The Effects of ERP Flexibility and National Cultures on Innovation performance at the post-ERP installation ages: A Cross-Cultural Comparative Study between China and the United States

Abstract

The increasing of market competition and the fast moving towards globalization require companies to improve their competitive advantages through both incremental and radical innovations. Apple Inc. is a good example to illustrate the importance of innovation in a company to achieve success. Many researches have indicates that the installation of ERP system affects the innovation performance and is an effective ways to improve the companies’ competitive advantages.

However, at the current post-ERP installation ages (For instance, Oracle has installed databases in nearly every one of the world’s top 500 companies), how to efficiently and effectively use and adjust ERP systems on the content of implementation and their effects on innovation performance are studied in this research. Furthermore, with the fast-growing of globalization, the cultures differences are playing more important roles in the relationship between IT system and company performances. Thus, in this study we also discuss the significant effects of national culture differences.

With the construction models and data collection from both China and USA, this paper not only provides the theoretical implementation for current literature, but also offers the practical applications for the decision makers at the multinational and international companies, who need the guidance to manage their groups and business located within different cultures.

1. Introduction

The financial crisis leads to the increasing of market competition and the fast moving towards globalization. In order to maintain and extend their competitive advantages, both the large companies and SMEs are putting more efforts on business model optimization and information system improvement, in terms of the supports on financial, top level managerial and human resources. With these growing investments, the next question faced by the managers is how to effectively allocate these resources to create competitive advantages and attract more resources? In other words, the companies have to find a way to sustainably develop and utilize their limited resources.
More current companies are looking for both incremental and radical innovation to increase the response rate to the dynamic market and offer the rapid and specialized solutions to the complex problems in different locations and situations in the world. To facilitate these needs, companies begin to emphasize the importance of new and flexible software supporting their new process innovation. For example, ERP system is widely used in the global innovation system (GIS), which consists of resources and institutions that are built through interactions among organizations from many countries and are accessible by firms from around the world.

While many companies emphasize the implementation of advanced information system, such as ERP, the performance of innovation is not achieved as they expected, and because the previously autonomous and creative mind are restricted to what’s on offer via “pull-down menus” (Trott, 2002). This paper tries to identify the research gap about the effect of ERP flexibility on the relationship between extent of EPR implementation and firm performance in innovation and propose that the ERP flexibility will reduce the severities of these problems in innovation aspect.

Furthermore, the culture difference will be considered as a contingent factor affecting the whole relationship. While a lot of companies are putting more efforts on the flexible computer applications, the working environment of the implementation has been considered as an important factor in R&D process innovation in the companies as well. It further shows that both managers and end-users of Chinese companies rate all seven factors lower than do their US counterparts. The understanding of these differences reveals the current stage of the progress of ERP implementation in China, namely that ERP implementation is not perceived as positively by Chinese managers and end-users as it is by their counterparts in the USA (Xue, et.al., 2005; Lin, & Rohm, 2009). The workplace environment is the cushion of the software implementation. The ERP flexibility and suitable workplace environment are critical for a firm to achieve the innovative value of ERP implementation and the expected firm performance.

2. Research Gap

The current emergent innovation researches have begun to emphasize the importance of both flexible computer software supports and working environment effects. However, there are still several research gaps existing in these researchers.

First, because most of the big established companies have implemented the ERP system, it has been well studied on the installment of ERP system. For instance, Oracle has installed databases in nearly every one of the world’s top 500 companies (Trott, 2008). However, the innovative performance and firm value created by ERP with time going has not been discussed. Rather than “yes” or “no” decision on ERP implementation, we will focus on the content of implementation and the effects on innovation performance in the post-ERP installation period.
Secondly, most of the current researches are still focusing the certain country and regions, such as European countries and USA, rather than studying extensively across a range of national boundaries. With the increasing of business globalization and the development of global R&D system, the effects of culture difference on working environment must be discussed in order to support the firms operating the process innovation in global environment and building the global innovation system.

Responding to the above current research gaps and practical necessity, this study about the effects of culture difference on the innovation through affecting the working environment was motivated.

3. Model Development

3.1. Theory bases

Souder and Jenssen (1999) propose a conceptual model which interests the antecedents and the affecting factors on the innovation performance. Based on this framework, we focus on the process innovation and the culture difference on working environment. There are many different initiatives of process innovation. In this paper, we choose the implementation of flexible computer software as the initiative of process innovation, due to the current fast development of IT system and the increasing importance on the modern business processes. The following sections provide RBV and TOE framework as the theoretical rationale of our suggested model.

3.1.1. Resource-Based Theory

RBV theorizes that a firm creates value by combining heterogeneous and immobile resources that are valuable, rare, inimitable or non-substitutable (VRIN) against competitors (Barney 1991). Resources are more likely to support firms’ sustained competitive advantages when they are protected by “isolating mechanisms” (Rumelt 1984) such as time-compression diseconomies, historical uniqueness, embeddedness and causal ambiguity (Barney 1991). In the IS literature, the RBV has been used to analyze IT capabilities (Mata et al. 1995) and to explain how business value resides more in the organization’s ability to utilize IT than in the technology itself. That is, IT business value draws upon the degree to which IT is used in the key activities in the firm’s value chain. The greater the use, the more likely the firm is to develop unique capabilities from its core IT infrastructure (Zhu et al. 2005). IT-enhanced capabilities that innovatively and creatively integrate various resources and environment cannot be easily imitated and substitutable. We propose that this IT capabilities initiated by ERP adoption and implementation enable firms to gain a competitive advantage against their competitors.
3.1.2. TOE Framework

Technology-Organization-Environment (TOE) framework is developed initially by Tornatzky and Fleischer (1990). In TOE framework, three aspects of a firm’s contexts that affect the process by which it adopts, implements, and uses technological innovations are identified. As technology diffusion theory, the TOE framework has been used in studying many different types of technology innovation. In this framework, three contexts affecting the implementation are introduced: Technological context, Organizational context and Environmental context.

Technological context is defined as extant and new technology relevant to the firm. We consider EPR as an advanced technology system for both intra- and inter-organizational levels. Organizational context is defined as descriptive measures which influence affect technology adoption and implementation such as size and scope, and the amount of internal slack resources. Environment context is the arena in which a firm conducts its business in dealing with competitors, access to resources supplied by others, industry characteristics and government (Torantzky and Fleischer 1990; Zhu et al. 2002). Here we mainly focus on the national culture difference as the contingent factors for the implementation.

According to Zhu and Kramer (2005), TOE is helpful to explain the adoption and implementation of innovative technology, because its driving force is well articulated in a comprehensive manner. Technological, organizational and inter-organizational characteristics are regarded as key drivers of technology diffusion. In this study, we identify the antecedents of ERP use in the context of innovative technology implementation with the discussion of national and organizational culture difference.

3.2. Research Model

Based on the theoretical and practical insights, we derive from the guiding framework to propose a conceptual model which studies the effect of ERP flexibility on the extent of ERP implementation, innovative performance, and eventually affects the firm performance in terms of finance and operation. Furthermore, according to the environmental factor in TOC, we also propose that the culture difference is a mediator which affects the above relationship.
3.2.1. Antecedence of the ERP implementation extent

Technological context has considered how firms can achieve the technological competitiveness from innovation (Chwelos et al. 2001, Iacouvou et al. 1995). More advanced and well developed technology will benefit the ease and cost of implementation, which enhance the extent of ERP implementation in firms.

**H1:** Technology development is positively associated with ERP implementation.

The previous papers supported the notion that the more organizational resources firms have, the greater value they can get from IT use (Dewan et al. 1998, Hitt 1999). Kwon and Zmud (1987) suggested that sufficient organizational resources cause a successful IT implementation. These resources can measure organizational readiness. Thus, the more organizational resources are available, the more likely firms can extend the ERP implementation. The above argument leads to the following hypothesis.

**H2:** Organizational resource is positively associated with ERP implementation.
3.2.2. Innovative performance of ERP implementation

With higher extent of ERP implementation, the employees are more involved into the environment of ERP information sharing. This information sharing can motivate the coordination and cooperation between different functions and departments. The information flow and idea sharing create more opportunity for the incremental innovation.

**H3:** the extent of ERP implementation is positively related to incremental innovation.

For the radical innovation, most traditional literatures emphasize that the ERP implementation is positively related to the radical innovation, especially in process innovation. However, because in this paper, we are testing the post-ERP ages, where most of the established big companies already installed ERP system. Then the radical innovation will be difficult to process, because of the nature of radical innovation and the pre-fixed functions of the ERP system.

The radical innovation needs the dramatic change, which affects many departments and personals, and maybe focuses on the future potential customers rather than serving for the current customers. However, the pre-decided fixed parameters in ERP system leave very limited ability to the users to modify the functions dramatically. Furthermore, the current ERP system does not have the time-going changing ability amount different departments and individuals, who are the sources of innovations in firms. So the changing cost is very pretty high, in terms of technology, finance and training. Thus, we propose the following statement:

**H4:** the extent of ERP implementation is negatively related to radical innovation.

3.2.3. The mediator of ERP flexibility

ERP flexibility will reduce the standardization of information, which might lead to the reducing of the information sharing. Because the information sharing is the most important factors influencing the new product innovation, ERP flexibility will moderate the positive relationship between degree of EPR implementation and the product innovation.

**H5:** the ERP flexibility will moderate the relationship between degree of EPR implementation and the incremental innovation.

Because of the nature of radical innovation and designed ERP functions, the extent of ERP system limited the dramatic changing in the established company with installed ERP system. However, this relationship could be different under the different degrees of ERP flexibility. The ERP system with high flexibility will definitely motive the radical innovation than the fixed ERP system with less flexibility.
**H6:** the ERP flexibility moderates the relationship between extent of ERP implementation and the radical innovation.

### 3.2.4. Performance

Performance is used as the measure for successful supply chain integration. The model proposed by Kaplan and Norton (1996) highlighted the inclusion of financial, internal business processes, customer, learning and growth views as reasonable measures of organizational performance. The measures selected consist of the following: 1) financial measures (Return on investment, sales growth and market share); 2) operational measures (production cycle time, new products time to market and percentage of supplier getting forecast). The motivation for using a multi-dimensional approach to measurement of performance is attributed to Kaplan and Norton (1996). Both financial and operational measures were therefore taken up. We hypothesize that the higher level of innovation, both incremental and radical, the better the firm performance (Frohlich & Westbrook, 2001; Ahmad & Schroeder, 2001).

**H7:** The incremental innovation is positively related to firm performance.

**H8:** The radical innovation is positively related to firm performance.

### 3.2.5. Contingency impact

**Environmental context**

Diverse external factors which influence firms to use innovative technology are mentioned in many studies. In this paper, we identify the national culture difference as the environmental factors. Culture refers to the way people think, feel, and act in a certain category, which could be nation, region within or across nation, ethnicities, religion, occupation, organization, or the gender. It is the unwritten rules of the social game. Cultures can provide competitive advantages, as well as obstacles to the innovation. Geert Hofstede has defined it as "the collective programming of the mind distinguishing the members of one group or category of people from another". (Hofstede 1997, p. 5)

**H9:** National culture difference has a contingency impact on the whole model.
4. Constructs

4.1. Organizational resources

Chwelos et al. (2001) defines organizational resources as the extent to which firms have sufficient technology and financial resources to undertake adoption. We define financial resources as capital asset to afford the cost of ERP installation, implementation, maintenance, and many other subsequent matters. Technology resources take into account the level of technological knowledge and expertise within organization.

4.2. Radical and incremental innovation

Innovation is an idea, practice, or material artifact perceived to be new by the relevant unit of adoption (Zaltman, et. al, 1973; Dewar and Dutton, 1986). Innovation can be classified as incremental and radical innovation (Abetti, 2000; Koberg et al, 2003). Miller and Dismukes (2005) define radical innovation as a degree of innovation that “creates dramatic change in technology, processes, products, and/or services that considerably transforms existing markets and industries, or even gives rise to new ones.” A definition for incremental innovation is given as a degree of innovation which is based upon extending existing technologies, emphasizing improvement of cost or features of existing products, services, or processes (Miller and Dismukes, 2005). Freeman (1974) indicates that the incremental innovation reinforces the capabilities of established organizations, while radical innovation forces them to ask a new set of questions, to draw on new technical and commercial skills, and to employ new problem-solving approaches.

4.3. ERP Flexibility

The ease with which a system or component of software can be modified for use in applications or environments other than those for which it was specifically designed, both installing stage and time-going stage. The software flexibility will give the organization larger room and ability to quickly respond to the unpredicted changes, due to the difficulties of predicting the actual changes of the inside and outside environments, including company organizational change or the customers’ and suppliers’ needs. According to the definition and discussion above, in order to measure the ERP system flexibility, the potential questions are proposed as following, from both installing stage and time-going stage.

1. “When you installing the ERP system, can the system modify according to your requirement?”
2. “With time going, can you change the ERP system matching your new ideas?”
3. “Do most of your new ideas end with the limitation and restrictions by ERP system?”

4.4. Extent of ERP implementation

Based on our literature research, there is no related paper to measure the extent of ERP implementation, because of the unique perspective and new views. However, we found the report that Cisco was ranked as the first organization to fully implement ERP system. For an instance, Cisco partnered with Yahoo to create a “My Yahoo!” version specifically molded for Cisco employees. Quarterly meetings could be watched in real time from employee desktops, either live or delayed. Thousands of Cisco’s employees tuned in to view Chambers speak. (Schwartz, 2006; Datta, 2005)

Measure of the extent of ERP implementation will be used in this paper will be

1. “Percentage of employees using ERP system”
2. “Hong long have been installed ERP system”
3. “Percentage of departments and functions using ERP system”

4.5. National cultural differences

To compare the differences between these two cultures, Geert Hofstede index is used in this study. Geert Hofstede originally identifies the four dimensions of cultures dealing with four anthropological problem areas: 1) ways of coping with inequality, 2) ways of coping with uncertainty, 3) relationship of the individual with her or his primary group, and 4) emotional implications of having been born as a girl or as a boy. These became the Hofstede dimensions of national culture: 1) Power Distance, 2) Uncertainty Avoidance, 3) Individualism versus Collectivism, and 4) Masculinity versus Femininity. Furthermore, based on Chinese Confucian dynamism, his modified model includes another dimension “Long-Term Orientation” category.

1. Power Distance –the extent to which an unequal distribution of power is accepted;
2. Individualism –whether a society is based on loose cooperation of individuals, as opposed to integrating people into cohesive groups;
3. Masculinity –how central a role traditionally male values like earnings, recognition, advancement and challenge play in a society;
4. Uncertainty Avoidance –the extent to which uncertain or unknown situations are seen as a threat.
5. Long-Term Orientation – it deals with virtue. Values associated with Long Term Orientation are thrift and perseverance; values associated with Short Term Orientation are respect for tradition, fulfilling social obligations, and protecting one’s 'face'.

Page 9 of 15
In Geert Hofstede analysis, China has the highest-ranking factor (118) in long-term orientation (LTO). This Dimension indicates the time perspective and an attitude of persevering, in other words, this society is willing to overcome obstacles with time, if they are not with strength. The Chinese rank lower in the Individualism (IDV) ranking, which may be related to the high level of emphasis on collectivist by the Communist rule or the strong family sense in Asian culture. This characteristic can lead to the loyalty, which help the people in a group to work as a team. In addition, China has a significantly high Power Distance, which indicates a high level of inequality of power and wealth within the society. This condition is not necessarily forced upon the population, but rather accepted by the society as their cultural heritage.
In Geert Hofstede analysis, USA has the high individual score (91), which indicates a more individualistic attitude and loose bonds with others. The United States has the lowest Long Term Orientation (LTO) score (29 compared to the world average of 45). The relatively lower Power Distance (PDI) score (40) in US indicates a greater equality between societal levels within government, organizations, and families which reinforces a cooperative interaction across power levels and creates a more stable cultural environment.

5. Research method

An empirical study of large firms will be performed to test the hypotheses and research model. The questionnaire will be designed to correspond to the relationship between antecedents of ERP, radical and incremental innovation and firm performance. To develop the questionnaire, the in-depth interviews with senior managers involved in the implementation of ERP will be performed. A pilot study will be undertaken to make sure that respondents will have no difficulties in completing the questionnaire. Some items will be adapted & reworded to fit the research context. In order to provide subjective assessments of content validity, the survey instruments will be sent to several scholars who are familiar with the literature.

As we finish development of the questionnaire, both a mail and a web survey will be used to collect data and test hypotheses. Follow-up phone calls will be made to all potential respondents who have not returned the surveys after a certain time.

This structural equation modeling will be performed through Amos, in which the scale’s internal consistency and reliability will be analyzed and the measurement model and structural model will be tested. Also in order to assess the discriminate validity of multi-item measures, factor analysis will be conducted.

6. Contributions and implementations

While most of the studies focus on the question, whether implement ERP system, at the age of most of the companies have installed ERP system already, this paper did a further study on the companies has installed the ERP system, and invest why some of the ERP systems are successful, not some of the others are not really meet the initial expectations, especially focusing on the innovation perspective. Through considering both incremental and radical innovation, we proposed the effects of ERP system flexibility on the relationship between the extent of ERP implementation and the innovation performance and firm outcomes.

Furthermore, with the globalization of ERP system and business, this paper has broken the boundaries of nationality and collected the data from both China and USA to study the culture
difference influencing the overall model. Thus, this research will provide the guidance for the decision makers in the companies operating in different countries and different cultures.
Reference:


