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Beyond Routine: Symbolic Adoption, Extended Use, and Emergent Use of Complex Information Systems in the Mandatory Organizational Context

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BEYOND ROUTINE: SYMBOLIC ADOPTION, EXTENDED USE, AND EMERGENT USE OF COMPLEX INFORMATION SYSTEMS IN THE MANDATORY ORGANIZATIONAL CONTEXT

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Abstract

Organizational investments in complex information systems (CIS) have reached a record high. However, the underutilization of these expensive CIS prevents organizations from achieving the advertised return on investment. This study attempts to address this issue from the perspective of extended use and emergent use. Extended use concerns using more of the technology features, while emergent use concerns applying the technology in a novel manner to support task performance. To study uses that surpass routine use, a special focus is placed on the motivational factor that drives these behaviors. Drawing upon the insights from information system (IS) infusion, the IS continuance model, and the symbolic adoption theory, this paper proposes a research model for understanding extended and emergent use in mandatory organizational contexts. The model was examined in two large manufacturing firms that had implemented CIS for at least two years. The results suggest that perceived usefulness, satisfaction, and symbolic adoption influence extended use, and that perceived usefulness, symbolic adoption, and extended use affect emergent use. More importantly, the concept of symbolic adoption offers a theoretical explanation for extended and emergent use from the motivational point of view. Implications for theory and practice are also discussed.

Keywords: Extended use, emergent use, symbolic adoption, infusion, IS continuance model

Introduction

Modern organizations make significant investments in complex information systems (CIS). For example, organizations 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). ERP implementation projects in large organizations can easily cost more than \$100 million (Robey et al.; Seddon et al. 2003). However, the results of these initiatives are rather disappointing. Nearly half of these projects experienced failures (Adam and O'Doherty 2003). And organizations that implement ERP rarely use their systems to the fullest potential and realize the promised return on investment (Jasperson et al. 2005). This underachievement can be partially attributed to the underutilization of the implemented systems. To

address this issue, this research turns to two use concepts (i.e., extended use and emergent use) that can potentially lead to higher organizational impact. This paper further investigates the factors that influence these two types of use behaviors with a special focus on the notion of Symbolic Adoption as the motivational explanation.

CIS are typically adopted at the organizational level, and employees are often obligated to use the adopted system. In mandatory contexts, it is common that employees routinely use CIS only at the basic level and in a normal manner prescribed by the management. This standard and routine use represents a surface level utilization (Agarwal 2000) that makes it difficult to reach the full potential of the system. Nevertheless, under the mandatory circumstance, employees still retain considerable discretion to determine whether, and to what extent, to use the CIS to support their tasks (Silver 1990; 1991). Meanwhile, the complexity of CIS allows users to utilize it at distinct levels. Higher level of performance is usually associated with higher level of use (Cooper and Zmud 1990). The highest level of use is expected to occur when system implementation process evolves from the routine stage to the infusion stage (Cooper and Zmud 1990). During the infusion stage, employees can use the system in a more comprehensive and sophisticated way to support their works. Such use behavior as extended use and emergent use, which surpass standard and routine use, can further materialize the value of CIS. In this research, extended use refers to using more of the technology's features to support an individual's task performance; emergent use refers to using a technology in an innovative manner to support an individual's task performance. But what are the factors that stimulate these use behaviors?

Symbolic adoption (SA) 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. The interest of this research centers on whether symbolic adoption can theoretically account for extended use and emergent use in a mandatory context. In addition, symbolic adoption has demonstrated its explanatory value beyond the Technology Acceptance Model (TAM) in voluntary contexts (Karahanna and Agarwal 2006). To extend the theoretical value of this concept, it is important to know if the concept offers additional leverage in the mandatory context and in other technology acceptance models, such as the IS continuance model that focuses on post-acceptance behaviors (Bhattacharjee 2001).

In short, this study examines the determinants that affect individual employees' extended use and emergent use of complex information systems, in particular when there is an organizational mandate to use the systems. The key purposes of this paper are (1) to identify the key factors that influence extended use and emergent use, (2) to study the role of symbolic adoption in explaining extended use and emergent use of CIS in the mandatory context, and (3) to investigate the value of symbolic adoption in the IS continuance model. The remainder of this paper is organized as follows. The next section delineates the theoretical foundations and proposes a research model for IS extended and emergent use. The third section describes the research methodology, including the procedures of data collection and measurement development. The fourth section presents the data analysis and results. Finally, this study concludes with a summary of limitations and the implications for theory and practice.

Theoretical Foundations and Research Hypotheses

Theoretical Foundations

This study investigates post-acceptance behaviors, particularly emergent use and extended use within mandatory organizational settings. Emergent use and extended use reflect the different dimensions of individual IS use at the infusion stage of system implementation (Agarwal 2000; Cooper and Zmud 1990; Moore 2002). Extended use concerns the extent of utilized system functions, while emergent use relates to the novel ways of applying the system. Since post-acceptance behaviors are not simply an extension of acceptance behaviors, some researchers have examined factors that might influence users' post-acceptance behaviors but not necessarily behaviors prior to their acceptance. Bhattacharjee (2001) developed the IS continuance model, which posits that perceived usefulness, confirmation of expectation, and satisfaction play important roles in affecting continuance intention at the post-acceptance stage. Given its focus on the post-acceptance behaviors, the IS continuance model serves as an ideal theoretical perspective for understanding emergent use and extended use.

Moreover, employees' IS use is often obligatory in organizational contexts, and employees may need to utilize a technology that has been mentally rejected. Rawstorne et al. (1998) and Karahanna (1999) termed this phenomenon

as “innovation dissonance,” which means symbolic decision is at odds with actual behavior. Innovation dissonance can lead to detrimental behavioral consequences (Markus 1983; Ram and Jung 1991). According to Klonglan and Coward (1970), in a voluntary environment, symbolic adoption is virtually a prerequisite in order for actual adoption to occur; on the other hand, in a mandatory environment, actual adoption is enforced and not necessarily predicted by symbolic adoption. Following this logic, symbolic adoption may not explain routine use that is enforced by the management. However, symbolic adoption may account for use behaviors that go beyond the management’s expectations (Karahanna and Agarwal 2006), such as emergent use and extended use. To formulate a research model to study extended and emergent use, this paper introduces IS infusion, the IS continuance model, and the symbolic adoption theory as the theoretical foundation.

IS Infusion

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 complex information 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 use that an organization is able to fully leverage its IS investment (Sage and Zmud 1994). Cooper and Zmud (1990) introduced a six-stage model of IS implementation process: initiation, adoption, adaptation, acceptance, routinization, and infusion. The last three stages refer to different levels of implementation activities. *Acceptance* reflects users’ commitment to use the IT. *Routinization* describes the state where system use is no longer perceived as out-of-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). 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 concepts of extended use and emergent use.

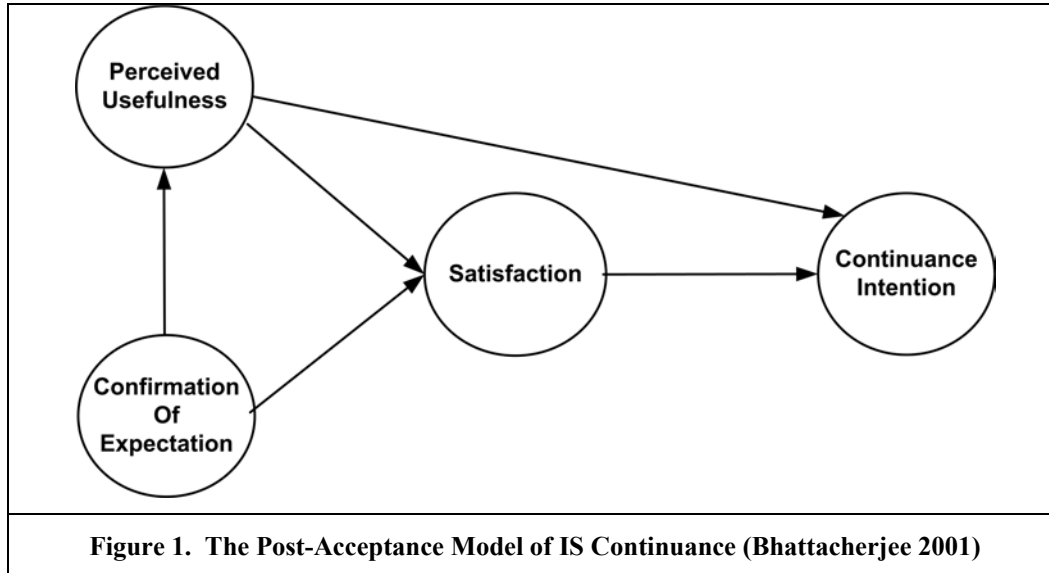
According to Saga and Zmud (1994), extended use describes how users’ apply more of the technology’s features in order to accommodate a more comprehensive set of work tasks. Schwarz (2003) later proposed a related concept, “deep usage,” which is defined as the extent of use of different technology functionalities. On the other hand, Saga and Zmud (1994) referred to emergent use as using the technology 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 mentioned some 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 generally concern two aspects of system use: (1) using more of the system functions, and (2) using the system innovatively. Some concepts link technology use to task performance, while others do not. In light of the above discussions and the emphasis on organizational contexts, this paper refers to *extended use* as using more of the technology’s features to support an individual’s task performance and *emergent use* as using a technology in an innovative manner to support an individual’s task performance.

IS continuance Model

Based on expectation-confirmation theory, Bhattacherjee (2001) developed an IS continuance model (Figure 1), which is best suited to post-acceptance stages. This model posits that users’ IS continuance intention is determined primarily by their satisfaction with prior system use. User satisfaction is determined 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, users’ extent of confirmation is positively associated with the perceived usefulness of IS use. This study employed extended use and emergent use, instead of continuance

intention, as the key dependent variables. This is because employees' use of CIS is usually compulsory in organizational contexts, and behavioral intention may not fully account for behavior (Nah et al. 2004; Rawstorne et al. 1998).



Symbolic Adoption Theory

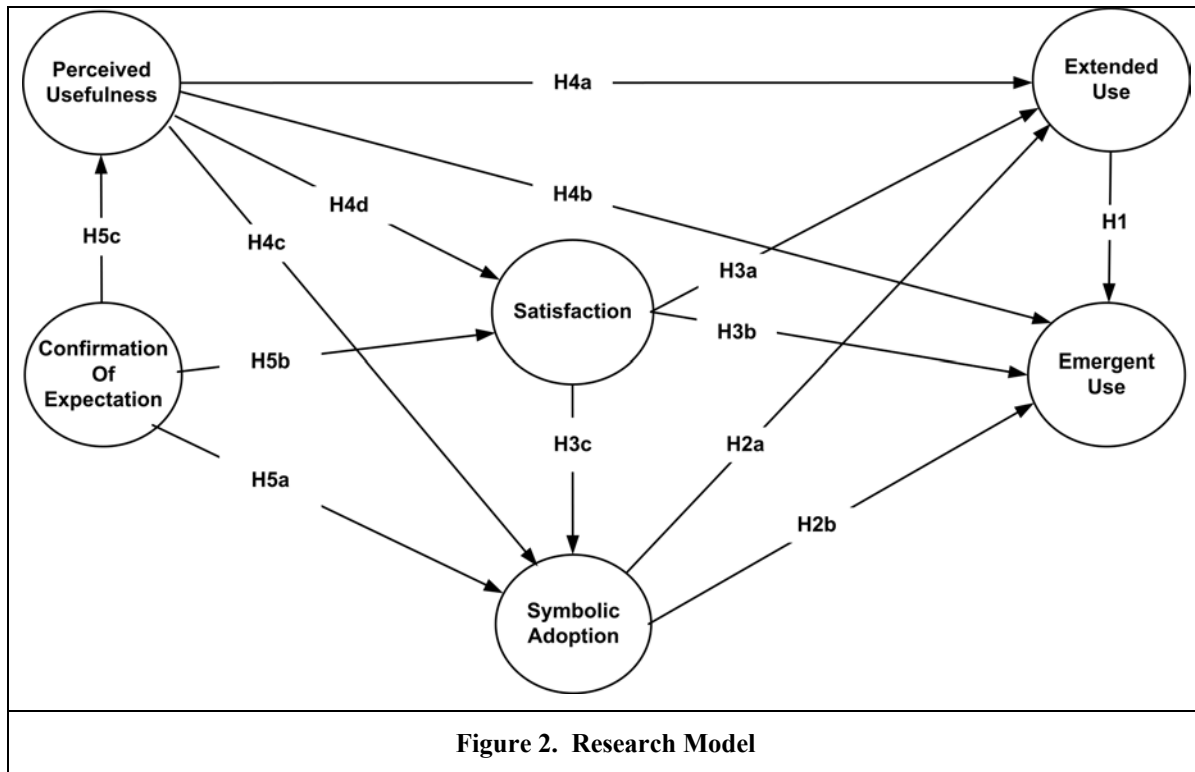
Moore (2002) suggested that motivation plays a critical role in determining IS use and the level of use. Symbolic adoption is defined as “the peak motivational state reflective of a user’s mental evaluation of the technology and its use as a worthwhile concept” (Karahanna and Agarwal 2006). Karahanna and Agarwal (2006) suggested that symbolic adoption, which was conceptualized as a formative construct, includes four sub-dimensions: (1) *mental acceptance*, which means the extent to which a user views the artifact, in principle, as a good idea; (2) *use commitment*, which stands for the degree to which one is committed to the use of the technology independent of whether it is mandated or not; (3) *effort worthiness*, which refers to the user’s positive evaluation of the return on resources expended in order to be able to use the technology; and (4) *heightened enthusiasm*, which represents the eagerness with which a user approaches the behaviors associated with technology use.

Klonglan and Coward (1970) suggested that there are two important components in the adoption process: symbolic adoption and use adoption. In a voluntary context, when an employee encounters the specific system adopted by the management, s/he has two decisions to make: to accept or not to accept the idea, and to use or not to use the system. A majority of extant research assumed that individual acceptance follows organizational system implementation almost immediately (Grover 1993; Premkumar 1994). However, mandated use takes the inverse order. It is common for an employee to be forced to use the system even before s/he has mentally accepted the system. In other words, the employee’s attitude and mental acceptance of the system has no bearing on his or her choice of using the system.

Karahanna and Agarwal (2006) emphasized two levels of usage: in-role and extra-role behaviors. *In-role behaviors* refers to employees using the adopted IT for the tasks and in the manner prescribed to them, while *extra-role behaviors* means discretionary constructive efforts that benefit the organization and that extend above and beyond the prescribed work activities. When symbolic adoption is less than actual adoption, employees are less likely to devote their resources, such as time and effort, to engage in extra-role behaviors with respect to the technology (Karahanna and Agarwal 2006), and thus limiting the overall potential benefits that can be derived from the system. Arguably, extended use and emergent use are instances of extra-role behaviors, since both concern use behaviors that surpass management prescriptions and constructively facilitate task performance (Karahanna and Agarwal 2006). As a result, symbolic adoption is critical in order for users to engage in creative and intensive modes of IS use to achieve IS effectiveness (Nah et al. 2004).

The proposed research model (Figure 2) rests on the synthesis of the notion of IS infusion, the IS continuance model, and the symbolic adoption theory. Extended use and emergent use represent IS infusion. In addition, the IS continuance model suggests that post-acceptance behaviors can be influenced by attitudinal considerations and

perceived usefulness. Finally, symbolic adoption offers the motivational explanation of extended use and emergent use.



Research Hypotheses

Saga and Zmud (1994) argued that the ultimate end-state for IS implementation is infusion, 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 information systems, more sophisticated use behaviors, such as extended use and emergent use, would be of greater value (Agarwal 2000). Saga and Zmud (1994) implied a temporal relationship between different use behaviors during the infusion stage. By using more of the technology (i.e., extended 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.

H1: Extended use is positively associated with emergent use.

In a mandatory context, employees are forced to use a newly implemented system. Employees' reluctance or unwillingness to use the system is commonly cited as the reason an implementation fails (Barker and Frolick 2003; Krasner 2000). The lack of user acceptance leads to rote, rather than sophisticated, use of the system (Nah et al. 2004). In this instance, sophisticated use is in spirit similar to extended and emergent use. Therefore, a good understanding of employees' mental acceptance of information systems is vital to system implementation success, especially when higher levels of use behaviors are of concern. When employees mentally accept a system, users are more likely to invest time and effort to engage in extra-role behaviors, such as using more system features and exploring the new ways to use the system.

H2a: Symbolic adoption is positively associated with extended use.

H2b: Symbolic adoption is positively associated with emergent use.

Satisfaction, an experience-based affect, is a user's feelings toward an IS (Oliver 1980). IS success models have supported the strong association between user satisfaction and use (DeLone and McLean 1992, 2003; Seddon 1997). The IS continuance model also suggests the behavioral influence of satisfaction on use at post-acceptance stage (Bhattacharjee 2001). In addition, in an organizational context, if employees are satisfied with their direct interaction with the system, they are more likely to embrace the system, try out more functions, and explore new ways of using the technology.

H3a: Satisfaction is positively associated with extended use.

H3b: Satisfaction is positively associated with emergent use.

Users' mental acceptance of an IS should also be related to their feelings toward the technology. Karahanna (1999) and Nah et al. (2004) provided empirical evidence that users' attitudinal affect toward system use is a significant predictor of symbolic adoption. Presumably if users are satisfied with their direct interaction with a system, they are more likely to elevate their mental acceptance of the system; strengthen their commitment to use the system; amplify the perception that investment in learning to use the system would be worthwhile; and even stimulate their enthusiasm about applying the technology to enhance their task performance. Hence, the following hypothesis is posited:

H3c: Satisfaction is positively associated with symbolic adoption.

Perceived usefulness captures the instrumentality of system use (Davis 1989). During the post-acceptance stages, perceived usefulness is formed mostly through users' first-hand experience. This experience-based belief about a system becomes more reliable as individual experience increases (Bhattacharjee 2001). Research in IS acceptance has consistently revealed the positive association between the perceived usefulness and actual use at various implementation stages, including the post-acceptance stage (Bhattacharjee 2001). Thus, perceived usefulness at post-acceptance stages may cause employees to extend the system capabilities and find new ways to use the system.

H4a: Perceived usefulness is positively associated with extended use.

H4b: Perceived usefulness is positively associated with emergent use.

Individuals' motivations to use an information system, to a large extent, rely on their belief in the practical utility of the system. If users believe that the system can enhance their job performance, they are more inclined to mentally accept the system; commit to using it; develop the perception that time and effort spent in learning the system would be valuable; and become more enthusiastic about using the system.

H4c: Perceived usefulness is positively associated with symbolic adoption.

Previous studies have revealed that perceived usefulness impacts individuals' affect substantively across IS diffusion stages (Davis et al. 1989; Karahanna et al. 1999). While both attitude and satisfaction represent individual affects, satisfaction can be conceived as a post-acceptance affect reflecting direct personal experience (Bhattacharjee 2001). Moreover, as perceived usefulness influences attitude affect during acceptance, perceived usefulness is expected to be the salient belief that influences satisfaction affect post acceptance (Bhattacharjee 2001).

H4d: Perceived usefulness is positively associated with satisfaction.

During post-acceptance stages, confirmation of expectation is an important cognitive belief (Bhattacharjee 2001). Confirmation is the extent to which users' expectation is confirmed. Conversely, disconfirmation occurs when actual performance is lower than expected performance (Szajna and Scamell 1993). Although mandated users in organizational contexts have no power to decide whether or not to use the technology, confirmation of outcome expectation may facilitate their mental acceptance of, commitment to, positive evaluation of, and enthusiasm about the system use. In addition, confirmation is positively related to satisfaction with IS use because it implies the realization of the expected benefits of using the technology (Bhattacharjee 2001).

H5a: Confirmation of expectation is positively associated with symbolic adoption.

H5b: Confirmation of expectation is positively associated with satisfaction.

Perceived usefulness is another salient cognitive belief during post-acceptance stages (Bhattacharjee 2001). At the acceptance stage, because users do not have enough information about the system, they are uncertain about what to expect from a new IS. Under this circumstance, users may have low initial usefulness perceptions of the system (Bhattacharjee 2001). Once they have actual experience with the system, their initial usefulness perceptions can be easily confirmed. However, if their initial usefulness perceptions are not confirmed during actual interaction, users may experience cognitive dissonance or psychological tension. Therefore, users often have the tendency to adjust their perceptions to be consistent with the reality. That is, confirmation can enhance perceived usefulness. The above discussion leads to the following hypothesis:

H5c: Confirmation of expectation is positively associated with perceived usefulness.

Research Method

The main focus of this research is the role of symbolic adoption in influencing post-acceptance use behaviors, particularly emergent use and extended use within mandatory organizational settings. ERP systems are the target CIS of investigation. An ERP system can be viewed as an enterprise-wide IS that integrates all aspects of business processes. Since it touches a wide variety of a company's internal and external operations, ERP system implementations are both complex and challenging (Gattiker and Goodhue 2005). Unlike traditional and simple information systems, ERP systems are sophisticated and represent a completely different class of IT application. Given the focus on employees' extended and emergent use, this research directly targets use behaviors at the post-acceptance stage. To do so, the scope of this study was confined within ERP systems that were initially adopted by the senior management and then needed to be diffused and infused throughout the organizations. The unit of analysis is the end user of an ERP system. Furthermore, to ensure the mandatory context, system use has to be mandated with respect to all participants. The sections below describe the procedures of measurement development and data collection.

Data Collection Procedure

The sample is a group of 450 employee users of the same ERP system in two large manufacturing firms in Guangzhou, China.¹ The two firms had used ERP systems for more than two years. The ERP systems they deployed were offered by the same top-ranking global ERP solution vendor. More attention is placed on large enterprises in

¹ Guangzhou is 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).

the manufacturing industry because these enterprises are more likely to possess sufficient resources, and ERP systems are widely used in this industry. According to the study conducted by Boudreau (2003), 15 months following the implementation, the ERP system installed in an organization was still not being used to its full potential. Since no general information is available about the time frame for attaining system infusion, one year seems an apposite time period for an enterprise to progress to the infusion stage. Therefore, the sampled firms were expected to have their ERP systems implemented for at least more than one year. The survey instrument was then administered to 230 employees in one organization and 220 in another. These employees were randomly sampled from various departments. Next, among the 401 returned surveys, 385 surveys were complete and usable for analysis, equivalent to a response rate of 85.6 percent. Table 1 presents the demographic characteristics of the survey sample.

Table 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 Resource Management	11.5%
	Others	23.4%

Measures

The research model has six constructs, all of which were operationalized using multi-item scales adapted from existing scales. The wording of measurement items was slightly modified to fit the particular context of ERP usage. All the measures use a seven-point Likert scale, from "strongly disagree" to "strongly agree." Items previously operationalized in the IS continuance model (Bhattacharjee 2001) were applied for confirmation of expectation (three items), perceived usefulness (four items), and satisfaction (four items). Since no established measures were available specifically for extended use and emergent use, similar constructs discussed in the earlier section were reviewed. For extended use, "deep usage" (Schwarz 2003) captures the extent of use of more system features. Three

items were adapted to reflect extended use based on the deep usage construct, with the link to enhance individual task performance. For emergent use, “Trying to innovate with IT” (Ahuja and Thatcher 2005) and “Intention to Explore” (Karahanna and Agarwal 2006; Nambisan et al. 1998) are the two most related notions that capture individual intention to use IS innovatively. Three items were adapted from these two constructs, with the emphasis on actual innovative use behavior that supports individual task performance. Symbolic adoption was conceptualized as a formative construct, consisting of four sub-dimensions, including heightened enthusiasm (three items), mental acceptance (three items), use commitment (three items), and effort worthiness (two items) (Karahanna and Agarwal 2006).

Data Analysis and Results

Structural equation modeling (SEM) was used for data analyses. Following the widely accepted two-stage approach, the measurement model was assessed prior to the structural model. Confirmatory factor analysis (CFA) was performed by using AMOS 5.0 to evaluate the construct validity, since this approach offers a rigorous assessment of the fit between the sampled data and the theoretical measurement model. Partial least square (PLS) was next applied in order to examine the structural model for its ability to model formative constructs (Gefen et al. 2000).

Measurement Model

Measurement properties of all multi-item reflective constructs were first evaluated with CFA. After deleting four items with low loading², the resulting fit indices suggest acceptable fit (Table 2). Table 3 shows the descriptive statistics of the research constructs.

Goodness of Fit Indices	Initial Model	Revised Model	Desired Levels
χ^2 /df	2.853	2.26	< 3.0
CFI	0.897	0.945	> 0.90
TLI	0.876	0.929	> 0.90
RMSEA	0.063	0.057	0.05-0.08
Standardized RMR	0.0646	0.043	< 0.05
GFI	0.852	0.903	> 0.90
AGFI	0.069	0.865	> 0.80
Number of Latent Variables	9	9	
Total Number of Items	28	24	

² The four items include one item from Perceived Usefulness, one item from Mental Acceptance, one from Use Commitment, and one from Extended Use.

Construct	Mean	S. D.
Confirmation of Expectation (COE)	4.76	1.22
Perceived Usefulness (PU)	4.84	1.25
Satisfaction (SAT)	4.57	1.21
Symbolic Adoption (SA): Heightened Enthusiasm (ENTH)	4.78	1.27
Symbolic Adoption (SA): Mental Acceptance (MAC)	5.15	1.24
Symbolic Adoption (SA): Use Commitment (UCOM)	3.95	1.30
Symbolic Adoption (SA): Effort Worthiness (EW)	5.10	1.27
Extended Use (EXU)	4.69	1.21
Emergent Use (EMU)	4.28	1.29

Notes: All constructs are seven-point scales with the anchors 1=strongly disagree, 4=Neutral, 7=Strongly agree.

Cronbach's alpha, composite reliability, and average variance extracted (AVE) of each constructs were also evaluated (Fornell and Larcker 1981). As can be seen in Table 4, the values of Cronbach's alpha and composite reliabilities are all higher than the recommended 0.707 (Nunnally 1994); and values of AVE are all above 0.50 (Fornell and Larcker 1981). Next, discriminant validity was supported because the value of AVE of a construct should be higher than its squared correlations with other constructs. The above results collectively suggest a good measurement model.

Dimensions	Number of Items	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
SA: ENTH	3	0.82	0.83	0.60
SA: MAC	2	0.75	0.77	0.58
SA: UCOM	2	0.78	0.79	0.69
SA: EW	2	0.74	0.81	0.59
COE	3	0.77	0.87	0.68
PU	3	0.83	0.89	0.74
SAT	4	0.87	0.91	0.71
EXU	2	0.73	0.77	0.71
EMU	3	0.82	0.90	0.75

Structural Model

Following the establishment of the measurement model, the structural model was assessed with PLS. Symbolic adoption is conceptualized as a multi-dimensional construct where each sub-dimension does not necessarily correlate with others (Karahanna and Agarwal 2006), and it should be treated as an aggregate multi-dimensional

construct (Law et al. 1998). Symbolic adoption is therefore modeled as a second-order formative construct consisting of the four sub-dimensions as indicators. It is measured using multivariate means for each dimension. The multivariate mean approach is based on the summated mean values of items. This approach is recommended for its advantage of permitting replications across samples (Hair et al. 1995), especially when the measurement items are internally consistent (Rozeboom 1979).

Next, a bootstrap analysis was conducted with 500 sub-samples. Figure 3 presents the results of the structural model, including weights³ of the formative construct (i.e., symbolic adoption), path coefficients between constructs, and explained variances of the dependent variables. All sub-dimensions of symbolic adoption are significant except use commitment. This may attribute to the mandatory use context, which requires little commitment from users to engage in use.

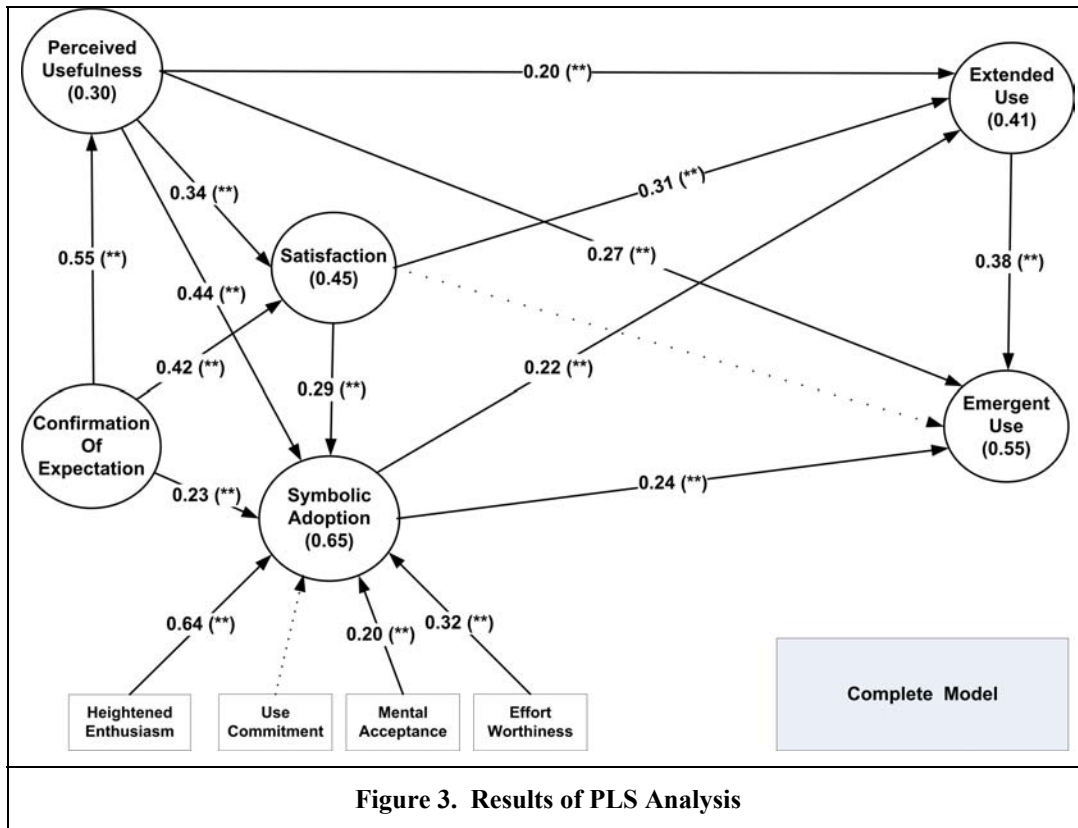


Figure 3. Results of PLS Analysis

As predicted, perceived usefulness (0.20), satisfaction (0.31), and symbolic adoption (0.22) all had significant influence on extended use and accounted for 41% of its variance. Furthermore, perceived usefulness (0.27), symbolic adoption (0.24), and extended use (0.38) all directly affected emergent use and explained 55% of its variance. Contrary to the hypothesis, satisfaction had no significant effect on emergent use. The impact of satisfaction to emergent use was mediated through symbolic adoption and extended use.

Also as expected, perceived usefulness (0.44), confirmation of expectation (0.23), and satisfaction (0.29) significantly influenced symbolic adoption and jointly explained 65% of its variance. In line with Bhattacharjee's study (2001), perceived usefulness (0.34) and confirmation of expectation (0.42) all affected satisfaction, accounting for 45% of its variance. In addition, confirmation of expectation (0.55) significantly explained 30% of the variance in perceived usefulness.

³ The weights of the formative construct in PLS are similar to the beta coefficients in a regression model.

Alternative Models

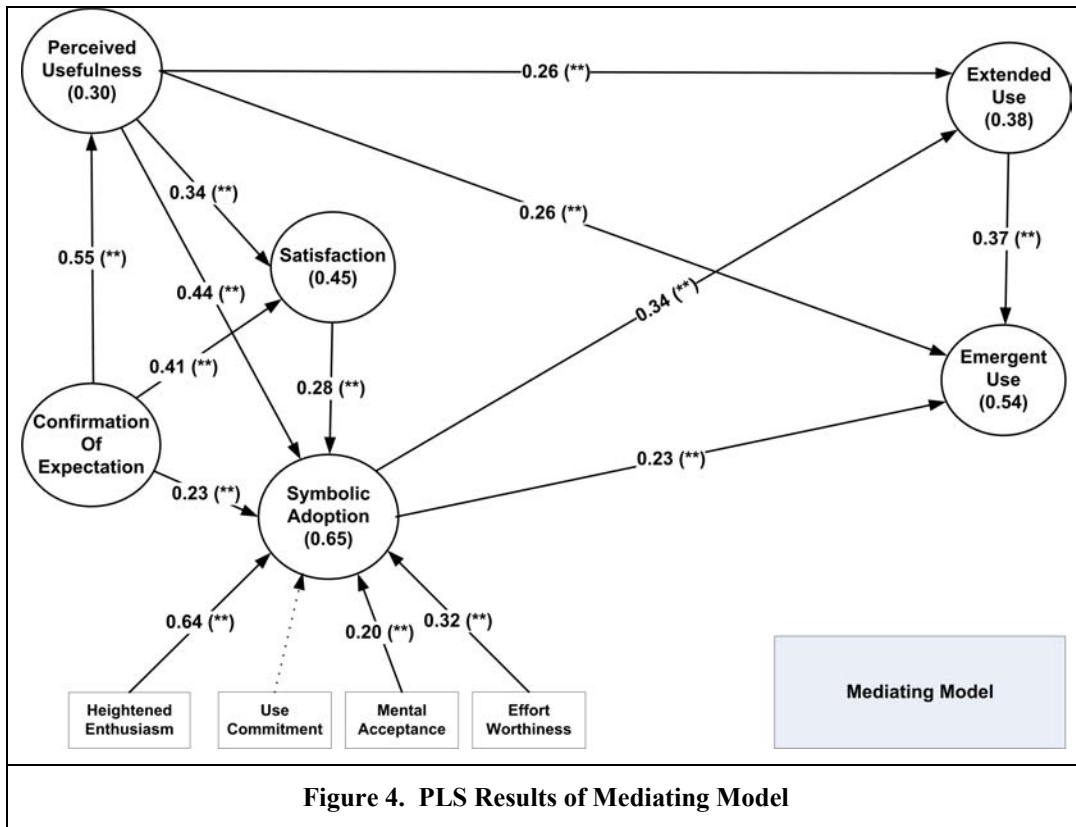
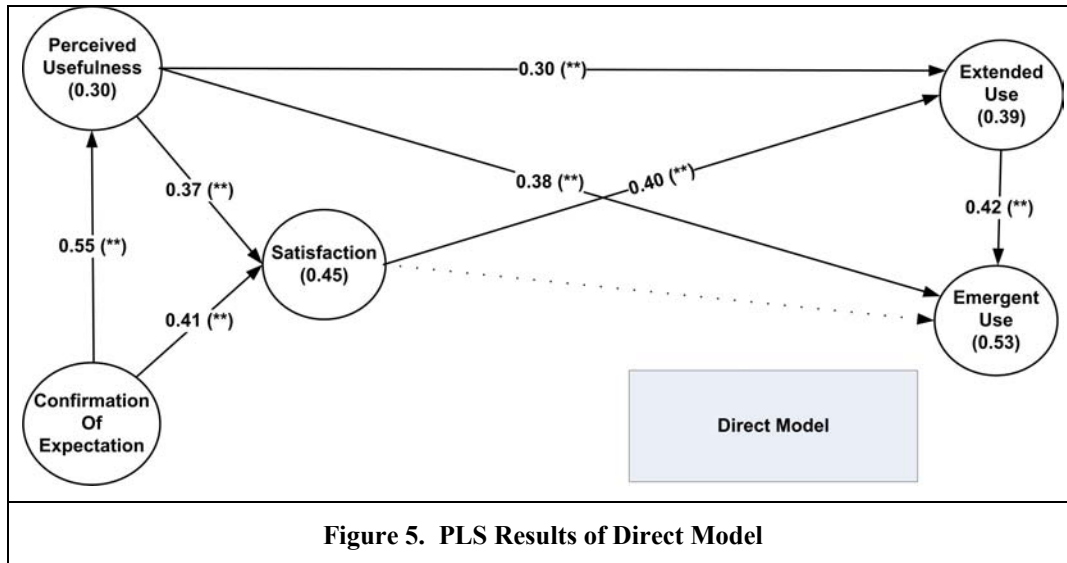


Figure 4. PLS Results of Mediating Model

To further verify the impact of symbolic adoption on extended use and emergent use, two additional models (i.e., the mediating and direct models) were also examined. The mediating model assumes that satisfaction has no direct bearing on the two types of uses, and its impact would be channeled through symbolic adoption. The results (Figure 4) illustrate that symbolic adoption mediates the behavioral influence of satisfaction. Without the direct path from satisfaction to extended use, the explanatory power of extended use decreased from 41% to 38%. And similar to the complete model, the mediating model successfully explained 54% of the variance in emergent use.

Next, in the direct model, symbolic adoption was not included. As shown in Figure 5, perceived usefulness (0.30) and satisfaction (0.40) both significantly influenced extended use and accounted for 39% of its variance. Perceived usefulness (0.38) and extended use (0.42) together accounted for 53% of the variance in emergent use. Similar to the complete model (Figure 3), satisfaction did not affect emergent use.



In all, extended use was affected by perceived usefulness, satisfaction, the two post-acceptance beliefs suggested by the IS continuance model, and symbolic adoption. Emergent use, on the other hand, was directly influenced by perceived usefulness, symbolic adoption, and extended use, but not satisfaction. The salience of perceived usefulness in these models suggests that employees are indeed pragmatic and utility-oriented when considering using the complex information system at a higher level. Symbolic adoption, on the other hand, reveals that a heightened motivational state which reflects personal evaluation of the IS does inspire employees to use more of the technology features and use the system more innovatively to support their task performance. Furthermore, the significant path from extended use to emergent use supports the assimilation theory that using more features increases the chances of using the system more creatively. Interestingly, satisfaction exerted little direct impact on emergent use. While the IS continuance model (Bhattacharjee 2001) proposes that user satisfaction derived from prior experience can shape intention for continued use, such satisfaction affect may also stimulate use that involves more technology functionalities, but not necessarily use that is creative in nature.

Across the three models, changes in the R squares, or the explained variance, of extended use and emergent use are minimal. For extended use, the R squares in the complete, mediated, and direct models were 0.41, 0.38, and 0.39, respectively; and 0.55, 0.54, and 0.53 for emergent use. Statistically, symbolic adoption seemed to contribute little to the explanatory power of the behavioral model for extended and emergent use. However, from the perspective of motivation theories, symbolic adoption provides a theoretical explanation to better understand extended and emergent use in the mandatory context.

Limitations

Similar to most empirical studies, this research has certain limitations. Measures of all constructs in this study were collected at the same point in time. However, the investigated constructs are not designed to remain unchanged. Thus, this cross-sectional study may not fully capture the complexity of the infusion phenomenon, thereby limiting the extent to which causality can be inferred. Future studies that use longitudinal research design will be able to infer causality more precisely. In addition, this study used self-reported measures for the extended use and emergent use constructs. These measures based on individual subjective perception may not faithfully represent the actual situation. It would be quite beneficial for future research to develop items that can objectively measure extended use and emergent use. Finally, the data were collected from a specific user group (i.e., employee users in large manufacturing organizations) using a single technology (e.g. ERP system). Caution should therefore be exercised when generalizing the research results to other technologies or environments. Future research may replicate this study to examine the robustness of the findings across a wide range of complex information systems as well as employees in other organizational contexts.

Implications

Complex information systems have become a core component of modern organizations. However, existing evidence shows that the functional potential of these applications is underutilized. 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). This phenomenon may be one of the major reasons for the under-achievement of complex information system implementation (Jasperson et al. 2005). Employees who explore the system features and innovatively use an IS can help organizations achieve significantly more for their investment. Better understanding of what drives individuals to use more features and use the system innovatively to its fullest extent is necessary for both researchers and managers.

Implications for Researchers

This study yields important implications for theory and research. First, motivation theories applied to the IS field to date primarily focus on intrinsic and extrinsic motivation (Venkatesh 1999; Venkatesh and Davis 2000). Intrinsic motivation refers to the pleasure and inherent satisfaction derived from a specific activity (Vallerand 1997), while extrinsic motivation emphasizes the utilitarian outcomes of the activity (Deci and Ryan 1987). Symbolic adoption, on the other hand, is indicative of a higher motivational state with four sub-dimensions: heightened enthusiasm, mental acceptance, use commitment, and effort worthiness. Results of this study show that symbolic adoption is a significant antecedent of extended use and emergent use. Although statistically symbolic adoption does not contribute much to the variance in the dependent variables, this concept opens a door to the wealth of knowledge in other motivation theories. This is particularly important as the attention of the field has progressed to the post-acceptance behaviors in which motivation for extra-role behaviors can be quite important.

Given the significance of symbolic adoption for post-acceptance behaviors, it is necessary to explore how to develop a higher motivational state of symbolic adoption. Future research should examine the antecedents of symbolic adoption and the moderators of its relationships with various use behaviors during post-acceptance stages. Toward this end, researchers may consider such factors as individual characteristics, organizational climate, managerial interventions, social dynamics, task and outcome interdependences, or organization citizenship behavior.

Implications for Practice

The findings of this investigation show that perceived usefulness and symbolic adoption are important determinants to extended use and emergent use. From the practical point of view, the association between perceived usefulness and extended and emergent use suggests that employee users appear to be fairly pragmatic. They are more likely to try more features and explore how to use IS when the system provides desirable utilities.

In addition, extended use and emergent use are extra-role behaviors (Karahanna and Agarwal 2006), and their accomplishment needs a heightened level of motivation. It is therefore important for managers to understand what managerial interventions can help develop this positive motivational state for employees. The concept of symbolic adoption in this study offers several dimensions that managers may leverage to enhance employees' motivation.

Moreover, satisfaction directly influences extended use and indirectly influences emergent use via symbolic adoption and extended use. This reflects the important role of satisfaction during post-acceptance stages. Meanwhile, this study points out that users' satisfaction is influenced by confirmation of expectation and perceived usefulness. The confirmation of users' expectations of usefulness about an IS results from their prior experiences. It is the process experienced by employee users that generates the most value. Therefore, to develop employees' positive satisfaction, managers should focus on factors as well as processes that can facilitate the creation of favorable user experience.

Conclusions

In summary, IS extended use and emergent use are two individual use behaviors that can occur during the infusion stage of IS implementation. Emergent use reflects the application of more technology features, whereas extended use concerns using technology in an innovative manner to support task performance. Understanding the use behaviors that go beyond standard and routine use permits insights into IS innovative behaviors that can lead to

significant organizational consequences. Synthesizing the knowledge from IS infusion, the IS continuance model, and the symbolic adoption theory, this research proposes a research model to explain extended use and emergent use of complex information systems in mandatory organizational contexts. The model was empirically examined in two large manufacturing firms that have implemented ERP systems with mandatory use for more than one year. The results suggest that emergent use is influenced by perceived usefulness, symbolic adoption, and extended use; extended use is influenced by perceived usefulness, satisfaction, and symbolic adoption. Although the statistical contribution of symbolic adoption to the dependent variables is limited, one should recognize the theoretical significance of symbolic adoption for these highest levels of use behaviors. Meanwhile, a good understanding of the employees' extended and emergent use provides an immediate linkage to specific factors that managers and employees can leverage to improve performance. This study is one of the early studies to link symbolic adoption and innovative use behaviors in mandatory organizational contexts. Their relationships should be worthwhile for further investigation in different use contexts.

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