ERP Assimilation Challenge: An Integrative Framework for a Better Post-Implementation Assimilation

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Introduction

ERP systems have proven to be one of the most important emerging information technologies in the recent years (Davenport, 1998). Although with a slow pace, ERP systems kept evolving in response to the changing market demands and the technological developments. Some of the main trends of ERP systems developments include the following: improvements in flexibility and integration, extensions to e-business applications, broader reach to new users, and the adoption of Internet technologies (Mello, 2002). If implemented properly and fully comprehended and assimilated by target users, ERP systems can have tangible and intangible implications for all functional areas in a company (Gefen and Ragowsky, 2005). Unsurprisingly, and according to a recent ARC Advisory Group study the ERP market has so dramatically increased that it has reached a value of $16.67 billion in 2005 and is forecasted to be over $21 billion in 2010. Despite the large-scale adoption of enterprise systems, attaining the expected benefits is still a challenging task. While a number of companies have enjoyed the benefits of ERP systems, others have had to scale back their initiatives and to accept minimum payoffs or to simply give up their ERP project (Soh et al., 2000 ; Al-Mashari and Al-Mudimigh, 2003 ; Umble et al., 2003 ; Markus et al., 2000). In fact, it has been estimated that more than 60% of ERP projects are unsuccessful (Rockford Consulting Group, 2004) and between 50 and

70% proects fail to achieve the desired benefits (Al-Mashari et al., 2003 ; Loh and Koh, 2004).

ERP assimilation and the concomitant realisation of long term advantages have often been implicitly assumed to be achieved when the ERP project ends on time and within the given budget. In many cases, such an assumption, as strongly argued by Markus and others, has proven to be erroneous (Markus et al., 2000). Indeed, ERP failure can have different degrees and can occur at different instances of the ERP life cycle (Donovan, 2001 ; Markus et al., 2000). It has been argued that ERP failure occurs when the installed system is underutilised and, hence, many of the idiosyncratic features have not been fully extended by their target users (Davenport 1998 ; Donovan, 2001 ; Jasperson et al. 2005).

All these issues raise questions about the critical ERP post-implementation stage for the system's survival and its assimilation in the company. It is during this stage that the effects of uncontrolled problems in previous stages appear due to the fact that users start the exploitation and the evaluation of the system. During the implementation stage, users are usually limited to learn the basic functionalities to help the system go live. Unlike clerical workers who use the system for routine tasks, experienced users need a few months to feel comfortable with the system and to trust it for their key tasks (Musaji, 2005). Perceiving the systems as being complex, intrusive and threatening, many users would limit their use to the basic and usual tasks. At the same time, and because they fear to look inept to use the system, they would try and test some features of the system which are the easiest to learn and with the least risk of error (Musaji, 2005). As a critical mass of users start mastering the

system and they see its advantages on their work and its capabilities, they start using it in a more creative way and exploring its more advanced functionalities and requiring, even, more functions to be added (Musaji, 2005). These are, in fact, some of the signs of the system's acceptance and assimilation which is very crucial and essential for the system's success. In order to fully benefit from the system's potential, the system needs to be fully assimilated in the firm (Armstrong and Sambamurthy, 1999 ; Purvis et al., 2001 ; Chatterjee et al., 2002). In order to efficiently assimilate the system, the firm needs to deeply understand the system's technology and capabilities, and to integrate it into its value chain functions (Chatterjee et al., 2002).

While considerable efforts have been made to discuss the ERP implementation process, there has been a dearth of research about the post-implementation stage (Shehab et al., 2004 ; Kwon and Zmud, 1987 ; Fichman, 2000) and the system's assimilation leaving the "failure after success" cases unresolved. This could be explained by the lack of a theory that guides the empirical research. Moreover, most of the realised studies that have examined the issue of ERP systems have implicitly assumed that ending the project on time and within budget would eventually guarantee long term advantages, ignoring the events which could emerge later which could radically change the project's performance. These suggests that there is a strong need to develop an adequate understanding of how and why the post-implementation period of some ERP implementations contribute to the provision of more business benefits than others.

This study differs from previous research by moving beyond the implementation stage so as to concentrate on the assimilation process which characterises the post-implementation stage. First, there is a dearth of theory based research about post-

implementation assimilation. Next, ERP systems represent a complex technological innovation for a firm. The firm could therefore encounter significant challenges when learning and assimilating the system in order to achieve the desired benefits (Teo et al., 2006). Moreover, possessing and mastering the use of an ERP system have become a critical asset for firms in order to be ale to adapt to environmental changes. For these reasons, both the diffusion of complex innovation theory and the institutional theory will be used in order to understand the ERP systems assimilation process. Most of the studies which used the diffusion theory examined the adoption antecedents. Little work has been done, however, when it comes to the post-implementation assimilation process. Using the institutional theory would further enrich the model and help investigating the external forces which would encourage (or hinder) ERP assimilation.

Building on ERP implementation and IT diffusion literature, we have developed an integrative conceptual model for ERP assimilation during the post-implementation stage of the ERP project life cycle. The technology–organization–environment (TOE) framework (Tornatzky and Fleischer 1990) will be adopted in order to explain the determinants of ERP assimilation. Our objective in this paper is to present an integrative conceptual model through trying to answer the following questions:

- What are the factors that influence the assimilation of ERP in manufacturing firms?
- How does the assimilation of ERP systems affect the benefits realized from deploying these systems?

The rest of the paper is organised as follows: section 1 gives an overview of ERP systems and explores a number of ERP challenges which would impede the ERP assimilation process. Section 2 explains the assimilation concept. Section 3 provides a general idea about prior work and highlights our contributions. Section 4 is devoted to the ERP assimilation model that we propose, including a description of the TOE framework and of the different determinants that we have identified. Finally, in the conclusion we highlight our research contributions and delineate the methodology we will follow to empirically test our research model.

1. ERP Systems challenges: impediments to assimilation

An ERP system is a packaged business solution that is designed, through a central database, to automate and integrate many (possibly all) business processes in an organisation (Jacobs and Bendoly, 2003). ERP systems are intended to be a "(central) comprehensive and integrated database which collects data from and feeds data into modular applications supporting virtually all of a company's business activities – across functions, across business units, across the world" (Davenport, 1998, p.123). Three main components constitute an ERP software: 1) a central database which represents the foundation of the system, 2) transactional application modules for the collection and maintenance of data in the central database, and 3) information generating application modules used to retrieve multiple views of the data. Many industries and various functional areas are served by ERP with the attempt of automating and integrating operations including supply chain management, inventory control, manufacturing scheduling and production, sales support, customer relationship management, financial and cost accounting, human resources, and any other management process (Hitt et al., 2002).

Adopting an ERP system is a challenging and complex organisational learning and change management process (Davenport, 1998; Tchokogue, 2005 ; Kumar et al., 2003). Indeed, the required reengineering of business processes, the heavy investments in time as well as material and human resources significantly increase the risks and challenges of ERP projects (Kumar et al., 2003). While a rapid and smooth adoption might reveal initial success, implementation quality can result in underutilisation of the product and in customer dissatisfaction (Markus et al., 2000).

Despite the attempts to lower the degree of complexity of the systems and the developments of various mid-range ERP systems, many organisations are still experiencing failures of their ERP initiatives (Somers et al. 2000). An effective system implementation is therefore a necessary but not sufficient condition to fully benefit from the system's potentials. In order to generate significant business value, the innovation should be integrated and embedded in the corporate value chain before it can generate business value (Kwon an Zmud, 1987 ; Delone and McLean, 1992).

Several ERP challenges and failure reasons have been reported in the literature. Davenport (1998), for instance, reports that one of the reasons for the failure of ERP is that organizations fail to reconcile between the requirements of its human and business systems and those of the new technological system. ERP failure has been also attributed to a plethora of reasons: the complexity of ERP systems, the lack of ERP product knowledge (Chang, 2004), the systems inappropriate project management, the lack of executives commitment, the lack of expertise to support the organisation holistically in every single ERP module, the unclear business objectives,

the poor communications, the lack of project methodology or poor adherence to the methodology used, the immature product releases, the mismatch between the delivered applications and the organisation's expectations, the resistance to change within the organization, and others (Umble et al., 2003 ; Bagchi et al., 2003 ; Loh and Koh, 2004).

Markus et al. (2002) investigated different road blocks in an ERP life cycle. Given that many projects have been terminated during the post-implementation phase, exploring the challenges of this phase has been of an increased importance. In order to be fully and properly deployed, the system needs to be accepted by its users. One major problem, however, is the lack of commitment, acceptance and readiness of the users to deploy the system (Kumar et al., 2003 ; Markus et al., 2000). These could be explained by the lack of appropriate training which keeps users continuously rely on project team and technical support personnel, lack of education about the system's advantages and different functionalities, lack of support documentation, failure to retain people who understand the system, high user turnover and difficulty of recruitment on new computer savvy hires (Kumar et al., 2003 ; Markus et al., 2000). Technology related problems are also another major road block during the post-implementation phase. These include risks of malfunctioning due to bugs in the software and data inconsistency, unreliable hardware, lack of documentation about system configuration to support evolving business needs.

All of the abovementioned challenges and problems would eventually negatively affect ERP assimilation.

2. The concept of assimilation

Organisational IT assimilation has been of an increasing interest to researchers in information systems for more than a decade (e.g. Cooper and Zmud 1990 ; Fichman and Kemerer, 1997 ; Chatterjee et al., 2002). The Webster's New collegiate Dictionary defines to assimilate as "to absorb into the system" and "to take into the mind and to thoroughly comprehend". Even though the concept of assimilation originated in anthropology, it has been used in several other disciplines, such as marketing, research and development and management science. One of the main applications of the concept is the assimilation of new technologies in organisations, both at the organisational and the individual levels. In anthropology, immigrants assimilation, also called incorporation, characterises "the degree to which members of immigrant groups forge primary relations with native-born members of other ethnic groups" and "fully enter into the societal network of the host society" (Brown, 2006, p75). The assimilation concept has also been used in the case of organisational new comers and has been interchangeably used with socialisation. Assimilation refers, in this case, to the process by which individuals from one cultural group become a part of or "blend," into a second group (Flanagin and Waldeck, 2004).

When it comes to the information systems field, IT assimilation is considered to be a central objective and an essential outcome of the adoption and implementation efforts (Armstrong and Sambaburthy, 1999).As a matter of fact, past researches had argued that prior to being able to come up with a successful business, a new technology is to be fully integrated and imbedded into the value chain of the given firm (Delone and Mclean, 1992)

Assimilation definitions in IS varied between designating one to several steps of the innovation diffusion and implementation process. For Gallivan (2001), for instance, assimilation refers to the six stages of the organisational IT adoption and implementation of Zmud and colleagues (i.e. Kwon and Zmud, 1987 ; Cooper and Zmud, 1990). These stages are: initiation, adoption, adaptation, acceptance, routinisation and infusion. Assimilation has been also used to refer to the process which extends from the initial awareness of the innovation, to its potential acquisition and wide-scale deployment (Fichman and Kemrer, 1997 ; Fichman, 2000). The process includes awareness, interest, evaluation, trial, commitment, and deployment (limited then general deployment). Diffusion only occurs when the technology spreads across a population of organizations (Fichman, 2000). In other studies (e.g. Agarwal et al., 1997 ; Armstrong and Sambamurthy, 1999 ; Ranganathan et al., 2004 ; Raymond et al., 2005), assimilation has been distinguished from adoption. While the latter refers to the decision about using or not the technology, assimilation refers to the extent to which the technology used in a comprehensive and integrated way and becomes routinised and embedded in the firm's work processes and value chain activities (Armstrong and Sambamurthy, 1999 ; Chatterjee et al., 2002 ; Purvis et al., 2001). In the case of ERP systems, Bajwa et al. (2004) consider five stages in the ERP assimilation process, which they call also the ERP life cycle. These stages are: awareness for the need of implementing and ERP, selection of package, preparation, implementation and operation.

For the purpose of our research, we will consider assimilation as the extent to which the organisation has progressed from understanding the ERP systems' potential and functionalities to mastering and deploying them in their key value chain processes. If

compared to Cooper and Zmud (1990) stage model, this process occurs during the post-implementation stage of the ERP life cycle and more specifically after the system goes live, as shown in Figure 1.

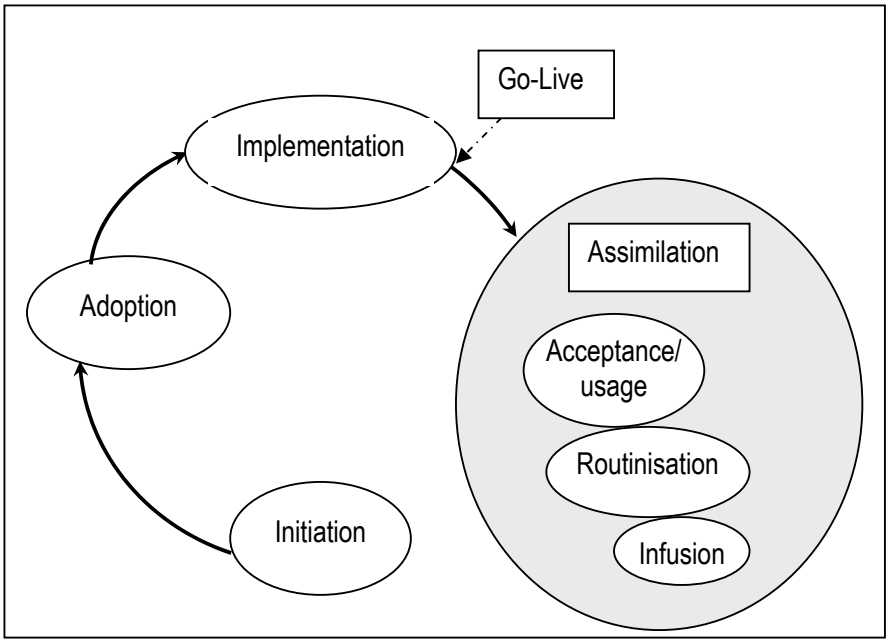

Figure 1: ERP assimilation process in relation to the other processes

We have to note also that assimilation can take various degrees. The firm and the system's target users start first by getting comfortable with the system by relying on it for their key tasks (Musaji, 2005). Once the system is mastered, users would try to push the system's limits some steps further by using it in creative ways and by requesting new functions and enhancements to the system (Musaji, 2005).

2.1 Assimilation of complex technologies

In order to comprehend the assimilation phenomenon, we will use the diffusion of innovation theory. It has been suggested that there are functional parallels between IS implementation in general and diffusion of technological innovation (Premkumar et al, 1994 ; Fichman, 1992 ; Kwon and Zmud, 1987). The main advantage of borrowing

the innovation diffusion theory is that it has already a valuable cumulative tradition and that it provides a strong theoretical base for IS researchers for evaluating IS and IS projects and for assessing the possibilities of the diffusion of the technological innovation and its incorporation within the organisation (Premkumar et al, 1994 ; Fichman, 1992 ; Kwon and Zmud, 1987).

The classical diffusion theory posits that innovation adoption process consists of preadoption activities embedded in the initiation stage and postadoption activities that facilitate implementation and continued use of the innovation (Rogers, 1995). The classical model has, however, received much criticism when applied in the context of complex organisational innovations (Fichman, 1992 ; Attewell, 1992 ; Rogers 1995). This model focused primarily on simpler innovations being adopted autonomously by individuals. These conditions make it unsuitable for innovations adopted by organisations where the decision making is dependent on several parties. Unlike simple innovations and technologies, adoption, implementation and deployment of complex technologies[1] are big decisions requiring complex organisational process and group decision making.

Rogers' basic model has been refined by Cooper and Zmud (1990) which have extended it into a six-stage model for technology innovation implementation namely: initiation, adoption, adaptation, acceptance, routinisation and infusion. During the initiation stage, pressure to change evolves from either organisational need or external forces or both. This need for change would be acknowledged by a key member or a group of members in the organization who rationalize the choice of an innovation. As

[1] "A complex technology is defined as a technology when first introduced, imposes a substantial burden on would-be adopters in terms of the knowledge needed to use them effectively" (Fichman and Kemerer, 1997).

a result, key managers at this stage realign their priorities and invest the necessary resources in the change effort (the technology adoption). In the third stage of adaptation, the organisation is prepared for the organizational innovation. This stage involves the technology installation and maintenance along with the revision and development (reengineering) of the organisational procedures and processes if necessary. In order to ensure the technology acceptance and to lower resistance to the new way of operating in the organisation, tactics such as communication and employee participation are employed. During the fourth stage of acceptance, users are induced to commit to the new technology through training, for instance. This stage is one of the early indicators of the technology acceptance in the firm. Acceptance would be exhibited by the changed attitudes and work habits and by starting to use the technology in the organisation's work. During the two final stages of routinisation and infusion (assimilation), the innovation gradually takes root as it is increasingly used in a more comprehensive and integrated way to its fullest potential.

Hence, researchers in the innovation adoption and implementation field have asserted that the internalisation and the effective use of the new technology can be realised when the knowledge barriers and knowledge burden are lowered (Purvis et al., 2001 ; Attewell 1992; Fichman and Kemerer 1997). Indeed, it ash been shown that most information technologies exhibit an "assimilation gap". This phenomenon occurs when the rate of the organisation's assimilation and deployment of the technology lags behind the technology adoption rate (Fichman and Kemerer 1999). One of the main advanced reasons of this gap is the high knowledge barriers. This gap between the firm's current state of knowledge and the required knowledge to effectively deploy the new technology should be, therefore, minimised (Teo et al., 2006) .This

can be realised through several institutional mechanisms internally (for instance through training, incentives etc.) and externally through the supply-side institutions which supply the technologies (for instance technology vendors, service firms and consultants) which can help transferring and lowering the barriers of knowledge (Attewell, 1992 ; Fichman, 1992).

3. ERP Post-implementation and assimilation previous works

Most of the studies which used the diffusion theory have mainly investigated the adoption antecedents and little has been done when it comes to the post-implementation assimilation process. Most researchers who identified ERP projects success factors primarily focused on the pre-implementation and the implementation stages (e.g. Umble et al., 2003 ; Verville and Halingten, 2002 ; Kumar et al., 2003). Other researchers suggested success factors for all the ERP life stages (e.g. Nah et al., 2001, 2006 ; Mabert et al., 2003 ; Zhang et al., 2003). Table 1 summarises some of the previous theoretical and empirical works that explored ERP projects by phases.

Authors	Initiation and selection	Adoption	Implementation	Post-implementation
Al-Mashari and Zairi (2000)	√	√	√	
Everdingen et al (2000)	√			
Shanks et al. (2000)	√		√	√
Verville and Halingten (2002)	√			
Motwani et al. (2002)			√	
Stratman and Aleda (2002)			√	√
Umble et al. (2003)			√	
Mabert et al. (2003)	√		√	
Zhang et al. (2003)			√	
Kumar et al (2003)			√	
Gargerya (2005)			√	
Tsai et al. (2005)	√	√	√	√
Sun et al. (2005)			√	
Bajwa et al. (2004)	√	√	√	√
Markus et al (2000)	√	√	√	√
Al-Mudimigh et al. (2001)	√	√	√	

Table 1: Previous researches on ERP by phase

These studies provide interesting insights about the ERP implementation stages. However, when it comes to the operation or post-implementations stage, except for vendor support, the identified factors were all internal and mostly technical. When it comes to studies limited to the post-implementation stage, very little research has been made. Stratman and Roth (2002) identified eight organisational competences to manage ERP post-implementation stages. Markus et al. (2000) identified the problems encountered in the different ERP life cycle stages and suggested some success measures for each stage. Nicolau (2004) suggested that a set of planned review activities, contribute to the success of the post-implementation success in ERP systems. As has been mentioned earlier, ERP assimilation is a requirement for the realisation of the improved performance and the other expected tangible and

intangible benefits. While previous studies limited the external factors to vendors and consultant support, we take an extra step forward by considering extra external influencing factors : the isomorphism pressures and external knowledge transfer institutions. Institutional pressures have been mainly considered to influence the adoption intention (e.g. Teo et al., 2003), the effect of these forces could extend also to other stages of the innovation adoption and assimilation process (Chatterjee et al., 2003 ; Gibbs and Kraemer, 2004). Hence, we posit that isomorphism forces influence the post-implementation stage of the ERP systems.

One other main contribution of this study, is that most of the published researches fail to ground their hypotheses in existing theory. Our integration of the assimilation concept, the complex technological innovations diffusion and the institutional theory into a comprehensive model will provide a better understanding of the ERP assimilation process.

4. ERP assimilation context: TOE framework

A meticulous review of the ERP implementation and assimilation literature would suggest that the technology-organisation-environment (TOE) framework (Tornatzky and Fleischer, 1990) is an appropriate starting point to our research. The TOE framework considers three aspects of the firm's context which would determine the process by which a firm adopts implements and assimilates technological innovations: a) the technological context defined in terms of the existing and new technologies of the firm; b) the organisational context which includes several descriptive measures such as management structure, quality of its human resources, scope and size; c) the environmental context which refers to the external institutional environment including

its industry, competitors, dealings with government and access to resources offered by others (Tornatzky and Fleischer 1990, pp. 152–154).

The TOE framework has often been used to study the determinants of adoption of a technology (Gibbs and Kraemer, 2004 ; Zhu et al., 2006). The framework has also been useful in studying the determinants of technology usage, implementation and routinisation (e.g. Zhu et al., 2006 ; Zhu and Kraemer, 2005). The TOE framework would be, therefore, appropriate to explore the factors which would determine ERP post-implementation assimilation.

Using this framework in conjunction with the complex technological innovations assimilation and the institutional theory will help us find the combination of variables that would be excellent predictors of ERP assimilation. The following figure illustrates the different sets of factors that we have chosen for our ERP assimilation model. Each factor is further detailed in the following sub-sections.

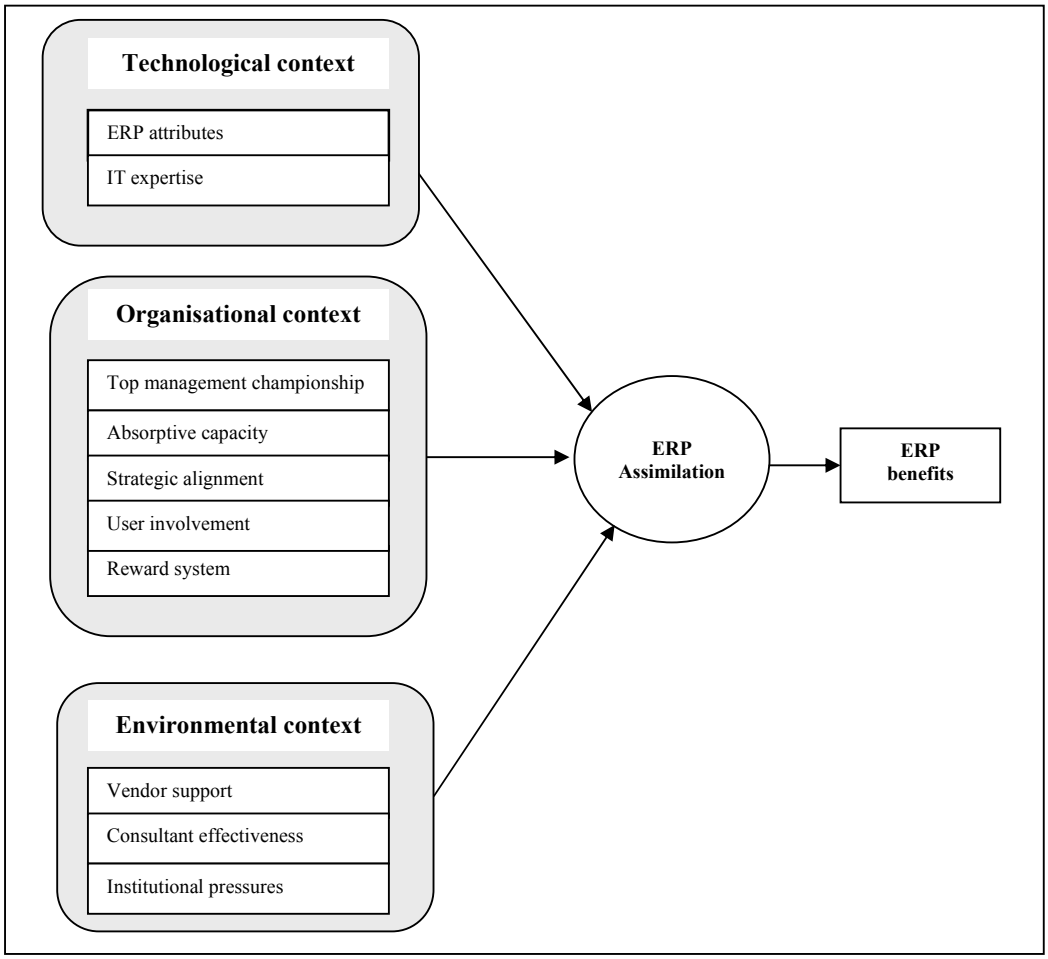

Figure 2: ERP assimilation framework

4.1 Technological context

The technological context describes the characteristics of the innovation in question as well as the organisation's internal technological landscape (Tornatzky and Fleischer 1990). For the purpose of our research, we have considered: ERP attributes, and IT expertise.

4.1.1 ERP attributes

The importance of innovation attributes has been strongly acknowledged in the innovation literature (Rogers, 1983). The system's quality significantly influences the end user's satisfaction and, by the same token, the degree of its assimilation. Moore

and Benbasat (1991) argue that voluntariness, relative advantage, compatibility, personal image, ease of use, visibility and result demonstrability, influence the technological innovation diffusion and assimilation. In an attempt to measure user satisfaction with ERP systems, Somers et al. (2003) tested the 12-item end-user computing satisfaction instrument (EUCSI) developed by Doll and Torkzaden (1988). These measure satisfaction with content, accuracy, format, timeliness, and ease of use. Similarly, Wu and Wang (2006) suggest that eleven ERP system characteristics are key factors in assessing user satisfaction. These are: ERP system information accuracy, timeliness, reliability, response time and completeness, output requirement (the layout design and flexibility of the output content), relevancy (the degree of congruence between user tasks and ERP functions), system stability, auditing and control (type of auditing rendered by the system), ease of use and usefulness of the system for the user.

Flexibility is another key characteristic of ERP systems and an essential requirement for the companies (Gupta and Kohli, 2006). ERP system should be flexible enough to support various business lines and organisational strategies in different industries (Gupta and Kohli, 2006). The system's parameters and codes can be defined, for instance, according to the business needs (Ahituv et al., 2002). An ERP should also enable the addition of modules (software segments) to support supplementary functions and business processes (Ahituv et al., 2002; Shehab et al., 2004). Furthermore, ERP systems could complement data processing and analysis when connected to other systems (Ahituv et al., 2002).

4.1.2 IT expertise

Senior managers may not have a precise idea about their need for the system, its capabilities and how to implement it. They are, therefore, dependent on their IT department to better understand these issues. Since many ERP vendors disclaim the responsibility for hardware and network infrastructure, the internal IS memories should have the required expertise to provide a reliable infrastructure (Grossman and Walsh, 2004). Moreover, once the implementation process is over, the IT department would be responsible for debugging and trouble shooting the system, continuously refining and adjusting it to the evolving business needs and retraining users (Kumar et al., 2003 ; Stratman and Roth, 2002).

4.2 Organisational context

The organisational context represents the different mechanisms, structures and characteristics that influence the propensity of adoption and assimilation of an innovation (Tornatzky and Fleischer, 1990). The organisational attributes include: top management championship, absorptive capacity, strategic alignment, user involvement and reward system.

4.2.1 Top management championship

Top management championship has been consistently found to be on of the most critical factors both in IT implementation and innovation studies (Ramamurthy et al., 1999 ; Purvis et al., 2001).). It refers to the extent that top management supports, directly and indirectly, and commits to the continuous use of the ERP. Research has even shown that it is the most predictive factor of the ERP project success (Somers and Nelson, 2004). Top management involvement and their sustained support

throughout all the phases of the project help ensuring a smooth change management and mobilising commitment of other stakeholders (Bingi et al., 1999 ; Somers and Nelson, 2004 ; Al-Mashari et al., 2003).

Since the beginning of the project, it is incumbent upon the organisations to clarify the reasons of their system's adoption so that they do not fall into mere reactionism to their competitors (Davenport, 1998). Throughout the project, senior management needs to constantly monitor and direct the project teams (resolving conflicts, communicating strategic goals and team achievements etc.) (Nah et al., 2003 ; Umble et al., 2003; Somers and Nelson, 2004 ; Zhang et al., 2004). At the end of the project, top management needs to encourage system usage and commitment of use. Their commitment is also crucial for the post-implementation stage especially when it comes to providing the essential resources for maintenance and upgrades and implementation in other units and departments.

4.2.2 Absorptive capacity

Among the post-implementation stage problems, Markus et al. (2000) have particularly cited the lack of improvement in users' ERP skill levels and the shortage in documenting the rationale for business rules and configuration decisions. As a matter of fact, they have argued that, in many cases, a considerable number of potential users remain untrained, which keeps them dependent on the project team and the IT personnel while performing their normal jobs. Both issues reflect, in fact, a lack of learning readiness in the organisation.

Cohen and Levinthal (1990) define the absorptive capacity as the firm's ability to appreciate an innovation, to assimilate and to apply it to new ends. A firm's

absorptive capacity includes two main components: its prior relevant knowledge, and its investments in acquiring new knowledge (Ravichandran, 2005).

Being a complex technology, ERP imposes a heavy learning burden on novel users in terms of understanding the system, and learning how to use it (Ke and Wei, 2006). Cohen and Levinthal (1990) stress that the firm's absorptive capacity is, in fact, largely a result of the firm's pre-existing knowledge in areas related to the focal innovation. Hence, the more a firm possesses prior ERP related knowledge, the less arduous the assimilation process is (Cohen and Levinthal, 1990, Ke and Wei, 2006). Prior related knowledge includes previous experience with similar technologies, knowledge about the different functionalities and possibilities of the system, the required behavioural and managerial changes.

Complex technological innovations require, however, promoting the firm's learning skills. The firm needs for, instance to committed and open to learning and experimentation and ready to knowledge transfer (Jerez-Gómez et al., 2005). Commitment to learning implies that the organisation provides the necessary resources for continuous learning. This includes putting in place certain procedures to capture, codify and disseminate ERP knowledge by individuals (technical specialists, consultants, etc.) and tools (manuals, databases, files, organisational routines, etc.) in order to ensure that what has been learned in past situations remains valid (Chen, 2004). Training, linkages to mediating institutions (user groups, standard setting bodies, universities etc.) would enrich the firm's technology related knowledge including its expectations and perceptions bout the technology (Ravichandran, 2005).

4.2.3 Strategic alignment

The importance of the strategic alignment of IS is still generating a debate over the ways of realising that goal (Bergeron et al., 2004 ; Hirschheim and Sabherwal, 2001 ; Sabherwal and Chan, 2001). It has been argued that increased performance requires the whole system's element co-alignment and integration (Bergeron et al., 2004). Differently stated, when a change occurs in the internal or external business environment, resultant inter-linked changes at the (business sand IT) strategic level and operational level (business and IT structure) are required (Bergeron et al., 2004). Based on this perspective, the fit of ERP systems (which are part of the IT infrastructure), business strategy, IT strategy and organisational structure are crucial to holding up the hypothesis that value and improved performance from ERP investments is achieved through simultaneous adjustments and alignment in the business environment.

4.2.4 User involvement

User involvement refers to the psychological engagement of users with the resultant IS product of that development process (Barki and Hartwick, 1989). It has been advocated in IS implementation for it increases user satisfaction and acceptance by: developing realistic expectations about system capabilities, providing an arena for bargaining and conflict resolution about design issues, leading to system ownership by users, decreasing user resistance to change and committing users to the system (Ives and Olson 1984). In the case of ERP system, user participation since the early stages of ERP adoption helps in recognising the particular needs and difficulties that the users encounter. Ignoring the users' needs increase the risk of resistance and rejection of the system (Markus et al., 2000). Low user satisfaction with systems

which do not satisfy their need is another risk which could increase resistance and turnover (Kumar et al., 2003). User participation for managers can represent a tool of "appeasement" and control for managers. It helps them identify the possible difficulties of the ERP initiative (Kawalek and Wood-Harper, 2002). It is, on the other hand, a reassuring and empowering tool for users. By seeing their voice being valued, users are more confident that the system is made for them and become more open to accept it (Kawalek and Wood-Harper, 2002).

4.2.5 Reward system

According to the expectancy theory, an individual's intention to perform an action is partly determined by consequence expectations (Cabrera et al., 2006). There has been evidence that reward strategies such as rewarding the acquisition of new skills, linking compensation to company profits and other strategies promote learning in the company (Jerez-Gomez et al., 2005). By rewarding certain behaviours, compensation strategies aim at institutionalising these behaviours so that they become predominant. Researches have shown that when individuals believe that training, for instance, will result in positive rewards and recognition, they are more likely to pursue voluntary training and development actions (Jerez-Gomez et al., 2005).

One other major advantage of rewards and compensations is that they significantly contribute in employee retention (Jerez-Gomez et al., 2005). In the case of ERP systems, it is common that the firm invests in a team of its employees, or super-users in order to manage the system. These are usually high skilled people who know very well their firm's business processes, have the expertise in the firm's system and in managing change. (Hare, 2004). Since they will be dealing with several parties in the firm, they usually possess also strong interpersonal skills. It is in the firm's interest to

retain these people, through reward systems, and to preserve the rich knowledge repository that they possess for the firm's benefit.

4.3 Environmental context

4.3.1 Isomorphism pressures

The Institutional Theory argues that organizational structure and actions are influenced by the institutional environments (Scott, 1995). According to it, organisational decisions are mainly made to legitimise themselves in their external environment and not purely to increase their efficiency (DiMaggio and Powell, 1983). The institutional theory postulates that institutionalisation occurs when organisations face several pressures (like competing for resources, customers, political power, social and economic fitness) which push them to be isomorphic with their environment (Dimaggio and Powell, 1983 ; Teo, et al., 2003). These pressures towards institutional isomorphism are described by DiMaggio and Powell (1983) as mimetic, coercive and normative forces.

Mimetic pressures force firms, especially under conditions of uncertainty, to imitate other structurally equivalent firms, mainly successful ones (DiMaggio and Powell, 1983). Mimetic pressures could help the firm to acquire legitimacy and prestige, to save on experimentation costs and on human actions (Teo et al., 2003). Because of the high risks and the associated costs of ERP systems initiatives, firms would tend to copy successful players in their industry.

Coercive pressures are the external pressures exerted by resource-dominant organisations (dominant suppliers and customers) and regulatory agencies and

legislative bodies (DiMaggio and Powell, 1983 ; Teo et al., 2003). In the case of ERP systems, coercive pressures might emerge from dominant suppliers and customers who require higher quality service and more efficient operations.

Normative pressures are exerted by professional communities and professional standards (DiMaggio and Powell, 1983). In the case of ERP systems, normative pressures could emerge would tend to emerge through ERP user group communities, professional agencies, conferences, training and other professional events. These would allow the sharing experiences between firms, learning about new functionalities, features, improvements, system gaps, lacunas etc. Because of the evolutionary nature of ERP systems, the influence of normative pressures could hardly be avoided.

4.3.2 Consultants effectiveness

Studying the relationship between the consulting services and the implementing organisation is of great importance in ERP projects. ERP projects are socially and technically complex projects. Although ERP systems are packaged software applications, consulting expenses represent the majority of project cost (about 60%) (Koch, 2002 ; Hitt et al., 2002 ; Haines and Goodhue, 2003). Consultants' intervention can vary from purely technical assistance (setup, installation, and customization of the software) to change management and strategic project planning and management tasks (Haines and Goodhue, 2003).

Organisations should, therefore, carefully choose their consultants, even during the post-implementation stage, in order to benefit the maximum from their services.

Consultants may have specific experiences in specific industries, comprehensive knowledge about certain modules and may be better able to determine which suite will work best for the company (Somers and Nelson, 2003). The rapid technological developments, however, and the lack of cumulative tradition, resulted in a shortage of fully qualified personnel who can advice to an organisation in every single ERP module, particularly where integration, tools and interfaces with external partner products are concerned (Chang, 2004 ; Markus et al., 2000). For many organisations, the best solution would be to choose the consulting services based on reputation and credibility, and to trust that service provider to help them acquire the needed knowledge and expertise and transfer it to its users (Haines and Goodhue, 2003). It is very important to ensure the consultant's involvement and commitment to the organization in order to ensure their continuity with the assigned personnel in all phases of projects, including the post-implementation stage. When evaluating the consultant's involvement, Haines and Goodhue (2003) distinguish between the level of involvement reflecting the number of consultants working on the project and the length of their assignment and the roles that the consultant assumes. Indeed, among the reported problems of the consulting services are the quick turnover and the discontinuity of services (Markus et al., 2000). Other reported problems with IT consulting services are the unwillingness of some of these services to take end-to-end responsibility for coordinating all parties (Markus et al., 2000) and their resentment to take subordinate roles to other firms. Problems of information asymmetry and lack of open communication are also prone to emerge between the implementer and the consulting service provider by fear of ceding authority to strangers (Markus et al., 2000). Consultants who perform strategic management tasks play an important role during all the stages of the project, while those whom perform technical tasks are less

important in the final stages of the implementation project. Once the company becomes well adapted with the product, consultants' intervention would be still useful for implementing upgrades and new modules.

4.3.3 Vendor support

The need for a strategic relationship between the ERP vendor and user organisations is unique and vital to ERP systems (Somers and Nelson, 2004 ; Chang, 2004). Research has shown that close fit between software vendor and the customer organisation influences positively the packaged software implementation success (Janson and Subramanian, 1996). The vendor's chief role is to offer ongoing and timely support through the different stages of the ERP implementation life-cycle, including the post-adoption stage (Chang, 2004). In the early stages, the ERP vendor provides the customer organisation with rapid implementation tools and technologies such as business process modelling, templates for industry specific business practices, bundling of server hardware with ERP software (Nelson and Somers, 2004). Not only do these tools and technologies reduce the time and costs of implementation but they are also "important for transferring knowledge about the use of the software, understanding the business processes within the organisation and recognising best practice" (Somers and Nelson, 2004). With the unceasing software developments, ERP systems require continuous investments in new modules and upgrades to improve their functionalities and to realise their strategic value (Somers and Nelson, 2004). Given their expertise with the software, the vendor's support in the form of technical assistance, software updates, emergency maintenance, user training and recycling, and other support services, is judged to be very important for the system's success (Chang, 2004 ; Somers and Nelson, 2004).

5. ERP benefits

Organisations' ultimate objective by investing in ERP systems is to reap the opportunities and benefits that they provide them with, once the system is implemented and rountinised in the organisation. These benefits are multidimensional: while some are quantifiable and/or tangible, many others are intangible and/or unquantifiable. ERP benefits could be classified into: operational, managerial, strategic, technological and organisational (Shang and Seddon, 2002 ; Raymond et al., 2006). Operational benefits are those which influence day to day activities. Benefits offered by ERP systems include: cycle time reduction, productivity improvement, customer service improvement. At the managerial level, the centralised databases, timely information and built-in data analysis capabilities improve decision making, planning and resource management of the different business divisions (Mabert et al., 2000 ; Shang and Seddon, 2002). By integrating the company's information and providing the opportunity to better understand the business processes, users' communication improves which helps them to develop a shared vision of the business. These organisational advantages in addition to the interconnectivity and the ability of establishing extended tight links with customers and external partners provide ERP adopting firms with valuable strategic advantages (Shang and Seddon, 2002).

6. Conclusion

Throughout this article, we have tried to develop a systematic account of ERP assimilation which could be useful in guiding ERP adoption initiatives and research. Our research model's integrated approach and the robust theory, on which we have based our hypothesis, will be very helpful in the identification and amplification of

the factors influencing ERP assimilation. This is significantly true for the ERP system's assimilation impacts on the realisation of the system's advantages. Indeed, despite the abundance of ERP literature, the existing research has been lacking the explicatory theoretical base.

A qualitative methodology is to be adopted in order to test and refine our model. We will be exploring four or five case studies of manufacturing companies operating in different industries, including the agriculture and the forest industries, that went through the experience of implementing ERP systems and that are at the post-implementation stage.

The results of our research will provide guidance to managers, IT professionals and consultants concerning the contextual factors which can influence positively the realisation of the aspired for benefits of ERP systems. They will also provide insight for the factors which are most problematic and most critical for the system's assimilation and long-term success in the organisation. Finally, our research will also allow traditional industries such as the forest products industry to learn from more experienced industries.

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