Business Strategy Series

Emerald Article: Explaining intention to use an enterprise resource planning (ERP) system: an extension of the UTAUT model
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Article information:
To cite this document: Mei Ling Keong, Thurasamy Ramayah, Sherah Kurnia, Lo May Chiun, "Explaining intention to use an enterprise resource planning (ERP) system: an extension of the UTAUT model", Business Strategy Series, Vol. 13 Iss: 4 pp. 173 - 180

Permanent link to this document: http://dx.doi.org/10.1108/17515631211246249
Downloaded on: 12-07-2012

References: This document contains references to 32 other documents

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Explaining intention to use an enterprise resource planning (ERP) system: an extension of the UTAUT model

Mei Ling Keong, Thurasamy Ramayah, Sherah Kurnia and Lo May Chiun

Introduction

In today's competitive business environment, companies strive to meet the increased competition by expanding globally and meeting customers' growing expectations. Companies aim to achieve higher profit by generating more output with lower total cost in the entire business chain. In this context, enterprise resource planning (ERP) becomes an important tool for the company to build strong capabilities, improve performance, undertake better decision making and achieve competitive advantage (Al-Mashari and Al-Mudimigh, 2003).

According to Marnewick and Labuschagne (2005), ERP enables an organization to automate and integrate the majority of its business processes, share common data and practices across the enterprise and produce and access information in a real-time environment. The ultimate goal of ERP system is that information must only be entered once (Marnewick and Labuschagne, 2005). In addition, ERP has been promoted as a desirable and critical link for enhancing integration between all functional areas within the manufacturing enterprise, and between the enterprise and its upstream and downstream trading partners (Muscatello et al., 2003). During the process, ERP implementation environment is affected by numerous software and technology systems available to managers, the complexity of the requirements from those systems and the need to adapt any existing or future software to the core ERP technology (Amoako-Gyampah, 2007).

In view of the complexity of implementation and cross functional nature, implementing ERP in an organization is not an easy task and does not always prove successful (Scott and Vessey, 2002; Ramayah et al., 2007). Seymour et al. (2007) mentioned that approximately 50 percent of all ERP implementations fail to meet the adopting organizations' expectations and this is supported by Jasperson et al. (2005). In 1996, Foxmeyer Drug, a $5 billion wholesale drug distribution company, argued that one of the major problems that led to their bankruptcy was due to a failed ERP system (Scott and Vessey, 2002).

Besides, ERP implementation is an expensive exercise, as the cost of a typical ERP implementation in a Fortune 500 company was estimated as between $40 million and $240 million and the enterprise application market is expected to grow from $47.8 billion in 2004 to $64.8 billion in 2009, according to AMR Research (Beatty and Williams, 2006).

As such, it is critical for organizations to understand the important variables to enhance the use of ERP among the end users since the resulting cost to the organization is tremendous. Aladwani (2001) stated that many ERP systems faced implementation difficulties because of end users’ resistance. Yi and Davis (2001) also noted that organizations will not realize desired returns on their investments in information technologies designed to improve decision-making unless users are able to use them (Amoako-Gyampah, 2007). Cooke and Peterson (1998), reported that 186 companies that implemented large systems found that resistance is the second most important contributor to time and budget overruns and is the
fourth most important barrier to implementation (Klaus et al., 2007). Hence, it is important for organization's to identify factors that would enhance user's acceptance of ERP system.

This research aims to examine the influence of selected factors on end-user's usage of ERP systems. The aim of this paper is to test some of the existing theoretical models in ERP implementation and facilitate organization's in diagnosing the main reasons why ERP system implementation is not achieving the expected objective. The outcome of the research could be to facilitate organization's in understanding the main contributors to end-user usage of ERP systems, to enable them to take necessary corrective actions taken to enhance end-user's ERP usage. A research model is proposed using factors identified from the literature review.

**Literature review and conceptual foundation**

*Technology acceptance model (TAM)*

According to Lee et al. (2003), technology acceptance model (TAM) is one of the most influential models used in explaining the acceptance of information technology (IT). Davis (1989) and Davis et al. (1989) developed TAM by looking into the perceived usefulness (PU) and perceived ease of use (PEU), which comprise of two major determinants of IT usage. PU is defined as the extent to which a person believes that using the system will enhance his or her job performance and PEU is defined as the extent to which a person believes that using the system will be free of effort. TAM states that computer usage is determined by behavioral intention to use a system, where the intention to use the system is jointly determined by a person's attitude toward using the system and its perceived usefulness. According to Davis et al. (1989), as learning progressed over time, the concern on perceived ease of use is less salient.

The underlying theory behind TAM is it is usage is voluntarily, however, in order to successfully implement ERP, TAM's usage must be mandatory throughout the organization. This is necessary since the system integrates data to produce organizational reports which are useful for managers and these reports would not be useful if only some departments used the system while others do not (Klaus et al., 2007). In a comparison of five theoretical models on theory of acceptance, Riemenschneider et al. (2002) found that apart from usefulness (significant across five models), subjective norm, voluntariness and compatibility were found to be significant determinants of end user acceptance.

*Unified theory of acceptance and use of technology (UTAUT)*

Venkatesh et al. (2003) proposed the unified theory of acceptance and use of technology (UTAUT) as an alternative to TAM. The four key components in UTAUT are performance expectancy, effort expectancy, social influences, and facilitating conditions. Performance expectancy measures the degree to which a person believes that using the system could help improve his or her performance, and this construct is similar to the usefulness construct in the TAM model. Effort expectancy measures the degree to which a person believes the system will be easy to use and this is similar to the ease of use construct in the TAM model. Social influence measures the degree to which a person believes that others who he/she cares about feel that he/she should use the system. Facilitating conditions measures the degree to which a person believes that organizational assistance is there to facilitate the usage of the system. UTAUT also considers the moderating effect of four other factors such as gender, age, experience and voluntariness of usage (see Venkatesh et al., 2003). Thus, as an extension to TAM, UTAUT takes into consideration the factor of voluntariness of usage which plays an important factor in ERP implementation. When comparing UTAUT and Riemenschneider's (Riemenschneider et al., 2002) results from the comparison of five theory of technology acceptance models, apart from usefulness (performance expectancy), UTAUT addressed the rest of the other important variables: subjective norm (social influence), compatibility (facilitating condition) and voluntariness. In view of this, UTAUT model was adopted as the basis of this study.
Performance expectancy (perceived usefulness). In UTAUT, performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in a job (Venkatesh et al., 2003). This factor was derived from the perceived usefulness factor as proposed in TAM. As mentioned by Davis (1989), PU was significantly correlated with self-predicted current usage ($r = 0.63$) and self-predicted future usage ($r = 0.85$). A system that is high in PU is one that the user believes will reduce his or her task ambiguities and eventually increases work-related performance (Davis, 1989; Venkatesh and Davis, 2000; Amoako-Gyampah, 2007). As evidenced by a research of comparison of five theories later in year 2002, usefulness was still found to be a strong and highly significant determinant of technology usage (Riemenschneider et al., 2002; Lee, 2009; Schaupp et al., 2010). Further research in Malaysia by Ramayah and Lo (2007) suggested that PU was the more influential driver for predicting the intention to use an ERP system. The greater the PU in using the ERP system, the more likely it is that ERP system would be adopted (Venkatesh and Davis, 2000):

$$P_1 \quad \text{Performance expectancy of the system will have a direct, positive effect on intention to use the ERP system.}$$

Effort expectancy (perceived ease of use). In UTAUT, effort expectancy is defined as the degree of ease associated with the use of the system. According to Venkatesh et al. (2003), this factor was derived from the perceived ease of use factor as proposed in TAM. Davis (1989) found that an application perceived by people which is easier to use is more likely to be acceptable. In a similar finding by Davis et al. (1989), effort-oriented constructs are expected to be more salient in the early stages of a new behavior, when process issues represent hurdles to be overcome, and later become overshadowed by instrumentality concerns. This is consistent with previous findings by Davis (1989), Davis et al. (1989), Amoako-Gyampah and Salam (2004), Venkatesh and Davis (2000), and Ramayah and Lo (2007) who found that effort expectancy (PEU) influenced behavioral intention to use ERP system through influencing perceived usefulness:

$$P_2 \quad \text{Effort expectancy of the system will have a direct, positive effect on intention to use the ERP system.}$$

Social influence. In UTAUT, social influence is defined as the degree to which an individual feels that it is important for others to believe he or she should use the new system. This factor is similar to the factor “subjective norm” as defined in TAM2, an extension of TAM (Venkatesh and Davis, 2000). In TAM2, subjective norm exerts a significant direct effect on usage intentions over and above perceived usefulness and perceived ease of use for mandatory systems. However, none of the social influence constructs are significant in voluntary contexts. (Venkatesh et al., 2003). As explained by Venkatesh et al. (2003), subjective norm significantly influences perceived usefulness via both internalization, in which people incorporate social influences into their own usefulness perceptions and identification, in which people use a system to gain status and influence within the work group and thereby improve their job performance, particularly in the early stages of experience. This normative pressure will attenuate over time as increasing experience provides a more instrumental (rather than social) basis for individual intention to use the system (Venkatesh et al., 2003; Lee, 2009; Schaupp et al., 2010):

$$P_3 \quad \text{Social influence related to the system will have a direct, positive effect on intention to use the ERP system.}$$

Facilitating condition. In UTAUT, facilitating condition is defined as the degree to which an individual believes that organizational and technical infrastructure exists to support use of the system. Similar discussion can be found in model of personal computer utilization by Thompson et al. (1991) The underlying construct of facilitating condition is operationalized to include aspects of the technological and/or organizational environment that are designed to remove barriers to use (Venkatesh et al., 2003). The construct of facilitating condition is having the same goal with compatibility construct from perceived characteristics of
innovating (PCI) which incorporates items that tap the fit between the individual’s work style and the use of the system in the organization (Riemenschneider et al., 2002).

The impact of facilitating conditions on usage of ERP system by end users is further decomposed to three factors which have the same purpose of tapping the fit between individual’s work style and the use of system in organization:

P4. Facilitating conditions related to the system will have a direct, positive effect on intention to use the ERP system.

Shared belief. Shared belief among the end users of an ERP system become important especially in an ERP environment where it cuts across functional boundaries and many users are involved in the implementation process. Amoako-Gyampah and Salam (2004) highlighted that a sense of mutual trust and commitment must develop between the various participants to ensure a free exchange of beliefs and opinions. They further commented that this shared sense of belief about the benefit of the new ERP system allows organizational participants to find common grounds and a shared sense of purpose. According to Ramayah and Lo (2007), shared beliefs in the benefits of resource planning systems were positively related to PEU and PU. Thus, to enhance end user usage of the implementation of new ERP system, there should be shared feelings between the employees, their peers and line managers:

P5. Shared beliefs related to the system will have a direct, positive effect on intention to use the ERP system.

Training. Training offers a good opportunity to help users adjust to the new ERP system and helps build positive attitudes towards the system (Aladwani, 2001). He added that through training, end-users can appreciate the benefits offered by an ERP system. In addition, the user’s experience with technology and the fit between task and technology could have further contribution to PEU (Ramayah and Lo, 2007). Hence, training becomes a mandatory facilitating condition to enhance end users knowledge, skill and this has a direct impact on their perception on system usefulness. According to Huang et al. (2004), “insufficient user training” ranks the third priority in terms of the top ten risk factor of ERP risk. Umble et al. (2003) supported this by saying that if employees do not understand how a system works, they will invent their own processes using those parts of the system they are able to manipulate:

P6. Training related to the system will have a direct, positive effect on intention to use the ERP system.

Project communication. Communication is a means through which information about the benefits of the technology flows from senior managers (decision maker) to others (Amoako-Gyampah and Salam, 2004). They further noted that effective communication will lead to the development of trust and exchange of information needed for technology acceptance. The research of Huang et al. (2004) which reveals the ineffective communications with users is ranked number 2 in the top ten risk factors of ERP implementation. Past researches found that communication is an important factor for a successful change in process, and lack of communication has been linked to many project failures (Kitchen and Daly, 2002; Falkowski et al., 1998; Holland et al., 1999). On the other hand, Roy Jakes, IS director of Guinness Global Support commented that communication was the key success factor in Guinness’ successful implementation of Integrated Business Programme in the year 2000 (Collyer, 2000):

P7. Project communications related to the system will have a direct, positive effect on intention to use the ERP system.

Gender. Venkatesh and Morris (2000) acknowledged that different gender gives a different impact on the use of any information system in both mandatory and voluntary settings. Venkatesh et al. (2003) noted that women tend to be more sensitive to others’ opinions and therefore find social influence to be more salient when forming an intention to use new
technology. Research on gender differences indicates that men tend to be highly task-oriented and, therefore, performance expectancies, which focus on task accomplishment, are likely to be especially salient to men (Venkatesh et al., 2003). In contrast, female end-users were observed to have higher levels of computer anxiety and their perceived ease of use tends to be lower than that of their male counterparts; women also weighted ease of use as a much more important determinant of behavioral intention than men (Venkatesh and Morris, 2000).

Venkatesh et al. (2003) identified gender as a moderating variable for the following relationship:

- performance expectancy and system use;
- effort expectancy and system use; and
- social influence and system use.

P8. Gender will moderate the relationship between performance expectancy, effort expectancy, social influence and intention to use.

Age. According to Venkatesh et al. (2003), research on job-related attitudes suggests that younger workers may place more importance on extrinsic rewards. Burton-Jones and Hubona (2006) found that age is a significant moderating factor between effort expectancy (PEU) and usage of the system but age was not a significant moderating factor between performance expectancy (PU) and system use. Generally, older end-users may find it hard to adapt to new system usage and effort expectancy (PEU) becomes an important factor on the impact of system usage. Thus, older workers shall have lower performance expectancy as they require more effort to learn the new ERP system and do not perceive that use of the system would increase their work performance.

Venkatesh et al. (2003) identified age as a moderating variable for the following relationship:

- performance expectancy and system use;
- effort expectancy and system use;
- social influence and system use; and
- facilitating conditions and system use.

P8. Age will moderate the relationship between performance expectancy, effort expectancy, social influence, facilitating conditions and intention to use.

Intention to use ERP system. Amoako-Gyampah and Salam (2004) opined that behavioral intention is the intention of end-users to make use of new technology. This is supported by Venkatesh and Davis (2000) as they found that there is a strong correlation between behavioral intention and actual behavior. This means end users who have high PU will use ERP when they believe that there is a positive user-performance relationship. Amoako-Gyampah and Salam (2004) further noted that it is appropriate to examine behavioral intention to use technology even when usage might be mandatory. Thus, when ERP usage is mandatory, end-users who have a low intention to use may reduce the frequency of system usage. As noted by Seymour et al. (2007), mandatory usage may represent the level of use needed to perform minimal job functions, and any usage beyond that will be voluntary.

Proposed research model

With the above literature review, a research model is proposed as shown in Figure 1 for this study.

Figure 1 presents the proposed research model, which is derived from UTAUT as proposed by Venkatesh et al. (2003) with few adjustments. The behavioral intention and user behavior factors have been combined and replaced by intention to use ERP system. The “intention to use ERP system” explained the behavioral intention and subsequently the actual ERP
usage. This is consistent with various past research models to identify end-users' usage intention in ERP environment (Amoako-Gyampah and Salam, 2004; Amoako-Gyampah, 2007; Ramayah and Lo, 2007).

The voluntariness moderating variable has been removed from the proposed research model because end-users of ERP systems are mandated to use the system. Therefore, there is no point measuring the voluntariness effect of the end-user.

Similar to the research model by Seymour et al. (2007), three constructs: training, communication and shared belief were used to measure the facilitating conditions construct. As this research will be performed in a cross sectional study setting, the moderating factor of experience was excluded from the proposed research model.

Conclusion

The findings from literature review reveal that various technology acceptance models have been introduced in the past two decades. However, there are new research models which lack empirical study. With the above proposed research model, further study could be carried out on the research and to gauge if this model can better explain the end-users’ intention to use an ERP system. Six independent variables and two moderating variables have been identified for further research on the impact of end-users’ intention to use ERP system. From the literature review, all six independent variables, namely performance expectancy, effort expectancy, social influence, training, communication and shared beliefs, contribute positively to the end-users’ intention to use the ERP system.

References


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