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The Adoption of ERP Applications in China

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ABSTRACT

The adoption of enterprise resource planning (ERP) applications started in the early 1990s in the US and Europe. Although many researchers have studied the critical success factors (CSFs) or developed implementation framework to guide the deployment of the complex IT projects, there have been many failed implementations. The implementation of ERP systems in China began in the late 1990s but has resulted in a disappointing success rate of about 10 percent. This paper will investigate which issues facilitate or hinder the adoption of ERP applications in China in the light of previous research reported on Western firms. The research methodology is secondary data collection and case narratives. Twenty small case studies about the implementation of ERP systems in Chinese organisations will be discussed. Since the data has been collected and presented by other practitioners for certain purposes, the limitations of this research are also considered.

Keywords

ERP, Implementation Issues, Chinese Organisations.

INTRODUCTION

The enterprise resource planning (ERP) system is a software package that provides a single, enterprise-wide shared database to serve and support the key business functions within an organisation. It brings together business processes and organisational data via the IS resource. In this way ERP allows different departments to communicate and coordinate with each other more efficiently (Laudon and Laudon, 2000). Increasingly organisations are finding that an integrated system to provide the real-time information to support operations and managerial decision-making is necessary to remain competitive.

Although ERP in China emerged in the late 1990s the empirical research base on ERP is inadequate. China is a big market for ERP vendors due to increasing numbers of multinational organizations now operating either alone or collaboratively in China, and the continued reform of China's industrial sector. The latter requires access to comparable western technologies to compete both domestically and internationally. Although ERP systems have been introduced in developed countries for over 20 years and have attracted hundreds of researchers to analyze both the technical and non-technical factors that would affect their implementation, the implementation processes remain problematic (Scott and Vessey, 2000). In China, based on limited empirical experience, the success rate of ERPmeasured as systems that have met their functional expectations within budget appears to be about 10 percent, much lower than that in western countries (Zhang et al, 2003). The main objective of this research, therefore, is to further our understanding of ERP implementation issues in China using the experience of firms in western countries as a starting point.

The remainder of this paper is structured in to five sections, namely: (i) literature review, (ii) research question, (iii) research methodology with the limitations of this research, (iv) twenty small cases of ERP implementations in Chinese companies are analyzed and discussed, and finally (v) a conclusion.

LITERATURE REVIEW

Many multinational enterprises have already established their branches or are outsourcing their manufacturing departments to mainland China. Although the growth in the economy of China attracts many overseas investments, IT/IS infrastructures in most Chinese companies are inadequate to support their fast growing business. On average Chinese enterprises invested only 0.21 percent of overall assets in IT, while their western counterparts invested 8 to 10 percent (ATM, 2002).

Zhang et al. (2003) cited a market report from IDC that in 1998 more than 90 percent of the ERP market in China was taken up by international vendors. Although overseas ERP providers still have a majority market share over the local providers the latter, for example CASE and Kingdee, are growing rapidly and the have advantage of an increasingly important strong base of local clients (Liu, 2001). Owing to the differences of the Chinese ERP market compared to the western one in terms of culture, management style and accounting systems, most western providers choose local or international partners to support their ERP implementation (Stiffler, 2003). Additionally, in order to access the Chinese ERP market some late entering overseas vendors set up joint ventures (JV) with local providers, such as IFS and Ufsoft (Liu, 2001).

Although ERP technology has been available to western firms for over 20 years, the comprehensive success rate (i.e.meeting functionality and budget requirements) of ERP projects was still disappointing, at around 30 percent (Zhang et al., 2003). Owing to the high rate of implementation failure, the complexity of an ERP project and its effects on the enterprise's competitive capacity or even survival, many researchers and practitioners have investigated factors that might affect ERP deployment. Following a literature review a total of 13 factors are commonly cited and are listed below:

(1) *Top Management Support* has been stressed by many authors as one of the standard CSFs in ERP projects (Bingi, Sharma, Godla, 1999; Holland, and Light, 1999; Nah, Lau and Kuang, 2001; Umble and Umble, 2002). Zhang et al. (2003) mentioned in their research that top management commitment had a positive influence on successful ERP employment.

(2) *Project Team* should consist of cross-functional and distinguished members from top and middle management, IT department, consultants, ERP vendor and hardware vendor (Kumar, Maheshwari, and Kumar, 2003; Nah, Lau and Kuang, 2001).

(3) *Change Management* is a critical factor in ERP projects. Some researchers recommended that the management of change should start in the beginning of an ERP project and carry on all through the project life cycle (Nah, Lau and Kuang, , 2001).

(4) *Training* is one of the essential issues that affect the implementation and the usage of ERP systems. Nah et al. (2001) suggested that training should be one of the main targets from the beginning of a project.

(5) *Infrastructure*, especially business and legacy systems, is viewed as an important factor in the initial stage of an ERP project (Nah, Lau and Kuang, 2001). Infrastructure has been regarded as one of the main obstacle in adopting ERP package in Chinese companies (He, 2004; Huang and Palvia, 2001).

(6) Getting the *Technical Support* from staff who have multiple skills is another challenge to ERP projects (Kumar, Maheshwari and Kumar, 2003). A Lack of well-trained and experienced staff is another major obstacle in carrying out the introduction of ERP systems in China (He, 2004).

(7) *Compatibility of ERP system* is a critical factor in an ERP project. A mismatch between the selected system's capabilities and existing business processes could cause installation failure (Bingi, Sharma and Godla, 1999; Umble and Umble, 2002).

(8) *Selection of Implementation Partners* is critical. Since ERP systems are complex and require multi-skilled personnel to carry out the project, the dependence on implementation partners is increasing (Kumar, Maheshwari and Kumar, 2003).

(9) *Consultation* has been a problem due to lack of competent consultants (Bingi, Sharma, and Godla, 1999). Due to the shortage of qualified ERP consultants, there is a challenge in keeping them throughout ERP projects (Bingi, Sharma, and Godla, 1999).

(10) The concept of *Business Process Re-engineering (BPR)* was first proposed by Hammer and Chamy in the early 1990s. BPR has been linked to the effectiveness of ERP systems by many authors (Bingi, Sharma, and Godla, 1999; He, 2004; Nah, Lau and Kuang, 2001; Zhang et al., 2003).

(11) *Data Accuracy* is the basic factor of an ERP system. Since ERP applications are integrated and share the same database, inputting inaccurate data would affect the function and credibility of the system (Umble and Umble, 2002).

(12) *Project Scopes* differ from one company to another. Holland and Light (1999) suggested two ways. One was step-by-step, while the other was to deploy most of the ERP modules in the organisation-wide scope.

(13) *The Relationship with Vendors*, especially international vendors, is vital for most Chinese clients who have adopted or are implementing ERP applications. Gaining a vendor's support in business process analysis, change of IT infrastructure and so forth are essential (Zhang et al., 2003).

The broad observation from the above literature is the multifactor nature of successful ERP implementation. In the case of China the limited research that has been done reinforces four of the above factors, namely: Top management Support; Technical Support; BPR implementation; and Vendor Relationships.

RESEARCH QUESTION AND METHODOLOGY

Deriving from the literature review, the original research intention behind this paper was to confirm existing insights and to add to our understanding of what issues, both technical and non-technical, that hinder or facilitate the implementation of ERP applications in Chinese companies.

The research methodology of this project was mainly secondary data collection from previous research papers and the Internet. This had distinctive advantages in terms of access to significant quantities of data relatively quickly. Twenty small 'cases' regarding the implementation of ERP in China were chosen and these are narrated in the next part. The empirical research instrument for this study was case narrative, rather than the traditional in depth case study based such as Yin (1989). There are no specific criteria for selecting organisations such as sector, geographic location, size or ownership due to the difficulties in

finding in-depth and academically suited case studies in this area. Hence, the essential requirement for selecting the final sample was the quality of narrative available for each organization in terms of the detail and richness of the data provided and the perceived objectivity of the data. Some of the selected cases were from the '50 recommended case studies of IS/IT development in Chinese organizations' (www.i-power.com.cn), others were generated from systematic searches. In selected instances telephone discussions to follow up particular points were carried out. The interpretive framework to investigate the data was derived directly from the literature review.

Because this research mainly depends on secondary data and the sample is limited to 20 firms it is impossible to generate conclusions, which are suitable for every company or business sector. Moreover, ERP vendors wrote some of the narrative data and therefore their objectivity could be questioned. However, the findings based on these 20 firms represents a significant increase in our knowledge of Chinese ERP experience and with caution can be treated as useful insights into implement ERP.

CASE NARRATIVES AND DISCUSSION

Case Narratives

In this part the research sample and findings are presented in three tables. Table (1) contains the company profiles, Table (2) for reasons of space displays a sample of three cases and the kind of data available to construct the narratives, and finally Table (3) summarises the key implementation issues highlighted by the selected companies and organised by the 13 factors identified in the literature review.

No.	Name	Locations	Sector	No. of Employees	ERP Vendor	Implementation Partner
1	ADLINK Technology	Beijing, Shanghai, etc.	Electronic Products	1,000	Digital China	Digital China
2	AsiaInfo Technology	Beijing, Hongkong, etc.	Communication Technology Products	1,000	Oracle	Andersen
3	Beijing Jeep Corporation	Beijing	Automobile Industry	1,200	SSA	SSA
4	Beijing Sanlu Factory	Beijing	Cosmetic Products	1,200	Intentia	Legend Advanced Systems
5	Changhong Electric	Sichuan, Guangdong etc.	Domestic Electrical Products	30,000	SAP	Don't Know
6	Formosa Optical	Hunan, Shanghai etc.	Optical Products	4,000	SAP	Covics Business Solution
7	FuYao Glass Industry Group	Fujian	Automobile Glass Products	1,500	SSA	Andersen
8	Harbin Pharmaceutical Group Holding Corporation	Harbin	Pharmaceutical Industry	20,100	Oracle	Beijing Riamb Software IT
9	Hefei MeiLing	Hefei	Domestic Electrical Products	2,495	Oracle	Shanghai Zhijie Technology
10	Heilongjiang Oil Factory	Heilongjiang	Oil and Gas	2,900	Langchao Genersoft	Langchao Genersoft
11	KaiQuan Pump Group	Shanghai, Jiangsu etc.	Pumping Tools	3,500	Kingdee	Kingdee
12	Nanjing Automation Research Institute	Jiangsu, Shanghai etc.	Electric Power Systems & Automation	2,200	UFSoft	UFSoft
13	Ningbo FuDa Electric Appliance	Ningbo	Domestic Electrical Products	2,370	Kingdee	Golden Tech
14	North China Aluminium	Hebei	Aluminum Products	1,000	HJSoft	HJSoft
15	SanLian Group	Dongbei	Electronics & IT etc	30,000	JDE	Don't Know

16	Shenzhen Development Bank	Guangdong, Shanghai etc.	Banking	6,000	Advance Business Solution	Advance Business Solution
17	Shine Way Group	Henan	Food Processing	28,000	In-house	Shine Way Software
18	XuJi Group	Henan, Fujian	Electric Power Systems	4,260	Symix	Symix
19	YiLi Group	Beijing, Inner Mongolia, etc.	Dairy Products	20,000	UFSoft	UFSoft
20	YuTong Coach	Henan, Gansu etc.	Automobile Industry	2,700	SAP	PWC

Source: www.i-power.com.cn and companies' website

Table 1. Research sample and company profiles

Name	Implementation
ADLINK Technology	Ÿ Decided to implemented an ERP system in June 2002 Ÿ Selected Digital China's ERP applications in July 2002 Ÿ Implemented modules: inventory, material, production, financial, sale, procurement etc. Ÿ The project was finished in May 2003 and the system is in use in three branch offices in Beijing, Shenzhen and Shanghai Ÿ The issues that caused concern: top management support, project team, training, technical support, compatibility of software, vendor support, data accuracy and implementation partner
AsiaInfo Technology	Ÿ Started the implementation of Oracle's ERP's financial application in June 1998 Ÿ Chose Andersen as the implementation partner Ÿ The financial module has been in use since August 1998 Ÿ Developed it's own sales management and budget management applications and integrated them with Oracle's financial module Ÿ The issues concerned: top management support, compatibility of software, consultation, project scope and implementation partner
Formosa Optical	Ÿ Decided to implement an ERP system in 2001 Ÿ Chose SAP as the software provider and Covics Business Solution as the implementation partner Ÿ Implemented modules: materials management, sales and distribution, financial, control, business warehouse and retail Ÿ The issues that caused concern: top management support, project team, training, compatibility of software, consultation, project scope and implementation partner

Source: www.i-power.com.cn

Table 2. Sample of Three Case Narratives

Factor (from lit. review)	Description
Top Management Support:	It was the most addressed issue with 18 out of 20 cases identifying this factor.
Project Team:	This element has been addressed in 8 cases and most of them recommended that the members should be free from daily duties and mainly focused on the project.
Change Management:	It was mentioned by 5 companies which regarded it as one of the elements that would impede or support the implementation of the ERP systems.
Implementation Partner	18 companies specifically mentioned who were their implementation partners and their importance.
Compatibility of Software:	This was the second most mentioned technical factor, addressed by 17 cases.
Vendor Support:	13 out of the 20 companies considered it would influence the implementation of ERP projects.
Training:	10 selected cases suggested that training affected ERP implementations and the acceptance and usage of the systems.
Infrastructure:	As one of the main obstacles in implementing ERP systems in China, 10 cases reflected their concern about it.
Project Scope:	9 companies mentioned that it had influences on ERP implementations.
BPR:	8 companies suggested BPR should be implemented before or parallel with ERP projects.
Consultation:	8 companies mentioned their implementation partners in the case narratives and implied that the effectiveness and support of consultants had a great impact on the projects.
Data Accuracy:	It is the foundation of ERP packages, however only 6 companies mentioned its importance.
Technical Support:	Only 4 of the cases mentioned that staff's IT skills, ERP knowledge and experience of introducing ERP projects influenced the results of the projects.

Table 3. Summary of results for the 20 case narratives

Discussion

Top Management Support was indicated by most of the selected companies. Among the 20 cases, 18 emphasized that this issue was vital to the success of the ERP projects. For instance AsiaInfo Technology cites the deep involvement of the CFO, Yin Han, in most of the main stages of the ERP project, including system selection, analyzing the business processes, and planning the implementation as a major contribution. In contrast the failure cases of Beijing Jeep Corporation, Beijing Sanlu Factory, Harbin Pharmaceutical Group Holding Corporation and Xuji Group, are attributed to: negative attitudes towards the ERP deployments among the senior managers including short-term vision; preoccupation with their own interests; and not understanding the concept of ERP and the changes it would bring into the organisations.

Therefore, a supportive senior management board, in terms of financial, human resources, empowerment and commitment, would facilitate the application of ERP systems.

Project Team was indicated by eight companies. Most of them suggested that the team members should mainly concentrate on the projects and be free from daily work. In the case of North China Aluminium, its ERP project team included IT staff, managers and other non-technical staff. The members were core employees of their departments and were selected to fully concentrate on the implementation of the ERP system. On the other hand, a high turnover of project team would hinder the deployment of ERP applications. A case in point was Beijing Jeep Corporation. The firm's CIO implied that many staff left the project team when they tried to implemented SSA's ERP package in 1993, which was one of the reasons that caused the failure of the project.

From the examples and reasons stated above, a stable project team, which consists of full-time members from various departments, would facilitate the deployment of an ERP project.

Change Management was indicated in five cases. Failing to manage change was one of the reasons that caused the unsuccessful introduction of the ERP project of Beijing Jeep Corporation. The resistance to change came from various levels of the company, from top managers to end-users. First of all, the whole organisation did not understand the necessity of change. Secondly the senior managers only focused on short-term profits and did not create a long-term vision for the

employees. Thirdly, the managers did not realise the importance of the ERP project and failed to mediate the conflicts between different departments. Finally, the end-users did not understand the benefits and functionality of the system and resisted using it. Inefficient change management also appears as end-users resisting the system owing to increased workload or unfamiliarity with the system. In the cases of Shine Way Group and North China Aluminium, the end-users of both companies complained about the system because of the increased workload.

Therefore, inefficient change management would hinder the implementation of ERP systems and sometime even lead to failure of the implementations.

Implementation Partners was indicated in eighteen selected cases. Some of them were vendors and others were consultancy companies. For example ADLINK Technology selected the local ERP vendor, Digital China, as the implementation partner. Several selected companies have proved the benefits of selecting different implementation partners other than the vendors. For example, Formosa Optical praised Covics Business Solution, the implementation partner, for being very useful in connecting the client and the vendor and developing a specific retail system which was compatible to both the business and SAP's ERP system. However, not every third party partner was competent to assist the implementation of the complex IT projects. A case in point was Legend Advanced Systems, which was the implementation partner of Beijing Sanlu Factory's ERP project. Although it was Intentia's only agent in China, the consultants and technical staff of Legend were not familiar with the system and failed to follow the vendor's advised implementation methodology. Consequently, Legend failed to deliver the project as required and compensated the client 2m RMB.

From the cases stated above, the selection of the correct implementation partner would facilitate the adoption of ERP applications in Chinese companies.

Compatibility of software was the most addressed technical issue within the cases, seventeen out of twenty. When selecting ERP systems between international and domestic products, some companies considered that the latter were more practical. In the case of Heilongjiang Oil Factory, a senior manager said that because the financial system and standard of China was different from the international system, the domestic financial module was more compatible to the Chinese companies. On the other hand, several companies which have implemented international ERP applications considered that oversea ERP systems were more flexible, stable and suitable for the further development of their organisations. For examples, Formosa Optical and AsiaInfo Technology were both agreed that SAP or Oracle's ERP system were the right choice for supporting their fast developing business.

In conclusion, the compatibility of software would affect the results of ERP projects. However, when it comes to comparing the suitability of international product and its domestic counterpart, it is not easy to conclude which one is more compatible.

Vendor Support was indicated in more than half of the selected cases, thirteen out of twenty. Within the thirteen cases, most suggested that domestic vendors were more supportive than their international competitors. They implied that compared to western vendors local providers had quicker response time, higher commitment to the projects and better understanding of the Chinese enterprises. For example, Digital China showed high commitment and interest in the project when implementing the ERP system in ADLINK Technology. The vendor was just a call away whenever the client needed help or problems occurred. When it comes to international vendors, most of the companies expressed their concerns about the poor services they provided. Beijing Jeep complained that SSA had not been very supportive in terms of high turnover of the project staff and not assisting the company to analyse the business processes.

From the cases stated above, the commitment of vendors would facilitate the implementation of ERP projects in Chinese enterprises and the support of local vendors seemed better than the international ones.

Training was indicated in ten of the selected cases. They mentioned various ways of training, such as organisation-wide, focus groups, general training and in-depth teaching programmes. For example, Hefei Mei Ling, KaiQuan Pump Group and Shine Way Group trained their employees in a company-wide base, including IT staff, project teams, managers and end-users. Although training is one of the vital factors of ERP projects, the quality of training is more important. In the failure case of Beijing Sanlu Factory, the firm started a company-wide training programme at the beginning of the ERP project. However, the managers still did not understand the changes that the ERP applications had brought into the company, especially the changes in their operations and business processes.

According to the above statements, effective training would facilitate the deployment of ERP applications and increase the acceptance of the systems. However, the quality of training programmes would affect the results of training.

Infrastructure was regarded as one of the factors that affected the adoption of the ERP applications by ten selected companies. Infrastructures, including IT and business legacy system, management foundation and the company's experience of using IT, were different from one organisation to another. Few companies claimed that their infrastructures were adequate to support the implementation of ERP applications. For instance, Beijing Jeep Corporation mentioned that its business processes and management foundation were not mature enough when it tried to deploy SSA's ERP applications in 1993.

In conclusion, inadequate infrastructure would hinder the implementation of ERP systems in Chinese companies.

BPR, which is also a new business concept in China, has been addressed by eight studied companies. Most of them suggested that BPR of major business processes should be introduced before ERP, while the BPR of other non-major operations could be carried out parallel with the projects. For example, before the implementation, Nanjing Automation Research Institute spent over three months analysing business processes and re-engineering the processes of purchasing and inventory control. However, in the case of Ningbo FuDa Electric Appliance, the company decided to carry out the ERP project and BPR in parallel. Both cases turned out to be successful.

In conclusion, BPR could facilitate the implementation of ERP projects in Chinese companies. However, it is difficult to conclude whether BPR should be introduced before or in parallel due to the situations of companies varying.

Project Scope was indicated in eight companies and most of them implemented the ERP systems module by module. For example, AsiaInfo Technology implemented Oracle's financial module first, then the sales application and human resources module. Some companies mentioned that because of inadequate infrastructure, small scope was more suitable and less risky for the organisations than the big bang deployment. For instance, Formosa Optical introduced SAP's ERP system in its Xiamen branches first, then to the rest of the branches in Mainland China.

From the cases discussed above, a step-by-step implementation mode would be more suitable for the adoption of ERP applications in China.

Consultation has been addressed by seven companies and most of them have implemented the ERP systems from international vendors. Some of the consultant companies have been helpful and assisted their clients to implement the complex IT systems, while others have been blamed for their inefficient services. For example, AsiaInfo Technology praised Andersen, an American consultancy company, for assisting the company to transfer the requirements to Oracle. However, not all consultancy companies were qualified to help their clients to deploy the ERP projects. In the case of Harbin Pharmaceutical Group Holding Corporation, many practitioners also condemned that the main reason for causing the failure of the project was the incompetent consultancy company, Beijing Riamb Software IT.

From the cases stated above, effective consultancy could facilitate the implementation of ERP projects.

Data Accuracy, which is a basic element of ERP systems, was regarded as one of the factors which affected the implementation of the ERP applications by six companies. Most of the companies implied that they have spent time in preparing correct data for the systems. For example, before the implementation of the ERP system, the project team of ADLINK Technology often worked over-time to correct and unify the bar codes or serial numbers of materials and products. If some data were wrong, the ERP applications could not function properly and might generate inaccurate reports or provide misleading information for decision-making. In the failure case of Beijing Jeep Corporation, Mr Che, the firm's CIO, criticised that inaccurate data had been the biggest obstacle of the ERP project.

From the examples stated above, data accuracy could affect the implementation of ERP projects. Therefore, it is worthwhile spending time to ensure the accuracy of the data saved in the systems.

Technical Support was indicated in four cases and three of them stated that the technical support from their internal staff were not sufficient to assist the implementation of ERP systems in the Chinese firms. KaiQuan Pump Group mentioned that because the company was in the machine tool manufacturing industry, the IT knowledge of its employees were low, which hindered the ERP implementation. ADLINK Technology, which is within the electronics industry, claimed that it had a group of employees who had the skills and knowledge to assist the implementation of the ERP applications.

Therefore, technical support of staff would facilitate the adoption of ERP applications in Chinese organisations.

CONCLUSION

The purpose of this study is to identify which factors would facilitate or hinder the implementation of ERP applications in

China. After analysing the data collected from the twenty cases, the main factors which facilitated the implementation of the ERP projects in the Chinese companies and measured by the number of times the issue was raised across the sample were in descending order: supportive senior managers; software compatibility; implementation partners; vendor support; training; infrastructure; project team; project scope; BPR; consultation; data accuracy; change management; technical support. In other words the Chinese companies appear to have experienced the full range of experiences identified in the western firms and this is a confirmatory research outcome. Although direct comparison with the literature review cannot be done some factors, in particular top management support, appear to be highly significant in both the Western and Chinese experiences. In contrast other factors such as the interrelated factors of software compatability and infrastructure appear particularly important in the Chinese context. This suggests the primacy of the 'situation' ie the importance of factors on the ground such as accounting conventions. A further and rather different observation emerging from the narratives was the relatively limited functionality of the Chinese cases. Unlike their Western counterparts comprehensive supply chain management (SCM) and customer relationship management (CRM) are uncommon. As these more complex e-business applications are adopted the implementation difficulties are likely to increase. Finally, because the implementation history of ERP in China is so short there is no longitudinal perspective on implementation and evaluation and is a reminder of the caution needed in the interpretation of current practice.

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