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INVESTIGATING INFORMATION SYSTEMS INFUSION AND THE MODERATING ROLE OF HABIT: A USER EMPOWERMENT PERSPECTIVE

Human Behavior and Information Technology

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Abstract

Organizations have made significant investments in information systems (IS) implementation. However, more than half of these IS implementations have reported failures due to underutilization. Although it is known that IS infusion is required for realizing expected returns on investments, most IS research has focused on initial adoption and continuance with only a handful examined infusion. These few IS infusion studies have produced inconclusive results as they have employed models and factors that are used for adoption and continued use. Compare to adoption and continuance, IS infusion requires authentic motivation of users. Thus, this study examines IS infusion using user empowerment as the authentic motivation based on the psychological empowerment theory which can explain employee's behavior beyond management prescription. Results show that the four user empowerment dimensions have significant effects on the three IS infusion subtypes. Further, results show that habit attenuates the importance of user competence for extended use and integrative use but reinforces the importance of usage meaning for extended use and user self-determination for integrative use. This study advances our theoretical understanding of IS infusion and offers suggestions to organizations in achieving IS infusion.

Keywords: IS infusion, user empowerment, authentic motivation, habit

Introduction

Organizations continue to make significant investments in information systems (IS). According to one estimate, spending on IS is to reach US\$300 billion by 2013 (Gartner 2009). Nevertheless, a worryingly high number of IS implementations has reported failure because of underutilization (Gibson 2003; Ventana Research 2006). For instance, 70 to 80 per cent of Green Beacon's customers have underused their IS (Morphy 2006) in which the low usage level has resulted in low value being realized (Saha 2005). This implies high level of IS usage is necessary for enhancing organizational performance (Aral et al. 2006). Moreover, organizations are able to leverage on their IS investments only at IS infusion which refers to *using the system to its full potential* (Saga and Zmud 1994).

Extant IS research has long examined initial adoption of new technology and continuance from several theoretical perspectives assessing narrowly conceptualized usage behaviors (Burton-Jones and Straub 2006). Findings from this wealth of studies can only inform about user's initial adoption of the IS and his/her intention to continue using because consideration of whether the IS has been used to its full capability has not been given. What is missing is thus user's *infusion* of the IS. This theoretical limitation explains to a certain extent our lack of understanding of IS underutilization. As such, a shift from examining typical narrow aspects of usage (e.g., frequency of use) towards

broader views of usage (e.g., infusion) has been advocated to understand user's usage behaviors in using the IS to its full potential (Chin and Marcolin 2001; Schwarz and Chin 2007).

Toward that end, recent years have seen IS researchers responding to the call. Jones et al. (2002) and Sundaram et al. (2007) examined user's overall IS infusion while Wang and Hsieh (2006) and Hsieh and Wang (2007) investigated user's extended use and emergent use of IS. However, these handful of IS infusion studies has employed models and factors used in examining adoption and continued use. Consequently, weak and inconclusive results have been found (e.g., Hsieh and Wang 2007; Wang and Hsieh 2006) because rational-oriented predictors (e.g., usefulness, ease of use) used in adoption and continuance studies are less appropriate for examining infusion which is an extra-role behavior (Cooper and Zmud 1990). Inasmuch as to pursue beyond organization's mandated usage would entail personal risk taking because effort is not formally recognized by organizational reward system, what the literature has neglected is a political and learning orientation which can portray user's authoritative influence for IS infusion over time (Cooper and Zmud 1990). Specifically, political and learning orientation assumes that individual would experience holding authority through accumulated learning, and is distinct from other orientations (e.g., rational orientation) as it takes account of decision making under condition of uncertainty. Thus with substantial usage experience gained from earlier stages, user would feel having the authority to perform beyond management prescription for IS infusion instead of relinquishes it to management by following standard use.

Indeed, before organization can optimize IS potential, it should first optimize the potential of individual users (Sundaram et al. 2007). Hence, an authentic motivation (i.e., the fullest manifestation of intrinsic motivation) which carries a self-authored and -endorsed authority is needed for IS infusion (Ryan and Deci 2000). Authentic motivation has a political and learning orientation in which an individual acquires authority from learning of his/her environment to pursue personal interest with uncertain payoff. Although previous research has examined extrinsic (e.g., perceived usefulness) and intrinsic (e.g., satisfaction) motivations in which they have high prognostic power for initial adoption and continued use, these motivations are not strong enough for infusion because they lack time to induce a high motivational state (Jasperson et al. 2005). Therefore, routinization is needed to stabilize user's motivation towards IS infusion (Saga and Zmud 1994).

Routinization provides a stable context which facilitates IS infusion (Sundaram et al. 2007). At the same time, it is also conducive to habit formation (Limayem et al. 2007) because against the IT implementation model, routinization either facilitates infusion or stagnates at current usage (Cooper and Zmud 1994). Particularly, habit differs from routinization which is a unique mindset forms under high routinization. On the one hand, high level of routinization provides sufficient time for user to leverage on his/her learning acquired from daily usage of the IS (Jasperson et al. 2005). As a consequence, the increasing reflective cognitive processing of user engenders an authentic motivation for IS infusion (Fazio and Zanna 1981; Jasperson et al. 2005). On the other hand, reflective cognitive processing dissipates over time and non-reflective cognitive processing would come to eclipse user's mindset. At this threshold, habit develops and user uses the IS automatically (Jasperson et al. 2005; Limayem et al. 2007). Thus, the level of IS infusion achieved will be contingent on the relative influence of the deliberative and spontaneous cognitive processes guiding user's accessible attitude in memory (Jasperson et al. 2005).

Based on the above research needs, this study aims to examine IS infusion using user empowerment as the authentic motivation based on the psychological empowerment theory (Thomas and Velthouse 1990) which adopts a political and learning model in explaining individual's feeling in control through an active engagement in his/her environment to pursue extra-roles in the absence of formal rewards. Particularly, IS infusion which is to fully use the IS beyond management prescription is a form of organizational citizenship behaviors (OCB). In addition, habit is examined in this study because habit which develops under extreme situation of routinization has the property that could moderate (i.e., enhance or suppress) user empowerment for IS infusion. Specifically, we seek answers to two research questions: (1) How user empowerment influences IS infusion? (2) How habit moderates the user empowerment and IS infusion relationship?

The contributions of this study are manifold. First, it develops a theoretical model which examines user empowerment leading to infusion of installed IS. Second, it shows the moderating role of habit in the context of IS infusion. Third, it offers practical insights for organizations in improving and achieving maximum level of IS utilization by identifying factors that lead to IS infusion.

Theoretical Background

IS Infusion

IS infusion represents the highest level of use and consists of three subtypes (Saga and Zmud 1994): extended use, integrative use and emergent use. This study defines extended use as *using more of the system features to complete tasks*; integrative use as *using the system to reinforce linkages among tasks*; and emergent use as *using the system in an innovative manner to support tasks*. Infusion is distinct from adoption and continuance as it requires comprehensive and innovative uses of the IS. Whereas the latter IS usages merely refer to initial and regular uses respectively.

Research hitherto done on IS infusion have used factors and models from existing literature and have produced mixed results. For example, perceived usefulness was found to become insignificant for SFA infusion (Jones et al. 2002) but was significant for extended use and emergent use of ERP system (Wang and Hsieh 2006). Satisfaction was significant for extended use of ERP system, but was found insignificant in their subsequent study (Hsieh and Wang 2007; Wang and Hsieh 2006). Table 1 below summarizes previous IS infusion research.

Research	Characteristics		Findings
	Theoretical foundation	Motivation	
Jones et al. (2002)	TRA and TAM	Perceived usefulness	Insignificant for infusion of SFA system
		Facilitating condition	Significant for infusion of SFA system
Wang and Hsieh (2006)	IS continuance model, IS infusion and symbolic adoption concepts	Perceived usefulness	Significant for extended use and emergent use of ERP system
		Satisfaction	Significant for extended use but insignificant for emergent use of ERP system
		Symbolic adoption	Significant for extended use and emergent use of ERP system but does not contribute significantly to their variances
Hsieh and Wang (2007)	IS continuance model, TAM and synthesized model	Perceived usefulness	Marginally significant for extended use of ERP system
		Satisfaction	Insignificant for extended use of ERP system
Sundaram et al. (2007)	TRA and performance concept	Routinization	Significant for infusion of SFA system

On the whole, it is evident that the weak and inconclusive results are a consequence of the employment of rational-oriented predictors and models which are less appropriate for infusion (Cooper and Zmud 1990). Thus on the basis that a political and learning model is needed for examining infusion (Cooper and Zmud 1990), an authentic motivation will be essential to understand user's feeling of being empowered which is gained through critical dialogue with his/her environment to pursue IS infusion.

Psychological Empowerment Theory

The recognition of the centrality of authentic motivation has motivated this study to select psychological empowerment as the theoretical foundation to further our understanding on IS infusion. Psychological empowerment takes an individual's attitudinal stance and focuses on one's experience. It is a feeling of in control, negotiated through critical assessment of one's immediate environment (Thomas and Velthouse 1990). Specifically,

individual who feels empowered is authentically motivated and will engage in the desired activities volitionally (Gagne and Deci 2005).

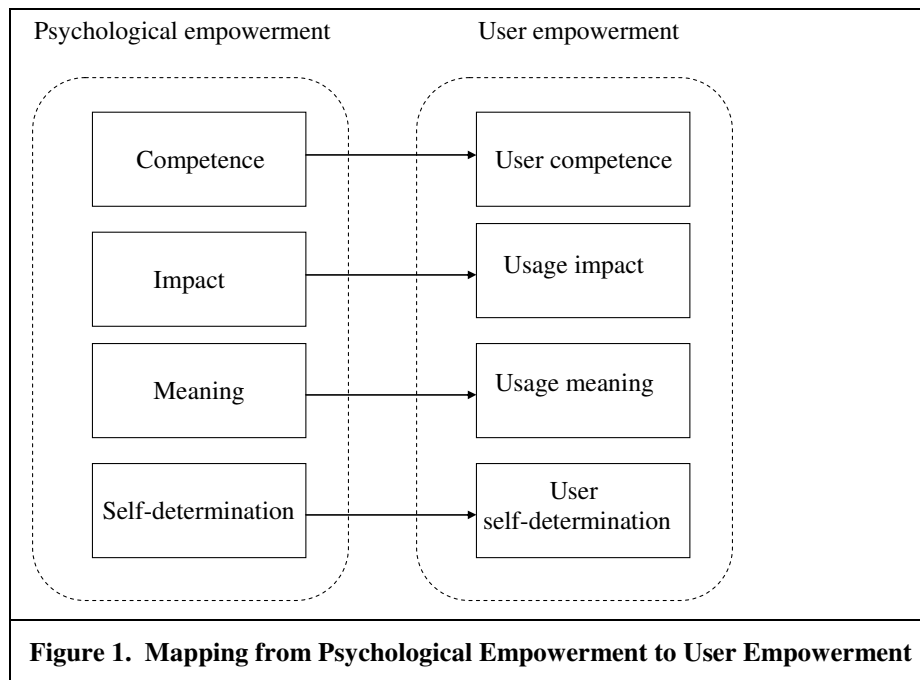
A pioneering work on psychological empowerment, Thomas and Velthouse (1990) adopted an interpretative approach and proposed four cognitions of empowerment. Building on Thomas and Velthouse’s conceptual work, Spreitzer (1995) defines each of the psychological empowerment cognitions as follows: Competence is an individual’s belief in his/her capability to perform activities with skill. Impact is the degree to which an individual can influence strategic, administrative, or operating outcomes at work. Meaning is the value of a work goal or purpose, judged in relation to an individual’s own ideals or standards. Self-determination is an individual’s sense of having choice in initiating and regulating actions.

Subsequently, there have been a number of empirical studies examining the effects of psychological empowerment on employee’s OCB, for instance, career intention and organizational commitment (Kraimer et al. 1999), work productivity and proactivity (Kirkman and Rosen 1999), and organizational commitment and job performance (Liden et al. 2000). Considering that psychological empowerment motivates employee in performing an array of OCB across multiple domains within his/her job role, there would be specific psychological empowerment influencing specific OCB in specific domain. By this reasoning, there would exist a specific psychological empowerment for IS infusion.

User Empowerment

This study proposes user empowerment and defines as *an authentic motivational state reflective of an individual’s orientation towards system usage*. Specifically, psychological empowerment and user empowerment differ in their levels of specificity. In this study, user empowerment is preferred to psychological empowerment because user empowerment, being a focused feeling of empowerment, is a more proximal predictor of IS infusion. Also, it has been suggested in the IS literature that the optimal level of specificity at which a concept should be assessed is a function of the specificity of the inquiry of interest (Agarwal et al. 2000).

As discussed earlier, the main premise of psychological empowerment theory is that empowered employee will exhibit OCB such as work proactivity (Kirkman and Rosen 1999) and innovative behaviors (Spreitzer 1995). In the same vein, user empowerment parallels the view of leading to extra-role behavior, this case IS infusion in particular. Based on the four dimensions of psychological empowerment (Spreitzer 1995), this study identifies four dimensions for user empowerment (see Figure 1): user competence, usage impact, usage meaning, and user self-determination.



Following the definitions proposed by Spreitzer (1995), we contextualize the four dimensions of user empowerment to be specific for system usage and defines user competence as *the degree to which an individual has relevant knowledge, skills and confidence in his or her ability to use the system*; usage impact as *the degree to which an individual's system usage can influence task outcomes*; usage meaning as *the value of system usage judged in relation to an individual's own ideals or standards*; and user self-determination as *an individual's discretion over system usage*.

Habit

Thereafter the adoption of an IS, past research has largely focused on user's intention as sole determinant of continuance usage. Such limited view on user's intention has been contended by IS researchers (e.g., Limayem and Cheung 2008) to be insufficient to fully understand the whole spectrum of the continuance phenomenon. Particularly, user's initial continued use is under the influence of intention, but his/her repetitive use of the IS would gradually become habitual when routinization is high. It is then likely that habit and not intention will come to dominate continuance usage (Limayem et al. 2007).

As the precondition for infusion (Saga and Zmud 1994), routinization creates an environment for both authentic motivation and habit to flourish. During this post-adoption stage, there will be two processes (deliberative cognitive process and spontaneous cognitive process) in operation within every individual user's mindset (Jasperson et al. 2005). When reflective cognitive processing is the primary driver, user is gaining experience, more information about system usage will shape and strengthen his/her attitude towards higher levels of uses (Fazio and Zanna 1981). Thus, from an individual learning perspective, the richer the learning process (greater the usage experience), the more predictive will be user's attitude toward his/her system use as user learns from the effect of his/her usage activities (Fazio and Zanna 1981). User would then leverage on his/her learning and develops an authentic motivation. When system usage becomes repetitive and routinized, habit for system usage will emerge. At this juncture, non-reflective cognitive processing gradually overrides reflective cognitive processing to become the primary driver.

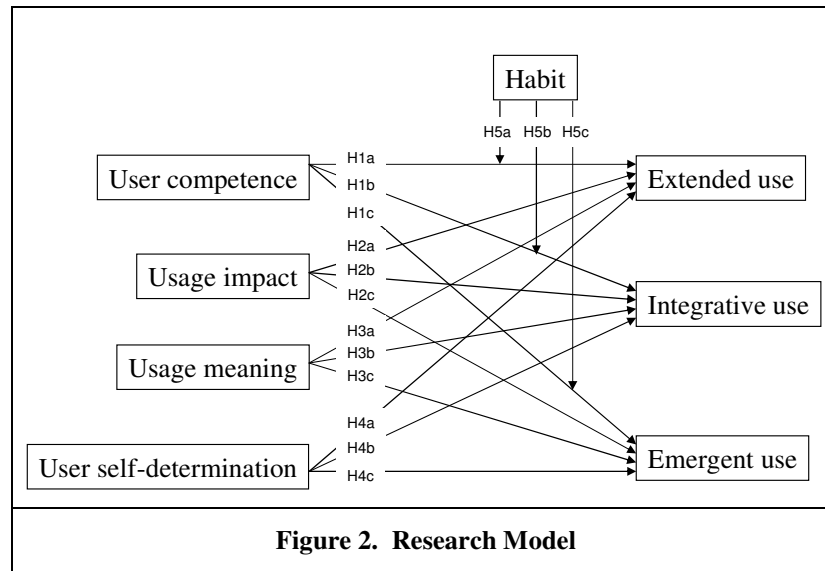
For this reason, there is a growing interest among IS researchers to examine the under-explored habit in post-adoption stage. Past research has conceptualized habit to be automatic in nature (Triandis 1980). When habit is formed, there is minimal attention to new information which results in less or no further learning (Verplanken 2006). Also, acquired knowledge will slowly become diluted as it gets displaced from user's accessible attitude (Aarts et al. 1998; Bassellier et al. 2001). Thus from the theoretical perspective, habit has a suppressing property in muting the importance of deliberative cognition on IS use.

A review of existing IS usage literature reveals that habit has been studied as both a direct effect on IS continuance usage as well as a moderator on the relationship between IS continuance intention and continuance usage. Studies that have examined the direct effect of habit had reported habit to explain substantial unique variance of IS continuance usage (Limayem and Cheung 2008; Limayem and Hirt 2003; Limayem et al. 2007). This shows that when user assumes a habitual usage manner, this will likely determine his/her IS continuance. However, examination of direct effect of habit on future behavior has been criticized to be powerful but of less theoretical value (Limayem et al. 2007; Verplanken and Aarts 1999). What will be more insightful is to examine the moderating effect of habit on cognitions for usage behaviors (Limayem et al. 2007; Verplanken and Aarts 1999). Such theoretical proposition has recently received empirical corroborations from Limayem and Cheung (2008) and Limayem et al. (2007), where both studies have found the predictive power of intention to be weakened by habit.

In line with previous research, this paper posits a moderating effect of habit on the relationship between user empowerment and IS infusion, and defines habit as *the extent to which an individual tends to use the system automatically because of learning* (Limayem et al. 2007).

Research Model and Hypotheses

Based on the theoretical discussion in the preceding section, we propose the research model as shown in Figure 2. The four dimensions of user empowerment are hypothesized as the antecedents of the three subtypes of IS infusion. In addition, among these enduring cognitions, competence possesses a dynamic characteristic as knowledge, skills, and confidence need to be renewed in keeping pace with changing environment (Bassellier et al. 2001), thus habit is hypothesized to moderate the relationship between user competence and IS infusion.



Psychological empowerment theory posits that individual who perceived competence would develop a feeling of in control of a particular situation (Thomas and Velthouse 1990). Thus, when user perceived having competence in using the IS to accomplish tasks, s/he would be able to maximize the usage (Bandura 1997). Armed with skills, knowledge and confidence, competent user has greater perception of the system potential and will anticipate and seize opportunities to perform value adding usage activities (Gorsline 1996). Specifically, user has a better grasp of the system functionalities and is able to use more of them to accommodate tasks (i.e., extended use) and to better organize related tasks (i.e., integrative use). S/he is also able to synthesize knowledge to experiment novel methods of use (i.e., emergent use) (Locke et al. 1984). Hence we hypothesize:

H1(a,b,c): User competence has a positive effect on IS infusion (extended use, integrative use, and emergent use).

When an individual feels empowered, s/he would perceive able to anticipate outcome (Thomas and Velthouse 1990). With the expectation of significant impact resulting from his/her usage level, user will be more engaged and channeled investments of discretionary work efforts to proactively exploit the IS to its full potential (Vroom 1964). Specifically, user would fully use the IS to enrich and broaden his/her task performance (i.e., extended use and integrative use), and add innovative elements (i.e., emergent use) to the customary way of system usage to improve the processes by which the task is performed (Bandura 1986). Hence we hypothesize:

H2(a,b,c): Usage impact has a positive effect on IS infusion (extended use, integrative use, and emergent use).

According to the psychological empowerment theory, individual performs target activity because s/he has perceived it to be meaningful (Thomas and Velthouse 1990). When a user perceives value of system usage to be in accordance with his/her personal needs and desires, s/he will perceive such use as being important and personally relevant (Baroudi et al. 1986; Jackson et al. 1997). When user perceives system usage to be meaningful, s/he would engage and commit in using more of the system functionalities to perform tasks (i.e., extended use), reinforce linkages among tasks (i.e., integrative use) and also try to use the IS creatively to accomplish tasks (i.e., emergent use) (Hunton and Price 1997). Otherwise, if user's perceived value of system usage is low, s/he would use it only perfunctorily (Lyytinen and Hirschheim 1987). This is consistent with Bandura's (1986) assertion that "people do not care much how they do in activities that have little or no significance for them, and they expend little effort on devalued activities" (p. 348). Hence we hypothesize:

H3(a,b,c): Usage meaning has a positive effect on IS infusion (extended use, integrative use, and emergent use).

An empowered individual would perceive having the autonomy to decide execution of target activity (Thomas and Velthouse 1990). When a user perceives the usage environment as being conducive and providing opportunities, s/he would take initiative to fully use the IS in tasks (Gagne and Deci 2005). Specifically, user perceives having discretion over the manners of system usage and need not wait for instructions before proceeding to exploit more of

the available system functionalities to support tasks (i.e., extended use), enhance coordination of related-tasks (i.e., integrative use) and explore new ways (i.e., emergent use) to better use the IS in accomplishing tasks (Scott and Bruce 1994). Hence we hypothesize:

H4(a,b,c): User self-determination has a positive effect on IS infusion (extended use, integrative use, and emergent use).

Previous empirical research has found habit to exhibit negative moderating effects on the relationship between IS continuance intention and IS continuance usage (Limayem and Cheung 2008; Limayem et al. 2007). Drawing on the concept of habit, our study posits that the positive relationship of user competence and IS infusion is contingent on habit. As user develops habit in using IS, s/he becomes less receptive to new information and stays with the current usage through established ways. Extra-role activities in exploiting more uses (i.e., extended use), reinforce task linkages (i.e., integrative use) and experiment with new uses (i.e., emergent use) which demand further learning would cease to occur (Verplanken and Aarts 1999). Consequently, competence which has a dynamic characteristic weakens over time because user's repertoire of knowledge, skills and confidence has become obsolete in face of changing environmental needs (Bassellier et al. 2001; Verplanken and Aarts 1999). Therefore as usage becomes habitual, user's perceived competence on his/her IS infusion would gradually be undermined. Hence we hypothesize:

H5(a,b,c): As the level of habit increases, the effect of user competence on IS infusion (extended use, integrative use, and emergent use) decreases.

Apart from the above hypotheses, we control for other potential determinants of IS infusion. The control variables are job type, rank, gender, age, job tenure, and work group climate for achievement. Previous research has suggested job type (Gallivan et al. 2005), rank (Gagne et al. 1997; Spreitzer 1996), gender (Correll 2001; Munro et al. 1997), age (Munro et al. 1997), job tenure (Munro et al. 1997), and work group climate for achievement (Joyce and Slocum 1984) may have effects on usage behavior. Job type (Gallivan et al. 2005) and rank (Gagne et al. 1997; Spreitzer 1996) are included to indirectly control for individuals' task-related requirements to use IS as individuals with different job natures and ranks are posited to experience feelings of empowerment to varying degrees (Zimmerman 1995). Gender has been found to correlate with competence in which male tends to overestimate, thus it is included as a control variable (Correll 2001; Munro et al. 1997). Work group climate for achievement is included because it has a positive effect on innovativeness (Anderson and West 1998). Finally, following previous research (Munro et al. 1997), we include age and job tenure to control for their potential effects on user competence. These variables will be included in the research model testing to control for their effects on IS infusion.

Research Methodology

Data to empirically validate the research model as shown in Figure 2 were collected through a field survey.

Target Organization and System

We collected data from a multinational high-tech manufacturing company in Singapore. The company, comprises of more than 5,000 employees, is one of the world's leading companies in its industry with annual revenue crossing US\$1 billion. In addition, the company has a long history of practicing empowerment as its corporate culture.

Prior to implementation, the company has been using a legacy system with several feeder systems to support their business processes. However over the years, the system environment has become increasingly complex with the ongoing modifications to meet changing business requirements. This has led the company to decide on adopting a solution package in streamlining and integrate its business operations. Thus in early 2007, the ERP system was implemented. The system comprising of eight major modules is critical to the company's business as it spans across core functions such as finance, inventory management, material requirements planning, procurement, online supplier systems, order management, and shipping. Using the ERP system, the company is now able to ensure data integrity, lower cost of asset ownership, manage supply base, facilitate communication with suppliers, improve operational efficiency, and streamline sales order process.

Instrument Development

For the measurement instrument development, we adapted existing validated scales for our research context, i.e., to use the system in tasks. One item for extended use was adapted from Hsieh and Wang's (2007) "use most of system features" (EXU2), another was adapted from Jones et al.'s (2002) "use all available system features" (EXU4). The other two items (EXU1 and EXU3) were newly developed to reflect the extended use based on their conceptualizations in previous research (Saga and Zmud 1994). The four items (ITU1, ITU2, ITU3, and ITU4) of the integrative use scale were developed based on the definition and literature review because there is no existing measure. For the emergent use scale, one item was adapted from Saeed and Abdinnour-Helm's (2008) "explore new uses" (EMU1), one item was adapted from Agarwal and Karahanna's (2000) "experiment with new ways of using" (EMU2), and two items were adapted from Ahuja and Thatcher's (2005) "often find new uses" (EMU3) and "use system in novel ways" (EMU4). As for the habit scale, one item was adapted from Limayem and Hirt's (2003) "become a habit" (HBT1) and three items were adapted from Limayem et al.'s (2007) "become automatic" (HBT2), "an obvious choice" (HBT3) and "is natural" (HBT4).

Regarding the four dimensions of user empowerment, firstly, user competence was conceptualized in terms of individual's knowledge, skills and self-efficacy. All the three items (UCP2, UCP3, and UCP4) from Spreitzer's (1995) competence scale were adapted which reflected the self-efficacy and skills concepts. Spreitzer's competence scale was further expanded to reflect the knowledge concept (UCP1) of user competence using one item for knowledge component generated based on the descriptions of user competence from Marcolin et al. (2000) and Munro et al. (1997) because no measure exists in the literature. For the scale of usage impact, all three items (UIP2, UIP3, and UIP4) from Spreitzer's (1995) impact scale was adapted. One additional item was included which was self-developed to assess the degree of usage effect on task outcomes (UIP1). For the usage meaning scale, in order to capture respondents' perception of system use as being important and meaningful, all three items (UMG1, UMG2, and UMG4) from Spreitzer's (1995) meaning scale was adapted with one additional item included which was adapted from May et al. (2004) to incorporate the value concept (UMG3). Lastly, all the three items (USD1, USD2, and USD4) from Spreitzer's (1995) self-determination was adapted for the scale of user self-determination with one additional item adapted from Ahuja and Thatcher (2005) to express the freedom to decide concept (USD3).

Three IS researchers reviewed the survey instrument along with the definitions of constructs. We then conducted a sorting exercise following the procedures from Moore and Benbasat (1991). Six graduate students were invited to participate in the sorting exercise. Overall, the six sorters correctly placed the items onto the intended constructs. The sorting results indicated that the inter-judge raw agreement scores averaged 0.84, Kappa scores averaged 0.82, and the average overall placement ratio of items within the targeted constructs was 0.94. Next, the measurement instrument was reviewed in a focus group comprised of eight employees working in the target company to check for any ambiguity of wording or format. Based on the results of the pre-tests and interviews, we made changes to the format and/or wording of the measures where appropriate. The final version is shown in Table 2 (see Appendix).

Data Collection

We collected data from the employee users within a period of three weeks. With the endorsement of the IT director and assistance from the IT manager, we randomly selected 500 daily users across ranks and departments. We then sent them survey invitation emails indicating the link to the online survey web site. Participation was voluntary. We sent out reminder emails to promote survey participation. As an incentive, we offered shopping vouchers to lucky respondents by lottery. A total of 206 complete and valid responses were collected which showed a 41.2% response rate with demographic characteristics of respondents as follows: gender (male = 59.7%, female = 40.3%), age (mean = 33.3 years, s.d. = 6.3), position (frontline employees = 60.2%, middle managers = 31.1%, managers = 8.7%), department (business planning = 10.7%, customer support = 12.1%, finance = 10.7%, manufacturing operations = 25.2%, production control = 9.2%, sales and marketing = 6.8%, shipping = 5.8%, supply management = 19.4%), and working experience at the current company (mean = 4.9 years, s.d. = 4.3).

We tested non-response bias. We equated late respondents (last week) with non-respondents, and compare with the early respondents (first week) to determine non-response bias. While we acknowledge the limitation of this method in capturing the true extent of non-response bias, nevertheless, it does provide some indication and has also been used by IS researchers (e.g., Compeau and Higgins 1995). T-tests showed that early and late respondents did not differ significantly in terms of gender, age, position, department, and working experience. The sample

representativeness was also supported as no significant demographic differences were found between the sample and user population as verified by the IT manager.

Data Analysis and Results

Scale Validation

This study carried out data analysis in accordance with a two-stage methodology (Anderson and Gerbing 1988) using PLS-Graph version 3.00. PLS was selected because it allows testing of both direct effects and moderating effects in a same model. Further, PLS is not constrained by the non-normality of data. The first step was to assess the constructs for convergent validity and discriminant validity by performing confirmatory factor analysis (CFA). In CFA, convergent validity of the measurement model was checked using three criteria. First, the standardized path loading of each item, which indicates its association with its intended latent construct, must be statistically significant and greater than 0.7. Second, the composite reliability (CR) and the Cronbach’s alpha (α) for each construct must be larger than 0.7. Third, the average variance extracted (AVE) for each construct must exceed 0.5. All values had satisfied the required thresholds. Thus convergent validity of the constructs was supported.

Next, we assessed discriminant validity of the measurement model by comparing the squared root of AVE for each construct with the correlations between that construct and other constructs. Discriminant validity is indicated if the squared root of AVE is greater than the correlations between that construct and other constructs. From the correlation matrix as shown in Table 3, each construct’s squared root AVE was larger than its correlation with other constructs. Discriminant validity was also assessed using a process of constrained confirmatory factor analysis. The constrained test involves setting the correlation among pairs of variables to unity (1.0), and then testing the model again. A χ^2 difference test was used for comparing the results between the original and the constrained model. Discriminant validity will be evidenced if the χ^2 difference is significant (supporting the original model). All χ^2 statistics were significant ($\Delta\chi^2 = 354.61-1154.11, p < 0.001$), indicating that the measurement model was significantly better than other alternative models. Hence discriminant validity was established.

	Mean	S.D.	UCP	UIP	UMG	USD	EXU	ITU	EMU	HBT
UCP	4.61	1.38	0.94							
UIP	4.98	1.45	0.50	0.97						
UMG	4.45	1.32	0.55	0.42	0.93					
USD	4.59	1.43	0.57	0.51	0.52	0.96				
EXU	4.49	1.48	0.56	0.27	0.53	0.60	0.95			
ITU	4.70	1.56	0.59	0.57	0.48	0.54	0.65	0.94		
EMU	3.92	1.51	0.56	0.54	0.52	0.53	0.66	0.79	0.97	
HBT	3.82	1.48	0.45	0.29	0.50	0.45	0.53	0.43	0.52	0.88

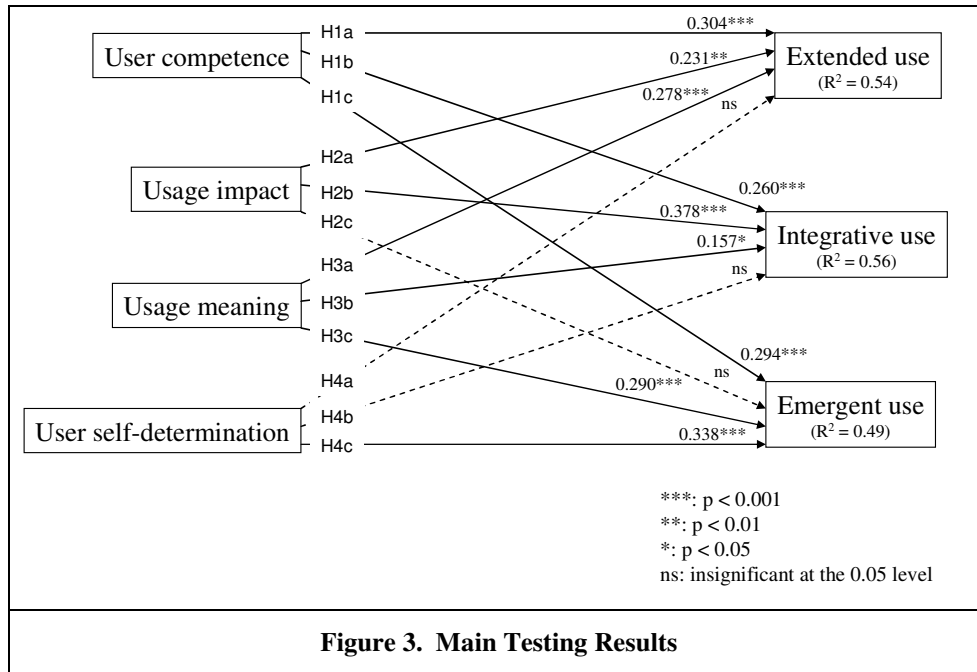
Note: Leading diagonal (bold figure) shows the squared root of AVE of each construct

We took a number of steps to reduce the potential of common method bias. These included appropriate instrument design, data collection procedures as well as testing our data for common method variance using procedure as suggested by Podsakoff et al. (2003) and Widaman (1985). Results of the test showed that fit of trait measurement model was a slight improvement over multifactor trait measurement model. Further, method factor accounted for only 1.45 per cent variance, which is less than the critical value of 25 per cent (Williams et al. 1989), thus indicated that our data do not suffer from common method variance.

Hypotheses Testing

We tested the hypotheses by applying the bootstrapping re-sampling technique to calculate the corresponding t-values for each path, in order to assess the significance of the path estimates (see Figure 3). User competence

(H1a,b,c), usage impact (H2a,b), usage meaning (H3a,b,c) and user self-determination (H4c) were found to have significant direct effects on extended use, integrative use and emergent use, explaining 53.8%, 56.0% and 49.0% of the variance, respectively. However, usage impact was found to have insignificant direct effect on emergent use (H2c). Similarly, user self-determination was found to have insignificant direct effects on extended use (H4a) and integrative use (H4b).



We additionally included six control variables (job type, rank, gender, age, job tenure, and work group climate for achievement) as alternative predictors of extended use, integrative use and emergent use. None of these variables had a significant result. We also tested for multicollinearity. In all cases, the variance inflation factor was below 10 and the condition index was less than 30, indicating that multicollinearity is not likely to have distorted the testing results in our study (Hair et al. 1998).

For the testing of moderation effects, we employed the item product terms approach (Chin et al. 2003). Results of the moderating test are shown in Table 4. Habit (H5a,b) was found to have significant negative moderating effects on the relationship between user competence and extended use (H1a), and on the relationship between user competence and integrative use (H1b). However, habit (H5c) was found to have insignificant moderating effect on the relationship between user competence and emergent use (H1c). In total, eleven hypotheses (H1a,b,c, H2a,b, H3a,b,c, H4c, and H5a,b) were supported and four hypotheses (H2c, H4a,b, and H5c) were not supported.

DV	Extended Use			Integrative Use			Emergent Use		
	D Only	D + Habit	D + I	D Only	D + Habit	D + I	D Only	D + Habit	D + I
UCP	0.304***	0.299***	0.250**	0.260***	0.256***	0.202*	0.294***	0.285***	0.222
UIP	0.231**	0.246**	0.254***	0.378***	0.387***	0.323***	-0.126	-0.101	-0.058
UMG	0.278***	0.220**	0.245***	0.157*	0.121	0.124	0.290***	0.193*	0.161
USD	0.059	0.029	0.047	0.090	0.071	0.128	0.338***	0.287***	0.342
HBT		0.125	0.069		0.078	0.088		0.208**	0.180
UCP × HBT			-0.250*			-0.231*			-0.058

R ²	0.538	0.548	0.571	0.560	0.564	0.598	0.490	0.519	0.550
ΔR^2		0.010	0.023		0.004	0.034		0.029	0.031
F value		4.425*	2.627*		1.835	4.144**		12.058***	3.376*

Note: 1. DV: Dependent Variable

2. D Only: Direct Effects Only; D + Habit: Direct Effects with Habit; D + I: Direct and Interaction Effects

3. * p < 0.05, ** p < 0.01, *** p < 0.001

Discussion and Implications

Discussion of Findings

User Empowerment for IS Infusion

There are several interesting findings in this study. Our results show that all four empowerment cognitions – user competence, usage impact, usage meaning and user self-determination have significant effects on one or more subtypes of IS infusion – extended use, integrative use and emergent use. Specifically, user assesses his/her daily system usage via reflective cognitive processing, which is the primary driver in his/her mindset (Jasperson et al. 2005). The direct experience makes available more information about the use of the IS which enables user to evaluate the usage in a clear, confident, and meaningful way (Fazio and Zanna 1981). Gradually, continuous assessment of system usage leads to an accessible attitude from user's memory which influences subsequent behavior (Fazio and Zanna 1981). Our findings have thus demonstrated the predictive validity of user empowerment from an authentic attitudinal perspective in motivating user towards IS infusion.

This study indicates that user competence significantly determines extended use, integrative use and emergent use. Our findings are similar with previous research where user competence was found to be an important determinant of user's system usage (Marcolin et al. 2000). Users who are competent with the target system are arguably more proactive in using it and would propose ways to fully utilize the IS beyond customary usage (Bassellier et al. 2001). This study thus has reaffirmed the importance to include user competence in IS usage models (Marcolin et al. 2000). Particularly, our study is the first to employ user competence in examining IS infusion, whereas previous IS infusion studies have not utilized any competence-related construct in their investigations.

Next, this study indicates usage impact to significantly determine extended use and integrative use. Previous research has used impact-related construct – perceived usefulness to examine IS infusion. Perceived usefulness was found to have significant effect on extended use (Wang and Hsieh 2006). Nevertheless, in their later study, Hsieh and Wang (2007) found perceived usefulness to have only marginal significance on extended use. One possible explanation for the inconclusive results could be that perceived usefulness becomes less important with increasing usage experience as the expected performance benefits for using the IS have been confirmed. Hence when routinization is high, users will be more concern about the direct usage impact on their task outcomes. Such concern grows over time and users will use the IS more fully the greater the usage influence (breadth and depth) on their task outcomes. Our findings bolster that of previous research by using a more relevant usage impact construct for the context of IS infusion.

For the third cognition, this study indicates usage meaning to have significant effects on extended use, integrative use and emergent use. Previous studies have used meaning-related constructs - attitude (Jones et al. 2002), satisfaction (Hsieh and Wang 2007; Wang and Hsieh 2006) and symbolic adoption (Wang and Hsieh 2006) to examine IS infusion. Attitude was found to have a significant effect on infusion (Jones et al. 2002). Symbolic adoption was found to be a determinant of extended use and emergent use (Wang and Hsieh 2006). Further, satisfaction was found to determine extended use but being a relatively weak motivation, as compared to symbolic adoption, has failed to determine emergent use (Wang and Hsieh 2006). However, contrary to their earlier study, Hsieh and Wang (2007) found satisfaction to have an insignificant effect on extended use. This suggests that satisfaction as a motivation is insufficient for IS infusion and a strong motivation such as symbolic adoption is necessary. Nevertheless, Wang and Hsieh's (2006) results have shown that symbolic adoption does not contribute significantly to the variances in extended use and emergent use. One possible explanation is that symbolic adoption is an intense affection whereas most people perform work activities for practical reasons, for instance to earn money for a living. As such, using motivation which focuses on individual's affection is not as feasible in an organizational

context. Our study refines previous studies by using an evaluation-based usage meaning in assessing the perceived value of system usage.

Lastly, this study indicates user self-determination to determine emergent use. Our findings parallel with previous IS studies (Jones et al. 2002) where facilitating condition (i.e., supportive work environment) was found to become important after adoption because an environment with avenues for support and removal of barriers are essential for users to attain higher level of use. Likewise, autonomy has been found to increase user's intention to innovate with IT (Ahuja and Thatcher 2005).

However, the results show three insignificant direct relationships. Usage impact was found to have an insignificant relationship with emergent use. One possible explanation is that emergent use requires innovative use of the IS which embodies uncertainty concerning the outcomes. Our findings resonate with Jones et al. (2002) where impact-related construct – perceived usefulness becomes insignificant in determining sales personnel's infusion of the SFA system. However, our findings contradict Wang and Hsieh (2006) where perceived usefulness was found to significantly determine emergent use. Furthermore, user self-determination was found to have insignificant relationships with extended use and integrative use. This may be due to the context of this study, an enterprise system, where there are company policies and procedures enforced in the use of IS. The linkages among tasks have already been configured and functions access rights given according to user's task types. As such, users would be unlikely to perceive much self-determination in using the IS.

The Moderating Effects of Habit

This study indicates habit to have significant negative moderating effects on the relationship between user competence and extended use, and on the relationship between user competence and integrative use. When an individual uses the IS everyday, the usage becomes automatic and the need for them to pay conscious attention to the sequences decreases. Specifically, non-reflective cognitive processing dominates user's accessible attitude where s/he will become less attentive to more information and skill acquisition (Ouellette and Wood 1998). As the usage has become effortless and efficient to them, user will remain satisfied with their current level of usage. Specifically, user's depth of knowledge base stabilizes and that its influence on extended use and integrative use will diminish with time because competence has a non-routine property (Bassellier et al. 2001) in which knowledge, skills and confidence acquired and utilized will attenuate as habit occurs (Aarts et al. 1998).

Nevertheless, habit was found to have an insignificant moderating effect on the relationship between user competence and emergent use. One possible explanation is that emergent use is a relatively more risky usage behavior because outcome of new uses are likely unknown, thus poses higher difficulties. To exhibit emergent usage behavior would require more persistent and resistance to counterinfluence, and this would lead to it being more salient in user's accessible attitude (Fazio and Zanna 1981). Furthermore, according to the theory of attitude-behavior consistency, stronger attitude will result in stronger attitude-behavior relationship (Fazio and Zanna 1981). Thus, the moderating effect of habit is insignificant in the presence of a strong user competence and emergent use relationship.

We conducted a *post hoc* analysis for any moderating effects of habit on the other hypothesized relationships. Two new moderating effects of habit were found: on the usage meaning and extended use relationship ($\Delta R^2 = 0.023$, F value = 2.627, $\beta = 0.194$, $p < 0.05$), and on the user self-determination and integrative use relationship ($\Delta R^2 = 0.034$, F value = 4.144, $\beta = 0.288$, $p < 0.01$). Interestingly, contrary to our expectation, these are positive moderating effects. These post hoc findings have thus gone beyond the theoretical assumptions of habit in demonstrating habit to be not only a suppressor but also an enhancer.

Plausible explanations for the positive moderating effects are first, habit developed is likely due to previous positive experiences in using the IS extensively which aligned with user's own value system (Verplanken 2006). User internalizes the usage experience when the perceived probability that usage will lead to particular perceived value becomes more salient. Under the habitual influence, user will then expend less mental effort and will anchor on initial deliberation that usage is significant and meaningful. Thus, value attached to extended use will be enhanced with the passage of time. Second, user likely would face constraining conditions in using the IS. But over time when usage becomes a habit, the subconscious usage circumstance allows user not to perceive any constraints in using the IS to better coordinate his/her tasks (Verplanken 2006). Particularly from the repetition of system usage, user experiences fluency and ease in his/her system use. Also, user believes that his/her usage behaviors are legitimate (i.e., doing the right thing) and this will strengthen user's sense of determination for system use. Gradually, user will

come to perceive able to self-determine system usage for reinforcement of linkages among tasks as it becomes automatic.

Limitations and Future Directions

The results of this study should be interpreted in the context of its limitations. First, although this study informs that user empowerment leads to IS infusion, nevertheless, it did not consider the manipulable antecedent condition that can evoke such authentic motivation in user. Previous research has found job design of high motivational potential to be able to prompt the feeling of empowerment in employee (Kraimer et al. 1999; Liden et al. 2000). Transferring this into the IS context, as user sense-makes his/her work environment everyday, future studies can identify user's immediate work environment characteristics, particularly the IS characteristics that can facilitate in evoking user empowerment. This way, a nomological network of user empowerment can be developed and tested.

Second, our focus is on a single company. This may raise concern about generalizability of our findings. Future research can replicate our investigation to the online context or other systems in organizations in different industries. The robustness of the results would then be established. This will also corroborate the efficacy of our theoretical model.

Third, data gathered for this study are cross-sectional in nature which made identification of the directions of causal influence difficult. An avenue for future research will be to undertake a longitudinal study in studying the inter-relationships among the four cognitions of user empowerment. Further, Saga and Zmud (1994) have suggested extended use and integrative use to eventually lead to emergent use. Wang and Hsieh (2006) have also found extended use leading to emergent use. Thus future studies can also test the temporal order of the three subtypes of IS infusion – extended use, integrative use and emergent use. Teasing out the inter-relationships among the user empowerment cognitions and the temporal order of infusion subtypes likely will uncover more insights.

Fourth, based on the psychological empowerment theory, our infusion model has demonstrated its appropriateness for examining IS infusion. Nevertheless, it is plausible and we cannot prove to the exclusion of other traditional predictors for example perceived usefulness, user satisfaction, incentive and so forth to explain variance in infusion. Thus further studies can include comparison with alternative models so as to establish the superiority of current research model as well as offer additional insights to existing body of knowledge.

Implications for Research and Practice

This study offers several salient implications for theory. First, existing IS infusion research has employed rational factors and models that are used for adoption and continued use which are inappropriate for examining infusion (Cooper and Zmud 1990). Comparatively, past research (e.g., Cooper and Zmud 1990) has suggested that authentic motivation of user might better explain user's infusion behaviors (Ryan and Deci 2000). Therefore, this study introduces a new concept, user empowerment, based on the psychological empowerment theory to IS literature. This study developed a theoretical model that examines user empowerment as the authentic motivation for explaining IS infusion.

Second, for the development of user empowerment construct, this study has identified four dimensions based on the four dimensions of psychological empowerment (Spreitzer 1995). For the development of infusion construct, this study includes integrative use and has extended previous research to examine the three subtypes (Saga and Zmud 1994) in one model. More importantly, the relationships between the user empowerment dimensions and the infusion subtypes are significant contributions towards theoretical advancement on IS infusion.

Third, existing IS research on habit are limited to IS continuance (e.g., Limayem et al. 2007). To the best of our knowledge, this study is the first to show the moderating role of habit at the highest level of use, IS infusion. In addition, this study provides explanations for the underlying mechanisms that govern user empowerment to IS infusion and the interaction between habit and user empowerment using deliberative cognitive process and spontaneous cognitive process, respectively (Jasperson et al. 2005).

There are also several implications for practice. The findings of this study show that user competence, usage impact and usage meaning determine extended use and integrative use, while user competence, usage meaning and user self-determination determine emergent use. In order to attain IS infusion, it is important for managers to devise strategies to foster user empowerment, i.e., authentic motivation, in users. As suggestions in developing each of the

user empowerment cognitions, managers can consider to provide user training (for user competence), communicate their support to the population of users (for usage impact), identify key users (opinion leaders) (Vecchio 1988) to share with others the value of using the IS in their tasks (for usage meaning), and aim for a flexible IS (for user self-determination). According to the priorities of each company, managers should identify their required infusion subtypes and focus on enhancing the corresponding determining user empowerment cognitions.

Inevitably, usage habit likely will be formed for system that has been in operation for some time, because humans are by nature creatures of habits. Managers should devise strategies and inject interventions appropriately to disintegrate unwanted habits from forming. Interventions such as training, enhancements or upgrade to the system (Jasperson et al. 2005) can help to breakdown habit which has been shown in this study to undermine user competence for infusion. On the other hand, this study has shown that habit can also be desirable as it anchors and enhances user's perceived usage meaning and self-determination for infusion. Therefore, managers should adopt effective strategies that can impede user competence from eroding away due to repetition while facilitate usage meaning and user self-determination to grow (Ouellette and Wood 1998).

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Appendix

Table 2. Measurement Instrument			
Construct	Item	Wording	Reference
Extended use	EXU1	I fully use the available ERP system features to	Self-developed

		complete my tasks	
	EXU2	I use most of the available ERP system features in performing my tasks	Hsieh and Wang (2007)
	EXU3	I make use of the available ERP system features thoroughly to accommodate my tasks	Self-developed
	EXU4	I use all available ERP system features to help me in my tasks	Jones et al. (2002)
Integrative use	ITU1	I use the ERP system for better connections among tasks	Self-developed
	ITU2	I use the ERP system to organize various tasks in an integrative manner	
	ITU3	I use the ERP system to coordinate multiple tasks	
	ITU4	I use the ERP system to handle related-tasks	
Emergent use	EMU1	I explore new uses of the ERP system to support my tasks	Saeed and Abdinnour-Helm (2008)
	EMU2	I often experiment with new ways of using the ERP system to accomplish my tasks	Agarwal and Karahanna (2000)
	EMU3	I often find new uses of the ERP system in performing my tasks	Ahuja and Thatcher (2005)
	EMU4	I use the ERP system in novel ways to complete my tasks	
User competence	UCP1	I have complete knowledge in using the ERP system	Marcolin et al. (2000), Munro et al. (1997)
	UCP2	I have mastered the skills necessary for using the ERP system	Spreitzer (1995)
	UCP3	I am self-assured about my capabilities to use the ERP system	
	UCP4	I am confident about my ability to use the ERP system	
Usage impact	UIP1	My ERP system usage highly affects task outcomes	Self-developed
	UIP2	The impact of my ERP system usage on task outcomes is large	Spreitzer (1995)
	UIP3	My ERP system usage has significant influence over task outcomes	
	UIP4	My ERP system usage has a great deal of control over task outcomes	
Usage meaning	UMG1	Using the ERP system is very important to me	Spreitzer (1995)
	UMG2	Using the ERP system is meaningful to me	
	UMG3	I feel that using the ERP system is valuable	May et al. (2004)
	UMG4	ERP system usage activities are personally meaningful to me	Spreitzer (1995)
User self-determination	USD1	I have significant autonomy in determining how I use the ERP system	Spreitzer (1995)
	USD2	I can decide on my own how to go about using the ERP system	
	USD3	I have a lot of freedom to decide how I use the ERP system	Ahuja and Thatcher (2005)
	USD4	I have considerable opportunity for independence in how I use the ERP system	Spreitzer (1995)
Habit	HBT1	The use of ERP system has become a habit for me	Limayem and Hirt (2003)
	HBT2	Using the ERP system has become automatic to me	Limayem et al. (2007)

	HBT3	When faced with a particular task, using the ERP system is an obvious choice for me	
	HBT4	Using the ERP system is natural to me	