Patterns of ERP Adoption and Implementation in China and Some Implications

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INTRODUCTION

The story is now a familiar one. Since 1978, when Premier Deng Xiaoping began the reform of the Chinese economy, the transformation has been unprecedented. The structure of firm ownership has changed radically to embrace private firms; the economy has grown at a rate exceeding 9% for the last 25 years; and, in 2005, China’s GDP of USD2.23 trillion made it the fourth largest world economy, ahead of the UK and France (China National Bureau of Statistics 2006). It is in this context that the remarkable growth of enterprise resource planning (ERP) expenditure can be viewed. In the 1980s, expenditure was negligible, and throughout the 1990s it was less than USD50 million per year. In 2000-5, ERP annual spending increased from USD71 million to 380 million, a yearly average of 42%; for 2006, the estimate is USD472 million (CCID 2006). This ERP expenditure is important not only in its own right but also because it is a precursor of e-business investment, particularly B2B. It is not surprising, therefore, that for international vendors, as well as the domestic suppliers, the China market is a priority.

The effectiveness of this expenditure is a different question. In Europe and North America, the success rate for ERP implementation is difficult to determine, in part because of the problems of defining success (Markus et al. 2000). In reality, 30–50% of firms appear to judge their implementation as successful, but this is not to say that the implementation was on time or budget (IT Cortex 2003, Martin 1998, Xue et al. 2005). In China, the rate is much lower and is believed to be nearer 10% (Zhang et al. 2003a). Clearly, successful implementation of ERP is a generic problem but one that is particularly acute in China. In all cases, problems arise from the inherent technical complexity of ERP and the scale and scope of organizational change needed to integrate previously separate functions and activities. In non-Western ERP implementations, including that of China, additional issues surface because of national differences, including management style, business models and data formats (Sheu et al. 2004, Stiffler 2003).

This combination of ERP’s importance as an IS application and its complex interaction with organizations has raised the research profile. In China much of this research has been concerned with a central
theme, namely, better understanding of the elements of successful implementation. This work has used both case studies (single and multiple) and survey-based approaches – for example, Bancroft et al. (1998), Reimers (2003) and Zhang et al. (2003b). The aim of this paper is to contribute further to this central theme but to do so in two ways. Firstly, as the focus of the research, the aim is to look at implementation experiences utilizing both international and domestic suppliers. This is needed since much of the extant research centers on international packages (e.g., Hong and Kim 2002, Riemers 2003, Xue et al. 2005). Secondly, the aim is to establish a broad perspective on ERP and a sense of the future implications and issues by explicitly including firms of different sizes and sectors. This dynamic is important since China is changing so quickly. Research undertaken only five years ago would have taken place within a significantly different setting.

To achieve this, the research, which was undertaken in 2005-6, combined 20 mini-case narratives derived from secondary literature and telephone interviews, and a single in-depth case. The remainder of this paper is organized into five sections: (i) literature review, (ii) research method, (iii) empirical results, (iv) discussion, and (v) conclusions and implications.

LITERATURE REVIEW

The ERP system is a software package that provides a single, enterprise-wide shared database to serve and support various business functions within an organization, including production planning, manufacturing, sales, finance and so forth. This allows different departments to communicate and coordinate with each other more efficiently (Laudon and Laudon 2000). This widely accepted definition captures the intra-organizational characteristics of ERP and the prospect of efficiency gains. What this and similar definitions do not convey is the inherent complexity of ERP applications and their implementation. Complexity is a common thread in the ERP literature, as authors seek to tackle technical and organizational dimensions and to explain outcomes; for example, Nandhakumar et al.’s (2005) in-depth single-case examination of the complex dynamics of ERP implementation. In this review, our aim is to identify contributions that provide previous insights into factors that affect implementation success. However, before doing this, we look first at the development of ERP, particularly in China. This provides a setting for the research and for the discussion later in the paper.

ERP development

The genesis of ERP is inventory control, material requirement planning (MRP) and manufacturing resource planning (MRP II). Throughout this sequence the technology and functionality have moved from stand-alone systems and manufacturing planning to integrated systems using shared databases and multiple applications, including financials, sales, distribution and quality assurance. Worldwide, the market for all ERP-related revenue for 2005 was estimated at USD24.2 billion. The industry has consolidated, and five vendors (SAP, Oracle, Sage, Microsoft and SSA Global) currently account for 72% of revenues, with anticipated individual firm growth rates of 3–15% (AMR 2006). This dominance by the international firms does not extend to China. Their strongest market position was in 1998 when they had 90% of new business (Zheng et al. 2002a), but by the end of 2002 more than 52% of the market was held by domestic suppliers (Liang et al. 2004). This trend continues in a market currently growing at 27% (CCID 2006). The change in the market over the last 10 years is significant and adds weight to the need for research that covers both domestic and international suppliers.

In China, the evolution of MRP to ERP has been very different from Western markets (Xue et al. 2005). It can be viewed in three stages, with government involvement clearly visible in the guise of policies, regulations and, importantly, research funding. Wang et al. (2005) have provided a comprehensive account of this development. Briefly, the initial stage in the early 1980s was characterized by academic research to develop and implement pilot MRP II systems – the first system was in a machine-tool company in Shenyang – and by the modification of international systems through academic partnerships. In parallel, the benefits of ERP were widely promoted to manufacturing firms. The second stage in the early 1990s saw a concerted effort to develop Chinese ERP software by key research institutions and to provide this prototype expertise directly to companies. Finally, the third stage, from the mid-1990s onward, was the commercialization of the Chinese ERP providers, many directly derived from the research institutes. Four of the leading domestic providers to emerge – HJsoft, Kingdee, Genersoft and Digital China – are included in the research sample. Chinese academics are now offering concepts and frameworks for ERP selection specifically for the China market (Wei and Wang 2004).

ERP implementation

The implementation literature spans both Western and Chinese experiences and is extensive. In the context of this paper, three strands can be identified. The first is the focus on organizational fit (Everdingen et al. 2002, Hong and Kim 2002). This approach can be linked to contingency theory (for a broad review and assessment, see Weill and Olsen 1989) and to the strategic alignment approach of Henderson and Venkatraman (1993). In
Hong and Kim’s survey-based research, ERP adaptation and process adaptation, which are a measure of organizational fit, account for 47% and 44% respectively of the implementation variance. Although the organizational fit perspective can be distinct, it can also appear as a variable in the critical success factor approach discussed below.

The second strand is that concerned with implementation as a process. Typically, these approaches define stages through which the implementation passes, each stage having a number of detailed activities and key personnel. Two widely cited examples include Bancroft et al. (1998), with five stages, and Markus and Tanis (2000), with four stages; this is termed the ERP ‘life cycle’. The latter comprises ‘chartering’, which involves defining the business case and solution constraints, and the identification of key actors such as the project leader and implementation partner; ‘project’, in which the technical system is defined and the testing and data conversion routines are agreed; ‘shakedown’, which involves the transformation from the newly introduced system to the system in routine organizational use through the elimination of errors; and, finally, ‘onward and upward’, which focuses on maintenance and upgrades that continually match the system with organizational needs. Within this framework, implementation problems can be anticipated and located.

The third strand is the critical success factor (CSF) perspective. This is the largest category of ERP implementation research and is based on the widely applied concept of success factors articulated by Rockhart (1979). Early advocates of this approach, as applied specifically to ERP, were Bingi et al. (1999), Holland and Light (1999), and Parr et al. (1999). The CSF approach is not only attractive to researchers but resonates with managers – it is accessible and robust, and it facilitates the identification and prioritization of factors that could influence implementation success. We identified over 20 authors who have adopted this approach either wholly or partially. They differ mainly in the number of factors used. Xue et al. (2005) adopt eight factors, of which five are cultural. Their method is case based and the focus is international ERP vendors. In contrast, Reimers (2003) has identified and used 32 CSFs drawn from eight sources. Reimer’s research, which is convincingly grounded in the Chinese context, is based on a survey in 2000 and captures the implementation experience of SAP/R3 users. This more fine-grained approach has enabled the author to confirm the significance of factors such as employee retention for implementation success. Particularly interesting in this study is the exploration of ownership characteristics (wholly state-owned enterprises (SOEs), wholly foreign-owned enterprises, joint ventures, etc.) and implementation outcomes. The work suggests that governance mechanisms that are influenced by ownership are significant, particularly the roles and powers of the steering committee and project team.

One explanation for the variation in numbers of CSFs is the level of resolution adopted. For example, Zhang et al. (2002) use five categories, but these are further subdivided into 10 factors. In truth, many factors overlap and interact. From a selected sample of 16 sources covering 1998–2005, we identified 13 factors as critical. Our criterion for the selection of factors was based on the importance and/or frequency of a factor in the source literature. Other factors not meeting this criterion, such as the management of expectations, use of a steering committee, and decision-making process/style, were omitted. The resultant list of 13 was judged feasible in two ways. Firstly, the individual factors were sufficiently distinct to provide a meaningful categorization. Secondly, the 13 factors were manageable in terms of the empirical process, particularly the subsequent organizational contact. The factors are summarized below in no particular order with example references.

1. **Top management support**, which is stressed by many authors as one of the key CSFs in ERP projects (Akkermans and Helden 2002, Bancroft et al. 1998, Bingi et al. 1999, Holland and Light 1999, Nah et al. 2001, Reimers 2003, Umble and Umble 2002).
3. **Change in management arrangements**, including process, timing, etc. (Nah et al. 2001, Reimers 2003).
6. **Technical support** level of skill both in-house and from consulting sources (He 2004, Kumar et al. 2003).
7. **Compatibility or fit of ERP system** to the existing business processes (Bingi et al. 1999, Hong and Kim 2002, Umble and Umble 2002).
8. **Selection of implementation partners** and their ability to provide multiskilled personnel (Kumar et al. 2003).
9. **Consultation access and retention** for both vendor consultants and implementation partners (Bingi et al. 1999, Holland and Light 1999).


The above formed the basis of the interpretive framework used in the research and is discussed below in the Method section.

METHOD

Given the research aims, the approach adopted combined secondary and primary data sources to provide elements of breadth and depth. Following the literature stage, which drew on academic and practitioner literature, there were three main stages.

Stage I

Here the task was to generate insight into the implementation experiences of a wide range of Chinese enterprises using domestic and international ERP systems, in terms of success factors. A survey approach was initially considered but was potentially problematic. In China, response rates to questionnaires are extremely low and in part explain why so much of the factor-based research is case based. There are exceptions such as Reimers (2003), who achieved over 70% response, but this was using explicit support from the SAP customer base and was restricted to SAP/R3. Similar success was achieved by Zhang et al. (2003) and by Hong and Kim (2002). However, in both instances, the samples were derived from a single ERP supplier or consultant and a prior relationship existed.

The chosen method was to generate mini-case narratives from Web sources and telephone interviews. Over 100 reports of ERP implementations were viewed from Web sources, both Chinese and English language sites. Some of the cases were identified from specialist websites highlighting IS/IT developments in Chinese organizations (i-power 2005). The tradition of the ‘public reporting’ of significant developments in Chinese enterprises is long-standing, originating in the practice of ranking state firms within industry sectors, and the awarding of industry prizes by the supervising ministries. This practice, although emphasizing positive performance, does not exclude comment on difficulties or indeed failures. From the initial review of about 100 enterprises, a selection was made. The first criterion used to select was the quality of the Web entry, since many gave only rudimentary details, with little or no reference to implementation issues. These sites were eliminated. Beyond this, enterprises were selected that varied in firm size, sector and origin of the ERP supplier and implementer. This yielded a sample of 20. Four of the samples were deemed difficult or failed ERP implementations, 12 were international suppliers and eight were domestic. The selected Web entries were followed up by telephone interviews to clarify and add further data where possible. The result was series of case ‘narratives’.

There are obvious limitations to this approach, since the narratives lack the objectivity of an independent case author. In some instances, the data provided are sourced from the ERP supplier or implementation partner. Overall, however, the limitations could be mitigated in the follow-up interviews and by cross-referencing. In compensation, the approach yields a large but focused sample appropriate to the research questions in an achievable way.

Stage II

This task was to add depth to analysis through an in-depth case study. It was undertaken by one of the authors with a Guangdong-based furniture company over a period of nine months ending in June 2006. Access was available to senior management, the ERP project manager, systems analysts and users. This provided a first-hand experience of ERP implementation to complement the Web-based narratives. The company was young, very fast growing and typical of the newly emerging Chinese enterprises.

Stage III

Here the data from the mini-case narratives were interpreted with the factor framework identified above. Our principle in deriving a suitable framework was to use the minimum number of CSFs conducive to the level of data we were dealing with and supported by the literature. The 13-factor analysis met this requirement. The case study was interpreted against the factor framework, but also against the implementation process perspective of Markus and Tanis (2000).

EMPIRICAL RESULTS

The empirical results deriving from the case narratives and the in-depth Shianco case study are discussed in turn below.
Case narratives

The results are summarized in three tables. Table 1 details the company profiles, including location, industrial sector and size measured by number of employees. Crucial information here is the ERP vendor and the implementation partner. Table 2 provides examples of the mini-case narratives generated from the Web sources and telephone follow-up. The data are ordered to provide easy comparison and record the implementation factors interpreted as closely as possible in terms of our 13-factor framework. Finally, Table 3 ranks the factors by frequency of occurrence.

Case study – Shianco Furniture

Shianco Company was established in Guangdong, southern China, in 1989 by a Taiwanese investor. It exports upmarket garden furniture, including chairs, sun umbrellas and sling loungers, to the USA, Canada, Australia and Europe. The company has expanded rapidly since then. Manufacturing facilities have grown from a single factory of 250,000 square feet to four factories in Shunde, Shanghai, Qingdao and Tianjin with a total of six million square feet today. It now has offices throughout mainland China, but also in the USA, Europe, Australia, Hong Kong and Taiwan. In the same period, the number of employees has increased from 200 to 15,000. Turnover exceeded USD100 million in 2005.

For the first four years, the company had no significant IT systems. Rapid growth brought major problems in controlling inventory, and data could not be shared across departments in the factory because of localized manual and stand-alone systems. In 2003, the CEO insisted that the situation was untenable and that a

<table>
<thead>
<tr>
<th>Name</th>
<th>Locations</th>
<th>Sector</th>
<th>No. of employees</th>
<th>ERP vendor</th>
<th>Implementation partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ADLINK Technology</td>
<td>Beijing, Shanghai, etc.</td>
<td>Electronic products</td>
<td>1,000</td>
<td>Digital China</td>
<td>Digital China</td>
</tr>
<tr>
<td>2 AsiaInfo Technology</td>
<td>Beijing, Hongkong, etc.</td>
<td>Communication technology products</td>
<td>1,000</td>
<td>Oracle (I)</td>
<td>Andersen Accenture</td>
</tr>
<tr>
<td>3 North China Aluminum</td>
<td>Hebei</td>
<td>Aluminum products</td>
<td>1,000</td>
<td>HJsoft</td>
<td>HJsoft</td>
</tr>
<tr>
<td>4 Beijing Jeep Corporation No 1</td>
<td>Beijing</td>
<td>Automobile industry</td>
<td>1,200</td>
<td>SSA Global (I) (D)</td>
<td>SSA Global</td>
</tr>
<tr>
<td>5 Beijing Sanlu Factory</td>
<td>Beijing</td>
<td>Cosmetic products</td>
<td>1,200</td>
<td>Intentia Lawson (I) (D)</td>
<td>Legend Advanced Systems</td>
</tr>
<tr>
<td>6 FuYao Glass Industry Group</td>
<td>Fujian</td>
<td>Automobile glass products</td>
<td>1,500</td>
<td>SSA Global (I)</td>
<td>Andersen Accenture</td>
</tr>
<tr>
<td>7 Nanjing Automation Research Institute</td>
<td>Jiangsu, Shanghai, etc.</td>
<td>Electric power systems and automation</td>
<td>2,200</td>
<td>Ufsoft UFIDA</td>
<td>Ufsoft</td>
</tr>
<tr>
<td>8 Ningbo FuDa Electric Appliances</td>
<td>Ningbo</td>
<td>Domestic electrical products</td>
<td>2,400</td>
<td>KingDee</td>
<td>Golden Tech</td>
</tr>
<tr>
<td>9 Hefei MeiLing</td>
<td>Hefei</td>
<td>Domestic electrical products</td>
<td>2,500</td>
<td>Oracle (I)</td>
<td>Shanghai Zhijie Technology</td>
</tr>
<tr>
<td>10 YuTong Coach</td>
<td>Henan, Gansu, etc.</td>
<td>Automobile Industry</td>
<td>2,700</td>
<td>SAP (I)</td>
<td>PWC</td>
</tr>
<tr>
<td>11 Heilongjiang Oil Factory</td>
<td>Heilongjiang</td>
<td>Oil and gas</td>
<td>2,900</td>
<td>Langchao Genersoft Kingsdee</td>
<td>Langchao Genersoft</td>
</tr>
<tr>
<td>12 KaiQuan Pump Group</td>
<td>Shanghai, Jiangsu, etc.</td>
<td>Pumping tools</td>
<td>3,500</td>
<td>KingDee</td>
<td>Covics Business Solution</td>
</tr>
<tr>
<td>13 Formosa Optical</td>
<td>Hunan, Shanghai, etc.</td>
<td>Optical products</td>
<td>4,000</td>
<td>SAP (I)</td>
<td>Symix (I) (D)</td>
</tr>
<tr>
<td>14 XuJi Group</td>
<td>Henan, Fujian</td>
<td>Electric power systems Banking</td>
<td>4,300</td>
<td>Symix (I) (D)</td>
<td>Symix</td>
</tr>
<tr>
<td>15 Shenzhen Development Bank</td>
<td>Guangdong, Shanghai, etc.</td>
<td></td>
<td>6,000</td>
<td>Advance Business Solution (I)</td>
<td>Advance Business Solution</td>
</tr>
<tr>
<td>16 Yili Group</td>
<td>Beijing, Inner Mongolia, etc.</td>
<td>Dairy products</td>
<td>20,000</td>
<td>Ufsoft UFIDA</td>
<td>Ufsoft</td>
</tr>
<tr>
<td>17 Harbin Pharmaceutical</td>
<td>Harbin</td>
<td>Pharmaceutical industry</td>
<td>20,100</td>
<td>Oracle (I) (D)</td>
<td>Beijing Riamb Software IT</td>
</tr>
<tr>
<td>18 Shine Way Group</td>
<td>Henan</td>
<td>Food processing</td>
<td>28,000</td>
<td>Shine Way Software In-house</td>
<td>In-house</td>
</tr>
<tr>
<td>19 Changhong Electric</td>
<td>Sichuan, Guangdong, etc.</td>
<td>Domestic Electrical Products</td>
<td>30,000</td>
<td>SAP (I)</td>
<td>Not known</td>
</tr>
<tr>
<td>20 SanLian Group</td>
<td>Dongbei</td>
<td>Electronics &amp; IT etc.</td>
<td>30,000</td>
<td>JDE (I)</td>
<td>Not known</td>
</tr>
</tbody>
</table>
A system was needed for business control and to improve efficiency. Together with the incumbent IT manager, senior managers looked for an integrated system solution and started interviewing both domestic and international ERP suppliers, and trials were carried out. Although SAP was the most expensive, it was selected because of its good reputation, strong technical support, commitment, functionality and compatibility with existing procedures. At the end of 2003, IBM was selected as the implementation partner.

The ERP project formally started in early 2004. After several months’ investigation of the business processes, managers started the implementation of the ERP modules in a planned order: production planning (PP), materials management (MM), sales and distribution (SD), financial accounting (FI), and costing (CO). With the help of IBM, the system was introduced to the whole company systematically, first in Shunde in Guangdong and then selected modules in the Hong Kong and Taiwan offices. The system went live in July 2005 just 15 months after project commencement. The implementation team is currently in Tianjin, northern China. The first goal of the project is to introduce the ERP system in all factories in Shunde, Tianjin, Shanghai and Qingdao by the end of 2007. This will provide a common platform for the whole company to communicate and organize the business. Already the next phase has been identified and will revise the system to provide more optimization possibilities and increased reporting flexibility for senior management.

The major investment that Shianco has made since the decision to adopt ERP has been in the IT function. From one person in 2004, the IT project implementation team has grown to 30 in 2006. The training of the professional staff in the ERP system by SAP, IBM and

<table>
<thead>
<tr>
<th>Name</th>
<th>Implementation</th>
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</table>
| ADLINK technology  | • Decided to implement ERP system in June 2002  
|                    | • Selected Digital China’s ERP applications in July 2002  
|                    | • Selected Digital China as implementation partner in July 2002  
|                    | • Implemented modules: inventory, material, production, financial, sales and procurement  
|                    | • The project was reported finished in May 2003; the system is in use in three branch offices in Beijing, Shenzhen and Shanghai  
|                    | • 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| • Started the implementation of Oracle’s ERP’s financial application in June 1998  
|                    | • Chose Andersen as implementation partner  
|                    | • The financial module introduced in August 1998 and customized  
|                    | • Developed its own sales management and budget management applications and integrated them with Oracle’s financial module  
|                    | • The issues concerned: top management support, compatibility of software, consultation, project scope and implementation partner |
| Formosa Optical    | • Decided to implement ERP system in 2001  
|                    | • Selected SAP as the system provider in 2001  
|                    | • Selected Covics Business Solution as the implementation partner in 2001  
|                    | • Implemented modules: materials management, sales and distribution, financial control, and retail over 2001-3  
|                    | • The issues that caused concern: top management support, project team, training, compatibility of software, consultation, project scope and implementation partner |

Table 3. CSF frequency

<table>
<thead>
<tr>
<th>CSF factors</th>
<th>Frequency of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Top management support</td>
<td>18</td>
</tr>
<tr>
<td>Implementation partner</td>
<td>18</td>
</tr>
<tr>
<td>Compatibility of software</td>
<td>17</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Vendor support</td>
<td>13</td>
</tr>
<tr>
<td>Training</td>
<td>10</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>10</td>
</tr>
<tr>
<td>Project scope</td>
<td>9</td>
</tr>
<tr>
<td>BPR</td>
<td>8</td>
</tr>
<tr>
<td>Consultation</td>
<td>8</td>
</tr>
<tr>
<td>Project team</td>
<td>8</td>
</tr>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Data accuracy</td>
<td>6</td>
</tr>
<tr>
<td>Change management</td>
<td>5</td>
</tr>
<tr>
<td>Technical support</td>
<td>4</td>
</tr>
</tbody>
</table>
in-house resources has been a huge commitment. The training of all operational staff was additional to this. The totality of training has been on a scale not anticipated. The current expectation, however, is that after the comprehensive implementation in the Shunde factory, the project team will lead the subsequent implementations in-house.

In terms of the CSF factors, there were four dominant issues – top management support, project team composition, training and change management. All other factors in the 13-factor framework were also evident but to a lesser extent. From an implementation process perspective, Shianco has passed through the first two elements of the Markus and Tanis (2000) model rapidly, namely, the ‘chartering’ and ‘project’ stages, and is now engaged in the ‘shake-out’ stage with some involvement in the ‘upward and onward’ stage. In 2007, Shianco will require suppliers to accept orders electronically, and this will formalize the extension of the ERP into the supply chain, confirming ERP’s increasing overlap with e-business.

Further observations on the case and the link into the mini-narratives are provided in the Discussion section.

DISCUSSION

Although we are cautious about the ranking of any results that by nature are subjective, some critical factors were mentioned or raised much more than others. This outcome we use as a device for introducing the discussion. The results from the mini-cases shown in Table 3 are grouped into three broad categories of perceived importance – high, medium and low. Each category is reviewed below. The degree to which the Shianco Furniture case study reinforces or challenges the mini-narratives is introduced later.

Case narratives – high CSFs

Three factors featured in 90% of the narratives. Top management support featured the most strongly and was considered by many to be vital. For example, in 1998, Yin Han, CFO of AsiaInfo Technology, was deeply involved in selecting the system, analyzing the business processes, planning the implementation and so forth. This was an early implementation of ERP financials, and Han’s commitment and leadership are directly associated with the success of the project. In contrast, in the failures of Beijing Jeep Corporation, Beijing Sanlu Factory, Harbin Pharmaceutical Group Holding Corporation and Xuji Group the lack of leadership for ERP was common. Managers were largely negative, and they had short-term vision and limited understanding of ERP and the changes it would bring into the organizations. This finding is entirely consistent with the early and later literature for both Western and Chinese implementations (Holland and Light 1999, Reimers 2003).

The two other high CSFs were the implementation partner and software compatibility. Implementation partners were mentioned 17 times – more than the original ERP supplier. This is in line with previous contributions (e.g., Kumar et al. 2003). Implementation partners can be either the supplier or a separate consultancy, and, increasingly, suppliers and implementation partners are strategic alliance partners. For example, ADLINK chose a local company, China Digital, to be both supplier and implementation partner. In contrast, Formosa Optical opted to have separate supply and implementation contracts and selected a local consultancy, Covics Business Solutions, to complement SAP as supplier. Both these arrangements were very successful. Using a local implementation partner has advantages, but problems still arise. Legend Advanced Systems was the implementation partner for Beijing Sanlu’s Intentia-supplied system that proved unsuccessful. Legend failed to follow Intentia’s implementation advice and lacked technical skills. They paid compensation to Beijing Sanlu of RMB2 million.

Software compatibility was also highly rated and fits with Bingi et al. (1999), Hong and Kim (2002), and Umble and Umble (2002). Compatibility was the most addressed technical issue in our sample, and the outcomes are not obvious. In the case of Heilongjiang Oil Factory, a senior manager said that because the Chinese financial system and standards were different from the international systems, the domestic financial ERP module was more compatible. This was important in their choice of Genersoft. On the other hand, Formosa Optical (SAP) and AsiaInfo Technology (Oracle) both agreed that international ERP systems were more flexible, stable and suitable for the further development of their organizations.

Case narratives – medium CSFs

In this category, there are seven factors. Four of them are internal – infrastructure, project scope, project team and BPR. Infrastructure consists of the technical platform, the legacy systems and the IT management structures and experience, as highlighted by Nah et al. (2001) and Huang and Palvia (2001). Clearly, infrastructure is different in every company, and that is why ERP implementations can never be routine. Few companies claimed that their infrastructures were adequate to support the implementation of ERP applications, and Beijing Jeep Corporation stated that its business processes and IT management were not mature enough when it tried to deploy SSA’s ERP applications in 1993. Project scope was an issue first introduced by Holland and Light (1999) as a key issue and was articulated in terms of incremental versus
comprehensive or parallel implementations. In this sample, the consistent view was that incremental implementation is more suitable for China. For example, AsiaInfo Technology implemented Oracle’s financial module first and then the sales application and human resources module. Formosa Optical introduced SAP’s system into its Xiamen branches first and then successively to other branches in China. The third factor in this internal category is the project team and is concerned with the membership and the management and operation of the team. There was strong support for departmental staff in the team to be allocated full-time to ERP implementation. North China Aluminum is an example where the ERP project team included IT staff, department managers and other non-technical staff, and all were full-time. Many authors have singled this out, including Wang et al. (2005) and Xue et al. (2005). BPR is the final internal factor in the medium category and tries to capture the readiness and competency of the company to change processes to take best advantage of ERP systems. BPR is a new business concept in China, and in our sample, there is no set pattern. For example, the Nanjing Automation Research Institute spent over three months analyzing business processes and re-engineering the processes of purchasing and inventory control before implementation. However, Ningbo FuDa Electric Appliances carried out the ERP project and BPR in parallel. Both were successful.

The external CSFs in the medium category comprise vendor support, consultation and training, and all three are linked. Poor vendor support is manifested in inadequate consultation and training, either directly with the firm, or indirectly in terms of support to the implementation partner. Within the 13 cases, most companies suggested that domestic vendors were more supportive than their international competitors. They implied that local providers had quicker response time, higher commitment to the projects and better understanding of the Chinese enterprises than Western vendors. 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. The quality of training was a recurring theme in the sample.

Case narratives – low CSFs

The three factors in this category are data accuracy, change management and technical support. Data accuracy refers to the readiness of the data in the existing systems prior to transfer to the ERP system. It includes both the content accuracy and the data formats. Six firms singled this out as important and required significant time to resolve. For example, ADLINK Technology often worked overtime to correct and unify bar codes and serial numbers of materials and products. In the failure case of Beijing Jeep Corporation, the CIO identified inaccurate data as a major obstacle to successful implementation. This outcome reinforces Umble and Umble (2002). Technical support was a factor indicated in four cases. The main issue was that the technical support from within the firm was not sufficient to assist the implementation of ERP systems in the Chinese firms. For example, the KaiQuan Pump Group mentioned that because the company was in the machine tool manufacturing industry, the IT knowledge of its employees was low, hindering the ERP implementation. ADLINK Technology highlighted a similar problem even though it is in the electronics industry. In this situation, there is greater dependency on external support and an increased training requirement for internal technical staff. Similar points have been made by Kumar et al. (2003) and He (2004). The final factor of change management in our sample was related to resistance to change and was specifically mentioned by Beijing Jeep, Shine Way Group and North China Aluminum. In all cases, the reason given was increased workload or unfamiliarity with the new systems. The ability to anticipate and manage this change was considered critical and is consistent with Nah et al. (2001) and Reimers (2003).

Shianco Furniture case study

Shianco provides an interesting counterpoint to the mini-narratives. The issue of top management support is prominent in both data sources. Given the commitment to change implied by ERP implementation, this is no surprise, but what emerges in the case is the difficulty for senior management to sustain that support. In Shianco’s situation, the demands of growing the business, opening new offices and factories, and finding new markets became higher priorities. The second critical issue in Shianco was the project team composition and its operation, and this reinforces the case narrative experiences. The Shianco case, however, provides a deeper insight into the importance of this factor. Implementation partners have limited resources, and in the open market sufficient numbers of ERP trained staff are simply not available. The responsibility, therefore, lay with Shianco to train and retain the necessary staff. The implementation partners, in this case IBM, took on the additional role of training the trainers. The project manager took the further step of assigning two members of the project team to each key position to avoid problems of staff turnover. This is very strong evidence to support the point made by Reimers (2002) that staff retention is a key issue in China.

Change management was the third critical factor in Shianco, and the findings here are somewhat counter-intuitive. Given that the existing systems in the company
were so basic, and the new ERP systems were not displacing well-crafted existing procedures, resistance might be expected to be low. This was not the case. Since everything was new, and there was so much to learn by users, including basic computing and keyboard skills, resistance was high. This took a year to overcome by further training and support at a level not anticipated. This finding totally supports the importance of competence in managing change.

The fourth critical factor in Shianco was the detailed user training, and this is closely linked to the project team responsibilities and to the change management factors. The ERP team devised training routines and examinations before users were given IDs for system access. The scale of this commitment was major and confirmed the importance of training, as evidenced in the literature and in the mini-narratives. Reflecting on the case overall is a reminder of the importance of context. All 13 critical success factors are valid, but it is context that determines their importance. Shianco is characterized by rapid growth and this informs everything, including ERP implementation. In their particular situation, staff availability is the biggest risk and explains the extraordinary commitment to training and team building.

CONCLUSIONS AND SOME IMPLICATIONS

Before drawing the conclusions and implications, there are obvious limitations. We set out to cover enterprises of different sizes, in different industrial sectors and with ERP products sourced internationally and locally. This is a major research design problem, and issues of desirability and feasibility clash. Our approach was to develop a set of stories, or mini-case narratives. Their limitation is the reliance on secondary sources, which can be partial. We tried wherever possible to mitigate this with follow-up contacts, but this is not a substitute for face-to-face interviews and the opportunity to develop context. The contrast with the quality of data developed in the Shianco case is a reminder of this fact. Another limitation is the interpretive framework. The critical success factors are not discrete but overlap, and, as researchers, we were faced with ambiguities in locating data within our taxonomy. For this reason we have not tried to make too much of the rank ordering of factors. Despite the limitations, which inform the generalizability of the results, some clear conclusions and contributions emerge.

Firstly, the results confirm that the general literature on CSFs has identified most if not all of the factors that impinge on successful implementation. They are generic and provide useful pointers to what is important, but they are not prescriptive, and context is all-important. This is not merely foreign versus domestic but applies at the firm level. The Shianco case study demonstrates this in the resources and importance given to employee training and retention, which in turn is directly linked to their remarkable growth. Secondly, we could find no evidence to suggest that international vendors such as SAP were more successful than domestic providers, even though they initially had the stronger representation in the China market. In the mini-case narratives, all four failed implementations were international systems, but the reasons for failure were organizational. Similarly, in our sample, the role of the implementation partner was key, but both international and domestic implementers had their successes and failures. The perception, however, is changing. The evidence emerging from the mini-case narratives suggest that Chinese firms believe that local consultants are best. Thirdly, the results provide some interesting implications for the development of China’s ERP market and implementation practices. The domestic ERP suppliers have had a commercial presence for less than 10 years but now have the majority of the market. China Digital is an example of this growing domestic expertise. As the market in China continues to grow, both international and domestic suppliers will benefit, but, increasingly, it is likely to be the Chinese firms that benefit most. This will also be the case for the implementation partners. In product terms, the trend is for ERP and e-business to overlap as SCM and CRM applications are conceptually and in practice linked to the core ERP applications.

Finally, the research suggests that direct comparisons between Western and Chinese ERP implementation experiences need to be treated cautiously. The Chinese economic and institutional context is so different. Chinese firms like Shianco Furniture, and there are many such firms, will typically revise major production plans every two years compared to five to six years for Western firms. This rate of change suggests that approaches to ERP implementation will need to be found locally.

References


