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# Assimilation of Information Technology in Enterprise Business Processes

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## ABSTRACT

The potential of ERP systems cannot be fully realized unless adopting firms make a concerted effort of assimilating the ERP technology into every aspect of their business processes. Yet few studies provide understanding of why ERP assimilates more extensively in certain organizations as against others (post-adoption). Based on the extant literature, we propose a model which can be employed to explain the extent of ERP assimilation. The model incorporates top management championship, compatibility, institutional influence, and absorptive capacity factors. This paper describes the model development, the model testing, and some preliminary results.

## Keywords

Enterprise Resource Planning (ERP), IT Assimilation, top management championship, compatibility, institutional influence, absorptive capacity

## INTRODUCTION

As the process of globalization and digitization of the economy accelerates, information technology (IT) is increasingly permeating every aspect of business and organizational processes. As a consequence, businesses around the world increasingly rely on IT to survive and prosper. Yet increased IT investment does not automatically lead to improved organizational efficiency and performance. Researchers and practitioners have long recognized that the significant business values of IT cannot be fully realized until their implicit functionalities are assimilated within the ongoing actions of individuals and teams of an organization (Armstrong and Sambamurthy, 1999, Purvis, Sambamurthy and Zmud, 2001, Zmud and Apple, 1992). The process of IT assimilation has been the subject of many studies during the last three decades. A comprehensive view of the technology assimilation process and the influential forces is still to emerge. In this study, we draw on the prior studies and attempt to develop a more complete IT assimilation model that incorporates most, if not all, of the constructs that have been found to have a significant impact on the IT assimilation process. We then test the measurement instruments and the proposed model using data collected from organizations that have implemented the enterprise resource planning (ERP) system.

## THEORETICAL DEVELOPMENT

### Theories of Technology Assimilation

Technology assimilation can be defined as “the extent to which the use of technology diffuses across the organizational projects or work processes and becomes routinized in the activities of those projects and processes.” (Purvis et al., 2001, p121). From this perspective, technology assimilation is in essence an innovation diffusion process within an organization after the initial adoption of the technological innovation at the organizational level has been completed. For that reason, the innovation adoption and diffusion theories (Mansfield, 1968, Rogers, 1983) form the foundation for most of the assimilation studies.

Researchers have adopted different perspectives when studying technology assimilation within organizations. The organizational learning perspective of innovation diffusion is proposed by Attewell (1992) to address the criticisms against both the communication based (Rogers, 1983) and the economics based (Mansfield, 1968) diffusion theories. Fichman and Kemerer (1997) extended the organization learning theory of diffusion by identifying the types of organizations that are most likely to be the early adopters even in face of higher knowledge barrier.

Researchers adopting the institutional perspective (e.g., Purvis et al., 2001) agree with the organization learning perspective that the users in the adopting organizations often encounter significant challenges in learning about the technology and in understanding how they must re-conceptualize their work process activities in order to use the technology effectively.

The knowledge-based perspective of technology assimilation (e.g., Armstrong and Sambamurthy, 1999) emphasizes the importance of the objective knowledge - senior leadership team's knowledge of IT and business- and the system of knowing - the senior leadership team's ability to recognize valuable business and IT information, develop learning, and apply the learning in guiding the diffusion of IT innovation activities (Armstrong and Sambamurthy, 1999).

### **The ERP Innovation**

Few computer applications have created such a profound impact on the operations, management, structure, and even cultures of organizations around the world as ERP in the history of enterprise computing. ERP systems are essentially packaged software applications that replace a firm's disparate transaction processing systems with a single, integrated system, embodying the newly understood tight interdependencies among a firm's functional units (Ross and Vitale, 2000). According to an AMR report, the worldwide ERP market in 2002 is about \$20 billion. A survey of 500 midsize to large companies shows that ERP penetration is 67%, and 74% of manufactures and 59% of service companies are either using or implementing ERP (Scott and Seddon, 2002).

One of the most significant differences between ERP and other IT innovations is the degree of impact of an ERP implementation on organizational processes, structures, and even cultures (Soh, Kien and Tay-Yap, 2000). ERP applications are much more susceptible to failure due to convoluted organizational issues. With implementation costs ranging from \$2 million to \$130 million (Ross and Vitale, 2000), any failure could cause serious damage to the adopting organization. Yet until recently ERP has been under-researched (Klaus, Rosemann and Gable, 2000). Given the significance of the ERP systems both in terms of their strategic role in competitions and the pervasiveness of their adoption in organizations, research on ERP assimilation is clearly called for.

### **Research Model and Hypotheses**

We developed a technology assimilation model by integrating the extant theories in the context of ERP assimilation. The main factors identified in the extant literature on innovation adoption and diffusion are included in our model, including top management championship (Armstrong and Sambamurthy, 1999; Purvis et al., 2001), compatibility (Cooper and Zmud, 1990), institutional influence (Purvis et al., 2001, Teo, Wei and Bendasat, 2003), and absorptive capacity (Zahra and George, 2002). Figure 1 shows the research model, and the development of the research hypotheses is presented as follows.

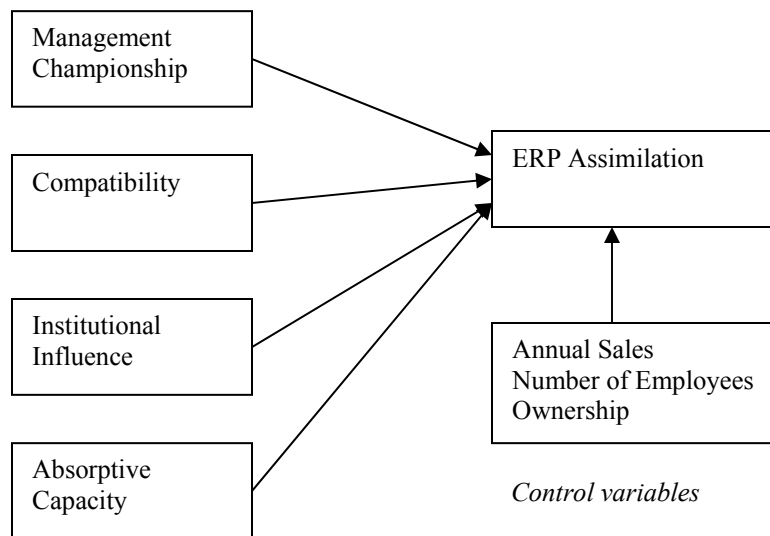


Figure 1 Theoretical Model of the Research

### *Management Championship*

Management championship refers to the extent to which the top management team advocates the use of a technological innovation (Purvis et al., 2001). Chatterjee (2002) discuss how two facets of the construct of management championship, *commitment* and *involvement* contribute to technology assimilation. Their study found that top management championship can positively influence the extent of organizational assimilation of technologies in their e-commerce strategies and activities. Sharma and Yetton (2003) also argue that a high level of management support is required to persist with attempts to successfully implement IT innovations.

*H1*: Top management championship for ERP has a positive and significant influence on the degree of ERP assimilation in the enterprise.

*H1a*: Higher level of top management belief in the benefits from ERP systems will lead to higher level of ERP assimilation in the enterprise.

*H1b*: Higher level of top management participation in the ERP assimilation process will lead to higher level of ERP assimilation in the enterprise.

### *Compatibility*

The significant impact of compatibility of an IT innovation with a potential adopter organization, on adoption and implementation success has been noted in many studies (Cooper and Zmud, 1990, Kwon and Zmud, 1987). Compatibility can be further refined into two categories: organizational compatibility and system compatibility (Beatty, Shim and Jones, 2001). The more an innovation is perceived as consistent with present systems, values, practices, procedures, and norms of the potential adopter the more likely it is to be adopted (Rogers, 1983). Most existing studies conclude that compatibility plays a significant role during the adoption decision making but few studies examine its role in IT assimilation. This leads us to the next set of hypotheses:

*H2*: Task compatibility between ERP and the adopter enterprise has a positive and significant influence on the level of ERP assimilation in the enterprise.

*H2a*: Higher compatibility between ERP and the enterprise's organizational culture will lead to a higher level of ERP assimilation in the enterprise.

*H2b*: Higher compatibility between ERP and the enterprise's IT infrastructure will lead to a higher level of ERP assimilation in the enterprise.

### *Institutional influence*

Institutionalization can be described as a process through which the societal expectations of appropriate organizational form and behavior come to take on a rule-like status in social thought and action (Martinez and Dacin, 1999). This process is marked by components of formal structure becoming widely accepted, as both appropriate and necessary, and serving to legitimize organizations (Tolbert and Zucker, 1983). DiMaggio and Powell (1983) outlined three basic institutional mechanisms that shape organizational behavior: the *coercive* mechanism stemming from political influence and the problem of legitimacy, the *mimetic* mechanism resulting from the standard responses to uncertainty, and the *normative* mechanism associated with professionalization of the members in an organizational field.

*H3*: The degree of institutional pressures on a focal enterprise contributes to the level of ERP assimilation in the enterprise.

*H3a*: Higher degree of mimetic pressure will lead to a higher level of ERP assimilation in the enterprise.

*H3b*: Higher degree of coercive pressure will lead to a higher level of ERP assimilation in the enterprise.

*H3c*: Higher degree of normative pressure will lead to a higher level of ERP assimilation in the enterprise.

### *Absorptive Capacity*

Absorptive capacity refers to a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage (Zahra and George, 2002). It is a widely acknowledged concept in literature and is understood to positively impact organizational success (Cohen and Levinthal, 1990). We propose to measure two dimensions of absorptive capacity (Zahra and George, 2002): *potential absorptive capacity* (PACAP) referring to its receptiveness towards acquiring and assimilating external knowledge, and *realized absorptive capacity* (RACAP) referring to the transformation and exploitation capabilities of an organization.

*H4*: The absorptive capacity of an enterprise has a positive and significant influence on the level of ERP assimilation in the enterprise.

*H4a*: Higher level of potential absorptive capacity will lead to higher level of ERP assimilation in the enterprise.

*H4b*: Higher level of realized absorptive capacity will lead to higher level of ERP assimilation in the enterprise.

## RESEARCH METHOD AND PRELIMINARY RESULTS

### Scale Development

The items measuring top management championship were derived from prior studies relevant to this construct (Chatterjee, Grewal and Sambamurthy, 2002, Jarvenpaa and Ives, 1991). Top management beliefs were assessed by asking respondents to rate the extent to which they believed in the potential of ERP to realize operational and strategic benefits, while top management participation was operationalized by asking respondents to rate the extent to which senior management actively took part in the management of ERP assimilation.

Compatibility scales were created on the basis of previous research regarding factors that affect adoption of innovations (Beatty et al., 2001, Jones and Beatty, 1998, O'Callaghan, Kauffmann and Konsynski, 1992). In accordance with the definitions of the two types of compatibility, the items of organizational compatibility ask respondents to rate their perceived alignment between ERP and the culture, values, and preferred work practices of the adopting organization, whereas the items of system compatibility ask respondents to rate the extent to which ERP can be readily integrated with the existing hardware, software, networking, and telecommunications architectures of the adopting organization.

The scales of the three institutional pressures were derived from the study of Teo et al. (2003). Mimetic pressure was reflected by the perceived success of adoption by competitors. Coercive pressure was evaluated by asking respondents to rate influences coming from local governments, industry associations, and market places. Normative pressure was assessed from the extents to which suppliers and customers adopted ERP and governments advocated IT usage.

The items of absorptive capacity were drawn from Szusanski's (1996) research on adoption of general best practices. Some modifications were made to make the scales more suitable in the context of ERP assimilation. All of the items of top management championship, compatibility, institutional pressures and absorptive capacity were evaluated on a 5-point scale on which 1 means "strongly disagree" and 5 means "strongly agree".

Given the complexity of ERP use, we argue that a single measure cannot sufficiently reflect a firm's ERP assimilation and a multi-dimensional measurement should be exploited. Based on the previous research on organizational use of IT (Hart and Saunders, 1998, Iacovou and Benbasat, 1995, Massetti and Zmud, 1996), ERP assimilation was measured from three dimensions: volume, diversity and depth. The three dimensions were operationalized as the total percentage of business processes accomplished by using ERP, the number of functional areas that automated by ERP, and the managerial level of ERP use, respectively.

A double translation approach was utilized to ensure the semantic equivalence of the English questionnaire and the Chinese questionnaire. The face validity of the scales was established by asking a panel of five experts in China's ERP industry to review the Chinese questionnaire. A few modifications were made according to the panel's comments.

### Preliminary Results

A field survey method was adopted for this study to tap responses from managers of Chinese companies that have implemented ERP. A sample was drawn from clients of UFSOFT, a leading Chinese ERP vendor for the data collection. Seventy-seven responses have been received. PLS was used for testing the measurement scales and hypotheses. Measurement assessment results indicate that all of the scales have acceptable reliability, convergent validity, and discriminant validity. We also preliminarily tested the research hypotheses and found that top management champion, institutional influence, and absorptive capacity positively affect ERP assimilation, while compatibility has no significant relationship with ERP assimilation. Further analysis and interpretation will be conducted to carry on this research.

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