Survey

Dear ERP System User:

You have been selected to participate in an important research project. The attached survey instrument has been developed to ascertain your attitudes toward ERP systems, your personal characteristics, and organizational context. The purpose of this survey is to understand factors important for employees to innovatively use ERP systems in organizations.

If your organization is implementing Enterprise Resources Planning systems, and you are using the systems to support your work, I cordially invite you to provide your opinions via the following questionnaire. The questionnaire has six pages. The questionnaire should take about 15 minutes to complete. The research results depend on your complete questionnaires. All of your response will remain **strictly confidential**. Your individual responses will only be available to the principal investigator of this project. Results will be presented in summary format only so that individuals cannot directly or indirectly identified.

Thanks for your support and cooperation. If you have any problem, please contact Ms. Wei Wang at (852) 2766 7404 (email: wang.wei@) during normal working hours.

Yours faithfully

Wei Wang

PhD Candidate
Department of Management and Marketing
The Hong Kong Polytechnic University

PART I: PERSOANL PROFILE (Strictly Confidential)

1. How long have you been in your organization?

[ ] <1 year [ ] 1-4 years (including 4) [ ] 4-8 years (including 8) [ ] 8-12 years (including 12) [ ] 12-16 years (including 16) [ ] 16+ years

2. What is your highest level of education?

[ ] Primary School [ ] Junior High School [ ] Senior High School
[ ] Junior College/Polytechnic [ ] Bachelor's Degree [ ] Master's Degree
[ ] Doctorate Degree or above

3. What is your age range?

[ ] 18-22 years old [ ] 23-29 years old [ ] 30-39 years old [ ] 40-49 [ ] 50-59 years old

4. Gender:

[ ] 1 Male [ ] 0 Female

5. Which department are you in?

[ ] Accounting and Finance [ ] Marketing [ ] Production [ ] Human resource management [ ] Others _____

PART II: PERCEPTIONS OF USERS' SELF-EFFICACY, ERP SYSTEMS AND THE EXTENT OF USE (ERP SYSTEM USERS）

Computer Self-Efficacy

Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment by circling a number from 1 to 10, where 1 indicates "Not at all confident," 5 indicates "Moderately confident," and 10 indicates "Totally confident."

0	1	2	3	4	**5**	6	7	8	9	**10**
Not at all confident					**Moderately confident**					**Totally confident**

CSE1 I could complete the job using the software package if there was no one around to tell me what to do as I go.	0	1	2	3	4	5	6	7	8	9	10
CSE2 I could complete the job using the software package if I had only the software manuals for reference.	0	1	2	3	4	5	6	7	8	9	10
CSE3 I could complete the job using the software package if I had seen someone else using it before trying it myself.	0	1	2	3	4	5	6	7	8	9	10
CSE4 I could complete the job using the software package if I could call someone for help if I got stuck.	0	1	2	3	4	5	6	7	8	9	10
CSE5 I could complete the job using the software package if someone else had helped me get started.	0	1	2	3	4	5	6	7	8	9	10
CSE6 I could complete the job using the software package if I had a lot of time to complete the job for which the software was provided.	0	1	2	3	4	5	6	7	8	9	10

For each of the statements below, please circle the most appropriate number to express your thought.

Please rate the following items on a seven-point likert scale according to your opinions and ideas by circling the most appropriate number. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=agree, and 7=strongly agree.

Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
1	**2**	**3**	**4**	**5**	**6**	**7**

Personal IT Innovativeness

PIIT1 If I heard about a new information technology, I would look for ways to experiment with it.	1	2	3	4	5	6	7
PIIT2 Among my peers, I am usually the first to try out new information technologies.	1	2	3	4	5	6	7
PIIT3 In general, I am hesitant to try out new information technologies.	1	2	3	4	5	6	7
PIIT4 I like to experiment with new information technologies.	1	2	3	4	5	6	7

Management Support

MS1 Training courses are readily available for employees to improve themselves in using the ERP system.	1	2	3	4	5	6	7
MS2 A central support (e.g. information center) is available to help with problems.	1	2	3	4	5	6	7
MS3 There is always a person in the organization whom employees can turn to for help in solving problems with using ERP system.	1	2	3	4	5	6	7
MS4 Upper management has provided adequate financial and other resources to the ERP system implementation effort.	1	2	3	4	5	6	7
MS5 Management is really keen to see that their employees are happy with using the ERP system.	1	2	3	4	5	6	7
MS6 Management has not provided most of the necessary help and resources to get the employees to use the ERP system quickly.	1	2	3	4	5	6	7

Confirmation of Expectation

COE1 My experience with using the ERP system was better than what I expected.	1	2	3	4	5	6	7
COE2 The service level provided by the ERP system was better than what I expected.	1	2	3	4	5	6	7
COE3 Overall, most of my expectation from using the ERP system was confirmed.	1	2	3	4	5	6	7

Perceived Usefulness

PU1 Using the ERP system improves my job performance.	1	2	3	4	5	6	7
PU2 Using the ERP system in my job increases my productivity.	1	2	3	4	5	6	7
PU3 Using the ERP system enhances my effectiveness in my job.	1	2	3	4	5	6	7
PU4 Overall, I find the ERP system useful to my job.	1	2	3	4	5	6	7

Satisfaction

SAT1 I am very satisfied with the ERP system usage installed in my organization.	1	2	3	4	5	6	7
SAT2 I am very pleased with the ERP system usage installed in my organization.	1	2	3	4	5	6	7
SAT3 I am very contented with the ERP system usage installed in my organization.	1	2	3	4	5	6	7
SAT4 I am very delighted with the ERP system usage installed in my organization.	1	2	3	4	5	6	7

Emergent Use

EU1 I often experiment with new features of this ERP system to support my work.	1	2	3	4	5	6	7
EU2 I have found new uses of this ERP system to enhance my productivity.	1	2	3	4	5	6	7
EU3 I have used this ERP system in novel ways to help my work.	1	2	3	4	5	6	7

Probably, there are other factors not involved in this questionnaire. I cordially invite you to provide your complementary opinions to me. Your opinions will be very helpful for my further research.

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Thank you very much for your time and participation.

The End

APPENDIX E: Questionnaire (CHINESE)

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

问卷调查

员工对自身的能力、ERP 系统以及使用程度的认识

ERP 系统的用户：

欢迎您参加以下这个研究项目。此项研究的主要目的是了解 ERP 系统深层次使用的促进因素，以验证我的研究模型，完成我的博士论文。

如果您任职的企业正在实施企业资源计划（Enterprise Resources Planning， ERP）系统，同时您也在工作中使用这个系统，我热忱地希望您把意见通过以下问卷提供给我。**本问卷调查共有 6 页，请您抽出宝贵时间回答以下问题。**该研究的分析结果有赖于您提供**完整**的问卷。本问卷调查仅供研究用途，您所填写的内容绝对保密，并不对外公开。问卷内容只用作整体性分析，您毋须填写姓名及任职公司名称。如您对研究结果感兴趣，请与我联系索取。谢谢您的支持与配合！

对此项研究有任何疑问，请与研究人员联系。联系电话： 130688（广州）。电子邮件：wangkeer_99@

填写本问卷大约占用您 15-20 分钟。

王玮
博士候选人
管理及市场学系
香港理工大学

APPENDIX E: QUESTIONNAIRE (CHINESE)

第一部分：ERP 用户的基本信息（由 ERP 系统的用户填写）

1．您在这个企业工作了多长时间？

◇1 1 年以下（包括 1 年） ◇2 1-4 年 （包括 4 年）◇3 4-8 年 （包括 8 年）◇4 8-12 年 （包括 12 年）◇5 12-16 年 （包括 16 年）◇6 16 年以上

2．您最高的教育程度是什么？

◇1 小学 ◇2 初中 ◇3 高中 ◇4 大专 ◇5 大学本科 ◇6 硕士 ◇7 博士或以上

3．您的年龄范围：

◇1 18-22 ◇2 23-29 ◇3 30-39 ◇4 40-49 ◇5 50 岁以上

4．您的性别： ◇1 男 ◇2 女

5．您在哪个部门工作？

◇1 财务部 ◇2 市场部 ◇3 生产部门 ◇4 人力资源部 ◇5 其它 （请写出具体名称）_____

APPENDIX E: QUESTIONNAIRE (CHINESE)

第二部分：ERP 用户对自身的能力、ERP 系统以及使用程度的认识
（由 ERP 系统的用户填写）

计算机能力的自我评定 (CSE)

我们在工作中常被告知使用电脑软件能够给我们的工作带来便利。回答下列问题时，设想你得到一个与你工作有关的新软件。对于这个软件的内容是什么并不重要，重要的是它将使你的工作更加容易，而且你以前从未用过它。

下列问题旨在让你说出是否能在不同的情境下使用这个软件。请表明在以下十种情境中用这个软件完成工作的信心程度，并圈选“0”至“10”范围内的数字来评估自己的信心程度。这里，“0”表示“完全不自信”，“5” 表示“中度自信”，“10” 表示“完全自信”。

0 1 2 3 4 **5** 6 7 8 9 **10**
完全不自信 **中度自信** **完全自信**

CSE1 如果使用软件时无人在旁指点，我也能用这个软件完成工作。	0	1	2	3	4	5	6	7	8	9	10
CSE2 如果我有软件操作指南供参考的话，我能够用这个软件完成工作。	0	1	2	3	4	5	6	7	8	9	10
CSE3 如果我曾见过其他人使用此软件，我就能够用它来完成工作。	0	1	2	3	4	5	6	7	8	9	10
CSE4 如果使用过程中遇到麻烦时，有人帮忙的话，我能够用这个软件完成工作。	0	1	2	3	4	5	6	7	8	9	10
CSE5 如果开始时有人帮助的话，我能够用这个软件完成工作。	0	1	2	3	4	5	6	7	8	9	10
CSE6 如果我有足够时间的话，我能够用这个软件完成工作。	0	1	2	3	4	5	6	7	8	9	10

请在下面的每条题目中，圈上最能表达你的想法的项目。

请在以下问项后圈选从“1”到“7”范围内的数字来表达自己的意见和看法。其中，“1”表示“非常不同意”，“4”表示“意见中立”，“7”表示“非常同意”。

非常不同意	不同意	少许不同意	意见中立	少许同意	同意	非常同意
1	**2**	**3**	**4**	**5**	**6**	**7**

信息技术的个人创新 (PIIT)

PIIT1 如果我听说有新的信息技术，我会想办法来试用它。	1	2	3	4	5	6	7
PIIT2 在我的同事中，我总是率先试用新的信息技术。	1	2	3	4	5	6	7
PIIT3 一般来说，我对是否使用新的信息技术犹豫不决。	1	2	3	4	5	6	7
PIIT4 我喜欢试用新的信息技术。	1	2	3	4	5	6	7

管理支持 (MS)

MS1 企业开设的培训课程能帮助员工提高 ERP 系统的使用能力。	1	2	3	4	5	6	7
MS2 支持部门（如信息中心）帮助解决 ERP 系统实施中的各种问题。	1	2	3	4	5	6	7
MS3 当员工在使用 ERP 系统遇到问题时，企业里总会安排人来帮助解决。	1	2	3	4	5	6	7
MS4 高层管理人员提供了足够的财力及其它资源来促进 ERP 系统的推广应用。	1	2	3	4	5	6	7
MS5 管理部门希望看到员工对 ERP 系统的使用感到满意。	1	2	3	4	5	6	7
MS6 管理部门没有提供必要的帮助和资源来促使员工们尽快应用 ERP 系统。	1	2	3	4	5	6	7

期望的确认程度 (COE)

COE1 应用 ERP 系统的体验比我想象的要好。	1	2	3	4	5	6	7
COE2 ERP 系统提供的服务水平比我想象的要好。	1	2	3	4	5	6	7
COE3 总的来说，我使用 ERP 系统的大多数期望都得到了确认。	1	2	3	4	5	6	7

感知效用 (PU)

PU1 应用 ERP 系统能够改善我的工作表现。	1	2	3	4	5	6	7
PU2 应用 ERP 系统能够提高我的生产能力。	1	2	3	4	5	6	7
PU3 应用 ERP 系统能够提高我的工作效率。	1	2	3	4	5	6	7
PU4 总的来说，我认为 ERP 系统对我的工作非常有用。	1	2	3	4	5	6	7

满意度 (SAT)

SAT1 我对 ERP 系统的使用非常满意。	1	2	3	4	5	6	7
SAT2 ERP 系统的使用令我感到愉快。	1	2	3	4	5	6	7
SAT3 ERP 系统的使用令我心满意足。	1	2	3	4	5	6	7
SAT4 ERP 系统的使用令我感到高兴。	1	2	3	4	5	6	7

创新性使用 (EU)

EU1 我经常尝试使用这个 ERP 系统的新功能来支持我的工作。	1	2	3	4	5	6	7
EU2 我已经找到了 ERP 系统使用的新方法来提高我的生产能力。	1	2	3	4	5	6	7
EU3 我以新的方式使用 ERP 系统来帮助我的工作。	1	2	3	4	5	6	7

也许还有其它因素没有在以上问卷中涉及。我热切希望您能利用以下空间，把补充意见反馈给我。您的意见将有助于我下一步的研究。

感谢您的支持与配合！

~ 完 ~

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