

Business Process Reengineering through ERP in China

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Abstract

Enterprise Resource Planning (ERP) systems have been suggested to be an alternative way to improve organization's business processes. Therefore, ERP implementation and Business Process Reengineering (BPR) activities should be closely connected. ERP systems are software packages with built-in assumptions and procedures about organizations' business processes and even the organization's particular market environment. The present study selects four companies in China where two of these companies have already adopted ERP systems and the other two are considering the adoption of these systems. The paper examines the impact of different organizational and national factors on the reengineering of the business processes to adopt ERP.

Key Words: BPR, ERP, Culture

Introduction

The key to the successful implementation of any ERP software package in an organization is a fit between the ERP system and the organizational processes it is there to support (Holland & Light, 1999, Robey et al, 2002). It is important to remember that ERP systems are packaged software solutions and they come with built-in assumptions and procedures about organizations' business processes. The ERP assumptions and procedures, under the title of 'best practices', seldom match exactly with those of the implementing organization's existing processes (Brehm et al, 2001).

Business organizations traditionally designed their own computer systems to fit their specific organizational processes and requirements. ERP systems, although offering the option of customization, are very difficult to change to completely match existing business requirements. Basic customization means to provide the basic parameters for the system to enable the system to respond to the present organizational structure. Any change beyond the basic customization has proved to be very costly and usually result in the loss of technical support by the vendor. In fact, many researchers and practitioners have suggested that it is easier and less costly to change the business processes to match ERP systems rather than *vice versa* (Davenport, 1998, Holland & Light, 1999). Thus, any ERP implementation not only is a large scale software deployment exercise but it is usually accompanied by large scale organizational change (Hammer, 1999, Robey et al, 2002). Consequently, a key issue in ERP implementation is how to find a match between the ERP system and an organization's business processes by appropriately customizing both the system and the organization. There have been different frameworks suggested in the past to find the best match between the ERP systems and the organizations (Luo & Strong, 2004, Berhm, et al, 2001, Parr & Shanks, 2000).

A significant number of ERP implementation projects undertaken in the 1990s overran time and cost budgets. Many organizations deliberately chose what they referred to as 'best of breed' meaning they were choosing the modules with the most relevant functionality, little realizing that to make the modules actually work together was likely to be a major effort which in itself might compromise the functionality of each module because of a lowest common denominator effect (Spratt, 2000).

As it was suggested by some authors (eg, Brehm et al, 2001) ERP systems work on the basis of some assumptions regarding the business processes and the market in which the organization operates. Some authors suggest that ERP modules should simply be thoroughly and correctly translated into the other language such as Chinese, including user interfaces, reports, and user help files (Liang et al, 2004) for the system to be successful. Others suggest that ERP systems are designed for rule-based, mature economies rather than relation-based governance like China (Shen, 1999). The adoption of ERP systems in India for example has resulted in a very painful transition and adaptation period, while the benefits have not been immediate or tangible (Natarajan 1998, and Rajshekhar 2000). In fact in some

cases the benefits have been perceived to be much less when compared to the massive cost (Tarafdar & Roy, 2003). What most of the authors believe to play a key role in a successful implementation of an ERP systems in an Asian country is the need for business process change during the implementation of these systems (eg, Motwani, et al 2002; Al-Mashari et al, 2000).

Standardized ERP systems have disadvantages such as storage needs, networking requirements, and training overheads. However, the scale of Business Process Reengineering (BPR) and customization tasks involved in the software implementation process are the major reasons for ERP dissatisfaction (Gartner Group, 1997). ERP implementation should involve the analysis of current business processes and the chance of reengineering, rather than designing an application system that makes only the best of bad processes (Scheer et al, 2000).

BPR through ERP in China

Some organizational models are available to analyse changes in an organization. From Leavitt's Model (Leavitt, 1965), McKinsey 7S Framework (Peters and Waterman, 2004), to Complex Adaptive Systems (Olson and Eoyang, 2001), all these models provide a rich picture comprehensive perspective on organizational change with different emphasises and they describe organizational changes in a consistent way. They are summarized as following table.

Perspective of Change in Organization			
Static	Congruence	Context	Dynamic
Objective, Strategy Structure, System People, Skill Management, Leadership Culture Work Group Climate	The "fit" between what it is and what should be, the formal and the informal	The changes within an organization are influenced by the past activities and context	Driving forces, Restraining forces, Emergent

Table 1: Organizational Change Models

BPR's practices involve all the elements mentioned in above models. Most literatures describe them from static view.

	Traditional organization	Re-engineered organization	Static Factors
Organizational structure	Hierarchical	Flat	Structure System
Work units	Functional departments	Process teams	
Nature of work	Simple task	Multi-dimensional work	System Skill
Employee roles	Controlled	Empowered	Management Leadership People
Managerial roles	Supervisors	Coaches	
Executive roles	Scorekeeper	Leaders	
Value system	Protective	Productive	Culture
Job preparation	Training	Education	Skill
Promotion criteria	Performance	Ability	Management
Performance measurement	Activity (inputs)	Results (outputs)	Objective

Table 2: Characteristics of redesigned organization (the idea from Hammer and Champy, 1993)

Table 2 compares the difference between a traditional organization and the redesigned one in terms of the static aspects identified above. For the congruence item, it refers to a broad perspective including all factors in which there is gap between "what it is" and "what it should be". The context view reminds us that BPR's practices should be examined in a specific context. For the dynamic perspective, it focuses semi-autonomous units and their interactions, these units could be people, a department, a team and a business process.

Research Design

According to CCW (China Computer World) survey, 47% of Chinese enterprises have adopted ERP modules, with an annual growth rate of 5% for new installations(Quan *et al.*, 2005). The main types of enterprises in China are state owned, private and joint. State owned enterprises (SoEs) are more traditional, while private and joint are more modern but share some common features. The research design is according to Table 3. The four selected companies all belong to manufacturing sector.

Characteristics of Research questions determine which research method should be used (Järvinen, 2000). BPR efforts are strongly related to many contextual factors and influenced by culture as a result Case study method is appropriate to examine phenomena under its real environment (Yin, 2002). According to Benbasat et al (1987), case study is suitable to study information systems in a natural setting. Case study could take on some types in terms of epistemology: interpretivist, positivist and combination of the two (Cavaye, 1996). This research adopts interpretivist epistemology, which assumed that “our knowledge of reality is gained only through social constructions such as a language, consciousness, shared meanings, documents, tools and other artifacts” (Klein and Myers, 1989). In this research, case study information came from documents, interview and direct observation. Documents in the cases includes ERP implementation memo, recorder files of meeting about ERP and descriptions of several business processes. All four locations were visited several times to collect information from the staffs both through interviews and informal sessions. The different methods of data collection can improve construct validity (Yin, 2002). Company A is compared with Company B, C with D to identify some features of BPR’s practices in China. At the same time, BPR efforts in A and C are also compared to recognise the difference between SoEs and Private (joint) enterprises.

	State-owned Enterprise	Private (Joint) Enterprise
ERP Adopted	Company A	Company C
Non-ERP Adopted	Company B	Company D

Table 3: The research design

Case Study

	A	B	C	D
Industry Sector	Manufacturing (Machinery)	Manufacturing (Power supply systems)	Manufacturing (Telecom Systems)	Manufacturing (Power supply equipments)
Owner	SoEs	SoEs	Joint	Private
Employee	1200	4700	4000	1000
Turnover (2004)	US\$ 90 million	US\$ 600 billion	US\$ 1200 million	US\$ 400 billion
Education Background	Medium level (300 employees received diploma degree or above)	High lever (3000 received diploma degree and above, 1500 got bachelor degree and above)	High level (73 % employees got bachelor degree and above)	High level (85 % employees got bachelor degree and above)
Organizational Structure	Traditional	Hierarchy	Matrix Structure or Mix of vertical and flat structure. Vertical features are dominating.	Matrix Structure or Mix of vertical and flat structure. Vertical features are dominating.
IS adopted	PDM, ERP, KBS, MES	PDM, MRPII, Storage management systems, financial management systems, order processing system, HR.	PDM, ERP, Purchasing systems	PDM, MRPII, Lotus Notes, HR, Storage management systems, order processing systems.

Table 4: Basic information about the case companies

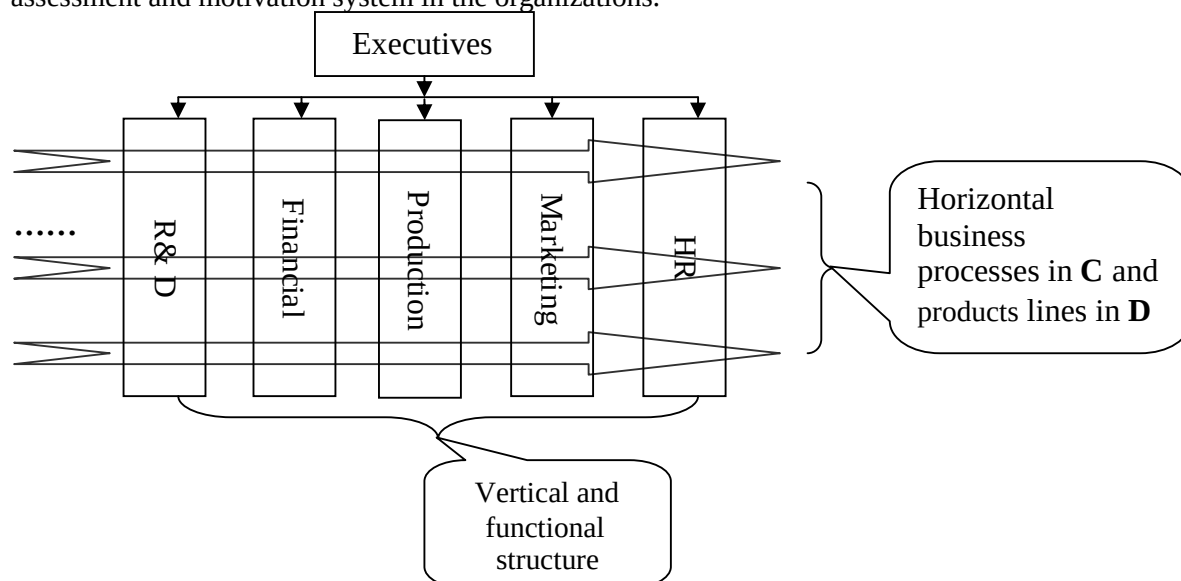
The research involved collection of background information regarding these companies on the basis of the companies' publications as well as the information presented on their web sites. This was followed by interviews with the supervisors and the heads of the relevant departments in these companies. The interviews used open ended questions to provide an opportunity for the researchers to collect information regarding the steps in the selected business process in each of these organizations. Then semi-structured interview was used to collect data. For the enterprises with ERP systems, the interview protocol consists of three parts: basic information about the company, ERP application in the company and BPR's efforts, while for the enterprises without ERP systems, the interview questionnaire only includes the basic information section and the analysis of their current business processes. In last section, very general information about case organizations is displayed. This section will provide more details of these companies.

Organizational Structure

A: Organizational structure in A represents a typical SoEs in China, traditional hierarchy. There are different departments within the organization for which vice-presidents are responsible. They directly report to the president. Some departments such as political affairs office and general office are typically marks of traditional SoEs. There are not well defined responsibilities among these departments. For many units except R&D, financial accounting and purchasing departments, the employees work according to the ad hoc arrangements by managers and habits. "I do not know what to do every day exactly, it is always right to follow the instructions" said an employee in customer centre.

B: Originated from a traditional SoEs, it reflects hieratical feature in organizational structure. It produces several large complex systems, unlike A, it is made of 5 divisions according to different products. In recent years, the structure was changed to some extent in order to increase efficiency and reduce the response time to customers. Some resource departments were built to serve all the divisions. "We restructure our company according to the concepts of business process. HR, financial accounting, marketing and purchasing departments serve all divisions" manager of purchasing department said. Although, B still possesses a hieratical structure, but it is aware of the concept of "business process" and their goal is a process-oriented organizational structure.

C & D: C and D possess very similar organizational structure which is a combination of vertical and horizontal structure together as following figure. The difference is that the horizontal arrows refer to business processes in C and products lines in D. This kind of structure influences the performance assessment and motivation system in the organizations.



Motivation of Applying ERP systems

A:

Internal Factors

- "...There are several IS within company, and they are not connected to each other. This reduces the correctness of data. One example is the difference between the valuation of inventory in production and stock management departments.
- The products in A are protected by government and there is no fierce competition. In recent years, the business in A reached its peak and they can invest the money on new project, ERP's adoption is just an outlet of its profit to some extent.
- Because A is a traditional SoEs, it is not easy to modify the organizational structure and managerial position without reasonable excuse. Adoption of ERP system is a good excuse for executives to reach this purpose.

External Factors:

- Adoption of ERP system in China is considered to be a symbol of innovative management. The application of IS also represents high achievements at the top management level.
- Usually the executive managers of SoEs are appointed by government. Chinese government has worked out a long term plan to call for the application of IS, so every SoEs have to take action to response.

C:

Internal Factors:

- There are nine separate IS in C. MRPII was introduced in 1995, this system just had the functionality in material management, did not incorporate the information of financial, asset management and sales and distribution. Like the A, this situation also caused Information Islands.
- Since 1995 and sudden increase in their business in response to a business boom in their industry the company faced some serious management problems. The organizational structure was not suitable to accommodate the fast development of the company and did not response to the requirements of customers quickly.

External Factors:

- China allowed foreign competitors to enter this particular industry at that time, and the competition was intensively fierce. Its previous management systems (structure, IS and business process) was on the basis of the traditional market and this was challenged by that sudden competition.

Implementation of ERP Systems - Changes in Organizational Structure

A:

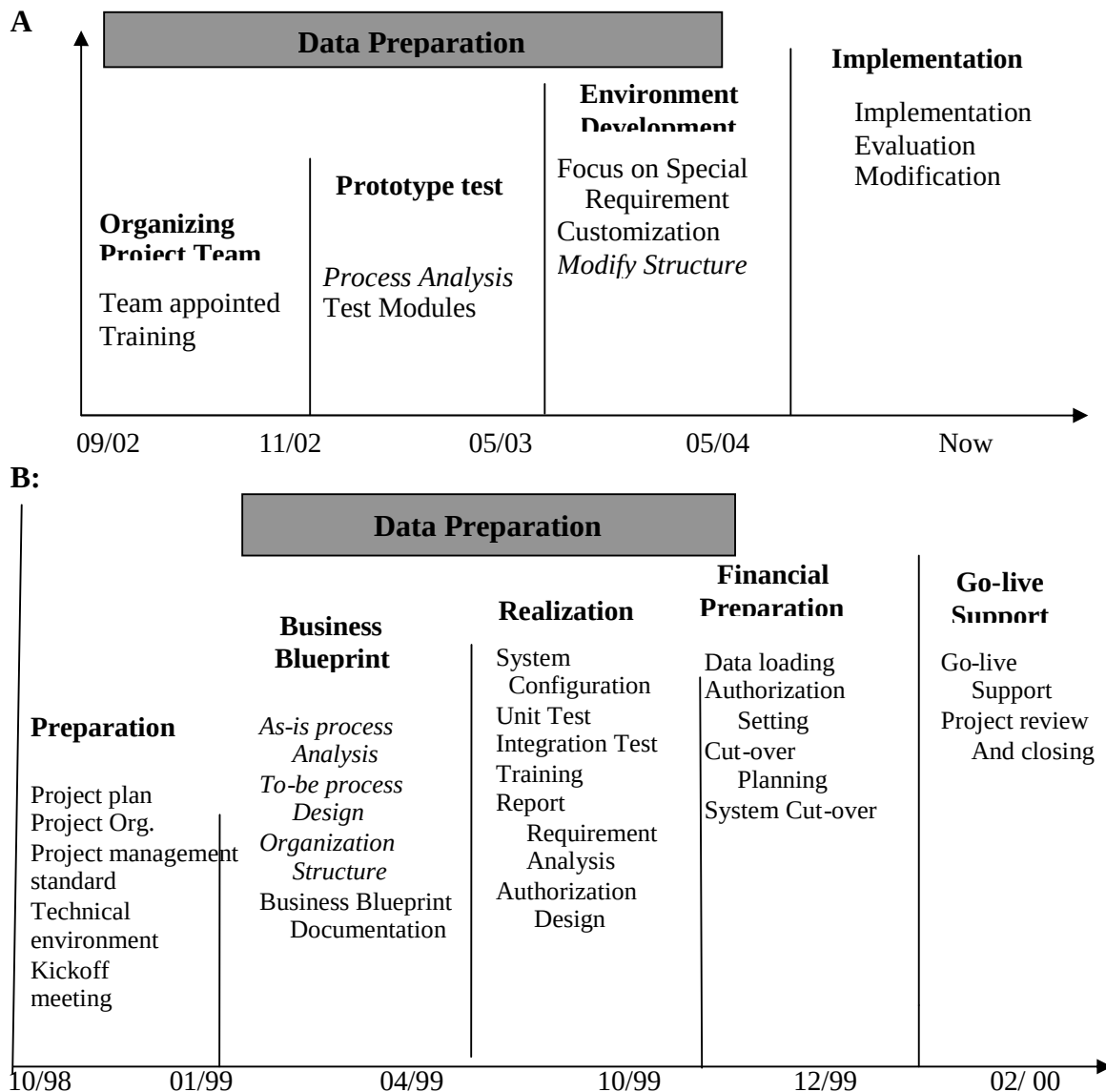
1. Just small changes in organizational structure occurred. At present it is still a traditional Hierarchy and function-oriented.
2. Process-oriented should be ideal structure for ERP system, but it is impossible to fulfil this changes in short time because the changes influence benefits from various aspects
3. "You know, process-oriented idea is new philosophy for us, in addition, turnover and profit of our company increase continually in recent years, accordingly, personal income also get better. Under this condition, most employees want to maintain current condition and do not take on much interest in this kind of reform. We cancelled some departments and combined them with other ones according to the requirements of the processes. With the aid of shared information, most business processes are optimised and simplified. But as a typical state-owned enterprise, organizational structure is influenced by some other factors such as politics and policy", ERP project manager. A also stresses the "business processes", but it seems just a concept in employees' mind. In practice they work as before and the assessment and motivation systems did not change.

C:

1. Before the implementation of ERP system, C started structure modification in 1998, from hierarchical and function-oriented to dual-matrix format, one is based resource service department and the other belongs to traditional divisions. Every department is located a cross point.
2. When implementing ERP, C reconstructed some business processes and re-organized its structure according to business processes and traditional departments.

3. This modification took several months with not so much difficulties and involved re-allocation of job roles, responsibility and the role of managers.
4. It also influenced the performance assessment such as bonus allocation. Employees' bonus is assessed according to the performance of both their business processes and departmental division.

Implementation of ERP Systems – the process



Benefits from ERP system

A:

Limited benefit: Streamlined the data flow and all departments can share the data.

C:

Significant benefit:

1. Redesign and integrate order-purchasing-production-selling-financial processes, increase management and decision making level.
2. Share physical flow and information flow. Schedule production more efficiently and accurately according to market needs. Managers can get useful information right now such as product cost, cash flow, payment and receivable.
3. Restructure organizational structure and form matrix format, improving efficiency and decreasing response time
4. Low operating cost. The circle time of stock reduces to 1/3 (from 240 days to 70 days).

BPR' Practices - Business Processes

A:

1. There are limited types of products in A and main frame of them are almost same, the difference lies in the different configuration. A has basic business processes as other companies such as purchasing, production and order processing, however, because it is a medium size enterprise, its business processes are relatively simple.
2. Core business is **production**. Because it runs a monopolistic business, it focuses on how to improve productivity.

C:

1. There are hundreds of products in C and most of them are complex systems. It has a very complex sales network and depends on many suppliers. In addition, it runs the business in a fiercely competitive environment. It has to provide best products and service for its customer and respond to them quickly.
2. The main business processes in C are production, sales, financial, purchasing, human resource and material management.
3. Before the introduction of ERP system, it had several years' experience of MRPII. Business process involving production and material management had been streamlined and redesigned in the adoption of MRPII, so the core business processes in C are **order processing and purchasing**. The main aim in C is to redesign and streamline the whole supply chain.

Implementation of BPR

A:

1. Because the previous business processes are basically simple and reasonable, it just integrated different IS to streamline the processes. They were not much concerned about BPR.
2. As mentioned above, for SoEs, business process change could involve many difficulties. The strategy is to maintain current working ways and seek to improve some detailed parts of specific process through ERP system. This also helps to keep stability in A. In BPR's implementation, there should be a trade off between improvement and stability, for SoEs, latter is more important.

C:

1. C paid much attention to BPR, as can be seen in ERP implementation. In business blueprint stage, main efforts is focused on BPR such as As-is process, Analysis To-be process and Design Organization Structure.
2. C worked out detailed plan to realise BPR in terms of business blueprint, BPR realization and change management.

Organizational changes after BPR through ERP

A: In A, after BPR through ERP system, the fundamental and explicit organizational structure is still traditional hierarchy, however, all the functional departments are connected through ERP system and some implicit business processes exist across departments. In the absence of job redefinition, roles reallocation, essential organizational restructuring and modifying performance assessment, the benefits from business processes are extremely compromised.

C: Around the implementation, C redesigned its business processes, changed its organizational structure and modified its performance assessment. The organization takes on a typical matrix structure.

Analysis of Business Process

This section will compare business processes between A and B, and C and D, to identify changes of business processes after adoption ERP system.

C and D

Sales Order processing is selected as an example to display the difference in C and D. This process in most companies generally includes the following steps: salesman reaches agreement about prices of products, delivery schedule with customer, contracts is signed and the order is passed to purchasing department and manufacturing department in which the products are produced. Then the supplier ships the products to its customers and payment is made. This process consists of function flow, output flow

and information flow (Scheer et al, 2000). Any function needs essential input information to make decision then pass output information to next function. For example, in check order function, supplier has to check for the customer credit and inventory level. The combination of these functions forms a business process. How these functions interact with each other means how the different elements in a business processes are arranged which results in different levels of efficiency and effectiveness. The aim of BPR is to reorganize these elements and improve its efficiency and effectiveness. Information systems are used to enable the changes of these functions and streamline them.

In C, due to the adoption of ERP system, IS in different departments are integrated and the functions in this process seem to be more efficient and effective. For example, salesman can check customer credit in one screen, while in D, checking customers' credit function is accomplished through three steps: fax customer information to contract evaluation department, then pass to financial department, then back to contract evaluation department, then the staff contract evaluation department informs salesman by phone or fax.

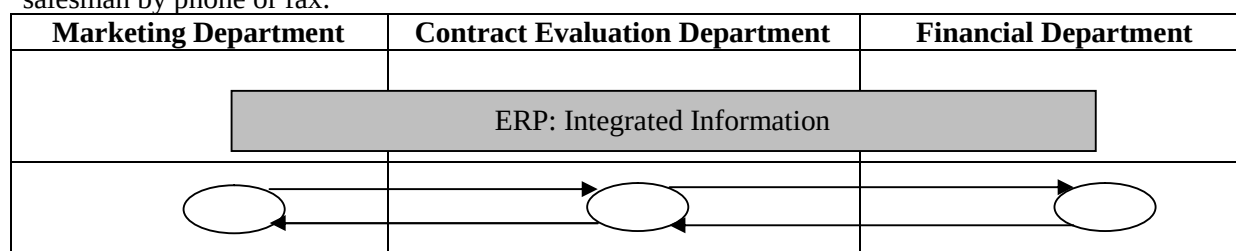


Figure 5: Credibility Check in C and D.

In D, order processing process involves six departments as following figure 5. The IS in them are different and separate each other. The common communication tools among them are phons, email and fax machines.

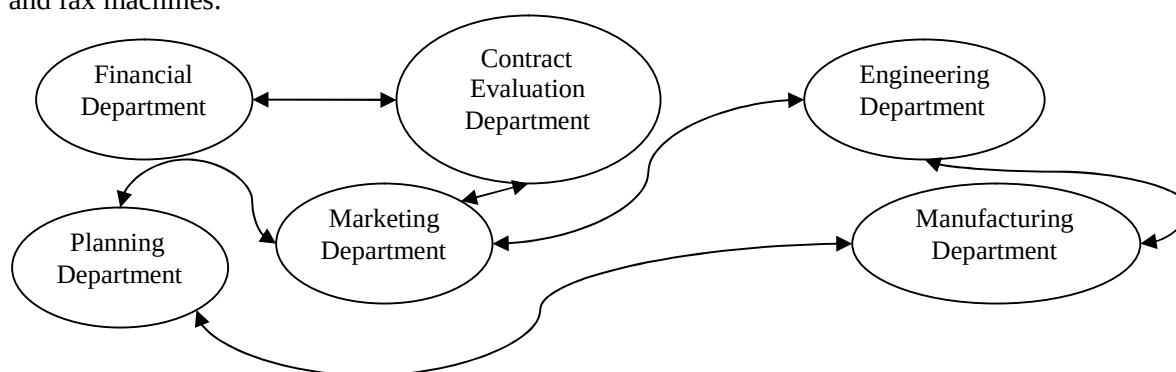


Figure 6: Departments involved in D.

In D, different departments have to enter the same data into different databases, and sometimes cause data error such as configuration error and delivery schedule error. Another problem in D is that it is difficult to determine delivery schedule because planning department can not possess accurate data in manufacturing department in real time. So, usually salesman just provides an approximate schedule with customers. In most time, the required delivery time is not met which is the main complain from customers.

In D, due to the fragments of IS in different departments, the business functions are not well supported by information flow and the process seems complex and redundant. Only marketing department is involved with the customers. The salesmen in the department need essential information stored in other departments to make any decision. The direct and indirect partners of marketing department are financial, contract evaluation, planning, manufacturing and engineering departments. In order to communicate with each other, they have to transfer the information by email, telephone and fax. C and D both belong to private enterprises and possess similar organizational structure, and they both emphasize "business process" in the organization. With the ERP system, C improves the efficiency and effectiveness of sales order processing.

Actually in D, in order to improve efficiency of information transfer, clear responsibilities in relevant departments are assigned. For example, one staff in engineering department is responsible for customers from certain areas. D organizes the sales order processing according to the industrial sector

and geographical areas of its customers. If some errors occur on certain process, all the involved employees are responsible for them. The company accordingly evaluate personal performance based on the departmental performance and process performance. All the staffs are with high sense of responsibility and they all devote themselves to the work. Although the working efficiency is not ideal, with the careful hard and over work, they also guarantee the effectiveness of the process.

So although ERP system can improve business process, the quality of business process is influenced by other factors such as evaluation system, human resource and organizational culture.

A and B

Purchasing process is selected as an example to identify the difference between A and B. Actually, this process could be viewed as a sub-process of sales order process. However it focuses on the section from sales order to manufacturing. Purchasing process does not necessarily occur after the sales order has been placed. Because A and B produce relatively standard products and they generate purchasing orders according to marketing planing, and current and prospective orders. Usually they keep a planned level of stocks. For suppliers of A and B, their purchasing process is another order processing process.

The aim of purchasing process is to guarantee the availability of essential material for manufacturing and to minimize the inventory. The involved activities in purchasing process include: 1) generating required material according to plan and current orders. 2) modifying the purchasing plan according to current business environment. 3) calculate the purchasing material through comparing required material to stocked material. 4). allocate the purchasing orders to different supplier according to previous contracts and led time. 5) update new material information and inform financial department. 6) accept material and pay.

With the help of ERP system, the information about required material for orders, current stocked material and detailed data about suppliers are integrated, so the process seems simple. After the required material purchasing plan is input, purchasing orders for different supplier can be produced automatically and immediately. This process involves a lot of complex business rules and calculations. The staffs in purchasing department focus on negotiating with the suppliers to reduce price and monitor the quality of supplied materials, and modify the business rules in the system. The most trivial tasks are accomplished by ERP system.

Purchasing process in B takes on more complex than that in A. An accurate purchasing plan needs a lot of information about current stock level, required material for products, and suppliers, also involves complex calculation, because all of these information is distributed in different departments and sometimes the data they keep are not consistent, this process consists of several additional manual activities. For example, to ensure the prices information in purchasing department and financial department are consistent, financial staffs usually check purchasing plan before it is placed, because sometimes purchasing department gets a new price of a particular parts and forget informing financial department. The outline of the process in A and B seems alike; however the efficiency and effectiveness in them are much different. Staffs of purchasing department in B always are annoyed by dealing with trivial data. A small error in data input or data transfer would cause vital deviation of purchasing plan. So B has to maintain high level raw material and final products stock level to counteract the error. They spend little time on choosing suitable suppliers, negotiating with them and control quality of material supplied.

Discussion

Enterprise Resource Planning (ERP) systems claim to be instruments for improving business processes such as manufacturing, purchasing, or distribution in an organization. Therefore, ERP implementation and Business Process Reengineering (BPR) activities should be closely connected. ERP systems are software packages with built-in assumptions and procedures about organizations' business processes and even the particular market environment. The present study selects four companies in China where two of these companies have already adopted ERP systems and the other two are considering the adoption of these systems. The paper is a report on the in-depth case study of these four. The major aim of the study is to find out about the BPR as a result of ERP implementation.

Findings are based on specific industrial sector and location. For others, the findings could be different to some extent. In addition, for companies in China, staff education background, organizational cultural, IT infrastructure and managerial philosophy are different in different industrial sectors and different types of companies. There should be more factors influencing business process in

implementation of ERP system which need to be identified. Although ERP system can improve business process, the quality of business process is influenced by other factors such as evaluation system, human resource and organizational culture (Davenport, 1998; Hammer and Champy, 2001).

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