

# *The process of enterprise resource planning implementation and business process re-engineering: tales from two Chinese small and medium-sized enterprises*

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**Abstract.** *Using an innovative process model, we describe and analyse the process of introducing enterprise resource planning (ERP) systems in two Chinese small and medium-sized enterprises and especially their decisions concerning business process re-engineering. First we compared the results from our cases with Martinsons' earlier work (2004). One case seemed to fit most of the characteristics of a private venture (PV) whereas the other case, also a PV, had a very low degree of fit. We used the process model to offer further insights and features such as its predictive power. Second, and as predicted, we also observed the differential role of top management support in the two Chinese companies. But thirdly, and somewhat surprisingly, we found that cultural issues were only of limited importance. Finally, the ability of the project team to deal with unexpected events was seen as critical in ensuring the stability of a project. In contrast, project drift is shown to lead to a degree of chaos. We offer some suggestions as to how stakeholders can improve their chances of implementing ERP systems more successfully.*

**Keywords:** ERP implementation, BPR, information systems, ISD, success, failure

## 1. INTRODUCTION

By implementing enterprise resource planning (ERP) systems, organizations are supposedly able to connect different divisions and functions together, thus many problems associated with using diverse legacy systems can be ameliorated, if not solved. ERP systems are believed to have had the most profound effect on an organization compared with any other information technology (IT) innovations (Rajagopal, 2002; Shang & Seddon, 2002). ERPs are considered

'the price of entry for running a business' (Kumar & Van Hillegersberg, 2000) and we have witnessed a rapid worldwide growth in the number of such systems. A study by IDC (<http://www.idc.com>) anticipated that worldwide spending on ERP software and related functions would grow at a compound annual rate of 13.5% between 2001 and 2006, hitting \$187 billion in 2006. However, much of the research into ERP development has had a distinctly Western flavour and has emphasized large organizations (Davison, 2002). In this paper we wish to focus on ERP development in two Chinese small and medium-sized enterprises (SMEs). SMEs are defined in Wikipedia as enterprises whose sizes range from 25–500 employees although Chinese SMEs tend to be larger than those in the West.

In China, market reform along with the entry to the World Trade Organisation has stimulated heavy investments in IT by local companies striving to become more globally competitive. In contrast, Martinsons (2002) gives an account of the struggles of Chinese companies to adopt electronic commerce systems. Constituting the bulk of software investment, the ERP market in SMEs is expected to reach RMB 24.3 billion by 2010 up from RMB 7.28 billion in 2005, an annual growth of 27.3% (CCW Research, 2007). Attracted by such tremendous growth potential, not only have many domestic ERP vendors emerged, but also global giant vendors such as SAP (<http://www.sap.com>) and Oracle have entered the Chinese market. China is now the third-largest IT market after the US and China's IT market is growing at double-digit annual rates (Martinsons, 2004). However, market expansion does not mean that ERP implementations are easily accomplished. On the contrary, a large number of organizations failed to implement their ERP or did not fully achieve expected goals following major investment in this area. Furthermore, this failure rate among SMEs is particularly high (Davison, 2002; He, 2004; China High-tech Industry Herald, 2005).

In order to realize the advantages of the 'best practices' of ERP, it is often advocated that organizations should re-engineer their business processes to match processes embedded in ERP systems (Markus & Tanis, 2000) but this can bring other problems to the fore, as no two organizations are identical (Wagner & Newell, 2004; Olsen & Sætre, 2007). One of the major hurdles to successful ERP implementation is that many Chinese SMEs regard implementing ERP as a means to achieve modernization rather than to replace legacy systems and realize organizational change. Therefore, conflicts between ERP processes and extant business processes may arise and, as we will show, this applies particularly to efforts to re-engineer.

The purpose of this paper is to study the outcomes of ERP projects in two Chinese SMEs and show how the **outcomes** are related to the **process** of implementation while at the same time paying special attention to business process re-engineering (BPR) decisions. Two comparative cases are analysed in some detail to demonstrate the relationship between ERP implementation and BPR, applying a parallel process model as a framework for case analysis (Newman & Zhu, 2007). With our aim of studying ERP implementation processes in Chinese SMEs and their relationship with BPR, this paper is specifically guided by two research questions:

- 1 What are the major issues associated with accommodating BPR when implementing ERP systems in Chinese SMEs?

**2** How can the success or failure of ERP projects be better explained using a socio-technical parallel process model compared with a more conventional factor study approach?

The remainder of this paper is structured as follows. Firstly, the main literatures related to ERP and BPR issues, and information systems (IS) implementation are reviewed. We then summarize the conceptual process model we employ. This is followed by a section detailing the qualitative research method chosen and a description of the research sites. Thereafter we present results from the two case studies, which are analysed and discussed. Finally, the paper ends with implications for various stakeholders and pointers for future research.

## **2. LITERATURE REVIEW**

### **2.1 ERP success and failure**

By streamlining data flows throughout the organization, ERPs promise dramatic gains to a company's efficiency and profitability (Davenport, 1998; Fahy, 2001). However, implementing ERPs is also associated with high risks. According to Escalle *et al.* (1999), ERP spending can run as high as 2–3% of company revenues. Many companies have been threatened with bankruptcy after their ERP projects failed. Researchers have reported negative outcomes of several major ERP projects in organizations such as FoxMeyer, Mobil Europe, Dell, Dow Chemical (Davenport, 1998), Siemens, Panasonic and Bruno Magli (Robey *et al.*, 2002). Therefore, an ERP system's ability to transform and streamline organizations cannot be taken for granted, but should be subject to investigation. Consequently, the success and failure of ERPs have been broadly studied by both academics and industry professionals. Owing to space considerations, we will not be addressing the complex question as to what constitutes success and failure in ERP implementation in this paper. Where the matter is not obvious, we will adopt a stakeholder view that may involve multiple and conflicting opinions on the subject.

Researchers have revealed a number of common issues that influence outcomes of ERP implementation projects. Rather unsurprisingly, Kwon & Zmud (1987) have concluded that the success or failure of an organization's introduction of an IS depends on the understanding of internal and external organizational environments, the IS itself and the implementation process. Features that affect ERP implementation vary across cases. However, some critical factors recur in the literature. Top management support is considered an indispensable success factor in ERP implementation (Bingi *et al.*, 1999; Chen, 2001; Martinsons, 2004). In his study of eight ERP projects in China, Martinsons (2004) reports that top management initiated ERP projects in five of his eight cases. Four of these were judged to be successful implementations, whereas all three cases promoted by IT managers were deemed failures. This was also supported by further evidence from a wider survey of Chinese businesses (Martinsons, 2004). While Reimers (2002) in his earlier study of ERP systems also found support for this argument, he noted that it was the type of management that was key. He claims and offers evidence to show that more modern types of management (e.g. consensus-building, empowerment) are crucial to supporting the introduction of ERP systems. This suggests that

if you delegate ERP responsibilities to middle managers and the IT group in particular, this may be seen by stakeholders as a signal that the ERP project is not highly critical to the organization.

## 2.2 BPR

In order to take advantage of the 'best practices' embedded in ERP systems, vendors commonly suggest that companies restructure (or re-engineer) their business processes. As indicated by Hammer (1999), 'a successful ERP implementation must be managed as a program of wide-ranging organisational change rather than as a software installation effort'. Companies such as IBM and Owens Corning implemented ERP systems and conducted BPR simultaneously (Hammer & Champy, 2001). According to Hammer (1990), re-engineering 'strives to break away from the old rules about how we organise and conduct business'.

### 2.2.3 BPR challenges in China

BPR, with its promise of changing radically an organization's business processes and dramatically improving performances (Hammer & Champy, 2001), has attracted the attention of many Chinese companies. However, academics have claimed that adopting new business methods and specific technologies depends on various cultural, social, economic and political factors as well as interactions between them (Ein-dor *et al.*, 1993). Among these factors, cultural issues have been considered the most important ones in Chinese companies (Martinsons, 2004).

The tenets of Confucianism suggest that a BPR effort will challenge Chinese ideology and the workforce will resist radical change including changes to the management hierarchy (Schein, 1992; Martinsons & Hempel, 1998; Martinsons, 2004). Confucius considered it important to maintain a state of harmonious equilibrium in society. This implies that incremental change is preferable in such societies. In contrast, BPR is based on radical change and rapid transformation of business processes. Therefore, most Chinese companies, following this tradition, would be more inclined **not** to re-engineer their business processes. In addition, as Confucianism stresses the importance of duty and obedience, the transformation from a hierarchical structure with management control to a flatter one with more participation is likely to meet with resistance from both managers and employees. The original study by Hofstede (1980) supports this argument: the power distance measure in Chinese societies, an expression of hierarchy in businesses, was significantly greater than in Western countries (c.f. Redding, 1990; Martinsons & Davison, 2007).

Most Chinese managers advocate stability and want to maintain power and control. Indeed, many employees are satisfied with getting explicit work instructions and are not willing to initiate actions that are often associated with risks (Martinsons & Hempel, 1998). Davison (2002) explores this issue, claiming that '... many clerical staff at the bottom of the hierarchy in a Chinese organisation feel much safer if they are told what to do; they know what is expected'. Furthermore, as the dominant organizations in China are still State enterprises, the

government may take actions to hold back re-engineering efforts if they affect employment negatively (c.f. Hammer & Champy, 2001; Martinsons, 2004). However, in our empirical cases, this State influence can only be an indirect one: both are privately owned and managed SMEs. This may challenge some of the previous findings concerning culture and ERP systems implementation in China. However, many of the results reported above come from factor studies, which, as we shall show, have significant epistemological limitations.

From a Chinese business perspective, Western ERP systems ignore some of the most cherished traditions and practices in China such as access to information and even basic numbering systems (Davison, 2002). Also the situation in China is that many organizations do not see the need to re-design their business processes. ERPs are the embodiment of Western values, bringing them into conflict with Chinese traditions (Davison, 2002). This suggests that Chinese companies implementing ERP systems are less likely to carry out BPR than their Western counterparts (O'Leary, 2000). But of course this is relative: many of these issues also apply to Western companies buying 'foreign' ERP systems. For example, a European company purchasing an American product may also find the address conventions have to be modified (e.g. zip codes to postal codes) and have to adapt systems of measurement from imperial to metric.

### 2.3 Studying Information Systems Development

The several models for studying Information Systems Development (ISD) can be categorized into two major streams of research: factor studies and process modelling.

#### 2.3.1 Factor studies

A large number of IS implementation studies have tried to identify factors that are related to IS implementation success and failure in general (e.g. Burke *et al.*, 2001; Poon & Wagner, 2001; Somers & Nelson, 2001; Umble *et al.*, 2003; Kanter & Walsh, 2004), and in particular ERP systems in China (Reimers, 2001; 2002; Martinsons, 2004). They use independent, control variables which are statistically associated with dependent variables, i.e. the project outcomes (Lyytinen, 1987). The value of these studies is that they use cause-effect patterns to investigate IS implementation difficulties, that have provided some valuable insight into the nature of IS problems (De Abreu & Conrath, 1993).

Nonetheless, some researchers (e.g. Markus & Robey, 1988; Newman & Robey, 1992) have noted that despite the prevalence of such studies, factor models have little practical utility in coping with IS problems due to their lack of understanding of implementation process features, i.e. they only emphasize **what** factors are associated with outcomes, not **how** they shape those outcomes (Barki & Hartwick, 1994; Robey, 1994). Processes are largely ignored and are closed boxed. For example, Holland & Light's (1999) model grouped critical success factors into strategic and tactical factors; the model suggested by Mandal & Gunasekaran (2003) focused on change management. However, all these models have some limitations when applied to ERP implementations (Makipaa, 2003). Moreover, cultural factors are often

treated uncritically in the literature just like another set of variables and these, like other factors, do not reveal how processes unfold over time.

### 2.3.2 Process modelling

Process modelling sees IS implementation as a sequence of events and seeks to explain how and why outcomes unfold over time (Boudreau & Robey, 1999). One of the premises of process research is that outcomes can only be interpreted in the light of the process (Newman & Zhu, 2007). According to Kwon & Zmud (1987), ISD can be represented as a socio-technical change process. Therefore, a process approach which focuses on the dynamics of social change can help researchers to analyse IS implementation processes practically. Process models typically examine critical events in sequence, linking antecedent conditions with outcomes. But, as pointed out by Newman & Robey (1992), process and factor models can complement each other, providing a more comprehensive explanation of IS implementation issues (De Abreu & Conrath, 1993).

## 3. RESEARCH MODEL

The conceptual foundation of this research model combines two streams of organizational change literature: a socio-technical model and punctuated equilibrium theory (Gersick, 1991) combined with social process theory. Leavitt's (1965) socio-technical change model (see Figure 1 below) is used to identify the relationships between structure, people, technology and task and their effects on IS implementation. The social process model is applied to describe the project outcomes through the study of the entire implementation process, where system change is seen as a construction of a sequence of critical events representing equilibrium periods (or incremental change between critical events) and disequilibrium periods (or 'revo-

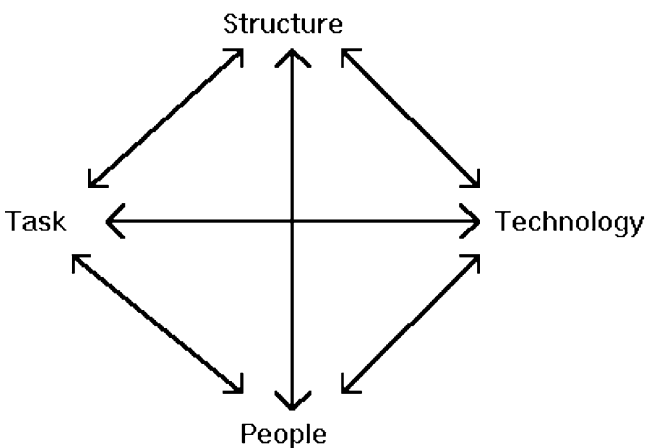


Figure 1. Leavitt's diamond (Leavitt, 1965).

lutionary change associated with instability) played out in organizational and external contexts (Tushman & Anderson, 1986; Pettigrew, 1990; 1992; Gersick, 1991; Newman & Zhu, 2007).

The appeal of the Leavitt model is its simplicity: changing technology (e.g. introducing ERP systems) cannot be done in isolation. The criticisms of it centre on the static nature of the model and the frequent need to discuss other components such as power, politics and culture. However, the processual dimension and change element can be augmented when combined with the other models.

### 3.1 Punctuated socio-technical model

During an ERP implementation process, when one component of the socio-technical system is affected by a significant event, a **gap** will emerge between this component and another one, thus breaking the process equilibrium. Gaps were interpreted by the researchers based on empirical evidence. This can be illustrated in Newman & Zhu's (2007) event model for socio-technical analysis (Figure 2). After the gap appears and is recognized, some actions may take place to remove the gap resulting either in restoring a balance (a successful intervention), a sustained existence of the gap (a failure) or a new set of gaps (a deepening crisis).

### 3.2 Parallel socio-technical process model

The model is predicated on the belief that a careful explication of the **process** of IS implementation projects will reveal **outcomes**. Integrated with Leavitt's socio-technical model and the punctuated equilibrium theory, Newman & Zhu (2007) described an innovative parallel process model (Figure 3). This is the model we apply as a framework to comprehensively analyse two ERP implementation cases in Chinese SMEs and to develop pictorial trajectories. Because we are interested in explaining how ERP projects can result in different outcomes, we chose two companies who experienced contrasting results.

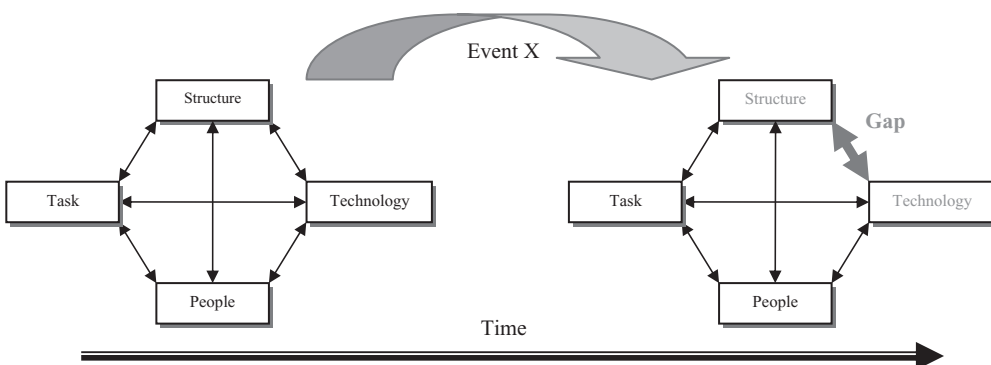


Figure 2. An event model for socio-technical analysis (following Newman & Zhu, 2007).

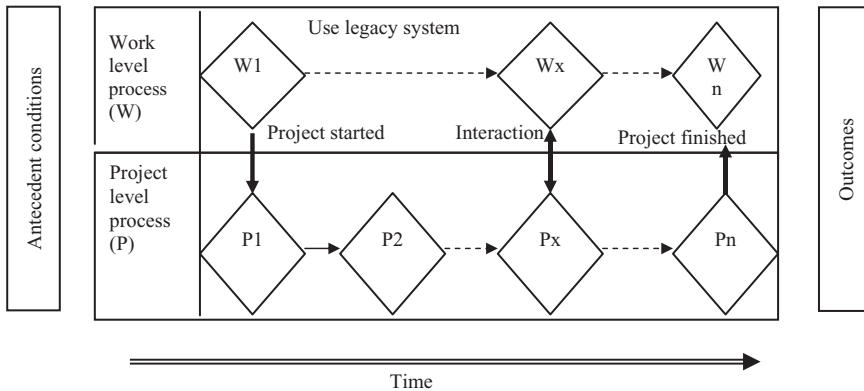


Figure 3. Parallel process model with socio-technical entities (adapted from Newman & Zhu, 2007).

#### 4. METHOD

In our research, two comparative cases in Chinese SMEs are examined empirically, guided by the principles of interpretive research suggested by Klein & Myers (1999). The examination in this research is framed in the form of 'events', 'gaps' and 'balances'. The cases trace the crucial interactions between the socio-technical elements and focus on the role of BPR.

##### 4.1 Research sites

Our two cases were selected from the clothing industry. The figures from the National Bureau of Statistics of China (2007) show that the annual retail sales in the clothing industry in 2007 (including garments, shoes, caps and other fashions) have increased by 23.5% compared with the same period in 2006. In order to fulfil the requirements of both internal organizational management and external coordination with business partners, more companies are investing heavily in IS. ERP, as large management software packages, have become popular in this industry. As most companies in the Chinese clothing industry are SMEs, it is important to pay attention to ERP implementations in SMEs within this industry.

The research sites of this study are two privately owned and managed Chinese medium-sized retail companies in shoes and fashions, respectively. At the time of writing, one company had successfully implemented its ERP and was actively using it while the other one had experienced delays, resistance and finally abandoned the project. There are differences between the two companies. Olmec has manufacturing facilities, and so an ERP makes more sense as a way to vertically integrate the value chain. Farina, on the other hand, has design/marketing/retailing functions but without manufacturing. The backgrounds of the two companies are described in the following sections.

#### 4.1.1 Olmec case background (antecedent conditions)

The first research site selected is the Olmec Shoe Company (pseudonyms are used to mask the identity of both companies – a condition of access). The brand of Olmec shoes has been fashionable all over China since the early 1990s. Founded in 1989, Olmec now has 12 branches, seven modern outsourced shoemaking factories, and a large number of unified stores nationwide.

In order to improve its competitive position in the marketplace, Olmec realized that its old IT infrastructure could not efficiently handle new processes and increasing volumes of data from different locations that came with its aggressive expansion. Olmec's product variety is acknowledged in the industry. At the time of considering an ERP, Olmec sold almost 2000 types of shoes, each type offered in more than 10 sizes. With the legacy system, it was increasingly difficult to handle large quantities of product information such as the production area, sales status, etc. Already well known for its excellent customer service, Olmec invested a great deal to support its multi-channel business. The top management of Olmec therefore decided that it was time to make some organizational changes. After extensive consultation, Olmec finally chose to implement an ERP system called real time enterprise (RTEN). This project was carried out with the clear support and leadership of top management.

#### 4.1.2 Farina case background (antecedent conditions)

The other company in this study is the Farina Group, which is a luxury goods retailer with more than 70 fashion houses nationwide. Farina designs, markets and distributes luxury clothing, accessories, fragrances, make-up and home furnishings under the various brands of the Farina Group. At the time the authors finished collecting data, the ERP project was still ongoing at Farina but was experiencing some significant difficulties and delays. We subsequently discovered that the ERP development was abandoned.

Farina has a comparatively flat organizational structure. Up to the time of purchasing their ERP system, the existing business processes had been working reasonably well in Farina. The decision to implement the enterprise application suite (EAS) was made by top management because they saw many companies in the same trade had already implemented ERP systems, and also because ERP vendors were competing to sell their products to the company. The top management of Farina made this decision with the purpose of modernizing the company. However, they specifically did **not** want to change existing business processes. Moreover, the project of implementing EAS was delegated to the IS department. Both of these decisions proved to be critical in the unfolding implementation story.

## 4.2 Data collection

Eleven semi-structured interviews were conducted in each company with stakeholders related to the two ERP implementation projects. With the purpose of pursuing rich, in-depth information, interviewees were selected from different levels within the two companies. Before the

**Table 1.** Interview schedules in Olmec and Farina

Title	Transcript (Y/N)
Olmec	
IT service manager	Y
General manager	Y
Internal consultant	Y
Technician	Y
IT service manager	Y
Vice general manager	Y
Vendor	Y
Staff from Department of Finance	Y
Store staff	N
Retail manager	N
Vendor	N
Farina	
IT manager	N
Vice IT manager	Y
Vice IT manager	N
Vendor	Y
Vice IT manager	Y
Technician	Y
Store staff	Y
Staff from Department of Accounting	N
General manager	Y
Vendor	Y
Vice IT manager	Y

IT, information technology.

interviews, secondary data from media accounts, Internet resources, company websites and annual reports were collected and carefully examined. These data were extremely helpful in planning interview questions. Interviews were all conducted one-to-one with open-ended questions. Respondents were encouraged to express their opinions freely, which revealed much insightful information in this research. As recommended by Myers & Newman (2007), we used a mirroring technique in questions and answers in order to elicit respondents' stories in their own words. We asked them to talk about both current events and to reflect on previous events, i.e. retrospectively. In order to focus on issues related to the research topic, respondents were not only invited to tell what they felt to be critical events occurring in the ERP implementation process, but they were also encouraged to focus on the BPR effort and its relation to the ERP project. Notes were made during all interviews and most of the interviews were tape-recorded (see below). These recordings were then transcribed forming the main data resource for subsequent detailed case analyses. Details of interviewees' titles and whether a transcript was made are shown in Table 1. The 22 interviews were conducted between March and July 2005. The interviews were conducted in Chinese and varied in duration between 25 and 80 minutes, averaging about 50 minutes each. One of the research-

ers then translated sections of the transcripts into English and discussed the findings with the other author before using them in the description. In order to enhance the validity of interviews, we asked for feedback on the completed narrative from one key informant in each company.

Since the authors had the opportunity to see the two companies' systems in use, we obtained first-hand experience by observing how people worked with the systems. Besides this, we had access to companies' internal documentation such as project plans, the ERP model and structure, business process, test documents, manual, help texts and some inter-office memos were accessed and examined. Information obtained from those documents was very helpful as supplementary data for case analysis.

### 4.3 Data analysis

The transcripts or sets of notes taken from documentary analysis and observation were subjected to an iterative multi-step process of data analysis. The research process started with the frameworks that have been explained in the previous section, which describes socio-technical change, social process and critical events associated with the two IS projects. Essentially, the process is a 'tacking' back and forth between the textual realm (the details) and the social realm of contexts and history (the whole). In hermeneutics it would be referred to as the hermeneutical circle (Klein & Myers, 1999). Hence, the generation of concepts and frameworks forms an ongoing part of the data analysis as well as its conclusion. Our analysis involved a detailed process mapping supported by a textual description. As a final step, the authors compared the results from the two cases looking for similarities and differences. These are highlighted in the discussion below.

## 5. RESULTS

### 5.1 General interpretation

Figures 4 and 5 illustrate the two companies' ERP project trajectories, which are drawn according to the framework of the parallel process model using the socio-technical entity concept. By iteratively combing through interview transcripts and combining them with information obtained from document analysis and observations, a set of critical events at both project level processes and organization work level processes was identified by the authors. These events were described in Leavitt's diamond and arranged chronologically in the two diagrams (Langley, 1999; Pentland, 1999). Finally, gaps that emerged between components of Leavitt's socio-technical system – *structure*, *task*, *people* and *technology* – were interpreted and distinguished.

In Figures 4 and 5, the third row of *project level encounters* offers a short description of critical events affecting the equilibrium of a project's implementation. The two projects are both viewed as punctuated equilibrium processes. The process in each company is mapped as a

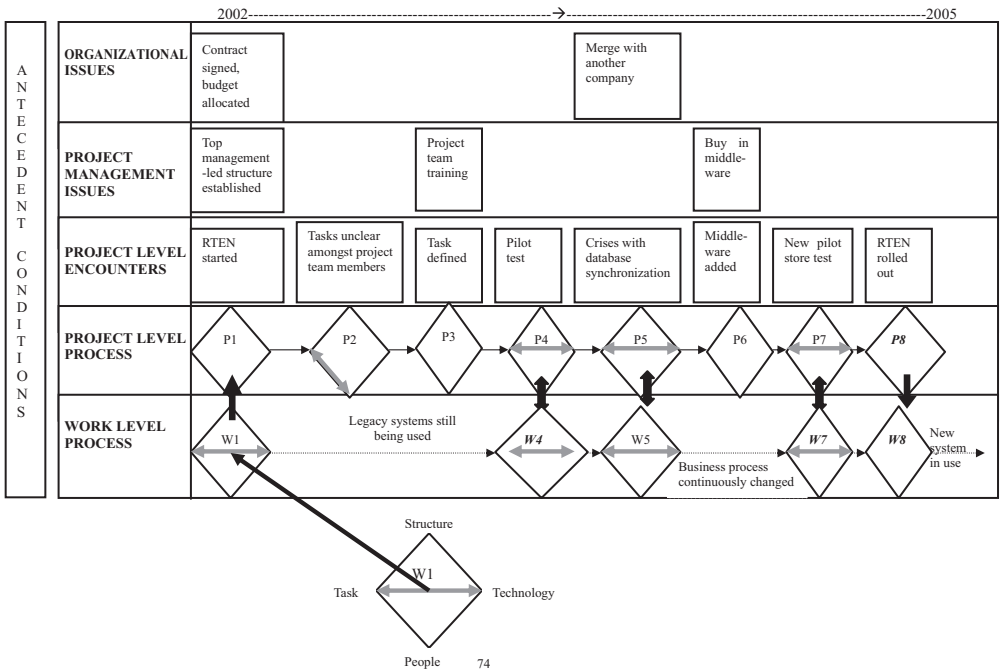


Figure 4. Olmec's real time enterprise (RTEN) project trajectory 2002–2005.

sequence of socio-technical entities (represented as diamonds in the diagrams) with gaps (indicated by thick grey arrows) between components. In the following two sections, a process analysis of ERP implementations in both Olmec and Farina are summarized based on Figures 4 and 5. Issues related to BPR are also highlighted.

5.2 The project implementation in Olmec – a brief description

5.2.1 Process analysis

In 2002, it was realized by senior management that the old IT infrastructure of Olmec (the legacy systems) was too inefficient. Therefore, in order to sustain the company's competitive position, top management started the process of organizational change by implementing a new IT system. The planning period lasted for almost a year before the vendor was selected and an off-the-shelf package was bought in.

The start of the project was motivated by a gap between functions of the legacy system and requirements for an expanding business (W1 in Figure 4). The initiative of this project was to fill the gap by adopting a new system and optimising the company's business processes (P1). After extensive consultation, a vendor was selected and the ERP package was bought. The project team was established to implement the RTEN system.

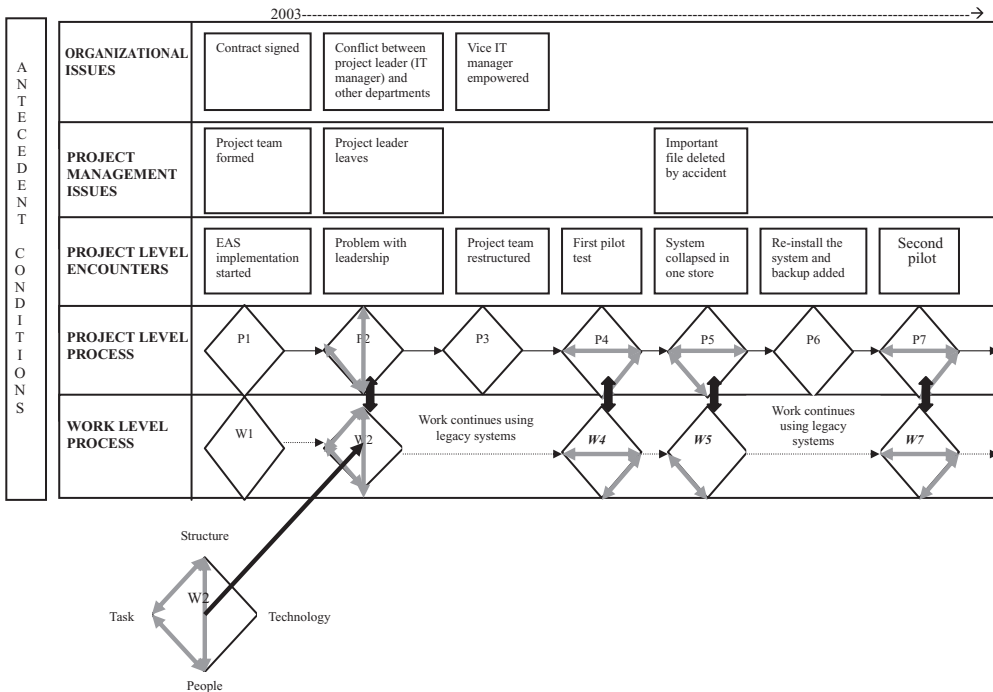


Figure 5. Farina's enterprise application suite (EAS) implementation trajectory 2003–.

At Olmec, top management actively supported this project. However, at the beginning stage, although the project team was formed, the responsibility of each team member was not clearly defined. Therefore there was a gap between people and task since each team member did not fully realize their mission (P2 in Figure 4). To deal with this situation, extensive communication and consultation with the vendor was made. After that, tasks were clearly defined amongst project team members (P3). Hence the project manager was in charge of the project that was implemented by the vendor. The vice general manager's task was to align BPR with both business objectives and IT objectives. Along with the ERP system being implemented, business processes in Olmec had been under review continually. Although RTEN is a standardized system, in practice, company tests are still necessary because new problems may arise when the system is applied to different platforms and operating systems. In the summer of 2004, the system was first ready for testing at the head office and one branch of Olmec. Before testing, end users were trained to operate the new system. During testing, they detected some technical problems. For example, a 'bug' occurred in the interface that could cause operators to skip the value of the key in the database thus interrupting the programme. Therefore, a gap emerged between technology and task (P4 and W4). This gap was solved after errors were systematically removed by the project team.

Totally unrelated to the implementation, and in order to enlarge its business, Olmec made a strategic decision to merge with another national shoe company. In Figure 4, this is shown in the line 'organizational issues'. The database of the other company was even larger than Olmec's. This merger increased the requirements for data transmission, requiring real-time data sharing but this resulted in a gap between technology and task in both process level and organizational work level (P5 and W5). They decided to buy a mature middleware package: Structured Query Language (SQL) Server Replication was added to solve the data transmission problem and database synchronization was finally realized (P6).

Olmec's workflow was improved to match the 'best practice' of the new system. By the end of 2004, the project team had carried out pilot tests at stores. They also trained the users to operate it. From this test, some technical problems were detected and also some practical problems associated with the invoicing system and account management system were uncovered. Hence, a gap appeared between technology and task (P7 and W7). In the following months, all project team members worked together to remove these bugs and solve other problems. The new system was successfully rolled out to all branches and stores in the first quarter of 2005. The business processes of Olmec improved dramatically and sales and revenues were beginning to increase. RTEN later entered the maintenance phase (P8). It was interesting to note that although Olmec's project was deemed successful by top management, the implementation was not without difficulties.

### 5.3 The project implementation in Farina – a brief description

#### 5.3.1 Process analysis

The project trajectory and organizational work process trajectory in Farina are shown in Figure 5. By the time the project started, the existing processes in Farina were working reasonably well (see W1 in Figure 5). The decision to implement EAS was made by top management for two reasons. First, Farina saw that many companies in the same trade had already implemented ERPs. Second, vendors were competing to sell their software products to the company. Therefore, Farina decided to buy in a software package in expectation of modernizing the company. The top management delegated the implementation of ERP to the IS department. The project began with an IS department-led structure (P1).

The project team was formed with the IT manager in charge of the implementation process. However, under time pressure from the project and due to insufficient communication, there were conflicts between the project management and various departments. Top management did not act swiftly to resolve this conflict and work drifted. Subsequently, the IT manager left the company under pressure leaving a leadership vacuum and delaying the implementation. Gaps therefore emerged amongst people, task and structure (P2 and W2). The problem of poor project leadership was then discussed in a meeting held by top management. Because it was not easy to recruit a new person to lead both the IS department and the EAS project in a short space of time, the decision was made to empower the vice IT manager to take over the role

of project leader. The gap caused by the IT manager's leaving was filled for that moment and balance was restored (P3).

In the next period the project team members did little to align the processes of EAS with those existing in Farina. They seemed to assume that the business processes of Farina would not conflict with those embedded in EAS. On the one hand, no attempt was made to redesign existing processes or design new ones within the company. On the other hand, the system was implemented by the vendor without any customization. When the system was first ready for testing in mid-2004 at the head office and two clothing stores, operators felt that many of their requirements could not be met by using the new system. They claimed that it was more convenient to handle business using the legacy system. Therefore, the pilot test revealed gaps between people and technology, task and technology at both project level and organizational work level (P4 and W4). The vendor and project team were trying to make some changes to EAS processes in order to match the end users' requirement.

Just after the pilot test was conducted, the new system suddenly failed in one pilot store because of a software problem. Since no backup was made in the system, EAS crashed and could not be rebooted. Gaps subsequently emerged between people, technology and task (P5 and W5). The only solution to the situation was to reinstall the whole system in that store. A method of backups to the EAS system was then introduced to prevent the problem from recurring. Training was provided to end users instructing them how both to operate and to maintain the system. As a result, process balance was restored (P6).

EAS was in a testing phase at the beginning of 2005. Because the customized system was not stable and could not be upgraded, many new technical problems were detected. Moreover, because end-users from different levels, different positions and working in different types of stores had different requirements, the system still needed modification in many places. Farina chose not to transform its business processes during the EAS implementation process. Consequently, the software package had to be modified again and again. Gaps revealed from the first pilot test in both project level and organizational work level were not eliminated but became more visible (P7 and W7). Since the investment was nearly 5% of total revenue, if the EAS project failed, the company would face a disadvantaged future, financially and competitively. Staff continued to use the legacy systems and we learned later that the EAS system was abandoned by Farina.

## 6. DISCUSSION

We begin by revisiting in turn the two research questions raised at the beginning of the paper:

### 1 What are the issues associated with accommodating BPR when implementing ERP systems in Chinese SMEs?

One way of displaying the results of our process studies is to compare our findings with those of previous ERP implementation research in China. Martinsons' (2004) paper summarizes the findings of 189 SAP customers drawn from Reimers' (2001; 2002) survey work.

**Table 2.** A comparison of Olmec's and Farina's results with Martinsons (2004)

Martinsons (2004) Results	PVs	
	Olmec	Farina
Common characteristics		
Projects are rarely completed on time. Budgets are massaged informally	Not supported. Completed on time within budget	Some support. Never completed
Lack of improvements after ERP implementation raises questions about value	Not supported. Management was pleased with results	N/A
Projects led by general management are judged to be much more successful than those let by IT managers	Supported	Supported
Eight ERP differences (PV vs. SOEs)		
Primary project aims. Competitive improvements (PVs) vs. Cost cutting and automation (SOEs)	General support. Olmec wanted to expand and become more competitive. The merger reinforced this.	Not supported. No clear aims. Farina was interested in automating existing processes
Role of top management. PVs – hands on approach. SOEs – delegate	Supported	Not supported
Role of steering committee. More frequent meetings and sharper focus on problem solving in PVs	Supported	Not supported. Problems escalated and were never resolved
Role of consultants. PVs use outside help from ERP experts	Supported	Supported
Scope of implementation. Cross functional emphasis in PVs	Not studied	Not studied
Pace of implementation quicker in PVs	Some support for this and probably related to TM support	Not supported. Farina got mired in ERP system-business process incompatibilities.
Implementation problems. Less frequent and less serious problems in PVs	Some support. They still experienced major issues from unexpected sources (e.g. the merger)	Not supported
Evaluation and outcomes. PVs undertake more systematic evaluation and control.	Supported	Not supported. Poor outcome and conflictual process were never under control
Summary of findings	Strong support	Mostly no support

PVs, private ventures; ERP, enterprise resource planning; IT, information technology; SOEs, state-owned enterprises; TM, Top Management.

Reimer's works are factor studies but Martinsons supplements Reimer's results with eight intensive case studies (a simple form of process model), four in state-owned enterprises (SOEs) and four in private ventures (PVs), which the author uses in a indicative manner. The findings are summarized in Table 2 with the first column used for both the common characteristics of ERPs in China (three rows) and differences between SOEs and PVs (eight rows).

**Table 3.** Summary of additional findings from a process perspective

Feature	Olmec	Farina
History (antecedent conditions)	Strong motivation to change. Great care in choosing the vendor. Strong and active Top Management support	Limited felt need to change. Limited search for vendors. Seemed excessively influenced by vendors. Top management delegated the work to the IT group
Process of ERP implementation including context	Some difficulties especially over the merger. BPR part of the process.	Many difficulties, conflict and resistance. No BPR conducted.
Gaps	Some	Many and persistent
Interventions	Yes and successful	Some but mostly fruitless
Interactions between Work and Project processes	Extensive and significant	Extensive and significant
BPR	Yes. Planned and conducted as part of the implementation process	No. An explicit management decision.
<i>A priori</i> prediction based on the model (at data collection phase)	Success. Continued use of RTEN	Failure
Outcome (at time of writing)	ERP system delivered successfully and actively used.	ERP system abandoned. Legacy system is still used.

IT, information technology; ERP, enterprise resource planning; BPR, business process re-engineering; RTEN, real time enterprise.

The support for these characteristics from the Olmec and Farina cases are presented in the two remaining columns.

In summary, Olmec, a PV, exhibited many of the characteristics summarized in Martinsons' (2004) study. In contrast, Farina offered little support for the earlier study. In fact, it appeared as if Farina was acting like a classic SOE.

Next we look at **what the process model adds to our understanding of ERP implementation in China**. This is to address our second research question:

**2** How can the success or failure of ERP projects be better explained using a socio-technical parallel process model compared with a more conventional factor study approach?

Our findings are summarized in Table 3 where salient features of the model are used to show the differences and similarities between the two cases.

The process model is explicit concerning the importance of history (antecedent conditions). The difference in motivation to change was marked between Olmec and Farina. Olmec had an urgent and growing need to replace its ageing legacy systems. Farina it appears did not and seemed to be excessively influenced by the ERP vendors. Farina's search for an ERP system was consequently limited. There were also clear differences in the support of top management and the care taken in choosing a vendor. It is reasonable to suggest that **early decisions in projects require greater care** due to path dependency.

The process diagrams (Figures 4 and 5) show the trajectory of a project, linking antecedent conditions to outcomes. As a general guide, the reader can judge **the difficulties a project is experiencing by the number of gaps** that occur (thick arrows), the persistence of these gaps

and the project team's ability to resolve these gaps, thereby restore equilibrium. In Olmec there were several gaps but fewer than at Farina, where there were many, several of which represented on-going, unresolved problems. **Gaps are common even in successful implementations:** the crucial point is how the project team and management resolve them. It was interesting to note that although Olmec's project was deemed successful by top management, the RTEN implementation was not without difficulties. There were gaps at several points and management had to cope with these by devising interventions. Crucially, Olmec was able to resolve all these problems and in particular cope with the merger that occurred during the project (i.e. context).

Additionally, the model introduces **the innovation of parallel processes**. In most situations, as in our cases, an organization establishes a project team separate from the legacy or work processes. As one of the novelties of our model, these are considered as parallel processes. In Figures 4 and 5 we can see the advantage of treating these processes separately. A project is often initiated as a result of a problem, which arises from the work process, as at Olmec. The larger the problem the greater the motivation to 'unfreeze' the workforce to make changes. However, in both Olmec and Farina we also see how the project and work processes interacted at various points. For example, when the ERP systems were piloted, this produced several gaps in both cases. But this interaction was not confined to pilot tests: there were other times when there were significant interactions all of which influenced the trajectories of the projects.

In contrast to the situation in Farina, Olmec gave high priority to changing business processes. Top management was actively involved in both the planning and implementing phases of the project. They always discussed with the vendor to make sure the 'best practices' embedded in RTEN matched the company's requirements. The ERP implementation interacted with the BPR initiative thus facilitating organizational change. However, in China, since most SMEs lack a formal business process model (Martinsons & Hempel, 1998), companies' structures and processes often do not match processes in the ERP systems. Therefore, most Chinese SMEs need to re-engineer their business processes either before or during ERP implementation projects. **Olmec's decision to carry out BPR during the ERP implementation process appears to be a good practice to emulate for other SMEs.**

As neither ERP project was fully complete at the time of data collection, the researchers could make a **prediction of outcomes** based on the features of the process model and the detailed evidence from the two SMEs. As the authors predicted, Olmec's RTEN was not only well received but it continued in use whereas Farina abandoned EAS and continued to use the legacy system.

To summarize, the disadvantage of process models is that they can only examine a relatively few cases. In contrast, factor models can look for statistical associations across many cases, linking factors such as top management support, culture, resistance, etc., with measures of outcomes. In our two cases, top management support and successful outcomes appear to be related, as predicted by factor studies. However, **many of the findings from Farina are at odds with those in Martinsons' (2004) study.** The explanations for these differences emerged only through a study of processes. Moreover, ERP implementations often require ongoing adjustment in work practices. Robey *et al.* (2002) showed that such changes

were necessary to overcome learning barriers, where learning is a continuous process following an ERP implementation. **Such explanatory power cannot be derived from factor studies alone.** It is probably no coincidence that Martinsons used case studies to further interpret the earlier survey findings (Martinsons, 2004).

As an aside, it was surprising to us that cultural issues did not play a more important role in the implementation processes at both companies. Where culture does seem to exert an impact is in the respect for authority by employees at both Olmec and Farina. In Farina, however, the lack of senior management support for the project and handing project leadership to the IT group was seen as a signal to workers about the importance of the project. This lack of leadership and direction and the turmoil over the IT leadership seemed to contribute to the resistance we observed at Farina. But in many other respects, we could have been describing ERP implementation processes in the West. However, the point has already been made that adopting software packages built abroad is not straightforward for companies, even in developed countries.

## 7. CONCLUSION

In this final section, based on our findings, we offer suggestions to stakeholders including senior managers, project leaders and researchers. For **senior management**, we see their importance in supporting major IT projects both initially when the vendor is chosen and the budget agreed, and later when important decisions and interventions have to be made. In Chinese SMEs this is particularly crucial as workers generally rely on clear leadership and direction. If that is missing, as at Farina, projects tend to drift or get mired in conflicts. Top management also need to issue clear directives about the need to conduct BPR. The practice at Olmec seems to be a good one to follow. Many of the ongoing struggles at Farina can be traced to their failings in this area and in particular their early decision not to conduct BPR.

It is trite so say that implementation is a process and that **project leaders** need to manage the process. But again our cases showed clear differences between the practices at Olmec and Farina. The crucial factor here was not that gaps (punctuations) appeared in the process – in both cases there were major gaps. It was the ability of the project leader to deal with the gaps and design appropriate interventions, which was the distinguishing feature. In Olmec, the project leader seemed particularly effective at problem solving and not allowing the RTEN project to drift, a stark contrast to what was happening at Farina. However, in fairness to the project leader at Farina, he was experiencing problems that were structural and not of his own making, following the decision by top management not to re-engineer business processes.

For **researchers**, the message is that empirical process models, while being labour-intensive and time consuming, yield many insights missing from the conventional factor studies (Table 3). While factor studies tell us what variables may be related to outcomes, process models tell us how the story of implementation unfolds over time, linking history to outcomes and placing the story within the context of the organization and beyond. We would recommend that others, including PhD candidates, consider similar approaches to research. More cases,

using a process approach in Chinese SMEs and other research settings will increase our knowledge in this area.

### 7.1 Future research

The data we have analysed above have already suggested further lines of research that will bear fruit and we will not repeat them here. Generally, with the purpose of examining problems associated with using BPR techniques when implementing ERP systems, more cases in different countries, different industries and different sized companies could be selected for further analysis. We also suggest that the surprising finding of how limited the effect of Chinese culture was on ERP implementation and BPR in our cases could be fruitfully explored. Two issues come to mind here. First, both of our companies were privately owned and managed. The effects of culture might be much more pronounced in SOEs where traditional values and structures may be highly prized and the reward systems are different from those in private companies. Second, traditional factor studies may find associations between cultural 'variables' and outcomes that were absent from our process studies. Consequently a combination of factor studies and process modelling may yield further insights here, each informing the other.

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