Investigating enterprise systems adoption: uncertainty avoidance, intrinsic motivation, and the technology acceptance model

Yujong Hwang[1]

[1]DePaul University, School of Accountancy and MIS, Chicago, IL, USA

Correspondence:
Yujong Hwang, DePaul University, School of Accountancy and MIS, 1 E. Jackson Blvd., Chicago, IL 60604, USA.
Tel: +1 312 362 5487;
Fax: +1 312 362-6208;
E-mail: yhwang1@depaul.edu

Abstract

Enterprise systems are gaining interest from both practitioners and researchers because of their potential linkages to organizational and individual user's productivity. Information systems (IS) researchers have been investigating the implementation and adoption issues of enterprise systems based on the organizational IS management perspectives. However, there are few papers that investigate enterprise systems management and implementation issues based on the informal control mechanisms, although the enterprise systems are control tools in the organization. Specifically, this paper applies Enterprise Resource Planning (ERP) adoption and implementation to the informal controls, such as cultural control and self-control, which can be viewed as a tacit perspective in knowledge management. Uncertainty avoidance and perceived enjoyment are used as informal controls in the ERP implementation in this paper, and are linked to the technology acceptance variables to investigate the relationships among them. Sociotechnical design, organizational control mechanism, knowledge management, and individual motivation are reviewed to support this potential linkage in the model. Field data via the online survey of ERP systems user group ($n = 101$) are analyzed with partial least squares and supported our hypotheses. Uncertainty avoidance cultural control and intrinsic motivation as self-control are the important antecedents of ERP systems adoption. Furthermore, the result helps the systems manager understand that informal controls should be applied to the ERP systems implementation to enhance tacit and social aspects of IS management.
European Journal of Information Systems (2005) **14**, 150–161.
doi:10.1057/palgrave.ejis.3000532

Keywords: informal control; enterprise systems; sociotechnical design; TAM

Introduction

Enterprise systems are gaining interests from both practitioners and researchers because of their potential linkages to organizational and individual user's productivity. Although the direct influence of enterprise systems on firm performance has been debated in the information systems (IS) community for a long time (Stefanou, 2001; Irani & Love, 2002; Ash & Burn, 2003), the importance of systems adoption by the end users is consistently emphasized for the successful implementation of enterprise systems (Al-Mudimigh *et al.*, 2001; Davison, 2002). Enterprise systems are usually large systems involving different types of stakeholders as end users in the organization, which makes this understanding difficult and complex (Panagiotidis & Edwards, 2001; Akkermans & van Helden, 2002). Furthermore, given the implementation environment of enterprise

systems with globalization involving Europe (Hanseth *et al.*, 2001) and Asia (Liang *et al.*, 2004; Martinsons, 2004), the complexity in adoption of the system becomes important issue for both academic researchers and practitioners. Thus, to help reduce the information technology (IT) implementation project failure rate, currently estimated at 85% (Hoffman, 1999), the adoption of stakeholders in enterprise systems implementation should be investigated and guided further.

Recently, Technology Acceptance Model (TAM) has been applied to Enterprise Resource Planning (ERP) systems, popular enterprise systems focusing on the integration of data and communication in the organization, to explain this complex implementation and adoption issues of stakeholders and end users (Amoako-Gyampah & Salam, 2004; Gefen, 2004). TAM is one of most widely applied IS model to explain end-user adoption of IT (e.g. Davis, 1989; Yi & Hwang, 2003) based on parsimonious relationships among ease of use, usefulness, and intention to use. Gefen (2004) found that the perceived usefulness of ERP contributes to client assessment that their business relationship with the vendor is worthwhile. Amoako-Gyampah & Salam (2004) also found that the use of managerial interventions, such as training and communication, to influence the acceptance of ERP systems are supported, since perceived usefulness and ease of use contribute to intention to use ERP systems. The application of TAM to enterprise systems implementation is complex, since enterprise systems need organizational viewpoint as well as individual perspective. Thus, more complete understanding and integration of organizational dimension and stakeholders' TAM variables are important issues for the practitioners and researchers to make enterprise systems work successfully.

IS researchers have been investigating the implementation and adoption issues of enterprise systems based on the organizational IS management perspectives. Control is an important topic in the design of IS based on organizational and economic approaches (Eisenhardt, 1985). Control is the mechanism to regulate or adjust the behavior of the controlee (Kirsch, 1996), and IS are recognized as important behavioral control tools in the organization (Eisenhardt, 1985). In addition to behavioral and outcome controls (Ouchi, 1979), Kirsch (1996) proposed that informal controls, such as cultural, clan, and self-controls, are available control mechanisms in the organization. These informal controls are even more important than formal (behavioral and output) controls in the knowledge-based economy (Malhotra, 2002). However, there are few papers that investigate enterprise systems management and implementation with the informal control mechanisms of end users.

In the enterprise systems implementation, project managers can use these informal controls as the motivation or values of end users to adopt the systems. Interestingly, motivation to use IS has been investigated based on two lenses: intrinsic motivation and extrinsic motivation (Davis *et al.*, 1992; Venkatesh, 2000). Recently, der Heijden (2004) found that perceived enjoyment and perceived ease of use, which are intrinsic motivational dimensions, are stronger determinants of intention to use than perceived usefulness, the extrinsic motivation. Hackbarth *et al.* (2003) also found the strong positive relationship between computer playfulness, the intrinsic motivation, and perceived ease of use. Intrinsic dimension of IS use is related to self-control in the organizational setting and tacit knowledge perspective (Malhotra, 2002). Thus, there is a potential linkage between individual level TAM variables and informal controls. Sia *et al.* (2002) explained ERP systems implementation with the empowerment concept that is related to self-control. They argued that ERP implementation gives users more job discretion than their functional needs, and there is the reduction in procedural formality within the modular design and the process orientation of ERP. This informal dimension of self-control in ERP systems implementation should be investigated further.

Specifically, this paper applies ERP adoption and implementation to the informal control mechanism, such as self-control (intrinsic motivation) and cultural control. Cultural dimension of ERP adoption has been widely investigated with the cross-cultural setting based on Hofstede's (1980) cultural dimension or case-based research (e.g. Hanseth *et al.*, 2001; the case of the introduction of SAP in a large Norwegian company). However, McCoy *et al.* (2005) recently advised that Hofstede's cultural dimension with nationality categorization should not be directly applied to technology adoption research at the individual level, since culture itself has changed fast after Hofstede's categorization in 1980. Furthermore, even in the same country, McCoy (2002) found that there are differences of cultural dimension among individuals based on the analysis of 4434 responses. McCoy *et al.* (2005, p 214) argued 'because people from the same country can score differently on cultural dimensions, a trait-based approach that assesses each individual's score might explain more variance in culture studies'. Data collected in the U.S. and Uruguay (McCoy *et al.*, forthcoming) also supports this argument. Thus, McCoy *et al.* (2005) advised that individual-level measures of culture, such as Dorfman & Howell's (1988) cultural orientation, should be used to test the relationship with TAM, specifically if it should be generalized and applied to the global environment outside of U.S. Given this advise and the importance of cultural issues of ERP systems in applying TAM, this study used Dorfman and Howell's measure as a cultural dimension. Uncertainty avoidance cultural dimension, supported by Dorfman & Howell (1988), and perceived enjoyment are used as informal controls in the ERP implementation in this paper, and are linked to the TAM variables to investigate the relationships among them.

Socio-technical approach of ERP implementation, where the socio-technical environment involves the entire business process and not just the technical aspects

Table 1   The conceptual framework of human and systems in IS implementation

Theory/emphasis	Human	Systems
Control mechanism (Ouchi, 1979; Kirsch, 1996)	Informal control	Formal control
Knowledge management (Malhotra, 2002, 2004)	Tacit knowledge	Explicit knowledge
Self-determination theory (Deci & Ryan, 1985)	Internal locus of control	External locus of control
TAM and flow theory (Davis et al., 1992; Venkatesh, 2000)	Intrinsic motivation	Extrinsic motivation
Socio-technical design (Grover et al., 1995)	Social approach	Technical approach

of the process, is also a relevant explanation of the proposed model in this paper. The goal of the socio-technical designers is to optimize the entire business process, not just the technical subsystems (Grover et al., 1995). Socio-technical analysis identifies social system boundaries, values, and formal and informal information. For example, stakeholder commitment to systems implementation and communication with stakeholders are fundamental socio-technical requirements. To build a solid foundation for ERP implementation, commitment to change from these stakeholders must be secured. Prototyping the change process for the various stakeholders to develop a more concrete appreciation of the process is an effective means for facilitating communication and building commitment. Employee practices regarding individual and team activities, work design, and levels of participation in decisions all help to develop commitment. It is important to engage in open and honest communication at all levels and throughout ERP implementation. Commitment, communication, and prototyping can be interpreted as the methodology to enhance cultural control mechanism in the ERP systems implementation. Uncertainty avoidance cultural dimension in this study is the informal control mechanism to ensure commitment and communication between controller (project managers) and controlee (end users).

Based on these literature and frameworks, we propose the conceptual framework of human and systems in IS implementation in Table 1. Human and systems aspects are classified as the theoretical emphases in the different literature in Table 1. The integration between these aspects has been emphasized in the IS, organizational, human–computer interaction, and psychology literature (e.g. Grover et al., 1995; Kirsch, 1996; Malhotra, 2002; Yi & Hwang, 2003). These frameworks and literature will be explained in the following chapters with the hypotheses.

Research model and hypotheses

Figure 1 presents the proposed research model. In addition to the TAM variables, such as perceived usefulness, ease of use, and behavioral intention to use, this study includes two more constructs as the antecedents of ERP adoption: uncertainty avoidance and perceived
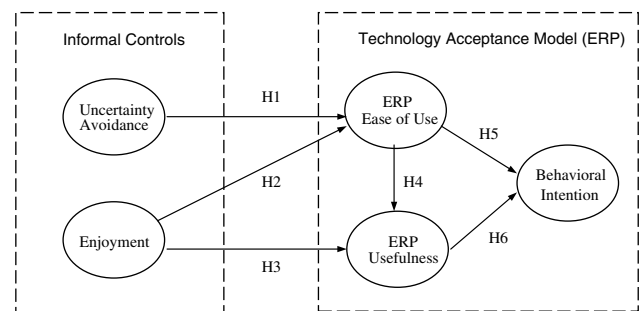
Figure 1   Proposed research model.

enjoyment. Karahanna & Straub (1999) observed that little attention had been paid to understanding factors that influence the belief constructs of perceived usefulness and ease of use. Most of the prior studies tested traditional and relatively simple IT environment, such as personal computer, e-mail, and spreadsheet. However, Igbaria & Tan (1997) and Lucas & Spitler (1999) argued that with the advent and adoption of complex IT systems that cut across functional and organizational boundaries requiring business process reengineering during implementation, it was clear that there is an increased need for studies that examine and extend TAM in a complex IT setting. Legis et al. (2003) recently concluded that TAM research would benefit from examining the introduction of business process applications and pointed out that it would be better if it were performed in a business environment. Amoako-Gyampah & Salam (2004) also examined TAM within a real business environment and extended TAM by considering it in the implementation of an ERP system.

In this study, direct effect of uncertainty avoidance culture on the perceived ease of use has been tested based on the field survey of ERP system users. The direct effects of enjoyment on ease of use and usefulness have also been tested. These two antecedents are interpreted as informal control mechanisms (Kirsch, 1996), based on tacit knowledge management and social aspect of systems implementation as shown in Table 1. The results would be beneficial to understanding the ERP implementation

in the global environment and extending TAM to the ERP systems environment. ERP systems are organizational-wide systems and their implementation involves multiple stakeholders, often in geographically dispersed locations (Amoako-Gyampah & Salam, 2004). It requires data standardization, integration of system with other IS, and the need to manage several consultants and vendors (Soh *et al.*, 2000). Thus, the results of this study will be important to understand the ERP implementation with the possible managerial interventions, involving control, globalization, and knowledge sharing in the organization.

It is true that there are other technology adoption model except for TAM, such as the theory of reasoned action (TRA; Ajzen & Fishbein, 1980), the theory of planned behavior, (TPB; Ajzen, 1991), and diffusion of innovation (DOI; Rogers, 1983). However, TAM was preferred than TRA and TPB in explaining the specific systems adoption, such as ERP systems in this study, with the parsimonious constructs (Davis, 1989; Taylor & Todd, 1995). DOI research is also one of the possible models to explain ERP adoption. Rogers (1983) identified several attributes of an innovation that are key influences on acceptance behavior, such as relative advantage, complexity, compatibility, triability, and observability. Agarwal & Prasad (1997) and Moore & Benbasat (1991) extended DOI research at the individual level. However, based on the in-depth meta analysis of DOI research that were almost the same literature reviewed by Moore & Benbasat (1991), Tornatzky & Klein (1982) found that only three innovation characteristics, relative advantage, complexity, and compatibility, are being consistently related to adoption behavior. Relative advantage is similar to the notion of usefulness, and complexity is similar to ease of use (Davis, 1989). Thus, TAM captures the core dimension of DOI, and it is relevant model to explain ERP systems adoption based on the recent popularity of TAM in this purpose. The other important dimensions of DOI, such as compatibility, can be tested in the future research based on the results of this study.

Uncertainty avoidance as a cultural control
Uncertainty has been used as one of central dimensions in the organizational management framework (Eisen-hardt, 1985). Organizational and economic literature explained that control is the methodology to reduce environmental uncertainty (Thompson, 1967). To effectively control uncertainty, IS have been used as the behavioral control methodology by providing direct monitoring and fast feedback to the controller in the organization. Ouchi (1979) showed that behavioral measure and output measure should be used as a formal control mechanism in the organization based on the knowledge of transportation process and output measurability. The other measure, informal control, could be used when these formal control mechanisms are unavailable. Eisenhardt (1985) enhanced Ouchi's argument incorporating an 'uncertainty' aspect of control

mechanism based on the agency theory. Uncertainty should be added if the manager depends on informal (social) control measures rather than the direct monitoring or behavioral measure by IS.

Jaworski (1988) summarized the marketing and management literature regarding control, and proposed the comprehensive research framework, including uncertainty as one of environmental antecedents of informal control. In his framework, informal and formal controls directly influence behavioral effects at the individual level. Plans, budgets, and quotas are considered formal control, whereas group norms and organizational culture are informal controls. Also, formal controls tend to be initiated by managers, whereas informal controls typically are constructed by the workers (Hopwood, 1974). Cultural control is realized by the accumulation of organizational stories, rituals, legends, and norms of social interaction (Meyer & Rowan, 1977; Smith & Steadman, 1981), involving an entire division or firm (Wilkins & Ouchi, 1983). Culture is defined as the broader values and normative patterns that guide worker behavior within an entire organization (Ouchi, 1979). The direct impact of cultural control on ERP implementation has not been investigated in the previous IS literature, although several papers focused on the cross-cultural studies on ERP implementation (e.g. Tarafdar & Roy, 2003). The cultural control mechanism is usually thought to be the dominant control mechanism for management positions requiring non-routine, non-programmatic decisions (Jaworski, 1988), which is the common case in ERP implementation.

Straub *et al.* (2002) suggested that social identity theory (Tajfel, 1972) is a theoretical approach to studying culture at an individual and organizational level in IS research. Tajfel (1972, p 292) defines social identity as 'the individual's knowledge that he belongs to certain social groups together with some emotional and value significance to him of this group membership'. Social identity has been found to have a strong effect on human behavior, especially on the behavior of employees in organization (e.g. Marques *et al.*, 1998; Hogg & Terry, 2000). An individual will identify themselves as part of multiple types of culture at the different level (e.g. some ethnic, some national, and some organizational), and certain cultures will be more salient to the individual at certain times (Ford *et al.*, 2003). The cultural difference among organizations or individuals rather than countries are consistently supported in the recent studies of ERP implementation (Hanseth *et al.*, 2001; Liang *et al.*, 2004; Martinsons, 2004). Martinsons (2004) showed that there are clear differences between state-owned enterprise and private ventures in China in implementing ERP systems. For example, she found that hands-on leadership mainly demonstrates commitment in private ventures, whereas state enterprises show tendency to delegate ERP responsibilities, even though these companies are in the same country, China. Liang *et al.* (2004) also argued that ERP strategies must address cultural differences and localized

strategies, based on the global ERP implementation cases. There are also several studies of European cases in ERP implementation to emphasize the globalization and cultural dimension with the individual's control mechanism in adoption. For example, Hanseth *et al.* (2001) showed that ERP implementation should be interpreted as globalization rather than tight control by technologies, using the case of the introduction of SAP in a large Norwegian company.

To help the individual-level analysis of culture, Dorfman & Howell (1988) provided the individual-level cultural measure based on Hofstede's (1980) cultural dimensions. They provided reliable and valid measure of culture at an individual level, which can be applicable to an individual's perception on the culture as a social identity like personality trait. It will be based on the individual's perception whether he or she belongs to certain social groups together with some emotional and value significance to him of this group membership. Thus, it can be used as the cultural control measure in the organization based on the social identity theory. Recently, McCoy *et al.* (2005) strongly advised to use Dorfman & Howell's (1988) individual-level cultural measures rather than nationality categorization of Hofstede (1980) when the cultural dimension is added to the individual-level technology adoption model, such as TAM. This study is the first empirical research to use Dorfman & Howell's (1988) individual-level cultural measures, based on McCoy *et al.* (2005), to explain extended TAM in the ERP systems implementation.

Uncertainty avoidance cultural orientation is the degree to which a person prefers structured over unstructured situations (Hofstede, 1980; Dorfman & Howell, 1988), and adopted to this study since uncertainty is an important environmental antecedent to the other control mechanism and behavior. Dorfman & Howell (1988) argued that uncertainty avoidance is related to anxiety that is the general feeling of anxiety when confronted with problems or challenges. Computers and databases can reutilize jobs, and telecommunication products such as e-mail, telephones, fax machines, and cell phones can reduce uncertainty in communication (Bagchi *et al.*, 2003). ERP system can be used as tools to reduce uncertainty among the users with structured business process and operations based on the behavioral control. Marakas *et al.* (2000) implied that individuals with external locus of control and high anxiety, related to low uncertainty avoidance, would negatively affect IT adoption with differential social attributions toward multiple computing technology. On the other hand, individuals with internal locus of control, who believe their own situations are within their own control, believe that using IT is easy based on the more proactive approach. The internal locus of control, related to perceived ease of use, can be enhanced by the multiple functions supported by IT (e.g. ERP system) in the organization that would make uncertainty avoidance (cultural control) possible using such system. Thus,

individuals who perceive they are in an organization with high uncertainty avoidance without anxiety of 'no control or instruction' would perceive the system is easy to use.

Transaction cost theory (Williamson & Masten, 1995) also shows the possible linkage between uncertainty avoidance and perceived ease of use. In the transaction cost theory, 'uncertainty' reflects the inability to predict relevant contingencies. Essentially, transaction costs are captured with two constructs to measure the benefits to the relationship: perceived ease of use and time efficiency (Devaraj *et al.*, 2002). Devaraj *et al.* (2002) found direct positive relationship between reduced uncertainty and ease of use ($\beta = 0.21$, $P < 0.001$). Therefore, the current study hypothesizes that:

H1: Uncertainty Avoidance (Cultural Control) will have a positive effect on Perceived Ease of Use.

Perceived enjoyment as a self-control

Eisenhardt (1985, p 147) extended the discussion of informal control to the intrinsic motivation, arguing that '…organizational managers use over-justification, despite some possible loss of intrinsic motivation, in order to achieve more overall effort.' Kirsch (1996) argued that management of IS development requires a balance between autonomous self-control and other control modes, and many key relationships in the IS development context are not governed by formal organizational mechanism. Self-control is a function of individual intrinsic motivation (Manz *et al.*, 1987). Kirsch & Cummings (1997) found that perceptions of self-control are highest for IS professionals with long organizational tenure who refine and extend existing work procedures and methods.

Malhotra (2002) also argued that self-control is based on the intrinsic motivation or perceived enjoyment of the systems. Enjoyment refers to the extent to which the activity of using a computer system is perceived to be personally enjoyable in its own right aside from the instrumental value of the technology (Davis *et al.*, 1992). According to Davis *et al.* (1992, p 1112), extrinsic motivation refers to 'the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself,' whereas intrinsic motivation refers to 'the performance of an activity for no apparent reinforcement other than the process of performing the activity *per se.*' Davis *et al.* (1992) and recently Venkatesh & Speier (2000) classified enjoyment as a type of intrinsic motivation and perceived usefulness as a type of extrinsic motivation. Several studies on flow theory showed the relationship between perceived enjoyment and perceived control, extent to which user feels in charge of the interaction (Ghani *et al.*, 1991; Ghani & Deshpande, 1994; Webster & Ho, 1997; Chan, 2001; Chung & Tan, 2004). Flow includes intense concentration, a sense of being in control, a loss of self-consciousness, and a transformation

of time (Agarwal & Karahanna, 2000). This shows that perceived enjoyment or flow enhances the perceived control that is mainly governed by self, which can be interpreted as self-control.

Self-determination theory (Deci & Ryan, 1985) showed that all individuals have natural, innate, and constructive tendencies to develop an ever more elaborate and unified sense of self. It focuses on how individuals develop a coherent sense of self through regulation of their behavioral actions that may be self-determined, controlled, or motivated. Technologies of knowledge work require proactive engagement of users unlike the technologies of data processing and transaction processing (Malhotra, 2004). Malhotra (2002) argued that tacit perspective of knowledge management should be managed and controlled mainly by self-control or intrinsic motivation rather than by formal controls based on the self-determination theory. The model of knowledge management through self-control also facilitates error detection and error correction (Stout, 1980) instead of compliance with pre-specified rules and procedures. For formal controls to be effective influence on individual's organizational behavior, these controls must be operated as self-controls that people exert over their own behavior (Hopwood, 1974).

Prior research proposed intrinsic motivation, such as perceived enjoyment, as a determinant of perceived ease of use (Venkatesh, 2000; Venkatesh et al., 2002; Yi & Hwang, 2003). Venkatesh & Speier (2000) and Venkatesh (1999) found that the game-based training method aiming at enhancing intrinsic motivation resulted in higher enjoyment and higher ease of use perceptions than the traditional training method. Venkatesh (2000) also showed that the effect of enjoyment on ease of use became stronger as users gained more direct experience with the system. Venkatesh et al. (2002) also reported that enjoyment (intrinsic motivation) had no direct effect on behavioral intention over and above ease of use and usefulness. Thus, we hypothesize that:

H2: Perceived Enjoyment (Self-Control) will have a positive effect on Perceived Ease of Use.

Self-control (Malhotra, 2002, 2004) and intrinsic motivation (Venkatesh, 2000) have been suggested as effective interventions to enhance systems adoption, which is applicable in the prototyping stage. Yi & Hwang (2003) found that enjoyment has a positive effect on the perceived usefulness of Web-based IS. It is well known that, when people are intrinsically motivated, they become productive and effective (Csikszentmihalyi, 1990). Agarwal & Karahanna (2000) found a multi-dimensional construct called cognitive absorption, a state of deep involvement with software, had a significant influence on usefulness over and above ease of use. Enjoyment was one of the subdimensions of cognitive absorption with the highest loading score. Tacit perspective of knowledge management using ERP systems can be managed and controlled mainly by self-control or

intrinsic motivation rather than by formal controls based on the self-determination theory. Socio-technical approach also supports the potential linkage between informal or intrinsic control and successful IS adoption that can be explained by perceived usefulness. Thus, we hypothesize that:

H3: Perceived Enjoyment (Self-Control) will have a positive effect on Perceived Usefulness.

Technology acceptance model

TAM is a well-known field in IS research. The relationship between perceived ease of use and perceived usefulness and their effects on behavioral intention have been investigated and supported by numerous TAM studies (e.g. Davis, 1989; Venkatesh & Davis, 1996). TAM posits that perceived usefulness and ease of use influences behavioral intention to use system. TAM also posits that perceived ease of use has a positive effect on usefulness, and all of the other antecedents of the intention to use are fully mediated by usefulness and ease of use. The causal relationship between behavioral intention to use system and actual use are also supported in the numerous previous studies (e.g. Davis et al., 1992; Yi & Hwang, 2003). For example, Yi & Hwang (2003) found the direct and significant influence of behavioral intention to use on actual system usage log data ($\beta = 0.19$, $P < 0.05$) in the Web-based IS environment.

Amoako-Gyampah & Salam (2004) showed an extension of the TAM in an ERP implementation environment and empirical supports of TAM in ERP systems adoption. They argued that the usage of ERP system incorporates both mandatory and discretionary usage. The mandatory usage represents a base level needed to perform minimal job functions and usage beyond that might become voluntary where the real value of ERP system might lie in. Even if usage were mandatory, effective usage leads to organizational benefits, not just selective benefits (Amoako-Gyampah & Salam, 2004). Gefen (2004) also recently found the positive effect of ERP ease of use on ERP usefulness based on the TAM. Given the recent interests of application of TAM in ERP implementation (Igbaria & Tan, 1997; Lucas & Spitler, 1999; Legis et al., 2003; Amoako-Gyampah & Salam, 2004; Gefen, 2004), we tested all of TAM variables including behavioral intention in the model to extend the TAM in an ERP implementation environment. Hypotheses pertaining to these relationships on ERP system adoption are shown in the proposed research model in Figure 1:

H4: Perceived Ease of Use will have a positive effect on Perceived Usefulness.

H5: Perceived Ease of Use will have a positive effect on Intention to Use.

H6: Perceived Usefulness will have a positive effect on Intention to Use.

Method and measures

The hypotheses tests are based on the field survey of ERP users. ERP system users in various organizations, who registered in the ERP system user group on the Web, are the target samples of this study. They are mostly company employees, who are different ERP system users, and are interested in the ERP implementation issues, voluntarily sharing the information and opinions regarding new ERP systems on the website. We developed online survey website and posted this URL in the ERP user group website, and 101 ERP system users ($n = 101$) in this website voluntarily participated in the study. The average age was 27 years, and 73% of participants were male. In all, 70% of participants reported having used ERP system for more than 1 year. A total of 81% of participants reported having used ERP system for more than 4 h in a week. There was no difference between the earlier participants and the later participants in the survey, showing that non-response bias was not an issue.

Most of the constructs in the research model were measured with the items adapted from prior research. All the questionnaire items used an 11-point Likert-type scale, where 0 = completely disagree, 5 = neither agree nor disagree, and 10 = completely agree. The four uncertainty avoidance items as a cultural control were adapted from Dorfman & Howell (1988). The uncertainty avoidance items were 'It is important to have job requirements and instructions spelled out in detail so that employees always know what they are expected to do,' 'Rules and regulations are important because they inform employees what the organization expects of them,' 'Standard operating procedures are helpful to employees on the job,' and 'Instructions for operations are important for employees on the job.' Enjoyment was adapted from Davis *et al*. (1992). The enjoyment items were 'I have fun using the ERP system,' 'Using the ERP system is pleasant,' and 'I find using the ERP system to be enjoyable.'

The TAM constructs were adapted from Davis (1989). The usefulness items were 'Using the ERP system would improve my performance in my job,' 'Using the ERP system would increase my productivity in my job,' 'Using the ERP system would enhance my effectiveness in my job,' and 'I find the ERP system would be useful in my job.' The ease of use items were 'Learning to use the ERP system is easy for me,' 'I find it easy to get the ERP system to do what I want it to do,' 'My interaction with the ERP system is clear and understandable,' and 'I find the ERP system easy to use.' Behavioral intention was measured with the following statements: 'I intend to check the information in the ERP system frequently,' 'I intend to download reports from the ERP system frequently,' and 'I intend to get the information regarding our business using the ERP system frequently.'

Data analysis

The proposed model and hypothesis testing was conducted using PLS (partial least squares) Version 3.0 (Chin & Frye, 1998). Whereas covariance-based structural equation model (SEM) tools such as LISREL and EQS use a maximum-likelihood function to obtain parameter estimates, the component-based PLS uses a least-squares estimation procedure, allowing reflective latent constructs, while placing minimal demands on measurement scales, sample size, and distributional assumptions (Fornell & Bookstein, 1982; Wold, 1982; Falk & Miller, 1992; Chin, 1998). This study used component-based PLS rather than other covariance-based SEM tools, because this study is exploratory research rather than confirmative study comparing the alternative models, based on Gefen *et al*.'s (2000) guidance on choosing PLS or the other SEM tools. Uncertainty avoidance and enjoyment is the new addition to the original TAM model, which should be investigated with the explorative approach. Chin (1998, p 311) also advises that 'if one were to use a regression heuristic of 10 cases per indicator,' the sample size requirement would be 10 times (1) the largest number of formative indicators or (2) the largest number of independent variables impacting a dependent variable, whichever is the greater. In our model, all items are modeled as reflective indicators because they are viewed as effects (not causes) of latent variables (Bollen & Lennox, 1991), and the largest number of independent variables estimated for a dependent variable is only two. Thus, our sample size of 101 is more than adequate for the PLS estimation procedures. Furthermore, this study includes the generalized dimension of cultural orientation with uncertainty avoidance, making the use of quantitative approach with PLS meaningful rather than qualitative case studies within a specific cultural situation.

The measurement model in PLS is assessed by examining internal consistency, convergent validity, and discriminant validity (Barclay *et al*., 1995). Internal consistencies (similar to Cronbach's alpha) of 0.7 or higher are considered adequate (Fornell & Larcker, 1981; Barclay *et al*., 1995; Compeau *et al*., 1999; Agarwal & Karahanna, 2000). Convergent and discriminant validity are assessed by applying that the square root of the average variance extracted (AVE) by a construct from its indicators should be at least 0.707 (i.e. AVE > 0.50) and should be greater than that construct's correlation with other constructs (Fornell & Larcker, 1981; Barclay *et al*., 1995; Chin, 1998), and an item should load more highly on the construct it is intended to measure than it does on another construct. The structural model and hypotheses are assessed by examining the significance of the path coefficients (similar to standardized beta weights in a regression analysis) and the variance accounted for by the antecedent constructs.

Results

Table 2 shows the means, standard deviations (s.d.), internal consistency reliabilities, and correlations among constructs. As recommended by Yi & Davis (2003), the internal consistency reliabilities were all higher than 0.7

Table 2   Means, s.d., internal consistencies, and correlations of constructs

Construct	Mean	s.d.	ICR	1	2	3	4	5
1. Uncertainty Avoidance	7.80	2.27	**0.92**	**0.75**				
2. Enjoyment	6.00	2.65	**0.96**	0.01	**0.90**			
3. Perceived Ease of Use	6.10	2.84	**0.96**	0.29	0.64	**0.86**		
4. Perceived Usefulness	6.44	2.37	**0.94**	0.06	0.67	0.52	**0.80**	
5. Behavioral Intention	6.57	2.64	**0.93**	0.01	0.45	0.52	0.52	**0.81**

Note: ICR = internal consistency reliability. All the constructs are on a scale of 0 (negative) to 10 (positive). Diagonal elements (bold) are the square root of AVE between the constructs and their measures. Off-diagonal elements are correlations between constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements in the same row and column.

Table 3   Factor structure matrix of loadings and cross-loadings – measurement model

Scale items	UA	ENJ	PEOU	PU	BI
UA1	0.719***	−0.067	0.099	−0.032	−0.086
UA2	0.895***	0.086	0.290	0.113	0.064
UA3	0.876***	−0.045	0.217	0.021	−0.049
UA4	0.948***	0.006	0.298	0.045	0.033
ENJ1	0.030	0.953***	0.666	0.571	0.423
ENJ2	0.074	0.933***	0.551	0.668	0.392
ENJ3	−0.064	0.953***	0.591	0.665	0.455
PEOU1	0.352	0.506	0.858***	0.464	0.405
PEOU2	0.238	0.610	0.936***	0.473	0.471
PEOU3	0.278	0.628	0.956***	0.532	0.530
PEOU4	0.197	0.606	0.946***	0.452	0.505
PU1	−0.038	0.672	0.439	0.878***	0.430
PU2	0.165	0.661	0.553	0.897***	0.475
PU3	0.007	0.539	0.459	0.911***	0.457
PU4	0.069	0.502	0.392	0.884***	0.490
BI1	0.106	0.467	0.504	0.539	0.913***
BI2	−0.033	0.414	0.471	0.431	0.919***
BI3	−0.063	0.309	0.413	0.412	0.859***

UA = Uncertainty Avoidance; ENJ = Enjoyment; PEOU = Perceived Ease of Use; PU = Perceived Usefulness; BI = Behavioral Intention (***$P < 0.001$).

without exception (minimum was 0.92), and the diagonal elements (square root of the variance shared between the constructs and their measures) were all higher than 0.707 and also higher than correlations between target constructs and other constructs without exception.

Table 3 presents the factor structure matrix of the study variables. As the cross-loadings are not shown in the PLS output, the author used the subsequent data analysis with SPSS and Excel to get Table 3, based on the guidance of Yi & Davis (2003). From the output of the PLS measurement model run, the rescaled data matrix and the matrix of latent variable scores (the eta matrix) were read by Excel and edited to reorganize the data into 102 rows (label line plus 101 records corresponding to respondents) by 24 columns (respondent ID, 18 columns of rescaled item scores and five columns of factor scores). Pearson's correlations were computed between the five factor scores and 18 rescaled item scores in this matrix using SPSS to obtain the factor structure matrix of loadings and cross-loadings shown in Table 3. Demonstrating strong convergent and discriminant validity, all

items exhibited high loadings on their respective constructs, and no item loaded higher on other constructs than the one it was intended to measure without exception. Collectively, the psychometric properties of the constructs were considered more than relevant.

Hypotheses testing results are based on bootstrapping (with 500 subsamples) to test the statistical significance of each path coefficient using *t*-tests, as recommended by Chin (1998). Figure 2 provides the results of hypothesis testing. Supporting H1, uncertainty avoidance had a significant positive effect on ease of use ($\beta = 0.28$, $P < 0.01$). Supporting H2, enjoyment had a significant positive effect on ease of use ($\beta = 0.63$, $P < 0.001$). Supporting H3, enjoyment had a significant positive effect on usefulness ($\beta = 0.57$, $P < 0.001$). Inconsistent with H4, ease of use had no significant effect on usefulness ($\beta = 0.16$, NS). The effect was in the hypothesized direction, but the significance level was not within the conventional $P < 0.05$. Supporting H5, ease of use had a significant effect on intention to use ($\beta = 0.34$, $P < 0.001$). Supporting H6, usefulness had a significant effect on intention to use ($\beta = 0.34$, $P < 0.001$). The model
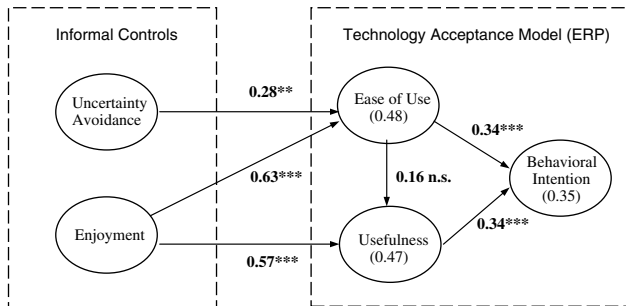
Note.* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2 PLS test of proposed model.

explained substantial variance in ease of use ($R^2 = 0.48$), usefulness ($R^2 = 0.46$), and intention to use ($R^2 = 0.35$). In sum, the model test supported all the hypotheses except H4. The direct effects from uncertainty avoidance or enjoyment on behavioral intention were tested, and there was no direct effect of these informal control constructs on behavioral intention to use ERP system over and above the effects mediated by ease of use and usefulness. In sum, the model test supported all the hypotheses except H4.

Discussion

The result of the study clearly points out the important roles of uncertainty avoidance culture and perceived enjoyment on influencing ERP system adoption. These cultural and intrinsic factors work as informal control in managing ERP implementation in the organization. To respond to the recent call to investigate ERP implementation with the extended TAM (Amoako-Gyampah & Salam, 2004; Gefen, 2004), and to include individual-level cultural dimension (McCoy *et al.*, 2005) and intrinsic motivation (der Heijden, 2004) in TAM study, this paper tested the interesting dimension of ERP adoption, informal control, and using empirical and field-setting data analysis. The model also illustrates the underlying complex relationships among these constructs and the existing TAM variables, incorporating social dimensions of control in ERP implementation.

TAM was supported except for the relationship between ease of use and usefulness when the model was connected to the cultural and enjoyment factors. It is a very interesting finding, since Yi & Hwang (2003) showed that when enjoyment was linked to TAM variables, ease of use had no significant effect on usefulness ($\beta = 0.02$, NS) over and above enjoyment, indicating that enjoyment was a dominant determinant of usefulness in the Web-based IS environment. As shown in Table 2, ease of use was significantly related to usefulness at $r = 0.52$ ($P < 0.001$). In the presence of enjoyment, however, ease of use no longer had a significant effect on usefulness, indicating that enjoyment is a stronger predictor of usefulness than ease of use is, and that the proportion of the usefulness

variance accounted for by ease of use beyond that accounted for by enjoyment is not significant. Empirical findings on the relationship between ease of use and usefulness have been mixed in the previous literature as explained by Yi & Hwang (2003). This study results support Yi & Hwang (2003)'s findings in that enjoyment might play a more influential role than ease of use in determining the usefulness perception within the Web-based IS context and ERP systems. One of the possible explanations on this finding is that currently many ERP systems are implemented or integrated on the Enterprise Application Integration and Web environment. Thus, enjoyment or intrinsic factors are more important than ease of use. Also, the survey was conducted online and most of the survey participants are proactive users of Web-community and ERP systems. The finding awaits further empirical validation by future research.

Conclusion

Using the actual ERP system users in the field as samples, the current study helps researchers and practitioners understand how ERP systems adoption and implementation can be successfully managed by informal control mechanism. Uncertainty avoidance culture and intrinsic motivation of end users in ERP implementation influence individual user's ease of use and usefulness of such systems. Specifically, intrinsic or self-control aspect is very important to ease of use and usefulness, and enhancing this self-control mechanism would make end users perceive that the systems are important for their job performance. Cultural control with uncertainty avoidance dimension mainly influence ease of use perspective in ERP adoption as hypothesized. To researchers, this study shows the possible and valuable inclusion of informal control mechanism in the explanation of ERP adoption behavior. In future research, the other informal control mechanism, such as clan control (Kohli & Kettinger, 2004), can be included in the model to completely understand these complex phenomena. Furthermore, knowledge management, self-determination theory, flow theory, and socio-technical design issues are merged with informal control mechanism and TAM as an integrative model in this study. However, compatibility dimension based on the DOI (Rogers, 1983; Moore & Benbasat, 1991) and social norm in the TPB (Ajzen, 1991), which are not tested in this study, could be related to uncertainty avoidance dimension, based on the intuitive interpretations of these constructs. Further study in this direction would be beneficial to understanding this important relationship. This study opens the door in these endeavors to understand the informal and cultural issues of ERP systems implementation.

To practitioners, this study shows ERP project leaders should consider informal controls as an important managerial intervention to make ERP systems work successfully. Depending only on formal control or mandatory use of systems would be missing another crucial dimension of control mechanisms, informal

controls. Kirsch (2000) proposed that reduced uncertainty of project influence project leadership in the organization. This leadership of end users would be an important resource of the company as a tacit knowledge of an organization. Another implication for practitioners is that informal controls can be applied to the agile methodologies (Fowler, 2003), focusing on people in developing IS. Agile methodologies focus on self-managed developers and users rather than on the mandated roles that people perform (Fowler, 2003). Thus, the agile methodologies promote a self-adaptive software development process and require responsible and motivated developers and users (Hoffer *et al.*, 2004). Informal controls are important managerial tools in this environment. This study would be beneficial to all of these endeavors for the successful implementation of ERP system with various control mechanisms in the socio-technical environments.

About the author

Yujong Hwang is an Assistant Professor of MIS/e-business at the School of Accountancy and MIS, DePaul University. He earned his Ph.D. in MIS at the University of South Carolina. His current research focuses on e-commerce, knowledge management, and human–computer interaction. His research has been published in Journal of MIS, Communications of the ACM, International Journal of Electronic Commerce, International Journal of Human–Computer Studies, and Journal of End-User Computing.

References

AGARWAL R and KARAHANNA E (2000) Time flies when you're having fun: cognitive absorption and beliefs about information technology use. *MIS Quarterly* **24(4)**, 665–694.

AGARWAL R and PRASAD J (1997) The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences* **28(3)**, 557–582.

AJZEN I (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes* **50**, 179–211.

AJZEN I and FISHBEIN M (1980) *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall Inc., Englewood Cliffs, NJ.

AKKERMANS H and VAN HELDEN K (2002) Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. *European Journal of Information Systems* **11**, 35–46.

AL-MUDIMIGH A, ZAIRI M and AL-MASHARI M (2001) ERP Software implementation: an integrative framework. *European Journal of Information Systems* **10**, 216–226.

AMOAKO-GYAMPAH K and SALAM AF (2004) An extension of the technology acceptance model in an ERP implementation environment. *Information & Management* **41**, 731–745.

ASH C and BURN JM (2003) Assessing the benefits from e-business transformation through effective enterprise management. *European Journal of Information Systems* **12**, 297–308.

BAGCHI K, CERVENY R, HART P and PETERSON M (2003) The influence of national culture in information technology product adoption. *Proceedings of the Americas Conference on Information Systems* 957–965.

BARCLAY D, HIGGINS C and THOMPSON R (1995) The partial least squares approach to causal modeling: personal computer adoption and use as an illustration. *Technology Studies* **2**, 285–309.

BOLLEN K and LENNOX R (1991) Conventional wisdom on measurement: a structural equation perspective. *Psychological Bulletin* **110**, 305–314.

CHAN CYN (2001) *An Empirical Investigation of Interactivity and Consumer Online Experience in Hypermedia Computer-Mediated Environments*. University of Auckland.

CHIN WW (1998) The partial least squares approach to structural equation modeling. In *Modern Methods for Business Research* (MARCOULIDES GA, Ed), pp 295–336, Lawrence Erlbaum Associates, Mahwah, NJ.

CHIN WW and FRYE TA (1998) PLS-Graph (Version 2.91.03.04).

CHUNG J and TAN FB (2004) Antecedents of perceived playfulness: an exploratory study on user acceptance of general information-searching websites. *Information and Management* **41**, 869–881.

COMPEAU D, HIGGINS CA and HUFF S (1999) Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly* **23(2)**, 145–158.

CSIKSZENTMIHALYI M (1990) *Flow: The Psychology of Optimal Experience*. Harper and Row, New York.

DAVIS FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* **13(3)**, 319–339.

DAVIS FD, BAGGOZZI RP and WARSHAW PR (1992) Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology* **22**, 1111–1132.

DAVISON RM (2002) Cultural complications of ERP. *Communications of the ACM* **45(7)**, 109–111.

DECI EL and RYAN RM (1985) *Intrinsic Motivation and Self-determination in Human Behavior*. Plenum Press, New York.

DER HEIJDEN H (2004) User acceptance of hedonic information systems. *MIS Quarterly* **28(4)**, 695–704.

DEVARAJ S, FAN M and KOHLI R (2002) Antecedents of B2C channel satisfaction and preference: validating e-commerce metrics. *Information Systems Research* **13(3)**, 316–333.

DORFMAN PW and HOWELL JP (1988) Dimensions of national culture and effective leadership patterns: Hofstede revisited. *Advances in International Comparative Management* **3**, 127–150.

EISENHARDT KM (1985) Control: organizational and economic approaches. *Management Science* **31(2)**, 134–149.

FALK RF and MILLER NB (1992) *A Primer for Soft Modeling*. The University of Akron, Akron, OH.

FORD DP, CONNELLY CE and MEISTER DB (2003) Information systems research and Hofstede's culture's consequences: an uneasy and incomplete partnership. *IEEE Transactions on Engineering Management* **50(1)**, 8–25.

FORNELL C and LARCKER DF (1981) Evaluating structural equations models with unobservable variables and measurement error. *Journal of Marketing Research* **18**, 39–50.

FORNELL C and BOOKSTEIN L (1982) Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research* **19**, 440–452.

FOWLER M (2003) *The New Methodologies*, martinfowler.com/articles/newMethodologies.html.

GEFEN D (2004) What makes an ERP implementation relationship worthwhile: linking trust mechanisms and ERP usefulness. *Journal of MIS* **21(1)**, 263–288.

GEFEN D, STRAUB D and BOUDREAU M (2000) Structural equation modeling and regression: guidelines for research practices. *Communications of the AIS* **4(7)** (tutorial).

GHANI J and DESHPANDE S (1994) Task characteristics and the experience of optimal flow in human–computer interaction. *Journal of Psychology* **128(4)**, 381–391.

GHANI J, SUPNICK R and ROONEY P (1991) The experience of flow in computer-mediated and in face-to-face groups. In *Proceedings of the12th International Conference on Information Systems*, New York.

GROVER V, JEONG SR, KETTINGER W and TENG J (1995) The Implementation of BPR. *Journal of MIS* **12(1)**, 109–144.

HACKBARTH G, GROVER V and YI M (2003) Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use. *Information & Management* **40**, 221–232.

HANSETH O, CIBORRA C and BRAA K (2001) The control devolution: ERP and the side effects of globalization. *The Data Base for Advances in Information Systems* **32(4)**, 34–46.

HOFSTEDE G (1980) *Culture's Consequences: International Differences in Work-Related Values.* SAGE Publications, Beverly Hills, CA.

HOFFER JA, GEORGE JF and VALACICH JS (2004) *Modern Systems Analysis and Design* 4th edn, Prentice-Hall, Englewood Cliffs, NJ.

HOFFMAN T (1999) Study: 85% of IT departments fail to meet biz needs. *Computerworld*. October 11, 1999.

HOGG MA and TERRY DJ (2000) Social identity and self-categorization processes in organizational contexts. *Academy of Management Review* **25(1)**, 121–140.

HOPWOOD A (1974) *Accounting and Human Behavior.* Prentice-Hall, London, UK.

IGBARIA M and TAN M (1997) The consequences of information technology acceptance on subsequent individual performance. *Information & Management* **32**, 113–121.

IRANI Z and LOVE PED (2002) Developing a fame of reference for ex-ante IT/IS investment evaluation. *European Journal of Information Systems* **11(1)**, 74–82.

JAWORSKI BJ (1988) Toward a theory of marketing control: environmental context, control type, and consequences. *Journal of Marketing* **52**, 23–39.

KARAHANNA E and STRAUB D (1999) The psychological origins of perceived usefulness and ease of use. *Information & Management* **35**, 237–250.

KIRSCH LJ (1996) Portfolios of control modes and IS project management. *Information Systems Research* **8(3)**, 215–239.

KIRSCH LJ (2000) Software project management: an integrative perspective for an emerging paradigm. In *Framing the Domains of IT Management* (ZMUD RW, Eds), pp 285–304, Pinnaflex Educational Resources Inc., Cincinnati, OH.

KIRSCH LJ and CUMMINGS LL (1997) Contextual influences on self-control of is professionals engaged in systems development. *Accounting, Management, and Information Technologies* **6(3)**, 191–219.

KOHLI R and KETTINGER W (2004) Informating the clan: controlling physician costs and outcomes. *MIS Quarterly* **28(3)**, 363–394.

LEGIS P, INGHAM J and COLLERETTE P (2003) Why do people use information technology? A critical review of the technology acceptance model. *Information & Management* **40**, 191–204.

LIANG H, XUE Y, BOULTON W and BYRD T (2004) Why western vendors don't dominate China's ERP market. *Communications of the ACM* **47(7)**, 69–72.

LUCAS H and SPITLER V (1999) Technology use and performance: a field study of broker workstations. *Decision Sciences* **30(2)**, 291–312.

MALHOTRA Y (2002) Is knowledge management really an oxymoron? Unraveling the role of organizational controls in knowledge management. In *Knowledge Mapping and Management* (WHITE D, Ed), pp 1–13, Idea Group Publishing, Hershey.

MALHOTRA Y (2004) Desperately seeking self-determination: key to the new enterprise logic of customer relationships. *Proceedings of the Americas Conference on Information Systems*, New York, NY.

MANZ CC, MOSSHOLDER KW and LUTHANS F (1987) An integrative perspective of self-control in organization. *Administration & Society* **191(1)**, 3–24.

MARAKAS GM, JOHNSON R and PALMER JW (2000) A theoretical model of differential social attributions toward computing technology: when the metaphor becomes the model. *International Journal of Human-Computer Studies* **45(3)**, 529–552.

MARQUES J, ABRAMS D, PAEZ D and MARTINEZ TC (1998) The role of categorization and in-group norms in judgments of groups and their members. *Journal of Personality and Social Psychology* **75(4)**, 976–988.

MARTINSONS M (2004) ERP in China: one package, two profiles. *Communications of the ACM* **47(7)**, 65–68.

MCCOY S (2002) The effect of national culture dimensions on the acceptance of information technology: a trait based approach. Unpublished Doctoral Dissertation, University of Pittsburgh.

MCCOY S, EVERARD A and JONES B An examination of the technology acceptance model in Uruguay and US. *Journal of Global Information Technology Management* (forthcoming).

MCCOY S, GALLETTA D and KING W (2005) Integrating national culture into IS research: the need for current individual-level measures. *Communications of the AIS* **15**, 211–224.

MEYER JW and ROWAN B (1977) Institutionalized organizations: formal structure as myth and ceremony. *American Journal of Sociology* **83**, 340–363.

MOORE G and BENBASAT I (1991) Development of an instrument to measure the perception of adopting an information technology innovation. *Information Systems Research* **2(3)**, 192–222.

OUCHI WG (1979) A conceptual framework for the design of organizational control mechanisms. *Management Science* **25(9)**, 833–848.

PANAGIOTIDIS P and EDWARDS JS (2001) Organisational learning: a critical systems thinking discipline. *European Journal of Information Systems* **10**, 135–146.

ROGERS E (1983) *Diffusion of Innovation: Third Edition.* Free Press, NY.

SIA S, TANG M, SOH C and BOH W (2002) ERP systems as a technology of power: empowerment or panoptic control? *The Data Base for Advances in Information Systems* **33(1)**, 23–37.

SMITH GD and STEADMAN LE (1981) Present value of corporate history. *Harvard Business Review* **59**, 164–173.

SOH C, KIEN S and TAY-YAP J (2000) Cultural fits and misfits: is ERP a universal solution? *Communications of the ACM* **43**, 47–51.

STEFANOU CJ (2001) A framework for the ex-ante evaluation of ERP software. *European Journal of Information Systems* **10**, 204–215.

STOUT R (1980) *Management or Control?: The Organizational Challenge.* Indiana University Press, Bloomington, IN.

STRAUB D, LOCH K, EVARISTO R, KARAHANNA E and SRITE M (2002) Toward a theory-based measurement of culture. *Journal of Global Information Management* **10(1)**, 13–23.

TAJFEL H (1972) Social categorization (English Translation of 'La Categorisation Sociale'). In *Introduction a La Psychologie Sociale* Vol. 1 (Moscovici S, Ed), pp 272–302, Larousse, Paris.

TARAFDAR M and ROY R (2003) Analyzing the adoption of enterprise resource planning systems in Indian organizations: a process framework. *Journal of Global Information Technology Management* **6(1)**, 31–51.

TAYLOR S and TODD P (1995) Understanding information technology usage: a test of competing models. *Information Systems Research* **6(2)**, 144–177.

THOMPSON JD (1967) *Organization in Action.* McGraw-Hill Book Company, New York.

TORNATZKY L and KLEIN K (1982) Innovation characteristics and innovation adoption implementation: a meta analysis of findings. *IEEE Transactions on Engineering Management* **29(1)**, 28–45.

VENKATESH V (1999) Creation of favorable user perceptions: exploring the role of intrinsic motivation. *MIS Quarterly* **23**, 239–260.

VENKATESH V (2000) Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research* **11**, 342–365.

VENKATESH V and DAVIS FD (1996) A model of the antecedents of perceived ease of use: development and test. *Decision Sciences* **27**, 451–481.

VENKATESH V and SPEIER C (2000) Creating an effective training environment for enhancing telework. *International Journal of Human–Computer Studies* **52**, 991–1005.

VENKATESH V, SPEIER C and MORRIS MG (2002) User acceptance enablers in individual decision making about technology: toward an integrated model. *Decision Sciences* **33**, 297–316.

WEBSTER J and HO H (1997) Audience engagement in multi-media presentation. *Data Base for the Advances in Information Systems* **28(2)**, 63–77.

WILKINS AL and OUCHI WG (1983) Efficient cultures: exploring the relationship between culture and organizational performance. *Administrative Science Quarterly* **28,** 468–481.

WILLIAMSON OE and MASTEN SE (1995) *Transaction Cost Economics.* Edward Elgar, Eldershot, Hants, England and Brookfield, VT.

WOLD H (1982) Systems under indirect observation using PLS. In *A Second Generation of Multivariate Analysis* Vol. I: Methods (Fornell C, Ed), pp 325–347, Praeger, New York.

YI MY and DAVIS FD (2003) Developing and validating an observational learning model of computer software training and skill acquisition. *Information Systems Research* **14(2),** 146–169.

YI MY and HWANG Y (2003) Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human–Computer Studies* **59,** 431–449.