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A framework of ERP systems implementation success in China: An empirical study

Zhe Zhang^{a,*}, Matthew K.O. Lee^b, Pei Huang^a, Liang Zhang^b, Xiaoyuan Huang^c

^a*School of Management, Shanghai Jiao Tong University, Shanghai 200052, P.R. China*

^b*Department of Information Systems, City University of Hong Kong, Kowloon, Hong Kong, P.R. China*

^c*Faculty of Business Administration, Northeastern University, Shenyang 110004, P.R. China*

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Abstract

Enterprise resource planning (ERP) system is one of the most widely accepted choices to obtain competitive advantage for manufacturing companies. However, the successful implementation rate is low and many firms did not achieve intended goals in China. This study develops an ERP implementation success framework by adapting the Ives et al. information systems (ISs) research model and DeLone and McLean's IS success model to identify both critical success factors and success measures. Qualitative case study research methodology is used to collect data and Atlas/ti program is used to facilitate data analysis. Discussion is made finally and suggested ERP systems implementation methodology is given at the end.

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1. Introduction

Kumar and Hillegersberg (2000) defined enterprise resource planning (ERP) systems as “configurable information systems packages that integrate information and information-based processes within and across-functional areas in an organization”. In information systems (ISs) area,

implementation is defined as “the process that begins with the managerial decision to install a computer-based organizational information system and is complete when the system is operating as an integral part of the organization's information system” (Burns and Turnipseed, 1991). ERP is probably the most rapidly growing system area in operations today. Thousands of companies have implemented or are in the process of implementing an ERP system. IDC predicts that ERP software sales in Greater China, comprising China, Hong Kong, and Taiwan, will grow at an annual rate of

*Corresponding author. Tel.: +86 021 64482867; fax: +86 021 62933262.

E-mail address: zhangz27@hotmail.com (Z. Zhang).

24.2%, up from US \$84.5 million in 1998 to US \$243.3 million by 2003. According to [CCID Report \(2004\)](#), ERP sales in Mainland China reached US \$226.9 million in 2003, and will reach US \$652.8 million in 2008, at an estimated growth rate of 23.5% over the next 5 years. Significant benefits such as improved customer service, better production scheduling, and reduced manufacturing costs can accrue from successful implementation of ERP systems ([Ang et al., 1995](#)).

However, ERP systems are expensive and time-consuming, and once ERP systems are implemented, management should evaluate whether it is successful. A recent Standish Group report on ERP implementation projects reveals that these projects were, on average, 178% over budget, took 2.5 times as long as intended and delivered only 30% of promised benefit. Nearly 1000 companies in China have implemented MRP, MRP II or ERP systems since 1980. The successful implementation rate is extremely low at only 10% ([Zhu and Ma, 1999](#)). The large difference of ERP systems implementation success rate between Western countries and China produces a need of research to examine generic and unique factors that affect ERP implementation success in China since foreign ERP vendors have more than 90% ERP market share ([IDC, 1998](#)) and more than 80% in 2000 (<http://www.sina.com.cn>) in China. Furthermore, Chinese culture is quite different from Western countries in terms of the four dimensions of national culture developed by [Hofstede \(2001\)](#) and the dimension of uncertainty avoidance is highly relevant to ISs implementation. Organizational culture is imbedded within national culture and it is regarded as the unique factor affecting ERP systems implementation success.

In Section 2, literatures on both determinants of ERP systems implementation success and success measures including IS literature are reviewed to facilitate understanding of current research status. The proposed conceptual framework and propositions are developed in Section 3. Section 4 introduces the research methodology of multiple-case study. Targeted interviewees and data collection method are described in this chapter. After that, data analysis is conducted in Section 5 and research findings are discussed in Section 6.

Finally, the study makes a conclusion with a summary on the study.

2. Literature review

By comparison to ISs research and other academic fields, theories on ERP systems implementation have been given less attention. Most published articles on the field of ERP systems implementation unavoidably lack theoretical support (see Appendix A). Thus, in this study ISs literature is reviewed in an attempt to find theories that could be adapted to the ERP field.

2.1. ERP systems implementation literature

Limited studies have been conducted to identify critical factors affecting ERP systems implementation success with many of them focused on single-case study of “how we implemented ERP systems in our company” ([Ang et al., 1995](#); [Bingi et al., 1999](#); [Cox and Clark, 1984](#); [Holland and Light, 1999](#); [Mandal and Gunasekaran, 2002](#); [Motwani et al., 2002](#); [Sum et al., 1997](#); [Wilson et al., 1994](#); [Yusuf et al., 2004](#)). Moreover, most studies that have measured ERP implementation success used only one or two surrogates of ERP implementation success ([Ang et al., 1994, 1995, 2002](#); [Burns and Turnipseed, 1991](#); [Malbert et al., 2003](#); [Umble et al., 2003](#); [Wilson et al., 1994](#)).

The literature varies regarding what variables are required for implementation success or responsible for failure. It suggests that problems with the implementation of ERP systems occur for a number of reasons. These reasons include:

- (1) The need for business process change during the implementation of an ERP system is needed ([Al-Mashari et al., 2003](#); [Bingi et al., 1999](#); [Burns and Turnipseed, 1991](#); [Hong and Kim, 2002](#); [Malbert et al., 2003](#); [Mandal and Gunasekaran, 2002](#); [Motwani et al., 2002](#); [Umble et al., 2003](#); [Yusuf et al., 2004](#)).
- (2) Lack of top management support, data accuracy, and user involvement can attribute to system implementation failures ([Al-Mashari et al., 2003](#); [Ang et al., 1994, 1995, 2002](#); [Bingi](#)

et al., 1999; Cox and Clark, 1984; Hong and Kim, 2002; Malbert et al., 2003; Sum et al., 1997; Umble et al., 2003; Wilson et al., 1994; Yusuf et al., 2004).

- (3) Education and training are frequently underestimated and are given less time due to schedule pressures, and less understanding of cross-functional business processes are often reported (Al-Mashari et al., 2003; Ang et al., 1994, 1995, 2002; Bingi et al., 1999; Cox and Clark, 1984; Malbert et al., 2003; Mandal and Gunasekaran, 2002; Sum et al., 1997; Umble et al., 2003; Yusuf et al., 2004).
- (4) When adopting an ERP system, there is a need to recognize the unique Asian context concerning cultures while the existing business models typically reflect Western practices (Al-Mashari et al., 2003; Hong and Kim, 2002; Motwani et al., 2002).

Based on Appendix A, culture factor was given more attention only in recent 2 years (Al-Mashari et al., 2003; Hong and Kim, 2002; Motwani et al., 2002; Yusuf et al., 2004) which could be a very important factor when ERP systems developed in Western countries are implemented in China context since ERP systems have built-in value bias reflecting the value priorities of the culture in Western countries (Kumar and Bjorn-Anderson, 1990). There is growing evidence that failures to adapt ERP packages to fit different organizational and national cultures leads to projects that are expensive and late. Moreover, Chinese culture is far different from that of Western countries.

As for how to define ERP systems implementation success, there is no agreed measures. White (1984) created ABCD Checklist that classified ERP implementations into four categories. User satisfaction is also used to serve as a surrogate for ERP implementation success (Al-Mashari et al., 2003; Ang et al., 1994, 1995, 2002; Burns and Turnipseed, 1991; Markus et al., 2000; White et al., 1982). White et al. (1982) defined successful ERP implementation along two dimensions: (1) improved performance and (2) user satisfaction (White, 1984; Yusuf et al., 2004). Predetermined corporate goals were used recently to measure ERP implementation results (Al-Mashari et al.,

2003; Umble et al., 2003; Yusuf et al., 2004). Markus et al. (2000) argue that the definition and measurement of ERP success are thorny matters and success depends on the point of view from which you measure it. From previous ERP implementation success literature review (Appendix A), there are seven measures used as surrogates of ERP implementation success:

- (1) User satisfaction (Al-Mashari et al., 2003; Ang et al., 1994, 1995, 2002; Burns and Turnipseed, 1991; Mandal and Gunasekaran, 2002; White, 1984; Yusuf et al., 2004).
- (2) Intended business performance improvements (Al-Mashari et al., 2003; Hong and Kim, 2002; Mandal and Gunasekaran, 2002; Markus et al., 2000; White et al., 1982; Yusuf et al., 2004).
- (3) Oliver White's *ABCD* Classification Scheme (Burns and Turnipseed, 1991; Wilson et al., 1994).
- (4) On time (Al-Mashari et al., 2003; Hong and Kim, 2002; Malbert et al., 2003).
- (5) Within budget (Al-Mashari et al., 2003; Hong and Kim, 2002; Malbert et al., 2003).
- (6) System acceptance and usage (Ang et al., 1994, 1995, 2002; Yusuf et al., 2004).
- (7) Predetermined corporate goals (Al-Mashari et al., 2003; Umble et al., 2003; Yusuf et al., 2004).

In the above measures of ERP system implementation success, Oliver White's *ABCD* Classification is not suitable in nowadays ERP system implementation in that most firms implemented ERP systems could achieve rough integration among ERP system modules. Meanwhile, even if ERP system implementation exceeds contracted delivery time and budget, firms may still think their ERP implementation is a success. While system acceptance and usage are inappropriate once the use of an ERP system is required. Thus, only user satisfaction, intended business performance improvements, and predetermined corporate goals could be used as success measures. However, the latter two success measures could be combined into one success measure due to their predefined nature.

2.2. Information systems literature

A large number of studies have been conducted during the past two decades to identify those factors that contribute to ISs success. However, the dependent variable of IS success is difficult to define and a cumulative research is not easy to come into being. Not until 10 years ago was the dependent variable—IS success identified by [DeLone and McLean \(1992\)](#) that has been considered a suitable foundation for further empirical and theoretical research, and has met with general acceptance ([Garrity and Sanders, 1998](#)).

[DeLone and McLean \(1992\)](#) conducted an extensive literature review on 180 empirical studies published in six top IS journals and one of the most important IS conference proceedings, classifying dimensions of ISs success into six categories ([Fig. 1](#) illustrates their IS success model):

- (1) *System quality*: The desired characteristics of an IS itself.
- (2) *Information quality*: The desired characteristics of the product of an IS.
- (3) *Use*: The receipt consumption of the product of an IS.
- (4) *User satisfaction*: The receipt response to the use of the product of an IS.
- (5) *Individual impact*: The effect of information on the behavior of a receipt.
- (6) *Organizational impact*: The effect of information on organizational performance.

In [Fig. 1](#), system quality and information quality singularly and jointly affect both use and user satisfaction. While use and user satisfaction

have positive or negative impact on the other. Use and user satisfaction are direct antecedents of individual impact. Lastly, this impact on individual performance should eventually affect organizational performance.

It is clear that actual use, as a measure of IS success, only makes sense for voluntary or discretionary users as opposed to captive users [Lucas \(1978\)](#). Moreover, in an involuntary situation of using an IS, user satisfaction leads to use rather than use stimulating user satisfaction [Baroudi and Davis \(1986\)](#). Thus, for [DeLone and McLean \(1992\)](#), when the use of IS is mandatory or required, the previous measures of system quality, information quality, and use become less useful. That means whether the quality of the system itself and the information outputs are satisfying or not, and whether users want to use the system or not, there is no choice for the user, users have to accept and use the IS. Secondly, [DeLone and McLean's](#) model has a causal and temporal relationship between each stage. They claim that the causal relationships that exist between the stages of communication also pertain to the categories of measurement. However, this does not have to follow. If this were so, then one need only be successful at the first stage. Furthermore, IS research now accepts that technical system quality is necessary but not sufficient to ensure IS success; yet the [DeLone and McLean](#) model might be seen as suggesting that technical system quality is sufficient.

User satisfaction is defined as “the extent to which users believe the information system available to them meets their information requirements” ([Ives et al., 1980](#)). Many authors have

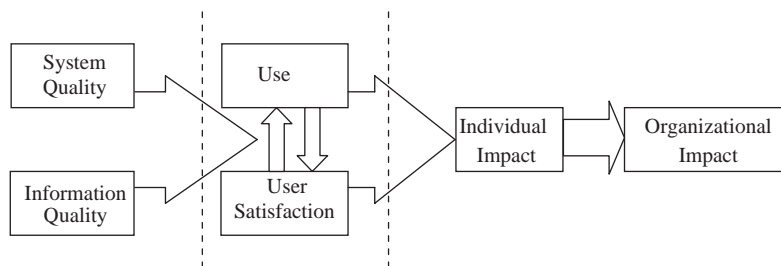


Fig. 1. DeLone and McLean's IS success model.

suggested time, cost, and user specification as success criteria. Wateridge (1998) points out that this implies that if projects do not meet time, budget, and specification they will be seen as failures, but projects can still be successful even if they have not met timescales and budget. Thus, it is not appropriate to define IS success by time, budget, and specification.

Based on descriptions and evaluations of five existing MIS research frameworks, Ives et al. (1980) proposed a more comprehensive research model partially validated by mapping 331 MIS Ph.D. dissertations into the framework. There are three IS environments, three IS processes, and the information subsystem itself, all of which exist within an organizational environment and an external environment. In their model (Fig. 2), Ives et al. claimed that the environmental characteristics define the resources and constraints, which dictate the scope and form of each information subsystem (Ives et al., 1980).

Five classes of environmental variables were delineated: (1) *External environment*, which includes legal, social, political, cultural, economic, educational, resource, and industry/trade considerations. (2) *Organizational environment*, which is marked by the organizational goals, tasks, structure, volatility, and management philosophy/style. (3) *User environment*, which is described by

characteristics of the user, user's organization, and user's task. (4) *IS development environment*, which includes the development methods and techniques, design personnel and their characteristics, and the organization and management of IS development and maintenance. (5) *IS operation environment*, which incorporates the resources necessary for IS operations.

The *information subsystem* represented by a circle is the output of the development process. The processes comprise the interactions between the IS and the environments. The classes of process variables are: (1) *Use process*, which focuses on usage of the IS by the primary user and is usually measured by task accomplishment leading to an effect on productivity and decision-making quality. (2) *Development process*, which yields the IS by selecting and applying organizational resources within environmental constraints. (3) *Operation process*, which is the physical operation of the IS and is primarily a function of the operations resource, with interfaces at the boundaries of other environments in the form of personal interaction. The process can be measured by resource use (e.g., time, cost), performance, quality of life and satisfaction of secondary users, and the service to users (e.g., turnaround time, response time for user requests, availability, error rates).

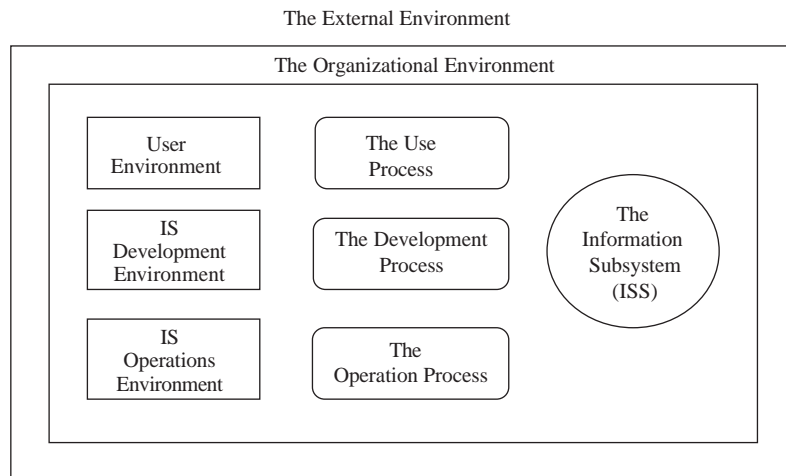


Fig. 2. Ives, Hamilton, and Davis's IS research model.

3. The conceptual research framework

Based on the ERP literature and the IS research model proposed by Ives et al., factors that affect successful ERP implementation in China have been identified in this research. From DeLone and McLean’s IS success model the dependent variables that measure ERP implementation success are defined. The theoretical bases for this study include Ives et al.’s IS research model combined with prior ERP literature to serve as the basis for independent variables identification, and the McLean and DeLone’s IS success model to serve as the basis for dependent variables definition in that the environmental groups are quite suitable to the ERP implementation success factors. They are adapted and combined with critical success factors identified in prior ERP studies to form critical success factors for this study. While the three process groups used in Ives et al.’s model are not applicable to the context of ERP system implementation in that Ives et al.’s model focuses on development and operation processes that are the next stage of ERP implementation. DeLone and McLean’s IS success model, which is widely accepted model for study of IS success, is suitable

to this research in that IS success is measured from different angles. Furthermore, ERP systems are also one kind of ISs.

With specific objectives in this study, through combining and adapting the Ives, Hamilton, and Davis model with ERP and IS success literatures, the research framework is developed and depicted in Fig. 3. The IS development environment and the IS operations environment are replaced with system environment and ERP vendor environment. Moreover, the three process measures of the use process, the development process, and the operation process are not completely suitable to the ERP implementation context. Almost all of enterprises in China purchase off-the-shelf ERP packages from outside ERP vendors rather than develop an ERP system in-house. Thus, the development process is not applicable. Further, the operation process is overlapping with the use process in the ERP implementation context, thus these two processes are modified and combined with ERP success measures such as user satisfaction, individual impact, and organizational impact. Moreover, the unique ERP success measure of intended business performance improvement is included to make the success measures complete.

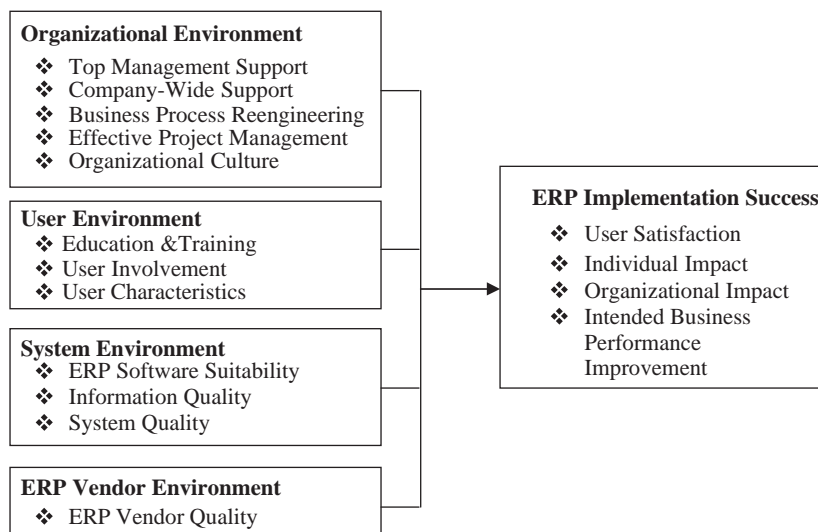


Fig. 3. Conceptual research framework.

The interactions among these success measures are beyond the focus of this study and not studied as a result.

In this study, since the use of an ERP system is required, the previous measures of system quality, information quality, and use become less useful. That means whether the quality of the system itself and the information outputs are satisfying or not, and whether users want to use the system or not, users have no choice but to accept and use the IS. The researcher proposes the following research propositions serving as guidelines for this research.

Proposition 1. *Organizational environment is associated with the ERP implementation success in China.*

Proposition 2. *User environment is associated with the ERP implementation success in China.*

Proposition 3. *ERP system environment is associated with the ERP implementation success in China.*

Proposition 4. *ERP vendor environment is associated with the ERP implementation success in China.*

3.1. Organizational environment

Five dimensions of organizational initiative proposition are identified including top management support, reengineering business process, effective project management, company-wide support, and organizational culture.

3.1.1. Top management support

Many studies have stressed the importance of top management support as a necessary ingredient in successful ERP implementation (Al-Mashari et al., 2003; Ang et al., 1994, 1995, 2002; Bingi et al., 1999; Cox and Clark, 1984; Sum et al., 1997; Umble et al., 2003; Wilson et al., 1994; Yusuf et al., 2004). Since ERP is a highly integrated IS, its design, implementation, and operation require the complete cooperation of line and staff members from all segments of the business. Top management support can play a useful role in *settling disputes* and in *providing clear direction*. Meanwhile, implementing an ERP system is not a

matter of changing the software systems; rather it is a matter of reengineering the company and transforming the business practices to the best business practices.

3.1.2. Reengineering business processes

Business process reengineering (BPR) is defined by Hammer and Champy as “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed” (Hammer and Champy, 2001). Implementing an ERP system involves reengineering the existing business processes to the best business process standard (Bingi et al., 1999; Burns and Turnipseed, 1991; Holland and Light, 1999; Mandal and Gunasekaran, 2002; Miles and Huberman, 1994; Yusuf et al., 2004). One of the principal reasons why ERP and other large technologically sophisticated systems fail is that organizations simply underestimate the extent to which they have to change and reengineering the existing business processes in order to accommodate their purchase.

3.1.3. Effective project management

According to Lock (1996), “project management has evolved in order to plan, coordinate and control the complex and diverse activities of modern industrial and commercial projects”. ERP systems implementation is a set of complex activities, involving all business functions and often requiring between 1 and 2 years of effort, thus companies should have an effective project management strategy to control the implementation process, avoiding overrun of budget and ensuring implementation on schedule. There are five major parts of project management: (1) having a formal implementation plan, (2) a realistic time frame, (3) having periodic project status meetings, (4) having an effective project leader who is also a champion, and (5) having project team members who are stakeholders.

3.1.4. Company-wide commitment

Since ERP systems are enterprise-wide ISs that integrate information and information-based processes within and across all functional areas in an

organization, it is imperative to get support from all functional segments of the organization (Ang et al., 1994, 1995, 2002; Cox and Clark, 1984; Sum et al., 1997; Wilson et al., 1994; Yusuf et al., 2004). Every person and department is responsible/accountable for the overall system and key users from different departments are ensured to commit to the project implementation without being called back to their prior functional job position frequently.

3.1.5. Organizational culture

Densley (1999) revealed that adapting the implementation to the prevailing cultural style was one important cause of project implementation failures. A company who implements an ERP system has to change its business processes to the ERP best-practice processes. The change both impacts on the customer's culture and is constrained by it (Krumholz and Maiden, 2001). Kumar and Bjorn-Anderson (1990) concludes that IS design methodologies have built-in value biases reflecting the value priorities of the culture in which they are developed. Since Baan IV user companies are studied only in this research and it is developed in the Netherlands and applied in China context, it is necessary to check whether cultural difference between the Netherlands and China exists or not. Based on Hofstede (2001) definition of national culture, four dimensions of power distance, collectivism vs. individualism, femininity vs. masculinity, and uncertainty avoidance can be used to make comparisons.

From Table 1, we can learn that China is obviously different from the other three countries except in the dimension of masculinity. It is safe to

draw a conclusion that Chinese culture is basically different from that of Western countries. According to Hofstede (2001), the dimension of uncertainty avoidance concerns with use of technology most. The inclination of members of a culture to avoid uncertainty and ambiguity profoundly affects the way in which institutions are organized and managed. Consistent with this logic, uncertainty avoidance will also likely affect the way in which individuals use ISs. In Western countries with high score of uncertainty avoidance, people are inclined to be tolerant of uncertainty, they need more clear information and tend to deploy ISs across departments within an organization, sharing the information to assist decision-making. However, in the low score holder of uncertainty avoidance such as China, people are more tolerant of unclear information, they are inclined to share information with others and reluctant to use ISs that require real time information entry and information sharing across different departments.

Cabrera et al. (2001) and Yusuf et al. (2004) argue that successful technological innovations require that either the technology be designed to fit the organization's current structure and culture or that the organization's structure and culture be reshaped to fit the demands of the new technology. While organizational culture is embedded within national culture and it is used as the unique critical factor that affects foreign ERP package (Baan ERP) implementation in China context.

Culture is defined by Schein (1992) as "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught

Table 1
International comparison data on cultural dimensions (Hofstede, 2001)

Country	Power distance index score	Individualism index score	Masculinity index score	Uncertainty avoidance index score
USA	40	91	62	46
Germany	35	67	66	65
The Netherlands	38	80	14	53
China	80	20	66	30

to new members as the correct way to perceive, think, and feel in relation to those problems". According to Hofstede's (2001) study, six main dimensions of organizational culture are identified to find their relationships with the implementation of ERP systems: (1) process vs. results orientation, (2) employee vs. job orientation, (3) parochial vs. professional identity, (4) open vs. closed communication system, (5) loose vs. tight control, and (6) normative vs. pragmatic mentality.

Process vs. result orientation refers to whether an organization is more concerned with the means and procedures that must be followed to carry out the work or with the goals that are pursued with that work. Process orientation is typical of mechanistic or bureaucratic organizations rich in rules and procedures, whereas results orientation is typical of organic, risk-taking organizations, in which mistakes are well tolerated and innovation is valued.

The employee vs. job orientation reflects whether the organization is more concerned with the well-being of the person or with getting the job done. Groups or committees often make the important decisions in employee-oriented cultures, and an effort is made to help new members adjust. On the contrary, job-oriented cultures tend to rely on individual, top-down decision-making.

The parochial vs. professional dimension reflects the weight that is given to the occupational cultures of the members of the organization. In parochial organizations, employees identify strongly with their organization, whereas in professional cultures employees identify more with their profession. In hiring new employees, parochial organizations rely on social and family background information, whereas professional cultures hire on the basis of job competence alone. Sociology has long known this distinction as "local" vs. "cosmopolitan". The former culture is less concerned with external competition, which results in passive attitude toward advanced management technique adoption such as ERP systems.

An open or closed system refers to the communication climate within the organization. In open system culture information flows easily through the organization, whereas closed cultures are more secretive. However, the deployment of an ERP

system requires transparent information flow across the whole company. People within the closed system would think they are going to be constrained by the ERP system, which inevitably leads to resistance to the ERP system.

Loose vs. tight control system reflects the degree to which organizations exert control over individuals. Tightly controlled cultures may observe strict meeting times and show a strong cost-saving consciousness. Loose control organizations are more permissive about individual's preferences. ERP system requires timely input of data, otherwise the output of the information about products, inventory level cannot be ensured accurate and timely in that ERP system integrates every department seamlessly. The deployment of ERP systems in a loosely controlled company would produce resistance from the people.

Normative vs. pragmatic mentality refers to the extent to which organizations conform to institutional pressures. Pragmatic organizational cultures are more market driven and are open to ad hoc solutions, while normative cultures are more concerned with following institutional rules. Meeting customer needs is a major objective in pragmatic cultures while normative cultures are more interested in adhering to the "correct" procedures as a way of obtaining legitimacy (Hofstede, 2001).

This study focuses on the three dimensions of *parochial vs. professional*, *open vs. closed system*, and *loose vs. tight control* in that they are most closely linked with ISs implementation.

3.2. User environment

People element is one of the most important factors affecting organizational ISs implementation and deployment. Lack of care about stakeholders within organizations will result in disaster. As such, lack of user education and training and user involvement in the process of ERP systems implementation also leads to failure.

3.2.1. Education and training

Education and training refers to the process of providing management and employees with the logic and overall concepts of ERP system (Mandal

and Gunasekaran, 2002; Sum et al., 1997; Yusuf et al., 2004). Thus, people can have a better understanding of how their jobs are related to other functional areas within the company. The user is the people who produce results and should be held accountable for making the system perform to expectations. Outside consultants/trainers have more experience of implementing ERP systems and they can help users to understand expertise of specific ERP systems. While in-house training is more effective in combining specific ERP system features with actual operational issues in the company.

3.2.2. User involvement

User involvement refers to participation in the system development and implementation processes by representatives of the target user groups. Some IS researchers suggest that user involvement in the development (i.e., purchase, design, modification, or implementation) of an IS is integral to the success of the system (Baroudi and Davis, 1986; Mandal and Gunasekaran, 2002; Yusuf et al., 2004). System implementation represents a threat to users' perceptions of control over their work and a period of transition during which users must cope with differences between old and new work systems. User involvement is effective because it restores or enhances perceived control through participating the whole project plan.

3.2.3. User characteristics

According to the Ives et al. research model, the characteristics of different users may also affect the ERP implementation success including education levels, characters, technical-oriented or business-oriented, etc.

3.3. System environment

Organizations cannot afford to neglect of technical aspects of ERP systems implementation in the following three perspectives. ERP vendors adopt different programming languages and focus on different business sectors to retain their core competence. Enterprises have to find the most suitable ERP packages in the market to ensure the perfect match between the ERP system and their

specific business industry and requirements. Moreover, the maturity of the ERP system and its internal logic as well as the system's strength and weakness should be fully understood to increase the chance of success.

3.3.1. ERP software suitability

Most large foreign ERP vendors have come to China's ERP market include SAP, Oracle, J.D. Edwards, Baan, PeopleSoft, FourthShift, QAD, SSA, Symix, etc. They have taken up more than 90% market share in China's market (IDC, 1998). These ERP vendors use different hardware platforms, databases, and operating systems. And certain ERP packages are only compatible with some companies' databases and operation systems. Thus, companies should conduct requirements analysis first to make sure which problems need to be solved and select the ERP systems that most fit their requirements. The hardware then is selected according to the specific ERP systems' requirements.

ERP packages provide generic off-the-shelf business and software solutions to customers. More or less they cannot fully meet the company's needs, especially when the business processes of the company are unique. Thus, customizing the ERP system to fit the company's needs is necessary. It is important for the company to choose those ERP systems that are easy to customize so that the cost and time consumed in the customization can be reduced as much as possible. Moreover, upgrade of the ERP system is necessary because the technical advance results occur continuously.

3.3.2. Information quality

Since ERP system modules are intricately linked to one another, inaccurate data input into one module will adversely affect the functioning of other modules. Garbage in garbage out. Thus, information quality is a major determinant of ERP success (Duchessi et al., 1989; Sum et al., 1997; Yusuf et al., 2004).

3.3.3. System quality

System quality of a specific ERP system also affects the implementation success. Dimensions of

system quality include flexibility of the system, reliability, ease of use, usefulness of specific functions, response time (Bailey and Pearson, 1983; Yusuf et al., 2004).

3.4. ERP vendor environment

Since most China's companies purchase ERP packages from foreign ERP vendors and use outside consultancy service, it is important to get the vendor support. Management needs to ask questions about the vendor, such as its market focus (for example, midsize or large organization), track record with customers, vision of the future, and with whom the vendor is strategically aligned. For a foreign vendor, it is important to ensure that their products have been customized into Chinese language and make sure the ERP vendor has the same version of the software in all the countries the company is implementing the system. Vendor claims regarding global readiness may not be true, and the implementation team may need to cross check regarding the availability of the software. In general, management must make sure that the software vendor provides continuous support throughout the implementation.

3.5. ERP vendor quality

Three dimensions of vendor quality are classified: (1) service response time of the software vendor; (2) qualified consultants with knowledgeability in both enterprises' business processes and information technology including vendors' ERP systems; and (3) participation of vendor in ERP implementation. It is important for the vendor's staffs to be knowledgeable in both business processes and ERP system functions. Also, the consultants should possess good interpersonal skills and be able to work with people. Software vendors should be carefully selected since they play a crucial part in shaping the ultimate outcome of the implementation.

3.6. ERP implementation success measures

Based on Delone and McLean's (1992) IS success model and ERP literature, user satisfac-

tion, individual impact, organizational impact, and intended business performance improvement are selected as ERP systems implementation success measures (see Fig. 3) at both individual and organizational levels. Since the objectives of this study are to explore factors that affect the ERP implementation success in China and variables that could be used to measure and evaluate whether an ERP implementation success is a success or a failure, the interactions among these success measures are not studied.

3.6.1. User satisfaction

According to Delone and McLean (1992), user satisfaction describes the receipt response to the use of the product of an IS. In this study of ERP systems implementation success, user satisfaction is adapted as the receipt response to the implementation and use of a certain ERP system. Mostly, the use of an ERP system is required. Thus, system quality, information quality, and system use are inappropriate for measuring ERP systems success. Meanwhile, even though DeLone and McLean classified system quality and information quality as dependent variables in their model, they described the impact of these two variables on the other dependent variables of use and user satisfaction. Therefore, system quality and information quality are inappropriate to serve as ERP implementation success measures. In the context of ERP system implementation, the user satisfaction measure concerns overall satisfaction and specifics satisfaction with the system implementation adapted from Doll and Torkzadeh (1988) and Delone and McLean (1992).

3.6.2. Individual impact

The individual impact variable refers to the effect of information on the behavior of a receipt in DeLone and McLean's IS success model. In this study, individual impact is adapted as the effect of the implementation and use of an ERP system on the behavior of a receipt, i.e., an ERP user. Several dimensions are used to measure individual impact including improved individual productivity, task performance improvement, decision effectiveness and quality, and time to make decision.

3.6.3. Organizational impact

Organizational impact concerns the effect of information on organizational performance in DeLone and McLean's IS success model and in this study it is adapted as the effect of the implementation and use of an ERP system on organizational performance. The dimensions of organizational impact include the impacts of an ERP system implementation and use on the organization's operating cost, overall productivity gains, customer service level, and the realization of specific ERP implementation objectives.

3.6.4. Intended business performance improvement

Based on White et al.'s (1982) research, intended business performance improvement could serve as an ERP implementation success measure. Most ERP adopters set performance objectives of the ERP projects which include cost reduction, business processes integration, time, cost, etc. Different enterprises have different objectives to implement ERP systems.

Since a mix of measures is used to evaluate whether an ERP system implementation is a success, only when all the four measures are given positive answers by the organization can we call it a success. And when all the four measures are marked as negative, the implementation is classified as a failure. Otherwise, the implementation success is difficult to determine.

4. Research methodology

4.1. Multiple-case study research design

A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations) (Benbasat et al., 1987; Yin, 1994). By its definition, case study research is well suited to the study of IS implementation, especially when context is important and the phenomenon is contemporary, which the researcher has no control over, the research is largely exploratory and it addresses the "how" and "why" questions (Benbasat et al., 1987; Yin, 1994). Multiple cases are suggested to increase

the methodological rigor of the study through "strengthening the precision, the validity and stability of the findings" (Miles and Huberman, 1994). Contrary to common misconception that case studies provide little basis for scientific generalization, case studies are generalizable to theoretical propositions, not to populations or universes (statistical generalization) (Lee, 1989; Yin, 1994). Research questions of this study include "what", "why", and "how" questions as following:

- What are the critical factors that affect ERP systems implementation success in China?
- Why are these factors critical for successful ERP implementation in China?
- How can ERP systems be implemented successfully in China?
- How can an ERP systems implementation be measured and defined as a success or a failure in China?

4.2. Validity and reliability

One advantage of using multiple sources of evidence (documents, archive records, open-ended interviews, focused interviews, observations, and physical artifacts) lies in its capability of providing multiple measures of the same phenomenon in each setting resulting in the development of converging lines of inquiry, a process of triangulation. Thus, the construct validity of the case study could be more convincing and accurate. Moreover, by using replication logic of the same interview protocol in multiple-case studies, the external validity of the information collected can be obtained. To increase the reliability of the information in the study, several methods or steps are taken. First, sufficient citation to the relevant portions of the case study database are made by citing specific documents, interviews, and/or observations; second, the database would reveal the actual evidence (herein means the interviewee's responses) and also indicate the circumstances (the four ERP user firms) under which the evidence was collected; third, these circumstances would be consistent with the specific procedures

and questions contained in the case study protocol, to show that the data collection followed the procedures stipulated in the protocol; finally, a reading of the protocol should indicate the link between the content of the protocol and the initial study questions. Thus, the ultimate “chain of evidence” is built and the reliability of the information in the case studies can be increased.

4.3. *Subjects of the case study*

We define an ERP user company as one that has installed at least the basic modules of the three major integral parts of Baan ERP system. These modules are manufacturing, sales and distribution, and finance. Moreover, the ERP system installed should have gone live no more than 2 years for the reasons of personnel change and difficulty of recalling past implementation process. The unit of analysis is the selected ERP user company. In each of these ERP companies, one or two persons who participated their firms’ ERP system implementation as a major team member (CIO, project manager) are interviewed.

4.4. *Data collection*

The target ERP user companies are obtained at the recommendation of Baan Company. From the recommended ERP user companies, we screen them and delete those companies that did not meet the criteria of the research. Finally, we focus on four ERP user companies that implemented Baan IV ERP package no more than 2 years. The same company size and the same business industry belonged allow the researcher to compare the ERP system implementation issues. The interview protocol is translated into Chinese and the transcripts are back translated into English to be coded and analyzed. Both digital recorder and tape recorder were used to avoid contingency conditions.

5. **Data analysis**

Unlike quantitative research, which could use standard statistics software to accurately analyze the collected data according to the formerly

proposed research model, qualitative research involves more text work. In this research, we use the software of ATLAS/ti to assist data analysis. The four cases selected and interviewed are located in the richest areas of Mainland China, the Pearl River Delta area (Cases A and B) and the Yangtze River Delta area (Cases C and D).

Since the transcripts obtained from the subjects are mainly audio files recorded and they are repeatedly listened to ensure no omissions and written down in paper. With coding scheme and codes formulated according to the research framework proposed and its components on hands, they are entered into the program of Atlas/ti. After that, the manuscripts translated into English are typed into Atlas/ti and make correlations between the sentences and the specific codes. The coding process is an iterative one, some codes can be condensed into one code in this process according to interviewees’ responses, which leads to the dimensions of the proposed framework to be consolidated. Meanwhile, through reviewing interviewees’ responses, new dimensions can be found and added to the framework easily in this process since no relevant codes can be linked to the sentences. Atlas/ti program assists the researcher to finish the coding process visually in an efficient way. After the coding process, we got the preliminary tables on success factors and measures based on the interviewees’ responses and data analysis as deliverables. These deliverables are returned back to the relevant interviewees for their confirmation via emails and post mails, and the final confirmed ones come into being as illustrated in the following sections.

Table 2 illustrates the differences between the four firms concerning the IT infrastructure before implementing the ERP system. Company A developed an MRP system in-house that runs quite well, but was incapable of processing large amount of data. Companies B and C bought an MRP II package and ERP system, respectively. Company B had to update its MRP II system in order to exchange data with its overseas headquarters and branches while Company C attempted to switch its small ERP system to a larger and more powerful ERP system to keep competence. These three firms had very good

Table 2
ERP implementation background comparison

Background dimensions	Case A	Case B	Case C	Case D
Industry	Home appliance	Electronics	Electronics	Home appliance
Number of staff	1000	900	400	400
Ownership	State owned	JV (Canadian)	JV (German)	State owned
Sales revenue (billions RMB)	2	2	0.8	1
IT infrastructure	MRP system was developed in-house	MRP II system installed	ERP system installed	No ISs used
ISO certificate conditions	ISO 9001	ISO 9001	ISO 9002	ISO 9002
Reasons to adopt ERP	Incremental change	Incremental change	Top-down strategy	Top-down by dictate
Implementation service provider	The ERP vendor	The ERP vendor	The ERP vendor	The vendor's partner
ERP package implemented	Baan IV	Baan IV	Baan IV	Baan IV

Table 3
Cross case effects matrix

Factors' effects on ERP implementation	Case A	Case B	Case C	Case D
Top management support	+++	+++	+++	+
Company-wide support	+++	+++	+++	-
Business process reengineering	++	+	++	+++
Effective project management	+++	+++	+++	+++
Organizational culture	+	+++	+++	---
Education and training	+++	+++	+++	+
User involvement	+++	+++	+++	+
User characteristics	+++	+++	+++	--
ERP software suitability	+++	+++	+++	+++
Information quality	+++	+++	+++	+++
System quality	+++	+++	+++	+++
ERP vendor quality	+++	+++	+++	---

+, Weak positive impact; ++, average positive impact; +++, strong positive impact; -, weak negative impact; --, average negative impact; ---, strong negative impact.

IT infrastructure. However, Company D had no ISs installed and computer usage was very limited. Moreover, Companies A, B, and C recognized the importance of using ERP systems to maintain their competitive advantage. The ERP system was implemented by the ERP vendor, while Company D's top management did not recognize the ERP's role in business and was forced to implement an ERP system as a trial site. Unfortunately, a third party was invited to implement the ERP system whose consultants were inexperienced with the Baan IV system,

which indicates the future problems with the ERP system implementation.

Table 3 illustrates the extent to which different factors proposed have affected Baan IV system implementations in the four firms. Based on interviewees' responses, the researchers determined relationships in Table 3 first and post mailed back them to all subjects for correction, finally the above relationships were confirmed by all subjects. In terms of the 12 factors' impact on the Baan IV system implementations in the four firms, no negative impact was found in Cases A, B, and C.

In these three companies, most factors have strong positive impacts on the Baan IV system implementations except two factors, BPR and organizational culture. Cases A and C have the same impact of BPR on the ERP implementation at the level of average positive impact since Case A is a state-owned enterprise that may need more BPR effort before or during the ERP program. Case C is a joint venture (JV) that had installed a relatively small ERP system, FourthShift, which maybe a little different from the large one, Baan IV. Thus, the business processes need to be changed for Baan IV implementation. Company B is a JV that had installed the MRP II system of Baan product series, which necessitates relatively little change on the current business processes to update to the ERP system of Baan Company.

Based on the subjects' responses (see Table 4), Case D has parochial, closed, and loose control system climate. According to Hofstede (2001), these three dimensions have a negative effect on IT deployment success. Parochial culture focuses on local competition rather than external, which means only local ERP implementation conditions are considered. Thus, it is difficult for Case D to adopt advanced technology to improve its competence. While the closed system discourages information sharing among team members, people in such system regards information as proprietary. While ERP operation requires high degree of information sharing across departments to ensure inventory, production scheduling, and procurement information updated timely as much as possible. Furthermore, ERP systems require timely data input to ensure end product of the system timely, useful, and accurate.

Both Companies B and C are JVs that have quite advanced organizational culture. Both Wes-

tern organizational culture and ERP products focus on open, professional, and tightly controlled culture, which show a perfect fit between the organizational cultures and the ERP system implementation requirements. Thus, organizational culture in Companies B and C has very strong and positive effect on ERP system implementation. While Company A is neutral in the dimension of loose vs. tight control system due to its management reform in past several years. This also affects ERP system implementation positively.

Among the four companies interviewed, only Company D shows negative impact on Baan IV system implementation. Furthermore, evidence shows that two “--” signs of strong negative impact of organizational culture and ERP vendor quality, one “--” sign of adequate negative impact of user characteristics, and one “-” of weak negative impact of company-wide support on the ERP system implementation. Moreover, only five “+++” signs of strong positive impact of effective project management, BPR, ERP software suitability, information quality, and system quality on Baan IV implementation in Company D. Three “+” of weak positive impact of top management support, education and training, and user involvement exist.

Company D is a state-owned enterprise that relies on top managers' personal experience and intuition to make decisions. Communication between departments is limited and orders are passed verbally, which results in low accountability recourse. People tend to be tolerant of unclear information. The characteristics of Company D's culture affected the ERP system implementation strongly and negatively. Since the third party was inexperienced with Baan IV implementation and it

Table 4
Cross case matrix on three dimensions of organizational culture

Dimensions of organizational culture concerned	Case A	Case B	Case C	Case D
Parochial vs. professional	Professional	Professional	Professional	Parochial
Open vs. closed system	Open system	Open system	Open system	Closed system
Loose vs. tight control system	Neutral	Tight control	Tight control	Loose control

was the first time experience with system implementation. The implementation service quality was poor and affected the ERP implementation strongly and negatively. Since the IT usage level in Company D was quite low and it is difficult to find the best key user candidates, the key user characteristics was another factor that affected the ERP project negatively. While the department heads' unwillingness to provide support and less attention on the ERP project also posed the negative impact. Furthermore, education and training and user involvement were not strongly supported by either the vendor or the key users. It is the top-down dictate from the headquarter that decides to adopt the ERP system, which made the top management in Company D simply to accept the order and adopt the ERP system. They did not recognize its importance of applying an ERP system in their company and consequently they did not give enough support to this big project. Based on the negative responses plus final suspension of Baan IV system even though it successfully went live, the implementation of Baan IV system in Company D was a failure.

From Appendix B we present the interviewees' opinions about the ERP implementation results. Both Companies A and C show adequate satisfaction with the ERP system implementation and the remaining B and D show weak satisfaction with the ERP system implementation. Company A shows strong evidence in the other three proposed success measures of individual impact, organizational impact, and intended business performance improvement. Company C shows strong evidence in organizational impact and intended business performance improvement, but adequate evidence in individual impact. Company B shows adequate evidence in both organizational impact and intended business performance improvement, but weak in user satisfaction and individual impact. However, Company D shows weak evidence in all the four proposed success measures with further suspension of using the ERP system. Thus, we could draw conclusions that even though Companies A, B, and C achieved different level of evidence in the proposed four areas of success measures, their

ERP projects could be said successes in that the ERP system has been used as one integrated part of these firms. However, Company D's ERP project could be classified as a failure due to the fact of its suspension of use.

Moreover, only one company, Company C, developed its own success measures of a quasi-Oliver White's *ABCD* Classification Scheme to evaluate its ERP implementation result. The other three firms did not assess their ERP projects very seriously. They simply formulated ERP implementation objectives at the very beginning of the ERP project when analyzing their business requirements. However, those objectives would be too broad, immeasurable and not suitable to evaluate the complicated ERP system implementation results.

6. Discussion

From above analysis, we get more detailed information about ERP systems implementation issues in China context. This study explains and confirms that critical success factors identified in Western countries are applicable to China context and all the four propositions get support from the study (see Table 3). Meanwhile, culture as the unique critical success factor has been confirmed by this study. Based on Hofstede (2001), three dimensions of organizational culture including *parochial vs. professional*, *open vs. closed system*, and *loose vs. tight control* are more closely linked with IT deployment in general and ERP implementations in specific than the other three dimensions. Chinese people are more tolerant to unclear information, relying more on personal experience, keeping more information among themselves than their Western counterparts. However, the ERP system deployment requires clear and accurate data/information, focuses on business processes and inter-department cooperation, which is incompatible to Chinese organizational culture. Thus, in order to obtain ERP systems implementation success, Chinese enterprises should take their organizational culture into account and try to change their culture to the modern management

requirements in terms of the three dimensions particularly.

Other factors that have been overlooked by prior studies can be classified as critical success factors in China context such as existing IT infrastructure of the company, ownership, and reasons to adopt ERP systems. Among the four companies, no MRP system was used in Case D only. It is the order from the headquarter to implement an ERP system in Case D. The implementation of Baan IV system in Case D was classified as a failure.

As for the success measures used in ERP user firms, only Company C developed a set of success measures like Oliver White's *ABCD* Classification Scheme to evaluate its ERP implementation result. However, the other three companies did not have their own success measures. Companies A and B did not evaluate their ERP implementations' results. Based on the fact that most firms in China do not have specific and quantifiable success measures, this study does play an important role in narrowing the gap of current status of success measures shortage in China enterprises and confirms that ERP success factors used in Western countries are applicable to China context. Furthermore, the success measures defined in this study are quite comprehensive on the one hand and concise on the other hand in that the four success measures can be used to measure different aspects of an ERP system implementation.

6.1. *Implications for academic researchers*

This study derives its theoretical foundation from the Ives, Hamilton, and Davis's IS research model and the DeLone and McLean's IS success model. An ERP implementation success framework has been developed and four propositions are developed based on the associations between four environmental factors and ERP system implementation success. This conceptual research framework gets support from the above two models and the empirical results obtained from this study provide support to the four propositions.

Based on the data analysis, we found that the variables of information quality and system quality from the DeLone and McLean's success model should be modified greatly considering the specific condition of a large mature off-the-shelf ERP package implemented in manufacturing enterprise. Information quality refers to product of an IS in DeLone and McLean's model. However, in the environment of ERP system, only when the input data were correct can the end users get accurate output information. Moreover, since an ERP system is used in organizations' daily business, it is natural that the information output is timely. Thus, only the integrity of raw input data in information quality affects the ERP system implementation result. As for the system quality in the ERP field, it also should be modified in that ERP system packages have been developed for many years and used in many sites, which enable the packages to be very mature and reliable. Of course, usefulness should be the first must for any ERP package in that the ERP vendors have to update their ERP packages more frequently to survive intense competition.

Organizational culture has been overlooked in prior studies. However, it does affect an ERP system implementation especially in a fully different cultural environment. Empirical evidence from this study suggests that organizational culture is an important unique factor for ERP system implementation success.

As for the success measures, system use should be another success measure in that even though Company D encountered many problems in implementing the ERP system, finally the system went live. However, the ERP system eventually was suspended, which is definitely a failure case of ERP system implementations. System use in this context means once the ERP system implementation has been completed it is used in daily business.

This study develops a conceptual framework with theoretical support from the IS field which should be taken into consideration when researchers are studying ERP implementation issues. This framework could be applied into other countries to test its applicability.

6.2. Implications for business practitioners

The implementation of a foreign ERP system in China's firms involves the issue of organizational culture, BPR, and standardization of the enterprise's operational processes. The critical success factors identified in Western countries are confirmed applicable in China context and culture is an important unique factor when an ERP system is implemented in Chinese firms. Meanwhile, reasons to adopt an ERP system, existing IT infrastructure, and company ownership should be taken into consideration in China context. ERP vendor quality should be given more attention in China context in that Case D selected a less experienced third-party consulting firm to lead the ERP system implementation and the ERP project in Case D was classified as a failure.

Once the ERP project goes live, enterprises should evaluate its implementation result to see what the ERP system could do to improve their business performance in that the ERP project is a large program that involves many people, money, and time investment. With correct evaluation of the ERP project, enterprises could find where they should spend more time and effort to improve and what places they succeed so that they could elevate their firm's operational performance.

In Appendixes C and D, we recommend a map to successful ERP system implementation and operation in China. Three stages of an ERP project are classified and different critical success factors should be given more attention in these stages. Following this map, the chance to succeed in adopting and implementing an ERP system in China context can be improved great.

7. Conclusion

This study aims to improve understanding of both generic and unique critical factors that affect ERP implementation success in China and establish measures to assess the extent to which an ERP system implementation can be defined

as a success or a failure. We developed a conceptual research framework to guide the research and four propositions concerning the associations between the proposed critical factors and ERP implementation success are developed. Qualitative research methodology is used in this study due to the research question. To make comparison possible, the researcher uses one set of case study protocol and interview questions in studying four ERP user firms that have implemented the same ERP system, Baan IV, going live no more than 2 years. Four ERP user firms were selected and interviewed based on the same size and business industry. The result of this research study can contribute to both the academic field and business industry.

We collected much information from the four ERP user companies including interviewees' responses, periodic status meeting minutes, ERP implementation plans, and ERP project proposals drafted by the Baan Company for triangulation, however, only in Case A two interviewees' cooperation is obtained and only one person in the other three firms, respectively, is available to accept the interview. It would be ideal if more interviewees from different positions within one firm could be available for the interview. The case study protocol could be used to study different ERP packages implementation to examine variations between different ERP systems and vendors. The conceptual framework could be used in other countries to test its applicability by further studies. Moreover, researchers could focus on more specific areas such as people resistance or organizational culture impact within one firm so that more detailed and in-depth information or deep-rooted failure reasons could be identified.

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Appendix A

Concept matrix: Critical success factors and ERP success measures mentioned in the literature

Critical success factors and success measures	Al-Mashari et al. (2003)	Ang et al. (1994, 1995, 2002)	Bingi et al. (1999)	Burns and Turnipseed (1991)	Cox and Clark (1984)	Hong and Kim (2002)	Malbert et al. (2003)	Theoretical support
Top management support	✓	✓	✓		✓			No
Clear goals and objectives		✓						No
Company-wide support		✓			✓			No
Communication	✓	✓			✓			No
Visibility of implementation		✓						No
Training and education	✓	✓	✓		✓		✓	No
Vendor support		✓	✓	✓				No
BPR	✓		✓	✓		✓	✓	No
Suitability of hardware and software	✓	✓		✓			✓	No
Project management	✓	✓	✓	✓				No
Data accuracy and integrity		✓			✓	✓	✓	No
Company expertise in IT		✓		✓			✓	No
User characteristics		✓	✓		✓	✓		No
User participation		✓	✓	✓	✓			No
Cultural fit	✓					✓		No
<i>Success measures</i>								
User satisfaction	✓	✓		✓				No
Intended business performance improvement	✓					✓		No
White's ABCD Classification Scheme				✓				No
On time	✓					✓	✓	No
Within budget	✓					✓	✓	No
System acceptance and usage		✓						No
Predetermined corporate goals	✓							No

continued on next page

Appendix A (contd.)

Critical success factors and success measures	Mandal and Gunasekaran (2002)	Motwani et al. (2002)	Markus et al. (2000)	Sum et al. (1997)	Umble et al. (2003)	White et al. (1982)	Wilson et al. (1994)	Yusuf et al. (2004)	Theoretical support
Top management support				✓	✓		✓	✓	No
Clear goals and objectives					✓			✓	No
Company-wide support				✓			✓	✓	No
Communication								✓	No
Visibility of implementation								✓	No
Training and education	✓			✓	✓			✓	No
Vendor support		✓		✓				✓	No
BPR	✓	✓			✓			✓	No
Suitability of hardware and software	✓			✓				✓	No
Project management				✓	✓			✓	No
Data accuracy and integrity				✓	✓				No
Company expertise in IT								✓	No
User characteristics							✓		No
User participation								✓	No
Cultural fit		✓						✓	No
<i>Success measures</i>									
User satisfaction			✓			✓		✓	No
Intended business performance improvement	✓		✓			✓		✓	No
White's ABCD Classification							✓		No
Scheme									No
On time									No
Within budget									No
System acceptance and usage								✓	No
Predetermined corporate goals	✓				✓			✓	No

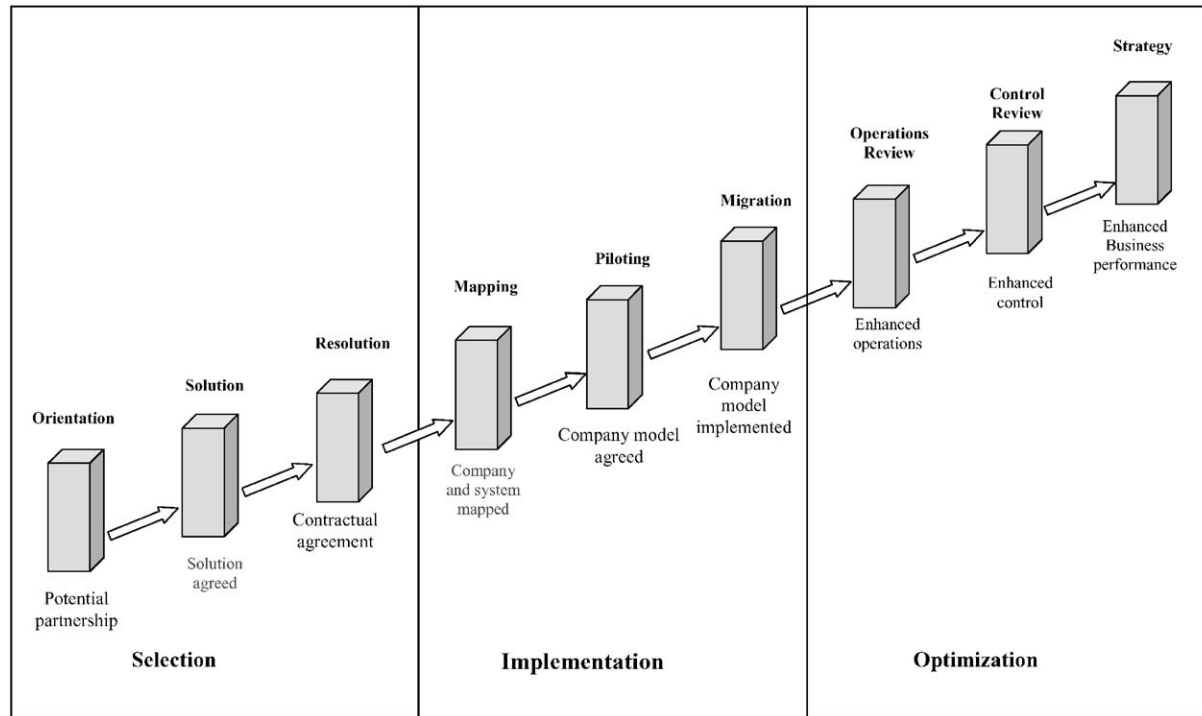
Appendix B

ERP implementation success measures matrix

ERP implementation success measure	Case A			Case B			Case C			Case D		
	Strong	Adequate	Weak	Strong	Adequate	Weak	Strong	Adequate	Weak	Strong	Adequate	Weak
User satisfaction		✓				✓		✓				✓
Individual impact	✓					✓		✓				✓
Organizational impact	✓				✓		✓					✓
Intended business improvement	✓				✓		✓					✓
Planned budget vs. actual costs	No budget: 3 millions RMB			No fixed budget			No fixed budget			N/A: 1.5 millions RMB		
Planned time vs. actual time	1:1.5 years			No time frame			No time frame			(1 USD = 8.3 RMB) 8:8 months		
Suggested success measures	<ol style="list-style-type: none"> 1. More efficient information flow than before. 2. Top management could monitor organizational operational performance 24h/day. 3. Capable ERP experts are cultivated to maintain the ERP system. 			<ol style="list-style-type: none"> 1. No success measures were used. 2. Inventory level did decrease, manufacturing lead-time also became shorter, and customer service level improved. 			<ol style="list-style-type: none"> 1. Quasi-Oliver White's ABCD Classification Scheme. 2. Inventory level lowered, account receivables decreased, and manufacturing lead-time became shorter, etc. 			<ol style="list-style-type: none"> 1. ERP implementation objectives. 2. User satisfaction. 3. ERP going live does not represent a success. 4. The ERP system should be one of the firm's integrated parts. 		

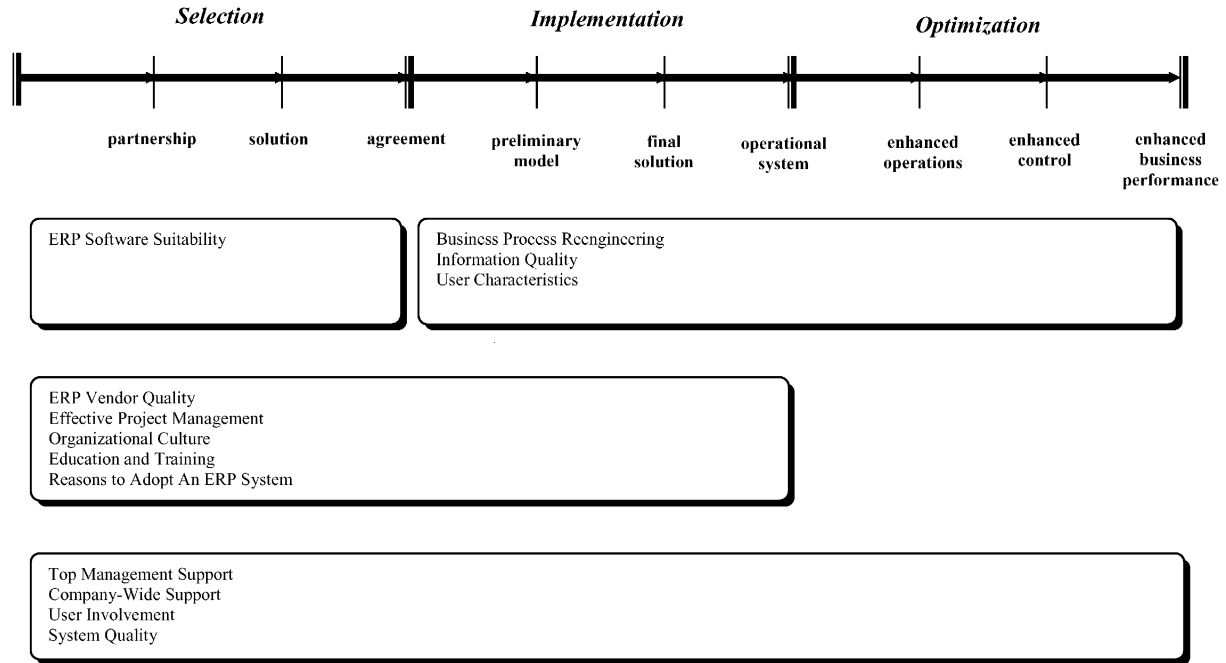
Appendix C

A recommended map to successful ERP system implementation and operation in China



Appendix D

Impact of critical success factors across successful ERP system implementation stages



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