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Barriers and Risks Associated with the Post-Implementation of ERP Systems in China: Cases of State-Owned Enterprises in the Electronic and Telecommunication Manufacturing Sector in Guangdong

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By

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Chapter Eight: Results and Findings of the Follow-up Case Study

8.1 Introduction

As presented and discussed in chapter five, a multi-case study was conducted in this project as a follow-up qualitative component that aimed at further exploring and validating the findings derived from the questionnaire. The two SOEs involved in the case study were identified from the group of SOEs that had participated in the survey. A total of 25 semi-structured interviews were carried out with the CEOs, IT managers, and departmental managers and system users in diverse departments (i.e. sales, financial, production, and purchasing department) of these two case companies. The data collected from the interviews were analysed by using the approach of thematic analysis (as discussed and justified intensively in section 5.9.1). As a result of the data analysis, seven individual concept maps (appendix 12) were produced to highlight the main themes and concepts identified. This chapter presents the findings of the multi-case study by using these concept maps as the frame and relevant quotes from the interviews as anecdotal evidence to support the argumentation.

In addition, as the purpose for doing this follow-up case study was to further explore and investigate a set of questionnaire findings (as discussed in chapter five and seven), it would not be ideal to report the case study findings without linking them with previous findings derived from the questionnaire and the literature review. Therefore, this chapter does not just report the case study results, but also compares and interprets them in light of the findings of the questionnaire (as presented in chapter seven) and the literature reviewed (as presented in chapter six). This approach enables triangulation to take place and thus results in a more in-depth and comprehensive discussion. The original ERP barrier and risk ontologies derived from the literature review were revised after the comparison and synthesis of the quantitative and qualitative findings. The revised ontology, which was one of the final outcomes of this study, is presented in this chapter.

Moreover, the purpose of this case study component was not to compare the issues existing in different case companies, but to seek evidence from the two cases to confirm and further understand a set of questionnaire findings. Due to this reason, this chapter

does not report the findings of the two case companies sequentially, but draws evidence from both case companies to provide a comprehensive discussion for the studied set of ERP barriers and risks.

This chapter firstly introduces the backgrounds of the two case companies. It then presents and discusses the findings of the multi-case study. The final ERP barrier and risk ontologies developed are presented in this chapter. The statistical correlations between the identified barriers and risks are also further qualified and discussed, in light of the qualitative findings.

8.2 Profiles of the case companies

Before presenting and discussing the findings, this section introduces the backgrounds of the case companies. In order to protect anonymity of the interviewees, the two case companies are respectively referred to as Company A and Company B:

- Company A is located in Guangzhou, the capital city of the Guangdong province. The company has around 400 employees, with an annual revenue of around 1.2 billion RMB.

- Company B is also located in Guangzhou. The company has 450 employees, and its annual revenue is around 1 billion RMB.

More detailed profiles of these two case companies are given below.

8.2.1 Company A

Company A has over 60-year operational history. In the 1990s, it was the largest manufacturer of electronic and telecommunication products (e.g. TVs, hi-fis, DVD players) in the Guangdong province. The company could rarely find rivals that could threaten its leading market position at that period of time. Nevertheless, as discussed before, continuous national economic reform and competition from numerous foreign and private companies have significantly changed China's business environment since the late 1990s, and resulted in increasingly drastic market competition in the local market. As a consequence, the market share of company A has been significantly

decreased during the last decade. In 2003, the company was reformed from a traditional state-owned enterprise to a limited company in response to the country's SOE reform policy. Although the company is still owned by the state after the reform, it now needs to be responsible for its own losses without gaining further financial support from the government. This change has further reduced the company's comparative advantage in the market. In addition, the number of employees of the company has been reduced from 1,700 to 400 after the reform. However, a substantial amount of employees in the firm are still low-educated and low-skilled staff. This type of staff may often be less inclined to learn new skills and adapt to a new working environment. This factor proves to be an obstacle for development and using ERP in the company.

IS applications (e.g. CAD, MRP and financial systems) have been extensively used in company A since the 1980s. During the interviews, it became evident that the company has had many successful stories in previous IS adoption. Since the 2000s, ERP has become increasingly prevalent in China. On the other hand, the top management team of the company felt that, the legacy systems and the current management mode could no longer support the firm to maintain competitiveness in the new market-oriented environment. Due to these reasons, the top management team decided to discard their legacy systems and implemented ERP in 2004. As a reformed SOE, the company received ¥500,000 RMB from the government to implement ERP. This ensured sufficient fund for the ERP implementation project. The system went live in mid 2005.

The ERP system is currently maintained by the firm's own IT department, which consists of three IT experts. Nevertheless, due to a number of internal issues and the mistakes made in the implementation stage, the company experienced a variety of problems when actually using and maintaining the implemented system, as further discussed in remainder sections of this chapter. As a consequence of these problems, the usage of the current ERP system is limited and the system is being underutilised.

12 interviews were conducted respectively with the Chief Executive Officer (CEO), IT Manager (ITM), Sales Manager (SM), Production Manager (PM), Purchasing Manager (PurM), Financial Manager (FM), 2 Sales Staff (SS1 and SS2), 2 Production Staff (PS1 and PS2), 1 Financial Staff (FS), and 1 Purchasing Staff (PurS) in Company A.

8.2.2 Company B

Company B was formed in mid 2005 between a SOE and a public corporation (a former SOE) as a result of China's SOE reform. The company produces four types of products, namely PCs, TVs, DVD players and radios. As a joint-venture company, company B inherited both original product manufacturing technologies from the SOE and modern management mechanism from the public corporation. A large amount of employees of company B, at both management and shop-floor level, are between 25 and 35 years old. These young employees normally hold a college diploma or a university degree. They also seem to be ambitious and be keen to learn new skills in order to enhance their career perspectives. Nevertheless, the company also has a substantial number of low-skilled and low-educated employees, who were inherited from the parent SOE. These low-skilled workers often have the same work behaviour as discussed above for company A.

Company B implemented ERP soon after it was established in 2005. The ERP implementation project of the company was initiated by the public corporation, where ERP system had been used since 2000. The parent companies believed that ERP would be an essential tool to ensure efficient operation and management in modern companies, and thus assigned a large amount of funds to the ERP implementation project. In mid 2006, the ERP system went live in company B. Since then, ERP has been used in all functional divisions of the firm. Nevertheless, because the ERP project was initiated by the parent companies and internal employees of company B were not fully prepared at the time of implementation, some unforgivable mistakes (e.g. lack of detailed user requirement analysis) were made in the system implementation stage. These initial implementation faults have resulted in diverse ERP usage and maintenance difficulties in the firm, as discussed later on.

Moreover, in order to reduce maintenance costs, the top management team dismissed the original IT department of the firm and outsourced the system maintenance service to an IT consulting firm in mid 2007. Since then, the human resource manager of the company has been appointed to be also responsible for internal IS issues and act as an internal contact with the IT consulting firm. The IT consulting firm is responsible for conducting any technical activities regarding system maintenance and enhancement for company B. As a consequence, people in the company considered they have two IT

managers: an Internal IT Manager (I-ITM) who is also the HR manager of the firm, and an External IT Manager (E-ITM) who is actually the owner of the IT consulting firm. Both IT Managers were interviewed by the researcher of this study. Moreover, another 11 interviews were carried out with the Chief Executive Officer (CEO), Production Manager (PM), Financial Manager (FM), Sales Manager (SM), Purchasing Manager (PurM), 2 Production Staff (PS1 and PS2), 2 Financial Staff (FS1 and FS2), 1 Sales Staff (SS), and 1 Purchasing Staff (PurS) in Company B.

As presented above, the backgrounds of the two case companies vary in many aspects, such as operational history, operational status, staff quality and ERP usage status, etc. These two companies thus cover a variety of issues, and are deemed to be able to render a rich picture to further explore and understand the ERP barriers and risks identified at previous stages of this study. The remainder sections of this chapter present and discuss the findings of this multi-case study.

8.3 Benefits for adopting ERP

In order to find out whether or not the interviewees had a sound knowledge about ERP, each interviewee was asked a general question regarding the benefits that they received from their ERP packages, at the beginning of the interview. A set of benefits associated with the adoption of ERP in the case companies were therefore identified. These ERP benefits proved to be an extra set of findings derived from the case study. It was deemed that these ERP benefits would contain additional information about ERP usage in the case companies. They are therefore presented in this section, before discussing the main findings on ERP barriers and risks.

Better data processing

Many interviewees indicated that ERP system helped them to process data of the entire organisation more efficiently. As highlighted by the Purchasing Manager (PurM) of company B, "the system will automatically categorise, manage and store the data collected through diverse business processes in a central database". The Financial Manager (FM) of company A reinforced that "the ERP will automatically process the data collected and produce a set of necessary statistics for related departments". Both

managers concluded that this feature of ERP system distinguishes it from previous IS applications that focus merely on a single business function.

Support information acquisition and decision making

ERP system enabled people in both companies to acquire needed information more easily. The Financial Managers of both companies stated that, in the past they would need to go down to the warehouse to check inventory records, whereas with ERP they can now see all this information from the PC in the office. The purchasing staff in company A also mentioned that "with this system, I can easily search and retrieve purchasing records made in previous years without spending ages on checking manual records". The Purchasing Manager of company B concluded that "ERP system allows us to obtain needed information more easily and speedily. With sufficient information and facts at hand we will be in a better position to make appropriate decisions and judgements".

Moreover, it is evident that, ERP does not just support information acquisition and decision making at the operational and tactical level, but also at the strategic level. This fact was highlighted by the CEO of company A:

> Nowadays, in top management meetings, the head of each department can often show me a statistical report that reflects the performance of each functional division. All these reports are obtained from the ERP system, and can provide a holistic view on the firm's current operation status. These reports are invaluable for decision making of the top management team (CEO Company A).

Improve operation transparency

When data derived from diverse business processes would be stored in the central database of ERP and shared across the organisation, it would enable operation of the firm to become more transparent. As confirmed by the Sales Manager (SM) of company A, "in the past, we would not be able to trace production progress of sales orders that we placed, whereas we can now check this information whenever we want from ERP". The CEO of the same company reinforced that:

> Data associated with different departments, especially accounting and purchasing department, can now be checked directly from the ERP system. As a consequence, operation of the firm becomes more transparent, and thus preventing hidden human frauds which may often arise in the past (CEO Company A).

Improvement in operation transparency also made staff of the firm more cautious when doing their daily jobs, "as any faults being made can now be easily identified by the others" (Production Staff in company B). As a consequence, "it helps to reduce the probability of occurrence of human mistakes, which may be caused by staff negligence" (PurM in company B).

Improve operation regularisation

It clearly emerged from the interviews that, ERP is not just an IT tool that facilitates information processing but also a management tool that regularises and formalises business operation. This was cogently stated by a Financial Staff of company A:

> In the past, we would often do our work in some informal ways without following formal business procedures. For instance, when a department claims for expenses they made, the expense invoice should be verified by our financial manager before being processed. However, such formal verification might not always be performed or would be done by only a financial staff in the past, and the claims could still be processed. After ERP was used, the system would not allow us to do this anymore. That is, a claim will not be processed by the system until verification is made by the financial manager, and only the financial manager has the system access right to verify a pending claim. This change does help the company to prevent some undesirable human frauds and regularise internal operation (Financial Staff, Company A).

Improve management efficiency

It was evident that the use of ERP resulted in substantial improvement in management efficiency in both companies. In particular, the CEO of company B stressed that:

> For Chinese CEOs who are keen to drive their companies further, they will never be able to do so by using traditional management mode. Modern management tools, like ERP, must be used in order to enhance management efficiency and regularise business operation. I, as a human being, will not be able to oversee every aspect of the business, and therefore need enterprise systems to assist me (CEO Company B).

Other managers in the case companies (i.e. SM in company A and FM in company B) also acknowledged that the ERP assists them to manage diverse business aspects that may not be easily handled by themselves, and thus allows them to spend more time on making important business decisions and dealing with external business issues.

Improve collaboration and communication

It was obvious from the interviews that ERP has improved horizontal collaboration and communication between functional departments of the case companies. As exemplified by a Sales Staff in company A:

> Sales orders that we enter to the system will be automatically sent to the manufacturing department for production and the financial department for book-keeping. This enables more efficient collaboration and communication between us and other departments in the firm (SS1 Company A).

In addition, another interesting fact that was found is that the longer the ERP is used in the firm, the more staff get familiar with computer usage. As becoming more computer literate, employees in the firm are more inclined to communicate with each other through electronic channels (e.g. emails) rather than traditional ones (e.g. face-to-face and telephone). This fact was confirmed by the CEO of company B:

> The use of ERP leads our staff to become more computer literate and more aware of computer capabilities...they now tend to use computer more frequently in their daily jobs, e.g. share ideas with colleagues and report problems to their superiors by emails (CEO Company B).

Note that, in this case, the use of ERP has led to communication improvement not just at horizontal level between colleagues, but also at vertical level between subordinates and superiors.

Improve entire organisational climate

As a result of the improvements discussed above, the entire organisational climate of both case companies has been significantly changed and improved after adopting ERP. The CEO of company B concluded that:

> Our people, from operational to managerial level, have gained more awareness of modern management concepts, and are more inclined to adopt advanced business tools in their work. Once they get used to this more transparent, regularised and collaborative working environment, they have become more enthusiastic, motivated and innovative. I believe this will lead to diverse tangible and intangible benefits to our company in the long term (CEO Company B).

Nevertheless, despite the apparent ERP benefits presented above, the case companies actually experienced a wide range of problems when using, maintaining and enhancing their implemented ERP systems. Next section presents the findings associated with the ERP exploitation barriers existing in the case companies.

8.4 ERP exploitation barriers

The analysis of the interview data identified a set of 31 ERP exploitation barriers existing in the case companies. These 31 barriers were found around cultural, organisational and system aspects. They included 22 barriers that were previously identified from the literature review and examined in the questionnaire, as well as 9 new barriers that had not been identified at previous stages of this project. Moreover, based on the questionnaire and case study findings, it was found that 4 barriers established in the literature were not actually an issue in SOEs. This section presents and discusses the case study findings regarding ERP exploitation barriers.

8.4.1 Cultural barriers

The analysis of the interview data identified five cultural barriers that are important to the case companies.

Power centralisation due to high power distance

As discussed before, the Chinese cultural characteristic of high power distance often results in Chinese leaders holding autocratic and close to absolute power in the company. Organisation characterised by this type of manager, are inclined to make centralised decisions (Martinsons and Hempel, 1998). Specifically, Martinsons and Westwood (1997) point out that, Chinese leaders may symbolically consult with their subordinates, but will rarely let them make a meaningful contribution to the decision-making process. From the IS perspective, Reimers (2002) reinforces that Chinese

leaders may make centralised decisions on important IS issues without consulting a wider group of people (e.g. IT experts and system users).

Although a significant amount (35.7%) of respondents in the questionnaire perceived power centralisation as an issue in their firms, the actual impact of this issue in SOEs may not be as negative as mentioned by above authors. In particular, it is evident from the interviews that, although CEOs in the case companies hold the power to make final decisions for IS issues, they would rarely make IS decision on their own without considering opinions of in-house IT experts and system users. This fact was highlighted by the Internal IT Manager (I-ITM) of company B:

> Normally, the departmental managers will tell me the IS needs of their functional divisions first. I will then look for suitable IS vendors, who can provide IS solutions to satisfy these needs. After further discussion and consultation with the department concerned, I will draft a project proposal which will be sent to the CEO. The CEO will then hold a meeting within the top management team to discuss the proposal further. He will then make the final decision based on the result of the discussion and the information I supplied (I-ITM Company B).

The ITM of company A reinforced that:

> The CEO will also be afraid that, if he makes IS decisions without listening to our voice, he may not be able to receive full support from us. In order to avoid potential hazard and resistance, he will normally ask for our opinion before making final decisions, especially for IS issues in which he is not an expert (ITM Company A).

It clearly emerged from the above quotes that, although the CEOs in the case companies got the power to make final decisions for IS issues, they would not abuse such power to make centralised IT decisions on their own. In-house IT experts and system users would often play an important role in IS decision making.

In fact, the real impact of power centralisation shown in the case companies is that, this issue may often result in arbitrary allocation of management power in the firm. This fact is clearly pointed out by the IT Manager of Company A:

> In many Chinese firms, the boss often holds ultimate power and control on many organisational aspects. Therefore, the real power assigned to a manager may not merely depend on his position in the firm, but may also depend on his personal relationship with the big boss. If you gain your boss's trust, your boss would be willing to offer you with more actual power. Otherwise, you

> may not be able to get as much power as you suppose to have. Due to this reason, and probably also because of other top management concerns, I found I was not assigned with sufficient power by my CEO to deal with IS-related issues (ITM Company A).

It is obvious that IT managers often play a crucial role to ensure success in continuous ERP usage, maintenance and enhancement. If they are not assigned with sufficient power and authority due to power centralisation, they will "not be able to deal with daily ERP usage and maintenance problems (e.g. user resistance) effectively" (ITM Company A). This emerged as a further ERP exploitation barrier, as discussed in section 8.4.2.

Insufficient use of critical thinking skills

As a result of high power distance, Chinese employees traditionally tend to receive and follow explicit instructions and directives from their superiors, rather than to critically question the suitability of decisions made by them (Martinsons and Hempel, 1998). As a consequence, Chinese employees may often be less inclined to use their critical thinking skills. However, 76.2% of respondents of the questionnaire disagreed with this statement. Responses of interviewees towards this issue were mixed from within both companies. Some managers interviewed perceived that "my people will actively analyse and solve the problems encountered" (Sales Manager Company B), while other managers considered that "thinking skill of staff is relatively weak and needs to be improved" (Purchasing Manager Company B). It seemed that whether or not workers are inclined to use their critical thinking skills may often "be influenced by the management style of their superiors" (Purchasing Manager Company B). Moreover, it was evident that the level of critical thinking skills of employee may often vary from person to person, and therefore "it is difficult for me to give a general and single answer on this issue" (Sales Manager Company B). Due to this fact, it is reasonable to argue that, the questionnaire finding may not properly reflect the reality and complexity of this issue.

By further analysing the interviews conducted, it became apparent that insufficient use of critical thinking skills was indeed a crucial ERP exploitation barrier to both case companies. In particular, anecdotal evidence from the interviews proved that IT managers and engineers of these companies might often not make sufficient use of their

critical thinking skills. As a consequence, many ERP implementation and exploitation tasks were inadequately conducted and performed:

> Our IT people had not established a detailed user requirement analysis when installing ERP. They just simply purchased a set of modules from the ERP vendor, without thinking carefully whether these modules contained everything that we need (PS1 Company A).

> Many basic tasks (e.g. system requirement analysis) were not conducted properly and rigorously in ERP implementation. As a consequence, a lot of our user needs have not been satisfied, and many functions that we expected have not been included in the current ERP system (FM Company B).

> I don't think they (i.e. in-house IT experts) have done enough during ERP maintenance. For instance, they don't have any detailed plans about when and how often redundant data of the system should be cleaned. They should really think about such issues in more details and plan ahead (PurS Company A).

It emerged from these statements that, IT staff of the case companies might often failed to think and analyse critically the assigned ERP tasks in either ERP implementation or exploitation. In fact, they may also lack experience for using critical thinking skills, or they may be poor professionals as discussed in section 8.4.2. As a consequence, these ERP tasks might often not be conducted by following a proper and rigorous approach.

Low uncertainty avoidance

Low uncertainty avoidance is another feature embedded in the Chinese culture (Hofstede, 1997). As discussed before, due to this cultural feature, Chinese managers are more tolerant of uncertainty and unclear information then their Western counterparts (Martinsons and Westwood, 1997). It was therefore expected that, Chinese managers may be less inclined to generate business forecasts and plans to predict an uncertain future (Martinsons and Hempel, 1998), and thus may underutilise the analytical functions of their ERP systems. However, the majority (78.6%) of the respondents to the questionnaire did not perceive this to be the case. The findings of the interviews also confirmed the questionnaire results. In particular, when asked whether the company would generate (e.g. sales and financial) forecasts and plans, all interviewees stated that this was an essential business activity that needed to be conducted on a regular basis in order to ensure efficient operation in their firms.

Curiously, the analysis of the interview data indicated a further ERP issue that could be caused by low uncertainty avoidance, that is, the reactive approach adopted by Chinese IT staff towards ERP problems. This issue was not identified at previous stages of this project. As stated by a staff in the production department of company A:

> As a daily user of the system, I actually identified many technical pitfalls of our installed ERP. However, our IT staff would rarely come to us and ask whether we experienced any technical problems about the system. Normally, what they will do is just wait...wait for us to tell them what has gone wrong. However, if the system pitfalls that I identified will not affect my own work too much, and also if I am too busy, I may not be bothered to see them...I don't think our IT staff knew these system pitfalls as they are not users of the system. They may only recognise these pitfalls until some serious problems have been caused (PS2 Company A).

As clearly shown in this quote, IT staff of this Chinese SOE would not proactively collect feedback from system users. They would generally wait for system users to approach them and tell them the system problems occurred. It is reasonable to claim that, such reactive approach could be a result of low uncertainty avoidance, which made both in-house IT staff and users feel tolerant of uncertainty and unclear information. It was obvious from the quote that, this behaviour may often lead to delay in identifying and solving ERP problems.

Collectivism

Under a collectivist culture, Chinese people often consider a group rather than an individual as a fundamental unit of political, social, and economic concerns (Hofstede, 1997). This cultural feature was not previously identified as important to ERP exploitation in this project. It however emerged from the interviews that, collectivism could actually be a significant and prominent ERP barrier in Chinese SOEs.

As introduced earlier, unlike a newly established SOE (e.g. company B), company A has over 60-year operational history. Although the firm was reformed in 2003, it still has a large amount of employees who have been working in the company for a few decades. It is evident that the phenomenon of collectivism would be particularly apparent in this type of SOE, as highlighted by the CEO of company A:

> A large amount of our employees have been working here for 30 years. So you can imagine that they would develop extremely strong relationships with each other after staying together for such a long time. Therefore, employees in this firm would have a strong perception on the groups that they belong to (CEO Company A).

It is evident that, because ERP is developed in the West which is characterised by a culture of individualism, it may often not fit in a collectivist culture. This fact was clearly pointed by the IT Manager of company A:

> After ERP was used, employees are required to communicate and interact with each other through computers more than by face-to-face. People are encouraged to do their work independently by sitting in front of the computer. Many of them thus feel that they have been isolated from their groups and friends. Moreover, in the past people in the same group could help each other to cover the mistakes being made. However, they will now not be able to do so under the transparent ERP environment. (ITM Company A).

This IT manager concluded that, such cultural misfit may "inevitably result in user resistance in accepting and using ERP in our firm. Therefore, it is essential for us to provide substantial ERP training to this type of employee".

Building business relationships based on personal guanxi.

It is widely acknowledged that, formal business contracts and legal agreements may play a less important role when doing business in China. Instead, personal *guanxi* or relationship networks may often present to be a more critical factor to ensure success in doing business there (Fan, 2002). As discussed before, personal *guanxi* networks are frequently used by Chinese managers to find business solutions and acquire additional resources for their companies (Fan, 2002; Lowe, 2003:12). Chinese leaders may also often utilise personal connections as the fundamental to establish and maintain inter-organisational relationships with business partners (Fan, 2002). It is however apparent that a business relationship, which is established based on personal connection and oral agreements rather than legitimate business contracts, can always be informal, insecure and unstable. In the ERP exploitation stage, user companies should strive to set up formal and stable business relationships with their system vendors or consultants. If such important inter-organisational relationship is built up based on personal *guanxi* of managers from both sides, it certainly presents to be a threat to long-term ERP exploitation success.

The majority (78.6%) of respondents however disagreed with that, establishment of business relationships between the firm and its business partners relied on personal relationships of people from both sites. The findings of the follow-up case study confirmed the questionnaire results. In particular, the IT managers of both case companies stressed that, as the implementation and maintenance of ERP concerned a large amount of investment, it was essential for them to sign up formal contract or legal service agreement with ERP system or service providers, in order to protect the benefits of both sides. Both IT managers recognised that lack of such a formal service agreement could inevitably lead to a set of maintenance risks (e.g. system or service provider denies to held legal responsibilities for maintenance mistakes being made). The occurrence of such risk events would result in system collapse and even business disasters. As a consequence, they concluded that a legal contract with system and service provider is a necessity for ERP implementation and maintenance. This is certainly a positive change in Chinese SOEs, as Chinese managers now seem to get better used to market-oriented rules and they tend to utilise legal weapons to protect the benefits of the firm rather than merely relying on personal connections and oral agreements as they did in the past.

Nevertheless, despite a formal and legal business contract will often be made, personal *guanxi* still seems to play an important role when building inter-organisational relationships between Chinese companies. Specifically, it was identified from the interviews that in the ERP implementation stage, Company B did not go through any formal vendor selection processes (e.g. conduct system requirement analysis and public bidding). Instead, the current system vendor was chosen because managers of both sites had good personal *guanxi*:

> We just selected ERP vendor A without comparing it with other system vendors...we also did not conduct any system requirement analysis to examine whether vendor A could satisfy our user needs. In fact, the decision of vendor selection was made by our previous CEO, as he had some friends working in vendor A (I-ITM Company B).

This type of decision could be extremely dangerous, as it might lead to an inappropriate system vendor to be selected and thus result in substantial ERP post-implementation problems. In fact, this was what company B finally found out:

> We did not know vendor A and their products too much at the beginning. But after the system went live, we just found out the installed ERP did not actually fit our needs. Vendor A is a famous ERP brand in China, but I feel that their ERP package did not address the special requirements that are unique to our manufacturing sector [...] and it is now too late for us to shift to a new vendor [...] If we go through the implementation process again, we would definitely choose an alternative and more appropriate system provider (I-ITM Company B).

It is obvious that, if company B selected the ERP provider through formal procedures rather than relying on personal connection, the problem mentioned in this statement could have been avoided. It also becomes apparent from this case that using personal *guanxi* to solve business problems may bring companies with immediate benefits, but can also raise substantial problems in the long-term.

Other predefined cultural barriers

There were another three cultural barriers identified in the original barrier ontology, namely High context communication, Unwilling to disclose problems and faults, and Trust personal common sense rather than system data. However, the majority of respondents to the questionnaire did not perceive these three predefined barriers as problems in their firms. The findings from the case study supported and confirmed the questionnaire results:

- *High context communication.* As discussed in previous chapters, social scientists (e.g. Hall, 1976) often state that high context communication is an issue embedded in the traditional Chinese culture. Martinsons and Westwood (1997) argue that high context communication makes use of MIS in Chinese organisations both difficult and undesirable. However, 81% respondents of the questionnaire did not perceive high context communication as a particular issue in their firms.

  This finding was supported by all interviewees, who stated that they would normally use direct and explicit form of communication at work in order to avoid unnecessary confusion. In fact, all interviewees pointed out that, because the most important data that they exchanged at work were actually numbers and figures (e.g. monthly sales amount), there was no need for them to use implicit form of communication under normal situation. Nevertheless, the interviewees highlighted that high context communication would be used when dealing with staff issues (e.g. deciding staff

promotions, handling employee mistakes, etc). It is however obvious that such human issues are not the concern of ERP systems, which focus mainly on processing operational data. In conclusion, both quantitative and qualitative findings showed that, high context communication was not an ERP exploitation barrier in SOEs. However, it is also possible that this barrier might be understated by managers, who might not be willing to disclose this internal issue to the researcher.

- *Unwilling to disclose problems and faults.* As discussed before, Chinese people were traditionally inclined to be reticent on the mistakes and faults that may be associated with them, in order to preserve *mianzi* (Shu, 2001). It was thus expected that, this could result in delays in reporting potential IS usage mistakes in Chinese firms. The majority (88.1%) of respondents of the questionnaire however did not perceive this to be the case.

  This questionnaire finding was further confirmed by the system users interviewed. When asked what they will do if they make an ERP usage mistake (e.g. input wrong data into the system but cannot correct it), all respondents stated they would report the problem immediately to IT staff who are responsible for ERP maintenance. These system users indicated they would not attempt to hide such ERP usage mistakes due to two reasons. Firstly, "any mistake like this will inevitably affect a set of following business processes. The longer the mistake is hid, the more serious the problem may be caused" (SS2 Company A). Secondly, "as ERP links all business processes together, one person's mistake can now be easily identified and recognised by the others. Instead of hiding the problem, it will be a better approach to report it and get it sorted as soon as possible" (PS1 Company B). It therefore became apparent that under the ERP environment, system users of SOEs seemed to be willing to disclose mistakes and faults associated with them. This issue thus did not prove to be an ERP barrier in these Chinese SOEs.

- *Trust personal common sense rather than system data.* Many scholars (e.g. Martinsons and Westwood, 1997; Zhang et al., 2005) state that, rather than analysing and using a large amount of data, Chinese managers are traditionally inclined to make decisions merely based on personal experience and common sense. As such, it was expected that Chinese managers may not trust and use the data

provided by ERPs (Reimers, 2002), and thus may underutilise the installed ERP system. However, the majority (71.4%) of respondents of the survey did not perceive this to be the case.

The findings from the interviews support the questionnaire result. In particular, all interviewees stressed that no one can make a proper decision without sufficient information in hand, and that valuable data and information are fundamental for them to make appropriate business decisions. Nevertheless, they also stated that personal common sense, which is led by personal experience, would also be valuable in the decision making process. In fact, there is no doubt that personal experience is important, and very often crucial, for an employee to play successfully in his/her role. It is also apparent that personal common sense, which is directly influenced by personal experience, would be important for decision making. CEOs of both companies concluded that, scientific data and personal common sense/experience are both essential and equally important for making appropriate business decisions in real practices.

Therefore, based on the quantitative and qualitative findings, it was evident that the above three cultural barriers are not particular problems for SOEs. These barriers are therefore not included in the final barrier ontology.

8.4.2 Organisational barriers

16 organisational barriers were found to be important to the case companies, as discussed below.

Business downturn

It is obvious that ERP maintenance and enhancement is closely related with the company's current operation. This fact was clearly pointed out by the IT manager of company A:

> Funds and resources that we can spend on ERP exploitation depend on the company's operation status and revenue. The better the company's performance, the more the top management will be willing to invest in ERP enhancement (ITM Company A).

Unfortunately, company A is currently experiencing a business downturn. As stated by the CEO of company A:

> As competition in the local market has become increasingly drastic, we are facing escalating pressure from our rivals. More importantly, after the company was reformed, we can no longer receive substantial support from the government. As a consequence, it is difficult for us to retain our competitive advantage in the market. We are actually facing a business downturn (CEO Company A).

It can be expected that company A would not be the only SOE that encounters such operational difficulties. Many other reformed SOEs, which have similar operational history as company A, may also find it difficult to adapt themselves to the new market environment. This was confirmed by the CEO of company A:

> Many other traditional SOEs, which have just been reformed recently, also found it difficult to adapt to the new business environment. As you know in the planning economic era, we don't need to worry about sales, and the government will help us to cover any losses we made. This however is not the case any more after the reform. We will still need to find a way to fit in with the new competitive environment (CEO Company A).

The IT manager of the firm went on to state that the current business downturn had resulted in a set of undesirable consequences to ERP exploitation:

> Faced with the current operation difficulties, our top managers tend to spend the majority of fund and resource on core business areas rather than on further ERP enhancement. As a result of insufficient fund, the ERP enhancement plan that we established would often not be executed (ITM Company A).

Inefficient collaboration between departments

It is widely acknowledged that ERP systems can help to break down departmental boundaries and encourage cross-functional integration and collaboration (Sia et al., 2002; Allen, 2005). However, Allen (2005) argues that, the technical data integration of different functional areas after using ERP does not mean the social integration of people within diverse functions. Evidence was found from the interviews to support Allen's argument.

In particular, a Financial Staff (FS1) of company B stated that, staff in the Purchasing Department would often input duplicated supplier records in ERP. This could cause a substantial problem to the financial work, that is, the number of supplier records that financial staff needed to deal with would be doubled and even tripled. When asked whether they recognised this problem, staff in the Purchasing Department responded:

> We knew this mistake would often happen. Because we are always very busy, when entering a new supplier record we may fail to check whether an existing record of this supplier has been stored in the system...also because our system cannot automatically detect duplicated records and give us related warnings, we would often enter duplicated supplier records into the system. It is true that we have not paid sufficient attention to this issue as such duplicated records will not affect our work too much, although this issue has significantly affected the financial department (...smile embarrassedly) (PurS Company B).

As clearly shown in this quote, staff in the Purchasing Department recognised the issue of duplicated supplier records and recognised the impact of this issue on the Financial Department. They however showed some indifference about the problems that resulted to the other departments, and failed to put a real effort to prevent this mistake from occurring again. From this exemplification it is clear that, although ERP could enable technical data integration of different functional areas, social conflicts of people within the different functional departments still seemed to exist in the case company. As a consequence, staff in the company seemed to worry only about the benefits of their own department and disregard the problems encountered by the other divisions. This clearly showed that collaboration between functional departments of this case company was inefficient. Such collaboration issue between functional divisions can have particularly significant impact under the ERP environment, as mistakes being made by one department would now have impact on the other related departments or business processes. More importantly, as the mistake may be made by another division, it is difficult for the divisions which have been affected to control and handle the situation. This fact was confirmed by the Financial Manager of company B:

> As these mistakes were made by staff in the Purchasing Department, I as the Financial Manager do not have the power and right to punish them. The only thing that I can do is to send complaints to the Purchasing Manager, but this doesn't seem to work (FM Company B).

It is however curious that the CEO of company B stated he did not recognise such collaboration problems in his company. This is probably why he disagreed in the

questionnaire that his company had collaboration issues between functional divisions. This fact further confirmed that the predefined organisational barriers were underestimated or hidden by respondents of the questionnaire due to a lack of awareness or even an unwillingness of managers to disclose internal problems to the researcher.

IS manager lacks ERP understanding and knowledge

There is no doubt that the role of IS manager or ERP champion is crucial to ensure long-term ERP success. It is however evident that the IS managers of both case companies do not have sufficient understanding and knowledge on IS and ERP. In particular, the analysis of the interview data indicated that, both IS managers did not fully recognise the strengths and pitfalls of the current ERP systems, and did not know how the current system could be further enhanced. In fact, such a lack of understanding is mainly caused by a lack of IS background and training:

> I was a programmer before getting promoted as the IT manager of the firm. So my background is concerned more with technical aspects rather than business aspects. My company has never sent me to any formal training which is designed specially for IS managers. I developed my knowledge about ERP and project management mainly from my ongoing work and reading at spare time (ITM Company A).

The Internal IT Manager of company B even stated that:

> I am actually the HR manager of the firm. Human resource management is the actual area that I am good at. However, the top management team now ask me to be responsible for the IS area as well. To be honest, I don't feel I have sufficient expertise and knowledge in IS and ERP, because I don't have a strong background and haven't done sufficient training in these areas (I-ITM Company B).

Due to a lack of ERP understanding and knowledge, both IT managers seemed to consider ERP maintenance merely as a technical task (e.g. server, network and hardware maintenance). They however failed to pay sufficient attention to some non-technical aspects which are often more crucial, e.g. conducting regular system review, establishing efficient ERP usage regulations, etc. Moreover, by further analysing the above quotes, it seems that there is a lack of top management support to ERP in the case companies. This explained why IT managers of the case companies were not sent to have extensive IS and ERP trainings.

IS manager has insufficient power

As IS managers are responsible for dealing with routine ERP usage, maintenance and enhancement problems, they must be assigned with sufficient power and authority to enable them to carry out these tasks smoothly. The IT managers of both companies however perceived that they had not been assigned with sufficient power to deal with routine ERP issues. In particular, the IT manager of company A stated that:

> As I have not been assigned with sufficient power, I always found it difficult to deal with user resistance and promote ERP usage and related business changes in the company. System users and even their departmental managers may not always be willing to cooperate and follow the ERP usage rules that I set up in advance (ITM Company A).

As discussed in section 8.4.1, this issue was mainly caused by the barrier of power centralisation in the case companies. In particular, as top managers hold very strong control on diverse organisational aspects, they may not always be willing to share a substantial part of this power to their subordinates (e.g. the IT manager). It is obvious that, when top management support and user involvement to ERP are also insufficient in the firm, "it will become a nightmare to IT managers as the situation will become totally out of their control" (ITM Company A).

Lack of in-house IT expert

In the questionnaire, a significant amount (31%) of respondents stated they did not have sufficient IT experts for ERP maintenance. The findings from the interviews confirmed that this lack of in-house IT expert was currently a crucial ERP exploitation barrier in the case companies. As stated by the IT manager of company A:

> We used to have 15 in-house IT staff, but now the number has been reduced to 3. I think insufficient salary is the main reason that makes people leave this firm. Also between 2000 and 2002, market demand for qualified IT experts had been very high. Many of our people left the firm at that time. As you know, our daily tasks do not just include ERP maintenance, but also cover a variety of IT-related issues, e.g. printers, network virus, Windows reinstallation, staff IT training, etc. We now often find it difficult to handle so many IT tasks by only three of us (ITM Company A).

As can be seen from this quote, insufficient salary and high market demand proved to be the main causes of insufficient in-house IT expert. In fact, and by analysing this statement more carefully, it becomes apparent that lack of top management support is also a further cause of this issue. In particular, it seemed that top management of this case company failed to make an effort to recruit additional IT staff to share the burden of the current in-house IT experts, probably because top managers "do not want to increase IT expenditure" (ITM Company A). As a result of insufficient IT expert, "IT and ERP problems that we encountered can often not be solved speedily, and thus affecting our working efficiency" (Purchasing Staff Company A).

Lack of knowledge management practices

It is widely acknowledged that, in-house IT experts will often be able to accumulate a large set of know-how and expertise through ERP implementation and post-implementation. As confirmed by the External IT Manager of company B:

> The process for implementing ERP is indeed an invaluable learning process for in-house IT staff. A junior IT staff may often become an IT expert after participating in the entire ERP implementation process, from which he/she will definitely develop a wide range of skills and expertise in e.g. project management, system requirement analysis, business process redesign, etc (E-ITM Company B).

It is therefore essential and important for user companies to capture such implicit knowledge and expertise from their IT experts in order for such knowledge to be shared effectively across the firm and with fellow IT staff. It is however a waste that no particular processes have been designed and used in the case companies to enable such knowledge capture and sharing to take place:

> The know-how and expertise that our IT staff have will only be stored in their own head. We will not normally write down and record such knowledge explicitly in a document...(why not?)...well, there is just no such practice in our company...and we are always busy, so no time to do so (IT Manager Company A).

It is evident that, due to a lack of proper knowledge management practice, "when IT experts left the firm, they would took away their ERP knowledge and expertise with them. If the remainder IT staff do not have the same level of skill and expertise, it can often result in difficulties and problems for ERP maintenance" (ITM Company A). It is

curious that, although the IT manager recognises the impact of this problem, nothing has been done to prevent the company from losing valuable ERP knowledge. This seemed to confirm the earlier argument that IT managers in the case companies did not have sufficient skills and knowledge to handle ERP-related issues.

Moreover, ERP know-how of IT experts is valuable, but ERP usage knowledge of system users is also important. It is obvious that experienced system users will often develop a substantial knowledge in operating the system. As exemplified by the Sales Staff of company B:

> Using the ERP system is actually a learning process. The more you use it, the better you get used to it. I used to search for sales contracts stored in ERP by using the Chinese names of the contracts, but the system could often not return the ones that I wanted. I now discover that, when searching for sales contracts, I should use contract numbers rather than contract names (SS Company B).

As shown in this quote, such a lesson learned by current system users may often help fellow ERP users to use the system more efficiently. In fact, this Sales Staff is "keen to write down some little tips for new users to teach them how to use the ERP system more effectively". However, the Sales Staff went on to state that "the company does not currently have any facilitates to let me store and share such information" (SS Company B). It is obvious that, if this sales staff leaves the firm, her 'little tips' will leave with her as well. It therefore proves to have a strong need for the case companies to become more aware of this organisational issue, and adopt certain knowledge management practises to capture the ERP expertise and knowledge from both their IT staff and system users.

Insufficient ERP post-implementation fund

Costs associated with ERP post-implementation are often very high. In particular, Ng et al (2002) state that "Annual maintenance costs approximate 25% of initial ERP implementation costs, and upgrade costs as much as 25-33% of the initial ERP implementation". Having sufficient fund to cover these costs was thus perceived by all interviewees as the fundamental factor to ensure long-term success in ERP maintenance and enhancement. However, the IT managers of both companies indicated that the company had not assigned sufficient fund to ERP post-implementation. In particular,

"the current ERP fund is only sufficient for us to conduct some basic maintenance tasks, but will not be enough for any further activities, e.g. functionality enhancement" (ITM Company A). The reason that resulted in insufficient ERP exploitation fund was highlighted by the External IT Manager of company B:

> Many top managers would consider ERP as a one-off investment. They may be willing to invest, said 1 million, in the ERP implementation project, but they will expect everything to be done perfectly and no further ERP cost will arise afterward. However, it is obvious that this will never be the case. When they are asked to invest continuously in ERP maintenance and enhancement, the top managers will often be reluctant to do so (E-ITM Company B).

This statement clearly indicated two important issues related to the top management in the case company. Firstly, top managers seemed to have insufficient understanding on ERP. As a consequence, they considered ERP as a one-off rather than a continuous investment. Secondly, top managers seemed to have short-term thinking regarding ERP adoption. As a result, they were willing to make short-term investment in ERP implementation, but were less inclined to assign fund to long-term ERP exploitation. In conclusion, insufficient ERP understanding and short-term thinking of top management proved to be the main causes of insufficient ERP exploitation fund. This conclusion was in fact confirmed by the IT manager of company A:

> Our CEO may only know ERP implementation is important, but it seems he does not recognise the long-term system maintenance is now the real challenge for us. I hope he can consider ERP usage and maintenance from the long term, and thus assign more fund to ERP exploitation (ITM Company A).

Inappropriate ERP training

Daily system users are responsible for daily operation (e.g. data entering and updating) of the ERP system, whilst managers are responsible for managing the users and monitoring their system usage. In other words, managers and daily users handle different ERP tasks, and thus should have different ERP training needs. It was therefore expected that managers and daily users should be trained differently. Curiously, the analysis of the interview data identified that the ERP training programs provided to managers were not separated from those provided to daily system users in the case companies. It can thus be argued a universal ERP training program may often not be

able to satisfy the diverse training needs of both managers and system users in different functional areas. This argument was supported by the Financial Staff of company A:

> I don't know why our managers were provided with the same ERP training as ours. In fact, I think they are supposed to receive more intensive training, which is designed specifically for them. Managers are not daily users of the system, but they are responsible for managing, selecting and arranging suitable system users to get the work done. They should thus receive extra training on management aspects, rather than only having technical training which is designed mainly for system users (FS Company A).

On the other hand, it was evident that both case companies only provided ERP training to employees in the system implementation cycle. No further training however had been organised and provided afterward. The Internal IT manager of company B explained that:

> We have been using this system since 2006. Our users have already got used to it. Besides, we have not added any new functions to ERP since it went live. So I consider there is no need to provide further ERP training to our users (I-ITM Company B).

This IT manager obviously overlooked a risk event that often occurred in her firm, that is, user turnover. It was evident that, the staff turnover rate of company B was relatively high. The company however failed to provide necessary ERP training to new staff recruited after the ERP implementation stage. According to a Financial Staff and the Sales Manager of company B, they joint the firm in 2007 when ERP had already been implemented, and the company had not offered them any formal ERP training ever since. As a consequence, they either "find it uncomfortable to use the current ERP system" (FS1 Company B) or "do not know what operational and analytical functions this system have" (SM Company B).

In conclusion, it was evident that the ERP training provided by both case companies was neither efficient nor sufficient. This barrier resulted in ERP usage difficulties at both operational and managerial level in the case companies.

Lack of proper ERP exploitation plan

In China, SOEs managers are often accused of spending too little efforts on establishing clear and detailed development plans and strategies (Xie, 2005). It was thus expected

that Chinese SOEs may often lack an explicit IS/ERP plan to guide ERP maintenance and enhancement in the long-term. 59% respondents of the questionnaire however did not consider their firms lacked an explicit ERP development plan. Nevertheless, the findings of the interviews showed that this barrier might have been underestimated or hidden by respondents in the survey. In particular, the IT manager of company A stated in the questionnaire that their firm had an explicit ERP plan. When asked about contents of the ERP plan in the interview, the IT manager indicated that:

> The ERP plan specifies the fund that will be spent on ERP maintenance each year, and some additional ERP functions that we think will be useful and may purchase in the future (ITM Company A).

It was however obvious from this statement that, the ERP plan of company A did not contain a detailed review and analysis of current system functions and user needs. Moreover, although this ERP plan recorded "some potential ERP functions" that might be purchased by the firm, it did not seem to contain any specific proposals to make this happen. Overall, it proved that the current ERP plan of company A was neither explicit nor detailed. It therefore seemed that the IT manager of this company did not have a sufficient knowledge and understanding on ERP/IS plan. In fact, insufficient ERP knowledge proved to be the main cause that resulted in a lack of proper ERP plan in the case companies, as confirmed by the Internal IT Manager of company B:

> We do not have a sufficient understanding about ERP plans, and do not know how a proper ERP plan can be established. In fact, we are not sure what benefits we can receive from this plan, and it seems to me that this plan will be difficult and complicated to establish. So we prefer leaving it (I-ITM Company B).

It clearly emerged from the interviews that, when a proper ERP plan was missing, both case companies lacked consistent and systematic guidelines to lead their ERP maintenance and enhancement. As a consequence, the implemented ERP systems of these companies were maintained by following a disorganised and inefficient approach:

> I don't think we have a plan to specify when and how often system data should be purged. Our IT staff just clean the data whenever they have time. If they don't do this on time, the system speed will become increasingly slow, and all system users will be suffered (PS2 Company A).

Lack of regular system review and evaluation

User requirements of a company may be constantly changed under highly dynamic and competitive market environment conditions. The implemented ERP system should therefore be continuously reviewed and enhanced in the post-implementation phase in order to meet new user requirements in the long-term. However, interviewees of both companies stated that no system review or evaluation had been conducted in the company since ERP was implemented.

> I can expect that it may be beneficial for us to conduct a system review regularly. However, we currently do not have sufficient IT experts to undertake this task. Considering the cost of human resource in the short-term, I will not try to recruit new IT staff just for conducting system review (CEO Company A).

This statement clearly indicated that lack of IT experts is a substantial barrier that prevented user companies from conducting regular system review and evaluation. The statement also shows that, top managers of the firm may often have short-term thinking, and thus may be reluctant to recruit new IT experts to fill the current knowledge gaps and to conduct review tasks. In fact, this short-term thinking of top management may also blind them to the long-term benefits of performing regular system reviews. Moreover, it is evident that lack of regular system review may also be the result of the Chinese cultural feature of low uncertainty avoidance. As discussed in section 8.4.1 Chinese managers are traditionally more tolerant of uncertainty and unclear information. As a consequence, they may often fail to adopt a proactive and systematic approach (e.g. regular system review) to detect current ERP pitfalls and identify emerging user requirements at an early stage. Lack of regular system review would inevitably result in delay in identifying and solving ERP-related problems in Chinese firms.

Lack of ERP usage regulations

It is obvious that system users may not always have sufficient self-discipline to use and operate the ERP system earnestly. It is therefore important for user companies to establish rigorous ERP norms to regularise ERP usage within the firm:

> A set of ERP usage regulations must have been set up before the system went live. These regulations should specify what consequences users will take for inappropriate and irregular

> system usage. Very often, IT and IS may not be of interest to operational staff, e.g. sales staff who may only be interested in sales and marketing. Therefore, they may not always use the ERP system earnestly and carefully. If users input incorrect data into the system due to whatever reasons, it will raise immediate impact on all follow-up processes. It is therefore important to establish valid ERP rules to regularise users' activities (External IT Manager Company B).

Despite a clear understanding on this issue, it was evident that both companies had not set up sufficient ERP regulations to restrict user activities. Further analysis of the interviews conducted indicates two fundamental reasons for difficulties in establishing ERP norms. On the one hand, top management of the company has not given substantial support and attention to this issue. On the other hand, IT managers do not have sufficient power and authority in the firm. As a result, it was very difficult for IT managers to "set up meaningful and valid ERP regulations that would be accepted, and more importantly followed, by employees" (ITM Company A). The external IT manager of company B stressed that: "lack of valid ERP rules can often result in irregular ERP usage in the firm, which will inevitably lead to poor data quality and even collapse of the entire implemented system" (E-ITM Company B).

'Iron rice bowl' issue in reformed SOEs

As identified in the PEST analysis, SOEs in the planning economic era were assigned with many social obligations, e.g. to provide lifelong employment for urban citizens. A career in traditional SOEs was therefore highly secure, and thus is colloquially called an 'iron rice bowl'. After the economic and SOE reform, SOEs are no longer required to offer lifelong employment to workers. However, because a large amount of employees in SOEs have been working in the firm for decades, they still hold an 'iron rice bowl':

> In the past we were required to provide lifelong employment to workers. As a consequence, a large amount of our employees have been working here for a few decades. This now creates a big problem for our company. That is, we cannot dismiss these old employees. If we dismiss them before their retirement, we will need to pay them a huge amount of termination fees (i.e. monthly wage * length of employment) according to the country's Labour Law. We certainly cannot afford this cost. As a consequence, we will not attempt to dismiss this type of staff, who therefore still holds an 'iron rice bowl' (CEO Company A).

A set of problems, which might affect ERP adoption and usage, clearly emerged from this statement. Specifically, the company has many elder workers, who may often be

"low-educated and less inclined to learn new skills and use new technologies" (FS Company A). This presents a potential obstacle for encouraging ERP usage and related business changes. More importantly, for these old and low-educated workers, the company is not able to discharge them due to potential dismissal fees that may arise. When workers recognise this fact (i.e. no potential job loss), they may often become indifferent to their jobs. Such indifference may often represent a further obstacle to ERP usage, as confirmed by a Production Staff in company A:

> Reformed SOEs are no longer obligated to provide lifetime employment to their employees. However, because I have been working here for 25 years, I am protected by the Labour Law...I still have an 'iron rice bowl'. I know that top managers will not attempt to discharge workers like me, because they cannot afford the high termination fee. So no matter I have good or bad performance, I don't need to worry about losing my job. I think this explains why it is so difficult to promote ERP usage in our company. I recognise that many old employees in the firm just don't care about their job, so they will not care about ERP either (PS1 Company A).

Low-skilled and elder staff

The traditional 'iron rice bowl' issue of SOEs results in that this type of company often has a large amount of low-skilled and elder staff. It is obvious that low-skilled and elder workers will often have low incentives to learn new skills and adapt to a new working environment. This factor presented an important barrier for continuous ERP usage and exploitation in user companies:

> Our firm is a 60 year old SOE. A large amount of workers in the company are elder and low-educated. If you expect us to be keen to learn new knowledge and strive for a better career future, this is certainly impossible. Many of us don't know how to use computer, and we don't want to learn it as well to be honest. So, how can you expect us to learn, accept and use ERP? (Financial Staff Company A).

The IT manager of the company concluded that:

> These elder workers present to be a big barrier for promoting ERP usage and related business changes in our firm, because they are indifferent to ERP usage, and are reluctant to learn and use new technologies (ITM Company A).

This barrier therefore must be addressed and overcome in order to ensure success of ERP usage and exploitation.

Lack of actual support from top management

In the questionnaire, the respondents of both companies strongly disagreed with the statement which said top management support to ERP post-implementation was insufficient in the firm. In the interviews, the participants also stated that top management did provide sufficient support to ERP. Curiously, when asked what kind of support top managers had actually offered, none of them could give any specific examples. Most interviewees just gave a response like this:

> Well, firstly they agreed to implement ERP...secondly, they have provided fund to implement and maintain the system...[Interviewer: have they got involved in specific ERP tasks, e.g. setting ERP usage norms?] I don't think so. Actually I think, probably because the system has now been used for a while, there may be no need for top management to do anything extra (FM Company B).

It clearly emerged from this statement that, top management seemed to provide only some basic support (e.g. funds) to ERP adoption, but they did not seem to be truly involved in ERP-related tasks. In fact, top managers in China may often fail to make an actual contribution to either ERP implementation or exploitation, as so cogently stated by the External IT Manager of Company B:

> In China, top managers often know ERP is an important and useful tool, but they actually do not have an in-depth understanding about it. When talking about ERP adoption and usage, all top managers will say it is a good thing, but they then just ask their subordinates to handle and follow these ERP tasks. They all stress the importance of ERP, but they will rarely get involved in it. I think this kind of verbal support is indeed meaningless. In my understanding, 'support' means some substantial involvement and contribution, but not just some verbal commitments (E-ITM Company B).

By analysing these two quotes more carefully, it is evident that the majority of interviewees do not have a clear understanding about what kind of support top managers are supposed to provide. As a consequence, they failed to recognise the fact that top management support and involvement to ERP exploitation was actually insufficient. It is however also possible that, participants of the research may not be willing to say something in detriment of their top managers in order to avoid potential personal risks. In any case, this finding proves that the ERP barrier regarding insufficient top

management support may have been underestimated by many respondents in both the questionnaire and interviews.

Moreover, further analysis of the interviews conducted indicates three fundamental reasons for lack of actual top management support. Firstly, and as already mentioned, top managers often have insufficient understanding and knowledge about ERP. As a consequence, "they do not know what they should do exactly to support ERP adoption and usage" (E-ITM Company B). Secondly, top managers may "not be willing to make long-term commitment to ERP exploitation due to short-term thinking" (E-ITM Company B). Finally, there may be "some internal conflicts within the top management team regarding whether to continuously invest in ERP" (ITM Company A). Due to these three reasons, top management may often fail to provide actual support to ERP post-implementation, which in turn results in a set of other crucial ERP barriers as discussed in this section, e.g. lack of ERP fund, lack of system review, lack of ERP regulations, lack of ERP plan, low user involvement, etc.

Short-term thinking

Short-term thinking of top management has been frequently reported (e.g. Yuan and Ma, 2005; Zhang, 2004) as an issue in Chinese firms. In fact, this short-term thinking may often be caused by the current economic pressure and the very hard business environments, as cogently stated by the CEO of company A:

> As the CEO of the company, the things that I care most are how much sales we are going to make this month, and whether all departments can meet the annual targets as promised to the board of directors. I do not have time to think about how the company will be in the next 5 years. But I just need to make sure the company can still survive in the market under my governance in the rest 12 months time (CEO Company A).

It is obvious that, ERP post-implementation, which is a long-term endeavour, requires long-term commitment of management. As discussed earlier, the short-term thinking of top management would result in a set of ERP exploitation barriers in the case companies, e.g. insufficient top management support to ERP, lack of system review, and insufficient ERP post-implementation fund, etc.

Low user involvement

As discussed above, the analysis of the interview data indicated that users of the case companies may often had low involvement in using, maintaining and enhancing the ERP system. It is obvious that, in comparison to new employees, elder and low-educated staff in Chinese SOEs would be less inclined to get involved in the use of ERP. In fact, and as discussed above, low user involvement in the case companies was also the result of a variety of other ERP barriers, e.g. the cultural feature of collectivism, insufficient ERP training, lack of actual support from top management, lack of strict ERP usage norms, and the 'iron rice bowl' issue, etc. As a result of low user involvement, IT managers of both case companies often experienced difficulties in encouraging ERP usage, promoting related business changes, and executing ERP regulations in the firm.

Fear of job and power loss

Fear of job and power loss was expected as a barrier to ERP exploitation in SOEs. However, 85.7% respondents of the questionnaire perceived that employees in their firms would not be afraid of losing job and power after ERP was used.

This finding was confirmed by interviewees in the case companies. In particular, as discussed earlier, due to the issue of 'iron rice bowl', top managers of Chinese SOEs would often be reluctant to dismiss elder staff, in order to avoid paying potential dismissal fees. As a consequence, even if elder and low-skilled staff became increasingly redundant after ERP had been implemented, they "do not need to be afraid of losing jobs" (Purchasing Staff Company A). On the other hand, both CEOs and departmental managers in the case companies stated that the power that they held in the firm "depended on their job positions" (CEO Company A). As such, they perceived that "the use of ERP would not affect their power in the company" (Purchasing Manager Company B).

In sum, both quantitative and qualitative findings support that 'fear of job and power loss' was not a particular problem to ERP exploitation in SOEs. As a consequence, this barrier was not included in the final barrier ontology.

8.4.3 System barriers

The analysis of the interview data identified a total of 10 system barriers that are crucial to the case companies, as presented and discussed below.

High enhancement and reconfiguration cost

In order to enable the installed system to maintain high efficiency, it is often necessary for user companies to purchase add-ons or further components to enhance ERP:

> The process of using the ERP system is also the process of optimising it. User requirements are constantly changing as the company continuously develops. As a consequence, the implemented system should be enhanced and modified accordingly (Purchasing Manager Company B).

Nonetheless, because ERP systems are potentially complicated and inflexible, the cost for ERP add-ons can be very high and thus may be unaffordable to many user companies. A significant amount (24%) of respondents in the questionnaire perceived this to be true. High enhancement cost thus proved to be a barrier that would prevent user companies from continuously improving the implemented system. This finding was further confirmed through the interviews. In particular, the external IT manager of company B highlighted that:

> It is always difficult to customise and modify the ERP system, of which the system infrastructure is very complicated. Especially after the system was implemented, cost for further modifying or reconfiguring the existing system would be very high. Very often, the cost for enhancing the existing system would be equal to 50% or more of the system implementation cost (E-ITM Company B).

High ERP enhancement cost presented a crucial factor that "prevented top managers from making further investment in improving the implemented ERP system" (CEO Company A). As a consequence, "the implemented ERP system may not be continuously modified, and thus may gradually become less efficient to support user needs" (ITM Company A).

System inflexibility

ERP systems are complicated IS packages that are traditionally difficult to customise and modify. System inflexibility is often identified as a problem in successful introduction of ERP in companies (Namjae and Kiho, 2003). A significant amount 33.3% (14) of respondents agreed that their ERP system could not be flexibly customised or reconfigured according to specific user requirements. This finding was further supported by the interviewees:

> Once the ERP system went live, the space and possibility for further modifying it became very limited. In fact, sometimes it is impossible to make certain changes to the implemented ERP system. If user companies attempt to enhance the implemented ERP regardless current system limitations, it may often damage the system infrastructure and thus result in system collapse (E-ITM Company B).

It is however apparent that, "as a long-term business tool, an ERP system will never remain unchanged after it goes live" (E-ITM Company B). Nevertheless, due to system inflexibility the implemented ERP may not always be properly modified and enhanced to meet emergent user needs in the post-implementation phase. This problem can often "reduce system efficiency and thus impact user satisfaction" (ITM Company A).

Integration difficulty caused by system incompatibility

ERP systems are often criticised for having low compatibility with other IS applications (Namjae and Kiho, 2003). Low system compatibility is the main barrier that can prevent user companies from integrating ERP with legacy or newly installed IS applications. A significant amount (35.7%) of respondents in the questionnaire perceived this to be the case. Respondents of the interviews supported this finding by further stating that:

> It is always difficult to integrate ERP with other ISs. This is actually a very common IS issue. As diverse IS packages are often developed by using different system infrastructures and technologies, they may not often be compatible with each other (E-ITM Company B).

Nevertheless, the IT manager of company A pointed out that: "with today's advanced information technologies, e.g. data warehouse, the probability for integrated ERP with

other IS has been highly increased" (ITM Company A). The external IT manager of company B however argued that:

> Nowadays, there are many technologies and approaches can be used to facilitate integration between ERP and other ISs. However, such integration can merely enable simple data exchange between the two systems. In other words, the two integrated system can rarely achieve real-time information sharing. In fact, it is often infeasible to integrate ERP with other ISs, because the cost for modifying both systems to enable data exchange between them would be very high (E-ITM Company B).

It clearly emerged from this quote that, despite advanced modern information technologies, it is still difficult and often unpractical for user companies to achieve seamless integration between ERP and other ISs. In fact, the potential high cost and technical difficulty may often prevent user companies from integrating the existing ERP system with other ISs, as further stated by the internal IT manager of company B:

> We will soon implement a new PDM system in the company. We recognise that, if we integrate our ERP with the new PDM, it will enable us to maintain high consistency of data stored in both systems. However, considering potential technical difficulties and cost, we are still reluctant to do so (I-ITM Company B).

Deficient system design

A significant amount (33.3%) of the respondents of the questionnaire stated that design of the current ERP system was deficient. Exemplifications were found from the interviews to support this finding:

> Our ERP system is too complicated and lacks flexibility. For instance, when we redesigned a specific job position, we need to modify the entire organisation chart contained in ERP. The system will not allow us to jump over unnecessary data to modify merely the information related to this specific job post. In other words, we will now need to go through many unnecessary processes and changes in this circumstance (Production Manager Company A).

> The ERP system is difficult and inflexible to operate. We often need to perform many unnecessary procedures and operation in the system before reaching the relevant page for data entry (SS2 Company A).

> More than 20 functions are shown in the system interface, but only 10 of these functions have been actually used by us. In other words, there are many unnecessary and unused functions

> displayed in our ERP system, and therefore making the system look very complicated (SS Company B).

It clearly emerged from these quotes that, the design of the implemented ERP systems in the case companies was both inflexible and over-complicated. The analysis of the interview data indicated a main reason for such system design deficiencies. That is, both companies did not complete a detailed user requirement analysis at the implementation phase. As a consequence, they merely purchased diverse standard ERP modules from the system vendor. Both companies however failed to refine and customise these ERP modules according to user needs. As a result, the design of the implemented system was over-complicated and deficient. Deficient system design can often result in "unnecessary usage troubles and difficulties for daily system users" (SS1 Company A).

Lack of vendor support

Insufficient support services from system vendors is a common barrier to the use of IS in companies (Namjae and Kiho, 2003; Wright and Donaldson, 2002). A significant amount (38.1%) of respondents of the questionnaire stated that supports and after-sale services provided by their system vendors were insufficient. All respondents of the interviews perceived this to be the case. In particular, the IT manager of company A stressed that:

> Vendor support had been insufficient since ERP implementation. Our ERP system vendor sent only one consultant to assist us to conduct the implementation project. This consultant would only come to our site once per week. As such, any urgent ERP problems that we encountered could often not be solved on time. Once the implementation project finished, any further support that we can receive from the vendor depends on the amount of maintenance fee that we paid. However, as we were dissatisfied with the support provided by the vendor in ERP implementation, we would not subscribe any maintenance service from them in post-implementation. As such, we did not receive any further support from them (ITM Company A).

As clearly shown in this statement, it was apparent that the service fee was an essential factor that affects the quantity and quality of vendor support in ERP post-implementation. It is evident that, the more the service fee paid to system vendors, the better the support received from them. It is however obvious that, user companies may often not be able to afford the high maintenance fees required by system vendors in the

long-term, and thus cannot receive necessary support from their ERP vendors. Lack of vendor support may often result in "delay in solving ERP-related problems and even system disasters, especially when the user company lacks in-house IT experts to handle ERP maintenance tasks" (ITM Company A).

Lack of third-party consultant support

Third-party consultant often plays a crucial role to enable success in introducing and maintaining IS (Bloomfield and Danieli, 1995). However, as China's consulting industry is still at the early development stage, it is often difficult for Chinese firms to recruit highly qualified consultants who can provide client companies with critical advices (Ma et al., 2003). A substantial amount (23.8%) of respondents in the questionnaire agreed that, third-party consultants they recruited had insufficient experience and skills to provide them with critical support. This finding was supported by the interviewees:

> Our firm used to recruit third-party consultants. However, I don't think they have sufficient knowledge and experiences to give us significant advices on either technical or management issues (ITM Company A).

> We have outsourced our ERP maintenance task to an IT consulting firm. I think the quality of consultants sent by this IT firm varied significantly. A few senior consultants of this firm are very high-skilled and experienced, whereas their fellow IT engineers are relatively low-qualified (I-ITM Company B).

In fact, user companies may often not be able to receive sufficient support from third party consultants, due to diverse external and internal reasons. From the external side, IT consulting firms may often not have sufficient high-qualified consultants due to the high market demand of this type of professional. As a result, consultants being sent to client companies may be "relatively low-qualified and unhelpful" (ITM Company A). From the internal side, Chinese top managers may often "lack sufficient understanding about the role and importance of third-party consultants, and thus be reluctant to assign fund to recruit high-qualified consultants" (E-ITM Company B). Lack of proper support from third-party consultant can lead to a set of consequences to ERP exploitation, as so comprehensively stated by the IT manager of company A:

> A good IT consultant will often have in-depth knowledge and expertise on diverse IS aspects. They can therefore help you to predict and identify potential IS problems in advance. This type of advice is invaluable for ERP implementation and exploitation. However, a low-qualified IT consultant will often not be able to provide you with critical advices, but may even lead you to make wrong IS decisions (ITM Company A).

Therefore, user companies should attempt to recruit and retain highly qualified system consultants, who can facilitate their long-term success in ERP post-implementation.

Slow system speed

A significant amount (26.2%) of respondents in the questionnaire stated that their ERP system had slow response time. Respondents of the interviews also perceived this to be the case in their firms. The external IT manager of company B highlighted a comprehensive set of reasons that could cause slow system response time:

> It is obvious that, the most common reason that leads to slow system speed is poor data quality. Very often, redundant and duplicated data stored in ERP may not be purged properly by IT staff. A large amount of inappropriate data will inevitably slow down the system. Network issues are also common problems that can affect system speed. Due to Internet virus or inappropriate network usage, system speed will often become slow. In addition, inefficient hardware is also the main reason for slow system speed. It is apparent that, without the support of efficient hardware, e.g. server, PC processor, etc, the implemented ERP will not be run efficiently (E-ITM Company B).

Slow system response time can inevitably affect "working efficiency of system users" (Sales Staff Company B) and thus "result in user resistance" (Purchasing Staff Company B). The financial staff of company A reinforced that "slow system speed can be a particularly irritating issue when everyone gets very busy at the end of each month".

Poor data quality

It is widely acknowledged that ERP systems require at least 98% data accuracy in order to work efficiently. Data quality is thus a crucial factor to successful introduction of ISs in companies (Wright and Donaldson, 2002; Sherer and Alter, 2004). It is however obvious that, it may often be a difficult task to maintain high data quality during system

post-implementation. Poor data quality was thus expected as a critical barrier to ERP exploitation.

Nevertheless, only 11.9% respondents of the questionnaire perceived that data in the current ERP system had poor quality (e.g. inaccurate, duplicated, or incomplete, etc). Evidence however was found from the interviews to prove that, this system barrier may have been underestimated by respondents in the questionnaire. In particular, when asked about the current data quality of ERP in the questionnaire and in the interview, the IT manager of company A stated that "data quality of our ERP system is good". Nevertheless, when asked the same question, other interviewees in the same company indicated that they would often experience incomplete and inaccurate data in their ERP. This clearly pointed to the fact that, the IT manager of this company did not have a clear understanding about the current data quality issues existing in ERP, probably due to a lack of regular system review as discussed earlier. As a consequence, this IT manager undervalued these data issues in both the questionnaire and the interview.

Further analysis of the interviews conducted identified a comprehensive set of reasons that could lead to poor data quality in user companies. Firstly, "duplicated and inaccurate data may often be entered to the ERP system due to user negligence" (FS2 Company B). Evidence from the interviews showed that, the probability of occurrence of this risk event can be significantly increased due to "lack of or inappropriate execution of ERP usage rules" (E-ITM Company B). Secondly, inefficient system design presented to be a further cause for poor data quality. In particular, inappropriate data may often be entered to ERP when "the system lacks the capability to detect automatically problematic data, e.g. duplicated data records, invalid data with wrong format, etc" (ITM Company A). Thirdly, when data access rights are assigned to inappropriate users, it can often cause data distortion. In particular, the external IT manager of company B stressed that "when users are allocated with inappropriate data access rights, they may enter some data that they should not enter, or delete some data that they should not delete. This can lead to a huge data quality problem" (E-ITM Company B). Last but not least, IT staff should also be responsible for any data quality issues occurred. In fact, system maintenance staff are supposed to purge and clean system data regularly, and therefore ensuring high data quality of ERP. The interviewees of both companies however pointed out that data cleaning tasks would often not be conducted regularly and properly in the firm.

Poor data quality will inevitably result in a set of significant impacts on ERP usage at both the operational and managerial level. At the operational level, "a large amount of duplicated and irrelevant data will slow down system speed, which will impact working efficiency of daily system users" (SS Company B). More importantly, "as the firm has now been integrated by ERP, one piece of wrong data may affect the entire company's operation" (FS2 Company B). At the managerial level, "inappropriate and invalid data will lead managers to make incorrect business decisions, which can cause business disasters" (Purchasing Manager of Company B). Overall, "data quality problems can increase user resistance, reduce user acceptance, and even lead to system collapse" (E-ITM Company B).

Misfits between system functions and user needs

System users may neither accept nor use an IS that cannot satisfy their needs. 69% respondents of the questionnaire perceived that functions of the current ERP systems met their requirements. However, it proved in the interviews that, this system barrier may also have been underestimated by the questionnaire respondents. In particular, although the IT managers of both case companies stated in the questionnaire that the current ERP met their user needs, evidence from the interviews indicated that there were many misfits between ERP functions and user requirements in these firms, as clearly shown in the following exemplifications:

> Each supplier record in ERP contains a unique ID code, supplier name and contact details, etc. Our ERP system can allow us to search supplier records by using only the ID codes but not supplier names. It is however obvious that, it would be easy for us to remember the name of a supplier, but there is no chance for us to remember the 10-letter ID code of each supplier record. I don't know why the system cannot meet this simple user need, but this problem has certainly caused a lot of troubles to us (Purchasing Staff Company A).

> As a sales manager, I am keen to see a comprehensive set of data related to supplier details, material prices, production cost, etc. I hope all these data can be retrieved and then displayed at the same place, and then I can conduct some statistical analysis and comparison on them by using ERP, so then I can decide the sales prices for our new products. I know this should not have been a very tough requirement, as many ERPs nowadays will offer such functions, but our ERP did not meet this requirement (Sales Manager Company B).

As exemplified and discussed earlier, the IT managers of both case companies had insufficient knowledge and expertise on ERP. They therefore failed to conduct a detailed user requirement analysis in the implementation stage. As a consequence, and as discussed earlier, both companies just simply purchased a set of standard ERP modules from their system vendors without making necessary customisations and reconfigurations on these ERP modules. This approach resulted in many misfits between the system and user needs, which caused usage problems in post-implementation.

In addition, by further analysing the interviews conducted, it became apparent that lack of regular system evaluation was also the main cause for having misfits between the ERP system and user needs in the case companies. In particular, because these firms would not conduct system reviews regularly, it was difficult for in-house IT staff to identify current system pitfalls and emergent user requirements in ERP exploitation. As a result, current system misfits were not modified properly, and the implemented ERP were also not continuously enhanced to meet new user needs in the case companies.

Lack of proper user requirement analysis

Lack of proper user requirement analysis emerged from the interviews as a crucial ERP exploitation barrier to the case companies. Requirement analysis is a tool that can be used to help the ERP implementation team to capture system needs from the perspectives of all the stakeholders. The ERP team can therefore base their selection of the new system on the results of this analysis. Furthermore, customisation can also be guided by requirement specifications. As a consequence, requirement analysis is often the first and one of the most significant tasks to be carried out in ERP implementation.

However, both case companies failed to conduct a detailed user requirement analysis in ERP implementation. When asked how the company identified user needs in the implementation stage, the IT manager of company A stated that "we have conducted some organisational symposiums and seminars with staff across the company to capture and understand their needs and opinions about ERP" (ITM Company A). It was however obvious that, "it is entirely impossible to capture the perspective of each important stakeholder through such general, simple and organisation-wide discussions" (FS1 Company A). It is in fact apparent that, this firm had adopted an inappropriate

approach in doing their IS requirement analysis, which should have involved a much wider set of systematic research and analytical activities. As a consequence of this inappropriate approach, "many important user needs had not been identified in implementation...the ERP system was therefore not properly designed and customised to satisfy our daily usage requirements" (PS2 Company A).

Indeed, the absence of an initial requirement analysis will also lead to maintenance difficulties, as highlighted by the external IT manager of company B:

> I am only involved in ERP maintenance in this firm, but not in ERP implementation. Therefore, it is important for me to get the results of the requirement analysis conducted in implementation stage. I can therefore identify which user needs have been satisfied by the current system, and which ones have not, and thus determine how the implemented ERP should be improved. The company however does not have such a document...in fact, no detailed requirement analysis was carried out in ERP implementation in this firm (E-ITM Company B).

In addition, user requirement analysis should not just have been performed in ERP implementation, but should also be conducted in post-implementation. In particular, user companies should regularly carry out a set of analytical activities to identity and capture new user needs emerging in post-implementation. The implemented ERP system can therefore be continuously enhanced to satisfy these emergent user requirements. Nevertheless, both case companies have not performed such requirement analysis during ERP exploitation. As a consequence, many misfits were found between ERP and user needs in the case companies, as discussed earlier.

8.4.4 Final ontology of the identified ERP barriers

The 25 ERP barriers contained in the original barrier ontology (as presented in chapter six) were examined in the questionnaire and subsequently further explored in the multi-case study. Findings from the questionnaire as well as the follow-up interviews proved that 4 original barriers could not be confirmed as particular ERP problems for SOEs:

- High context communication;
- Unwilling to disclose problems and faults;
- Trust personal common sense rather than system data;
- Fear of job and power loss.

These 4 original barriers were therefore not included in the final barrier ontology.

On the other hand, the predefined barrier 'low-qualify and ill-trained staff' was found to be more appropriate to be divided into two barriers, namely 'low-skilled and elder staff' and 'insufficient ERP training'. Additionally, the analysis of the interview data indicated another 9 ERP barriers that were not identified at previous stages of this research project. It was felt that these 9 barriers identified from the two case companies would be transferable to the other Chinese SOEs studied, considering the similar context that these companies engaged with. These barriers were thus added to the final ontology:

- User resistance caused by collectivism;
- Business downturn;
- IS manager lacks ERP understanding and knowledge;
- IS manager has insufficient power;
- Lack of knowledge management practices;
- Lack of regular system review;
- Lack of ERP usage norms;
- 'Iron rice bowl' issue in SOEs;
- Lack of proper user requirement analysis.

Consequently, by analysing, comparing and synthesising the findings of the questionnaire survey and the multi-case study, the researcher revised and extended the original barrier ontology derived from the critical literature review, and identified a set of 31 important ERP barriers that would prevent SOEs from achieving long-term success in ERP exploitation. A final ontology is developed to highlight these barriers, as presented below.

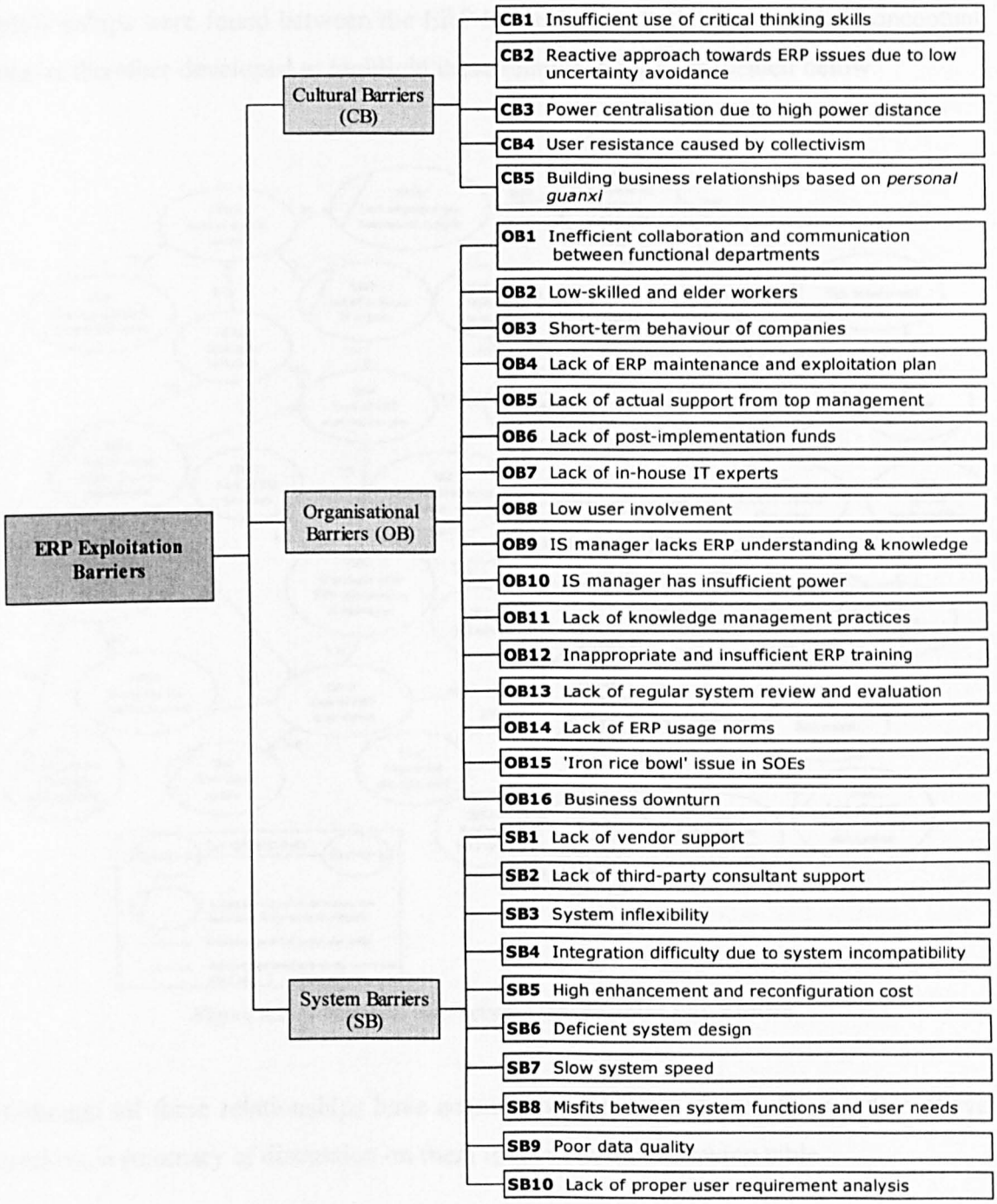

Figure 8.1: Final ontology of the identified ERP barriers

8.4.5 Relationships of the identified ERP barriers

A correlation map was developed in chapter seven (Figure 7.2) based on the questionnaire findings to highlight the correlations between the barriers identified. These correlations were further explored and validated in the multi-case study. Moreover, additional relationships between the ERP barriers were identified from the interviews conducted. By synthesising the quantitative findings of the questionnaire and qualitative findings from the follow-up case study, a comprehensive set of 48

relationships were found between the ERP barriers identified. An extended conceptual map is therefore developed to highlight these relationships, as presented below.

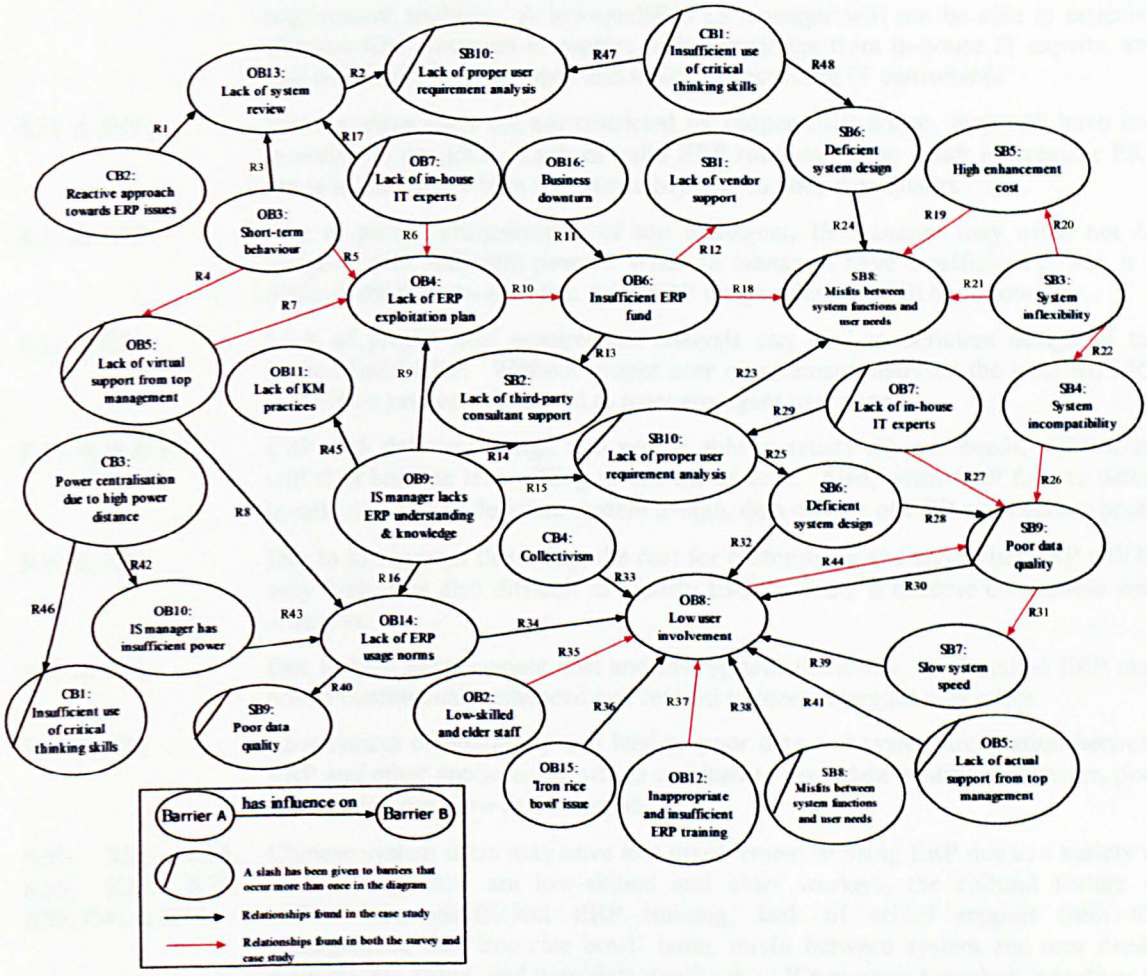

Figure 8.2: Conceptual map between the identified ERP barriers

Although all these relationships have actually been presented and discussed in above sections, a summary of discussion on them is given in the following table.

ID of Relationship Concerned	Brief Discussion
R1, R2, R3 & R17	Lack of regular system review is the result of a lack of in-house IT experts, top management's short-term thinking, and the reactive approach adopted by IT staff. Without conducting system reviews regularly, user companies will fail to identify emergent user requirements.
R4 & R5	Short-term thinking of top managers can lead to insufficient top management support to ERP, and the absence of an efficient ERP exploitation plan.
R7 & R8	Lack of ERP plans and lack of ERP usage norms are the result of insufficient actual support from top management.
R6, R27 & R29	Insufficient in-house IT expert is the cause of poor data quality, lack of ERP plan and lack of proper user requirement analysis.
R10, R11, R12, R13 & R18	Business downturn and inappropriate ERP plan can lead to insufficient ERP fund. Without paying sufficient fees, user companies will not be able to receive sufficient support from system vendors and third-party consultants. Also, without

	sufficient ERP fund, the implemented ERP may not be continuously revised and enhanced. As a consequence, misfits between system functions and user needs will occur.
R9, R14, R15, R16 & R45	When IS managers have insufficient ERP knowledge, they may fail to establish efficient ERP plans and usage norms, and may also fail to conduct proper user requirement analysis. A low-qualified IS manager will not be able to establish efficient KM processes to capture tacit knowledge from in-house IT experts, and also overlook the importance and value for recruiting IT consultants.
R34 & R40	When system users are not restricted by proper ERP norms, they will have low incentive to use ERP. Lack of valid ERP rules can often result in irregular ERP usage in the firm, which will inevitably lead to poor data quality.
R42 & R43	Due to power centralisation of top managers, IS manager may often not be assigned with sufficient power. When IS managers have insufficient power, it is difficult for them to establish strict ERP usage rules that will be followed.
R23 & R25	Lack of proper user requirement analysis can lead to deficient design of the implemented ERP. Without proper user requirement analysis, the installed ERP will not be properly enhanced to meet emergent user needs.
R24, R28 & R32	ERP with deficient design will not be able to satisfy all user needs. ERP users will thus become less willing to use the system. Also, when ERP fails to detect invalid data due to deficient system design, data quality of ERP will become poor.
R20 & R22	Due to low system flexibility, the cost for customising and enhancing ERP will be very high, it is also difficult to modify ERP to make it become compatible with other ISs.
R19 & R21	Due to high enhancement cost and low system flexibility, the installed ERP may not be continuously enhanced and revised to meet emergent user needs.
R26 & R31	Low system compatibility can lead to poor data and system integration between ERP and other applications, which can lead to poor data quality. Moreover, poor data quality can slow down system speed.
R30, R33, R35, R36, R37, R38, R39, R41 & R44	Chinese system users may have low involvement in using ERP due to a variety of reasons, e.g. they are low-skilled and elder workers, the cultural feature of collectivism, insufficient ERP training, lack of actual support from top management, the 'iron rice bowl' issue, misfit between system and user needs, slow system speed, and poor data quality etc. When users have low incentives to use ERP, they will not use the system properly and thus impact data quality.
R46, R47 & R48	Power centralisation may lead Chinese workers to become less inclined to use their critical thinking skills, and thus resulting in ERP tasks to be inadequately conducted and performed.

Table 8.1: Brief discussion of relationships between the identified ERP barriers

8.4.6 Further discussion and conclusion

By triangulating and synthesising the findings from both the questionnaire and the multi-case study, the researcher identified a set of 31 ERP exploitation barriers. The findings confirmed that issues embedded in the Chinese culture (e.g. low uncertainty avoidance, high power distance, and collectivism) would have important impacts on ERP usage and exploitation in SOEs. On the other hand, crucial ERP barriers also existed in diverse organisational aspects (e.g. top management, in-house IT experts, ERP maintenance processes and system users, etc) in the SOEs studied. Moreover, barriers related with a variety of system issues (e.g. system vendor, system design, and

data quality, etc) should also be carefully handled in order to ensure long-term success in ERP exploitation.

In conclusion, the findings showed that crucial ERP barriers were not found around the system category as traditionally expected. It was evident that crucial ERP barriers would exist in a variety of cultural, organisational and system aspects in SOEs. These findings thus confirmed the conclusion made in the previous chapter that, potential failure of ERP systems cannot be conveniently attributed to system aspects, such as the software package and the ICT infrastructure. Other types of barriers (e.g. cultural and organisational barriers) should in reality be as important as the technical ones. Moreover, as shown in the relationship/conceptual map of barriers, the identified cultural, organisational and system barriers seem to be interwoven and closely related with each other. These barriers are therefore very difficult to manage and remove. Nevertheless, it clearly emerged from the relationship map that, organisational barriers are often the triggers for complex networks of barriers, including the system ones. It can therefore be concluded and suggested that, SOEs should pay more attention to the identified organisational barriers, as properly managing these may directly help them to mitigate the system ones.

Moreover, evidence from the interviews confirmed the argument made in the previous chapter that, many cultural and organisational barriers were underestimated by respondents in the questionnaire. It clearly emerged from the interview findings that, such underestimation was caused by a lack of understanding and awareness on diverse cultural and organisational issues. More importantly, in an interview with a Chinese senior IT consultant (i.e. E-ITM of Company B), it was identified that managers in Chinese SOEs would often be reluctant to address problems embedded in the organisational and management mechanism, because many managerial staff might be receiving personal benefits from these organisational shortcomings. Thus the attempt to solve these management pitfalls might be seen as challenging by the whole management team. Furthermore, in order to avoid potential personal risks under the bureaucratic environment, managers in Chinese SOEs might often tend to disregard existing organisational and management problems. In order to ensure long-term ERP success, there seems to be a need for Chinese managers to become aware of the importance of cultural and organisational barriers, as well as to become more willing to face diverse internal shortcomings.

This section focused on ERP exploitation barriers which are the first major part of findings of this study. The second part of findings, which are related with ERP exploitation risks, are presented and discussed in the next section.

8.5 ERP exploitation risks

The analysis of the interviews conducted indicated a set of 27 ERP exploitation risks that proved to be critical to the case companies. These 27 risk events were found across diverse operational, analytical, organisation-wide and technical aspects. They covered all the 24 risk events that were short-listed from the questionnaire findings as presented in the previous chapter, as well as 3 new risk events that had not been identified at previous stages of this project. The following sections present and discuss the case study findings regarding these ERP exploitation risks.

8.5.1 Operational risks

Operational staff input inappropriate data into ERP

As discussed before, all preliminary data of ERP is inputted by operational staff. Under the ERP environment, one staff's mistake (e.g. inputting incorrect data into the system) will raise immediate impact and may disturb the operation of the whole company. As a consequence, the majority (85.4%) of respondents of the questionnaire perceived the occurrence of this risk event to have a high to medium impact. The importance of this risk event was further confirmed by the interviewees. As exemplified by the Purchasing Manager of company B:

> If a staff inputs incorrect data into the system, many people across the firm will suffer. For instance, engineers in the Technology Department will often input wrong information in the Bill of Materials in ERP. An inaccurate Bill of Materials can significantly affect the accuracy of the material requirement plans generated by the ERP system, which in turn leading to inappropriate production or purchasing orders to be released. In this example, mistakes made by engineers impact directly the operation of the Production and Purchasing Department in the firm (PM Company B).

It is obvious that, this risk event may be caused by human mistakes due to insufficient training or just staff indifference, demotivation and tiredness. More importantly, further analysis of the interview data indicated that this was mainly a result of inappropriate ERP usage norms in the case companies, as so highlighted by the External IT Manager of company B:

> Very often, IT and IS may not be of interest to operational staff, e.g. sales staff who may only be interested in sales and marketing. Therefore, they may not always use the ERP system earnestly and carefully. As a result, a set of ERP usage regulations must have been set up before the system went live. These regulations should specify what consequence users will take for inappropriate and irregular system usage...The absence of such strict norms will lead to difficulties in handling system misuse (E-ITM Company B).

It clearly emerged from this quote that, lack of ERP usage regulations might significantly increase the probability and frequency for operational staff to input incorrect data into ERP, as "staff do not need to take any consequences of the mistakes they made in this circumstance" (E-ITM Company B). When operational staff continually input incorrect data into ERP, the system may contain a large set of inappropriate and problematic data, e.g. inappropriate BOM, duplicated supplier records, and incomplete customer files, etc.

ERP contains inappropriate BOM

As discussed before, a bill of materials (BOM) is one of the key inputs used to generate material requirement and purchasing plans (Koh et al, 2000). As such, inappropriate BOMs can often lead to inaccurate material requirement plans to be generated, and thus result in that materials required in production may not be ordered and delivered at the right time and/or in the right quantities (Zhou et al., 2005). As a consequence, 87.5% respondents of the questionnaire considered the impact of having inappropriate BOM as high to medium. Findings of the interviews confirmed that this risk event presented to be a critical and frequently occurred ERP risk to the case companies:

> As a result of human mistakes, the BOMs stored in our ERP often contain inaccurate information. For instance, 2 SLDs (i.e. the name of a component part) should in fact be used in the production of Product A. Our BOM however may inaccurately state that 3 SLDs are required. In this circumstance, our production and purchasing plans will be distorted completely. In another scene, the BOM may contain incomplete description of a component or material required. This

> may mislead suppliers, and resulting in that the materials delivered to us are not the actual things we want. The occurrence of these problems will definitely increase production lead time, which in turn causes problems to the Sales Department, as products may not be delivered to end customers on time (Purchasing Manager Company A).

A further exemplification regarding duplicated BOMs was identified in company B:

> For the same product, I will often find two duplicated and exactly the same BOMs in our system. The problem is that, when product designers need to modify the BOM of a product, if there are two duplicated BOM records in ERP, the designer may only modify one of them but ignore the duplicated one. As production staff may not recognise this circumstance, they may use the duplicated, which is also the unmodified, BOM record in production. This can cause a huge problem for production, as well as direct financial loss to the company (PS1 Company B).

> I think the occurrence of duplicated BOMs is mainly caused by human negligence. The second reason for this problem is that our system will not be able to detect duplicated BOMs and give related warnings. That is, for instance, when we try to save a document into the PC, if this document has already existed, Windows will ask whether you want to replace the existing document or save changes with a different name. If the ERP system can give us such warnings, it can prevent us from storing duplicated BOMs into the system. Unfortunately, our ERP does not contain such functions (Purchasing Staff Company B).

These statements clearly indicated a set of causes and consequences for inappropriate BOM. In particular, human negligence and inefficient system design were the main reasons for duplicated BOMs in the case company. It was also obvious that, due to lack of ERP usage norms, staff who inputted incorrect information into BOMs would not need to take any consequences. As a result, the problem of inappropriate BOM did not seem to be properly controlled in the case companies. It was also evident from the above quotes that, inadequate BOM would impact and distort normal operation of a number of functional divisions, e.g. production, purchasing and even sales department.

ERP has inappropriate supplier records

Manufacturing companies will inevitably deal with a large number of material and component suppliers. In order to ensure efficient procurement and production, the implemented ERP system should maintain accurate records about current suppliers as well as materials and prices they offered. However, containing inappropriate supplier records in ERP was perceived by the majority (more than 70%) of respondents of the

questionnaire as a risk event that had medium probability of occurrence and impact. In the context of the case studies, this risk event proved to be a frequent and critical risk. In particular, the Financial Staff (FS1) of company B stated that: "our ERP system often contains duplicated records for the same supplier. This problem gives us a big headache". This Financial Staff went on to state that:

> The occurrence of duplicated supplier records will result in many problems to our financial work. Specifically, we will need to make transactions with hundreds of suppliers, when many of these suppliers have duplicated records in ERP, the actual number of supplier records that we need to deal with will be doubled and even tripled. More importantly, each supplier record will often contain some transaction and account payment records, and thus cannot be deleted even it is later identified as duplicated. This can significantly increase the amount of data of ERP, and thus affect system speed (FS1 Company B).

The Purchasing Department in the case company should hold responsibility for duplicated supplier records, as "they are responsible for entering this type of data into the ERP system" (FS1 Company B). When asked about this risk event, the Purchasing Staff responded:

> We knew such mistake would often arise. Because we are always very busy, when entering a new supplier record we may fail to check whether an existing record of this supplier has been stored in the system...also because our system cannot automatically detect duplicated records and give us related warnings, we would often enter duplicated supplier records into the system. It is true that we have not paid sufficient attention to this issue as such duplicated records will not affect our work too much (Purchasing Staff Company B).

It clearly emerged from this statement that, the reason for having duplicated supplier records was due to indifference and negligence of staff of the purchasing department in the case company. In fact, and by further analysing the interview data, it became apparent that lack of strict ERP usage norms should be the essential cause for the occurrence of this risk event in company B, as so clearly pointed out by the Financial Manager of the firm:

> Purchasing staff will not need to take any consequences of such mistakes they made. So this mistake just occurs repetitively in the firm (FM Company B).

It therefore seemed that having efficient ERP usage norms is crucial to ensure proper usage of ERP system, and thus reducing the frequency of occurrence of user mistakes,

as further discussed in section 8.4.2 and 8.5.3. Moreover, this problem actually also highlighted internal conflicts between functional departments in the case company, as discussed in section 8.4.2.

System contains incomplete customer files

There is no doubt that customer information files are important and valuable data stored in ERP. The majority (more than 70%) of respondents of the questionnaire perceived that, having incomplete customer files was a risk event that had medium probability of occurrence and impact in their firms. Findings from the interviews confirmed that this event was also a frequent risk event occurred in the case companies:

> We often have incomplete customer information files in our ERP. This is mainly caused by irregular use of the ERP system. In particular, we are supposed to record all customer information into ERP. However, in real practices, many of us may often just input this type of data in the legacy system rather than in the newly installed ERP, and thus resulting in incomplete customer files in the ERP system (SS2 Company A).

It clearly emerges from this statement that, there is a strong need for this case company to establish strict ERP usage norms in order to regularise ERP usage in the firm. Evidence from the interviews showed that, incomplete customer files could lead to very significant problems, especially for staff who were responsible for after-sales services:

> Very often, when customers ring up for some after-sales inquiries and problems, we will not be able to retrieve their files and order history stored in the ERP system. As a consequence, we will not be able to answer their questions. This really puts us in a very embarrassing situation, and can certainly reduce customer satisfaction and loyalty (SS1 Company A).

ERP contains inaccurate inventory records

Remaining over 95% accuracy in inventory record is a prerequisite to enable ERP systems to work properly (Zhou et al., 2005:75). As exemplified in chapter six, inaccurate inventory records can disturb operation of the entire firm. Therefore, 90% respondents of the questionnaire perceived this risk could lead to a high to medium impact. Respondents of the interviews also considered this risk event as critical:

> Inventory record is probably the most important type of data for manufacturing firms. We plan our production and procurement based on how much stock we still have. So if the inventory record of ERP does not match the actual stock level, our production and purchasing plans will be distorted. This can certainly increase financial costs (Purchasing Manager Company A).

The purchasing manager of company B reinforced that, "this problem is often caused by human mistakes and negligence, especially when users are not restricted by proper ERP usage rules". Nevertheless, the purchasing managers of both companies stressed that, this risk event occurred "quite frequently when the ERP system just went lived, but since the system has been used for a few years the situation is now under control" (PM Company B). It thus seemed that inaccurate inventory record would occur more frequently at the early stage of ERP usage.

8.5.2 Analytical risks

Managers cannot retrieve needed information from ERP

Not only operational staff but also managers are key users of an implemented ERP system (Scapens and Jazayeri, 2003). Although managers will not be responsible for entering daily data into ERP, they will use data and reports provided by the system to make important business decisions. However, 90.5% respondents of the questionnaire perceived that, 'managers cannot retrieve needed information from ERP' was a risk event in their firms. More than 85% of these respondents considered this risk event had a medium probability of occurrence and impact. All managers interviewed confirmed that they might not always be able to retrieve needed data and information from the current ERP system. It is obvious that, the occurrence of this risk event may be caused by a lack of ERP training of managers. More importantly, evidence from the interviews showed that 'misfit between system functions and user needs' was also the essential cause for this risk event:

> I often need to deal with a large amount of data related to sales orders, material prices, production cost, etc. I hope the ERP system can automatically gather all these types of data and generate a set of statistical sales reports for me. However, our current system does not contain sufficient analytical functions, and thus may not be able to provide me with the statistical reports that I want (Sales Manager Company A).

In addition, poor data quality also presented to be a main cause that prevented managers from retrieving needed information in ERP, as highlighted by the Financial Manager of company B:

> A large amount of raw data will be entered and stored in ERP. The system will then generate a set of statistical reports by using these raw data. Nevertheless, if the quality of these raw data is poor (e.g. inaccurate,), the system will not be able to generate any meaningful statistics for us. As a consequence, we will not be able to obtain the needed and useful reports from the system (FM Company B).

When managers often cannot retrieve needed information from ERP due to any of the above reasons (i.e. lack of training, misfit between system and user needs, and poor data quality), "they may gradually become less inclined to get involved in ERP usage, maintenance and enhancement. The view of managers may also inevitably affect the attitudes of their subordinates towards using the system" (Purchasing Manager Company B).

ERP generates inappropriate forecasts, plans and budgets

As discussed in chapter six, it is always a difficult task to establish business forecasts to predict the uncertain future. Many leading foreign (e.g. SAP) and Chinese (e.g. UFIDA, and Kingdee) ERP vendors have thus embedded a set of analytical tools in their ERP packages to assist user companies to develop more appropriate business forecasts and plans (e.g. sales forecasts, production plans, and financial budgets, etc). Nevertheless, despite the fact that the ERP is adopted to facilitate forecasting tasks, user companies may still face difficulties when conducting such analytical activities. In particular, more than 78% respondents of the questionnaire stated that, the probability for their ERP to generate inappropriate business forecasts (e.g. sales forecasts, production plans, and financial budgets) was medium to high. Moreover, more than 87% respondents perceived the occurrence of this risk event could lead to a high to medium impact. Analysis of the interviews conducted indicated that poor quality of raw data would be a fundamental cause for this risk event:

> Having comprehensive and accurate operational data is the prerequisite for us to generate appropriate sales forecasts, production plans or financial budgets. However, although the ERP system will help us to capture and store daily operational data more easily, the data stored in ERP may not always have high quality due to a variety of reasons, e.g. inappropriate system

> usage and data maintenance. Inaccurate or incomplete raw data can definitely affect the accuracy and appropriateness of the business forecasts generated by using ERP (Financial Manager Company B).

It was evident that, inappropriate business forecasts and plans would affect cash flow and capital utilisation of the company:

> The purpose for establish business forecasts, either sales forecast, production plan or financial budget, is to predict the company's future in terms of how many we can sell, how many we should produce, how much we can get, and how much it will cost. Managers can therefore allocate resources and capital of the firm based on the results of such forecasts. Inappropriate forecasts can thus often impact cash flow and capital utilisation of a company (FM Company B).

ERP generates inappropriate material requirements plan

Material requirements plan is one of the most important analytical outputs generated by ERP. It is often used by manufacturing firms as the basis for releasing orders of materials production or procurement (Slack et al, 2004). As a consequence, an accurate material requirements plan is the fundamental for ensuring that materials required in production can be ordered and delivered at the right time and in the right quantities (Koh et al, 2000). Nevertheless, 80% of the respondents of the questionnaire stated that, the probability for their ERP to generate inappropriate material requirements plan was medium to high. In addition, 97.5% if the respondents perceived the occurrence of this risk event could lead to a high to medium impact. Respondents of the interviews further confirmed that this would be a frequent and critical risk in their firms. In particular, the interviewees highlighted that the occurrence of this risk event should be attributed to inappropriate BOM and unfixed supplier lead time:

> BOMs contained in our ERP often have some inaccurate and incomplete information, and thus significantly affecting the appropriateness of the material requirement plans generated. In addition, calculation of material requirement plans is made based on fixed supplier lead time. However, under the irregular business environment, the actual lead time of our suppliers may often vary. As a result, materials that we ordered may not always arrived on time. In this case, the original material requirements plan will no longer be valid and need to be re-calculated (Purchasing Manager Company B).

It was obvious that inappropriate material requirements plan could significantly impact normal production, as it would result in "materials that should be used at a later stage

may have arrived too early, while materials that are required now may not arrive on time. The entire production process will therefore be distorted" (Purchasing Staff Company A). More importantly, the External IT Manager of company B reinforced that:

> The generation of a material requirements plan involves a set of complicated calculation processes. Therefore it often takes a few hours for ERP to complete such requirement plans. During these few hours, the speed of the ERP system will become very slow. If a few days after, we find out the generated plan is actually inappropriate due to incorrect BOM, we will need to perform all calculation processes again. This can be very irritated, and will affect working efficiency of other system users (E-ITM Company B).

8.5.3 Organisation-wide risks

Personnel change in top management team and top management support

As discussed before, top managers, who have been involved in ERP implementation, should have a better knowledge regarding the IS background and needs of the company, and therefore be more willing to provide continuous support to the system post-implementation. However, according to China's recent SOE policies, members in the top management team of SOEs will be re-elected every three years. The new top management team may or may not be willing to provide continuous support to ERP. As a consequence, personnel change in top management team was perceived by 81% respondents in the questionnaire as a risk event that had medium to high impact. Interviewees of the case study confirmed that substantial changes in the top management team might result in discontinuous top management support to ERP post-implementation:

> The new top managers may not have a good understanding on ERP, and even have not used ERP before in their previous company. They thus may be less interested in and pay less attention to this system (Purchasing Manager Company B).

Nevertheless, the external IT manager of company B highlighted that, the impact of this risk depended on whether the company has a comprehensive ERP implementation and usage record:

> The new top managers may know nothing about the company's IS usage background. Therefore, it will be very helpful if the firm contains a full ERP historical record about why ERP was

adopted, what benefits it has resulted in, and how it should be further enhanced. By reading this information, new top managers can get used to the company's situation more easily. This may increase their interests in ERP usage and enhancement (E-ITM Company B).

Cannot receive sufficient or continuous support from system vendor or consultants

User companies, especially those who do not possess sufficient in-house IT experts, may often rely on system vendors or third-party consulting firms to maintain the implemented ERP system. However, as ERP exploitation is a continuous process, there would be a risk that user companies may not be able to receive sufficient and constant supports from their ERP vendor or consultant in the long-term. The occurrence of this risk event may inevitably cause significant ERP maintenance problems to user companies. As a consequence, 87.8% respondents of the questionnaire perceived the occurrence of this risk event could lead to a high to medium impact. All interviewees in the case study considered this risk event as critical, and highlighted a comprehensive set of causes that would increase its probability of occurrence:

Once the implementation project finished, any further support that we can receive from the vendor [as well as third-party consultants] depends on the amount of maintenance fee that we paid. In other words, if we fail to pay them sufficient fees at any period of time, we may not be able to receive continuous post-implementation support from them (IT Manager Company A).

(Secondly) staff turnover in the vendor and consulting company may often be high. As a consequence, IT maintenance experts sent by system vendors or consulting firms to our firm are often different, and therefore cannot provide us with consistent services (I-ITM Company B).

(Finally) it is possible that some system vendors [or consulting firms] may go bankrupt under the extremely competitive business environment. They thus will not be able to offer continuous maintenance services to user companies (Financial Staff Company A).

The consequence of the occurrence of this risk event was clearly pointed out by the IT Manager of company A:

It can result in delay in solving ERP maintenance problems, and thus can impact system performance and even lead to system disasters. The situation can become particularly serious, if the user company also lacks in-house IT experts to deal with ERP maintenance issues (ITM Company A).

Data access right is allocated inappropriately

As discussed in chapter six, data access right of the ERP system must be allocated appropriately to system users. Otherwise, system data may be accessed and modified by irrelevant users, which can result in data loss, errors and information leakage. Although the majority (78%) of respondents of the questionnaire perceived this risk event had a low probability of occurrence, 73% of them stated that the occurrence of this event could lead to a high to medium impact. Findings from the interviews confirmed that this risk event would have critical impacts to the case companies. In particular, the External IT Manager of company B highlighted that:

> Inappropriate allocation of data access right can lead to many undesirable outcomes. Firstly, important and confidential data stored in the system may be accessed by unauthorised people, which may result in significant business loss. Nevertheless, for many user companies, a more significant and frequent consequence is that important data stored in the ERP system may be modified or even deleted by irrelevant users, due to lack of awareness. This can lead to serious loss and damage of system data (E-ITM Company B).

Furthermore, IT managers of both case companies claimed that, they had set up a clear policy to specify what types of data access rights should be assigned to which levels of staff and managers. It was however evident that, such data right policies might often not have been executed properly:

> The data right policy was executed strictly at the beginning. After a while however, the control has become very loose. In particular, the IT manager, who is responsible for authorising access to the system, will now just give data access rights to any staff upon request (SS2 Company A).

When asked about this issue, the response of the IT manager of company A was over-optimistic:

> I recognise we do not have very strict control on data access authorities. In fact, I do not think we have many confidential data storing in ERP...so even these data are seen by other people, it will not cause a big problem...plus, people in our firm are all very nice, so they will not attempt to conduct any malicious activities to harm the company (ITM Company A).

These quotes clearly indicated that, inappropriate execution of data right policy and the over-optimistic view of the IT manager would be the main causes that might lead to misallocation of data access authorities in the case company.

Confidential data is accessed by unauthorised people

As discussed above, inappropriate allocation of data access right may directly result in confidential data of ERP to be accessed by unauthorised people. It is obvious that, the occurrence of this risk event may potentially lead to information leakage and financial loss. As a consequence, 76% respondents of the questionnaire stated the impact of this risk would be high to medium. Interviewees of the case study confirmed the importance of this risk event by stating that, "having unauthorised people to access to our confidential business data can lead to unpredictable business crisis" (CEO Company B). Apart from misallocation of data access right, analysis of the interviews conducted indicated a further reason that could result in the occurrence of this risk event:

> In order to avoid losing important data due to system crush, we will often keep paper copies of confidential data stored in ERP. However, the management of these paper copies in our firm is relatively terrible. In particular, all these copies are just put in a big cabinet and can be accessed by any staff. This increases the probability for sensitive data to be accessed by irrelevant people (Purchasing Staff Company B).

It clearly emerged from this statement that, confidential business data should be managed and protected properly both inside and outside the ERP system. It seemed that managers of the case company should pay more attention to this issue in order to avoid potential data leakage risks.

Lose qualified IT staff

Experienced IT experts often present to be an invaluable knowledge repository to the company. Nevertheless, 76.2% respondents of the questionnaire stated that there was a medium to high probability for them to lose qualified in-house IT/ERP experts during the ERP post-implementation stage. 83.3% of these respondents perceived that the occurrence of this risk event could lead to a high or medium impact. Findings from the interviews confirmed that losing qualified IT staff was a frequent and critical risk event to the case companies. High market demand for this type of professional is certainly an essential reason that makes qualified IT experts leave their original company during ERP post-implementation. Moreover, analysis of the interviews conducted identified a further set of reasons that would increase the probability of occurrence of this risk event.

Firstly, once they acquired better skills and experience through the ERP implementation project, in-house IT experts will attempt to move to a better job, as cogently stated by the external IT manager of company B:

> The process for implementing ERP is indeed an invaluable learning process for in-house IT staff. A junior IT staff may become a real IT expert by developing a wide range of skills and expertise through the ERP implementation project, e.g. project management, system requirement analysis, business process redesign, etc. So as the level of their skills increased, the probability for them to look for a better job will also increase (E-ITM Company B).

Secondly, job overload presented to be a further reason that could discourage in-house IT experts from carrying on the current job:

> A common problem experienced by in-house IT staff is job overload. I used to have conversations with many in-house IT staff. All of them complain that they have spent too much time on dealing with a variety of repetitive and non-technical IT issues of the firm, e.g. printers, network virus, Windows reinstallation, etc. They therefore cannot pay sufficient attention to things that they are truly interested in, e.g. ERP upgrade. As a consequence, they may try to seek for a more challenging and well-paid job, e.g. system consultant (E-ITM Company B).

Thirdly, top managers may often fail to make a real effort to retain in-house IT experts:

> ERP-related problems can definitely affect the work of operational staff. These IS problems however may not have a substantial impact on managers at the strategic level in the short-term. As a consequence, top managers will often fail to recognise the importance of the work conducted by IT staff, and thus will fail to make an effort (e.g. provide better salary) to retain this type of professional under the high market demand (ITM Company A).

Losing experienced IT experts would have direct impact on system maintenance in user companies:

> The role of an experienced IT staff is difficult to be replaced. Newcomers, who lacks experience and expertise, may not be able to handle maintenance problems properly. They will often need to spend a lot of time on solving a problem that may be resolved by an experienced IT expert in just a few seconds (ITM Company A).

Moreover, losing qualified IT experts will often also lead to the loss of valuable ERP know-how and expertise accumulated over time, as discussed below.

Lose ERP-related know-how

As confirmed by the External IT Manager of company B, "in-house IT staff will be able to learn and develop a large set of skills and expertise through ERP implementation and post-implementation". It is therefore essential and important for user companies to capture such implicit knowledge and expertise from their IT experts in order for such knowledge to be shared effectively across the firm and with fellow IT staff. Nevertheless, Chinese companies may often fail to adopt systematic knowledge management practices to capture valuable knowledge from in-house experts:

> The know-how and expertise that our IT staff have will only be stored in their own head. We will not normally write down and record such knowledge explicitly in a form of document...(why not?)...well, there is just no such practice in our company (IT Manager Company A).

Due to a lack of proper knowledge management practices, "valuable ERP knowledge and expertise acquired by IT experts will always be lost when these in-house experts leave the firm" (ITM Company A). The External IT manager of company B reinforced that, "losing such valuable knowledge also means that fellow IT staff loss the opportunity to learn from the mistakes and experience from previous IT experts. This should be considered a significant loss of the firm".

Lose qualified system user

Apart from losing qualified IT experts, losing qualified system users also emerged as an important ERP risk from the interviews. In particular, the IT manager of company A highlighted that:

> An experienced system user will certainly be familiar with the operation of the ERP system and related business processes. However, when he/she left, the newcomer, who often has less or even no prior knowledge about the job, the system and the company, will need to learn everything from the very beginning. As such, there would be a high probability for the newcomer to make unforgivable mistakes at work and thus bring in unpredictable hazards to the others in the firm (ITM Company A).

The high market demand for qualified staff presented to be the fundamental reason that enticed experienced system users to leave their current jobs, as cogently highlighted by the CEO of company B:

> China is in its rapid development stage. As a result, market demand for any kinds of high-skilled and well-trained staff is extremely high. This has resulted in the very high staff turnover rate in our firm. Many of our staff only consider the current job as a temporary one. Once they acquired high qualifications from the current job, they will often jump to a better post (CEO Company B).

Therefore, there seemed to be a need for the case companies to make a further effort to retain highly qualified staff and reduce the frequency and probability for losing qualified system users.

Users do not receive sufficient and continuous training

System users should be continuously trained and re-trained in ERP post-implementation in order to ensure them to have sufficient skills to use the installed system (Willis and Willis-Brown, 2002). However, as discussed before, staff and managers of many companies may not receive sufficient and continuous ERP training, usually due to lack of funds, resources and expert trainers. More than 78% respondents of the questionnaire perceived this as a frequent and critical risk event in their firms. This questionnaire finding was further confirmed by the interviewees. In particular, the IT managers of company A highlighted that:

> We have provided a few training sessions to our users during ERP implementation. No further training however has been provided afterward. The reason is that we do not have extra funds to recruit external trainers to provide additional training to our users, and our internal IT people do not have the skills and expertise to do so (ITM Company A).

It clearly emerged from this statement that, lack of ERP fund and lack of internal trainers were the main cause for this risk event in the case company. As a result of insufficient training, system users may often "find it difficult and uncomfortable to use the current ERP system" (SS1 Company A). It is obvious that user acceptance on ERP may be substantial reduced in this case.

Company does not assigned sufficient fund to ERP

ERP adoption and exploitation require a large amount of investment. Insufficient funds can certainly prevent the ERP implementation project from progress and full completion (Lientz and Larssen, 2006; Loh and Koh, 2004), and can also disturb system maintenance, upgrade and revision in the post-implementation phase. 81% respondents of the questionnaire perceived the occurrence of this risk could have a high to medium impact. In the follow-up interviews, the interviewees identified that, the amount of fund that could be assigned to ERP exploitation depended on the company's current operation status:

> Funds and resources that we can spend on ERP exploitation depend on the company's operation status and revenue. The better the company's performance, the more the top management will be willing to invest in ERP enhancement (ITM Company A).

This statement clearly pointed out the risk that, if the company's revenue decreased, the amount of ERP fund might also be reduced correspondingly. This was confirmed by the IT manager of company A:

> Faced with the current operation difficulties, our top managers tend to spend the majority of fund and resource on core business areas rather than on further ERP enhancement. As a result, the amount of ERP fund has been relatively reduced in recent years (ITM Company A).

Ill-defined ERP exploitation plan and unclear direction for further ERP enhancement

A clear ERP plan is crucial for successful ERP exploitation. If the ERP plan is ill-defined or misfits with the business strategy (Lientz and Larssen, 2006), the implemented ERP system may not be maintain and enhanced efficiently. 72.5% respondents of the questionnaire perceived the probability of occurrence of risk in their firm as high to medium. Moreover, 67.5% respondents said this risk had a medium impact and another 25% perceived its impact as high. Interviewees of the case study confirmed that this risk was a frequent and critical risk in the case companies. Analysis of the interview data indicated that insufficient knowledge of in-house IT expert was the essential reason for the occurrence of this risk event:

> We do not have a sufficient understanding about ERP plans, and do not know how a proper ERP plan can be established. In fact, we are not sure what benefits we can receive from this plan, and it seems to me that this plan will be difficult and complicated to establish (I-ITM Company B).

It was apparent that, without an explicit ERP exploitation plan, the company would not be able to retain a clear direction for further ERP enhancement:

> I don't have a very clear idea about how the current ERP should be enhanced and improved...we have not established a plan to address this issue actually. Because we think the current system does not have many major problems, so we prefer leaving it like this (I-ITM Company B).

As a consequence, the implemented ERP system may not be properly enhanced in post-implementation and thus may gradually become incapable to support business strategies and goals.

ERP exploitation plan cannot be executed properly

It is a common practice for user companies to establish a detailed ERP exploitation plan to specify how the implemented ERP system would be maintained and enhanced in a given period of time (e.g. one year). Such plans would often provide in-house IT staff with guidelines on maintaining and enhancing the installed ERP. However, evidence from the interviews showed that the established ERP plan might not always be executed properly by user companies. The occurrence of this risk event could be attributed to two main reasons. Firstly, user companies may not be able to assign sufficient ERP fund to implement the maintenance plan:

> The amount of funds and resources, which we are allowed to spend on ERP exploitation, determines whether or not the ERP plan can be executed successfully. Without sufficient fund, the maintenance and enhancement activities that we planed in advance may never be able to carry out properly (ITM Company A).

Secondly, and as further stated by the IT manager of this firm, top management support was another crucial factor that could affect the execution of the ERP plan:

> The amount of fund allocated to ERP maintenance and enhancement is often determined by top managers. In fact, top managers will also decide whether or not an established ERP plan should be implemented. Moreover, the execution of an ERP plan may require the commitment and

cooperation of staff across the company. As a result, with sufficient top management support, the ERP plan will definitely be executed more smoothly and successfully (ITM Company A).

ERP regulations are not executed properly

As discussed in previous sections, it is important for user companies to establish rigorous ERP norms to regularise ERP usage within the firm. Nevertheless, evidence from the interviews showed that, although a set of ERP norms had been established, these norms might not always be followed by system users in the case companies:

> According to the company's ERP regulations, all sales orders should be entered into and processed by the ERP system. However, such ERP norms may not always be followed by system users, who will often just input sales orders into the legacy system rather than into the ERP (Financial Manager Company A).

> Although the company requires us to use ERP to store supplier records, we may not always do so. In fact, a spreadsheet had been used to record this type of data before ERP was implemented, and we will still use this spreadsheet to record supplier data. Very often, the supplier contact list stored in the spreadsheet is more accurate, up-to-date and complete than that stored in ERP (Purchasing Staff Company B).

By analysing these statements more carefully, it became apparent that when the established ERP regulations were not followed by system users, the implemented ERP system might not be operated and used properly. Inappropriate system usage can in turn "lead to many data quality issues in user companies" (ITM Company A).

Further analysis of the interview data indicated that lack of top management support was the fundamental reason for inappropriate execution of ERP norms in the case companies:

> Top management commitment is the key to solve any conflicts and problems in the firm. If top managers give a must-do order to force all system users to follow the ERP norms earnestly and keep tracing how well these norms are executed, we will be able to use the implemented ERP successfully. However, because top management involvement is insufficient, some system users just adopt an indifferent manner towards ERP usage (PS1 Company A).

In addition, 'IS manager lacks power' also presented to be an essential reason that led to difficulty in executing the established ERP norms across the firm:

> As I have not been assigned with sufficient power, I always found it difficult to deal with user resistance and promote ERP usage and related business changes in the company. System users and even their departmental managers may not always be willing to cooperate and follow the ERP usage rules that I established (ITM Company A).

In sum, both top managers and IT managers of the case companies need to make a more substantial effort to ensure efficient execution of established ERP regulations, in order to enable long-term ERP success.

8.5.4 Technical risks

ERP cannot be seamlessly integrated with other IS applications

Apart from ERP, user companies may often implement other types of IS applications, e.g. PLM, SCM, CRM, etc. It is a common practice for user companies to integrate their ERPs with these IS applications, in order to achieve better data accuracy and consistency, as well as to reduce difficulties for maintaining these systems. However, as discussed before, the installed ERP may not always be seamlessly integrated with other IS applications. 90% respondents of the questionnaire perceived this risk event had a medium to high probability of occurrence, and 95% considered it had a medium to high impact. Findings from the interviews confirmed that this was a frequent and critical risk event in the case companies. In particular, the external IT manager of company B highlighted two fundamental causes for this risk event:

> It is very difficult to integrate ERP with other ISs, due to two reasons. Firstly, ERP is always a complicated system which has low compatibility. Therefore, we can never expect to integrate an ERP with other ISs without making substantial customisation on both systems. However, and secondly, the IT people who conduct such customisation may not have sufficient technical skills to do it properly. As a consequence, ERP may not be integrated with another IS seamlessly and completely (E-ITM Company B).

Poor data quality is the direct result of the occurrence of this risk event, as further pointed out by the same IT manager:

> This can significantly impact data quality. In particular, when the systems are not integrated properly, data stored in both systems will often be inconsistent and problematic (E-ITM Company B).

Seamless integration is not achieved between modules of the ERP system

As discussed in previous chapters, ERP system is frequently mentioned as an integrated software package to facilitate integration of business processes and functions of the firm (Gable, 1998; Kumar and Hillegersberg, 2000; Shehab et al, 2004). Nevertheless, in real practices it is possible that modules of the installed ERPs may actually not be seamlessly integrated. More than 92.7% respondents of the questionnaire perceived the occurrence of the risk event could lead to a high to medium impact. This risk event may be caused by inappropriate system customisation during the ERP implementation cycle, as pointed out by the external IT manager of company B:

> Inadequate system customisation during the ERP implementation stage may damage the system infrastructure. Consequently, components of the implemented ERP may not be seamlessly integrated (E-ITM Company B).

It however seems that the probability of occurrence of such a mistake in ERP implementation may be low, because "system customisation in ERP implementation will often be done by well-trained IT experts from the system vendor, and the system will normally be tested before going live" (ITM Company A). In fact, what seems to be the matter is that the installed ERP system may be inappropriate customised and revised by ill-trained IT staff during ERP exploitation, as further highlighted by the external IT manager of company B:

> Due to cost reasons, user companies may often ask internal IT staff or recruit third-party IT consultants to enhance and revise the implemented ERP. However, because these IT experts are not from the vendor company, they may not be properly trained to customise a specific ERP package. System infrastructure of ERP may be damaged due to inappropriate system enhancement and customisation. This can often lead to system fragmentation of ERPs (E-ITM Company B).

Delay in identifying and solving ERP pitfalls

Technical pitfalls may often exist in the ERP system due to poor system design or technical mistakes being made in the cycle of implementation and even post-implementation. It is therefore important for user companies to conduct system audits to identify major breakdowns, inconsistencies and deficiencies in the implemented ERP

(Willis & Willis-Brown, 2002). Delay in identifying and solving these system pitfalls will inevitably affect both system performance and business operational efficiency. As such, 87.8% respondents of the questionnaire perceived the occurrence of this risk event to have a medium to high impact. Evidence from the interviews showed that the occurrence of this risk event could be attributed to a variety of reasons. In particular, lack of regular system review proved to be the most direct cause for delay in identifying and solving current ERP pitfalls:

> Our IT people have never done any system review for the implemented ERP system...(as a consequence,) they often fail to identify technical pitfalls existing in the current system in advance (FS2 Company B).

In addition, and as discussed in section 8.4.1, Chinese IT staff may often adopt a reactive approach toward ERP issues. As exemplified by the Production Staff of company A, "our IT staff would never come to us and ask whether we experienced any technical problems about ERP. Normally, what they will do is just wait...wait for us to tell them what has gone wrong" (PS2 Company A). As a result of this reactive behaviour, Chinese IT staff may often "fail to identify ERP-related pitfalls at an early stage. They may only recognise these pitfalls until some apparent and serious problems have been caused" (PS2 Company A).

Duplicated data is not properly purged

As stressed by Loh and Koh (2004), purging and discarding invalid and problematic system data are fundamental processes to ensure the highest level of accuracy possible. Nevertheless, these data cleaning tasks may not often be performed properly by user companies. More than 87% respondents of the questionnaire stated that, there was a high to medium probability that invalid system data were not properly discarded in their firms. It is obvious that, when this risk event occurs, IT maintenance staff will often take the blame. Nonetheless, findings from the interviews showed that, not only IT staff but also key system users should take the responsibility for purging inappropriate system data:

> IT staff are responsible for general data maintenance and cleaning. However, they may not have sufficient knowledge to manage and purge certain types of technical data (e.g. BOMs). In this case, it is better to ask the person who creates these data to delete them. In the example of

> BOMs, it will be more appropriate to ask product engineers rather than IT staff to purge any inappropriate BOM records (Purchasing Staff Company B).

However, evidence from the interviews showed that system users might often be reluctant to take up data maintenance tasks:

> Normal system users often have low incentives to take up ERP maintenance tasks. They will often rely on IT staff to deal with such problems for them (Financial Staff Company A).

Lack of user support and involvement thus seem to be the fundamental reason for difficulty in purging duplicated technical data (e.g. BOMs, supplier transaction records, etc) in the case companies. In addition, inappropriate purge of duplicated system data will inevitably "increase the amount of data of the ERP system, which can affect system speed" (Purchasing Staff Company B).

System crush

Hardware or software crash can often happen when using a computerised information system. This is actually an unavoidable risk event that can occur at any time during ERP post-implementation. The occurrence of this risk event will result in the ERP system to be out-of-work for a period of time and thus disturb normal operation of the company. Thereby, 87.5% of the respondents to the questionnaire considered system crash could lead to a high to medium impact. Analysis of the interview data indicated a variety of reasons that could increase the probability of occurrence of this risk event:

> In order to keep implementation costs within budget, the PCs and server purchased by the company have relatively low setting. This now becomes a problem in ERP post-implementation, as our server cannot afford the number of system users and the amount of data exchange. This can often result in system crush in our firm (ITM Company A).

> Internet virus, inappropriate network usage, inappropriate system usage, and large amount of redundant data can often lead to system crush. In order to reduce the frequency of occurrence of this event, user companies should regularise network and system usage, as well as ensuring data purging tasks to be conducted routinely (E-ITM Company B).

These potential causes should therefore be carefully handled in order to reduce the frequency of occurrence of this risk event.

System fails to detect invalid data

A well-designed ERP system should be embedded with capability to detect invalid data, e.g. duplicate customers and suppliers, incorrect item numbers, unreasonable amounts and dates, and unusually high quantities or unit prices, etc (Sage, 2005; Alter, 2002:199). Nevertheless, it is apparent that not all implemented ERP systems will be efficient enough to detect invalid data automatically. 80% respondents of the questionnaire stated that the probability for their ERP to fail to detect invalid data was medium to high. If invalid data cannot be automatically detected and prevented from getting into the system due to poor system design, significant data errors and data quality problems may be raised. As such, 90% respondents of the questionnaire considered the occurrence of this risk event could lead to a high to medium impact. This risk event also occurred in the case companies:

> Our ERP system can detect certain types of problematic data, e.g. unusual quantities and prices, but it is incapable of detecting duplicated BOM or supplier records and give automatic warnings. As a consequence, duplicated BOMs and supplier records will often be inputted into our system (Purchasing Staff Company B).

Inappropriate configuration and customisation in ERP implementation emerged as the main reason that resulted in the installed ERP to be incapable of detecting invalid data, as highlighted by the external IT manager of company B:

> Modern ERP systems should contain a set of functions to detect diverse types of problematic data. Nevertheless, due to inappropriate initial configuration, some self-contained detection capabilities of ERP may have not been activated. In another scene, for systems that do not contain data detection functions, user companies can still customise the ERP to allow the system to contain such capabilities. User companies however may often fail to customise the system to address this issue in ERP implementation. In sum, due to inappropriate initial configuration or customisation, the installed ERP will often lose the capability to detect invalid data (E-ITM Company B).

Evidence from the interviews confirmed that, failing to prevent invalid data from entering into the system would not just increase the amount of redundant data in ERP, but would also affect normal business operation:

> Duplicated BOMs can certainly consume data storage space of our system. Worse of all, when product designers need to modify the BOM of a product, if there are two duplicated BOM records in ERP, the designer may only modify one of them but ignore the duplicated one. As production staff may not recognise this circumstance, they may use the duplicated, which is also the unmodified, BOM record into production. This can cause a huge problem for production, as well as direct financial loss to the company (PS2 Company B).

System is not properly and continuously enhanced

User requirements of the company may be constantly changed under highly dynamic and competitive market environment conditions. The implemented ERP system should therefore be continuously reviewed and enhanced in the post-implementation phase in order to meet new user requirements. Failing to enhance the implemented ERP properly and continuously implies a risk that will make the installed ERP become less efficient. More than 87% of the respondents of the questionnaire perceived this to be a frequent and critical ERP risk to their firms.

Interviewees of the case study also stated that their firms often failed to enhance the implemented ERP system properly. Analysis of the interviews conducted indicated that, lack of system review was the fundamental reason that prevented the case companies from identifying current ERP problems and emergent user requirements and enhancing the installed ERP accordingly:

> Our IT people have never done any system review for the implemented ERP system...(as a consequence,) they often fail to identify what technical pitfalls the current system has and what extra functions we want from ERP...without know the existing ERP pitfalls and our new usage needs, I don't think our IT people can revise and enhance the system properly (FS2 Company B).

Nevertheless, further analysis of the interview data also showed that, even if IT staff had identified current ERP pitfalls and emergent user needs, they might still not be able to improve the installed ERP properly, due to low flexibility of ERP and high enhancement cost:

> I know our current ERP has a few technical pitfalls. However, due to low system flexibility of ERP, we cannot do anything to overcome these pitfalls. Although some of these pitfalls may be improved by reconfiguring or further customising the ERP, we cannot afford the potential cost that will arise (ITM Company A).

It is obvious that, when the implemented ERP is not properly and continually improved, the ERP system will gradually become less efficient, which may "impact business performance and reduce user acceptance toward the system" (E-ITM Company B).

8.5.5 Final ontology of the identified ERP risks

The original risk ontology derived from a critical literature review (as presented in chapter six) contained 40 risk events. Findings from the questionnaire identified that these predefined events were all risk events to successful exploitation of ERP in SOEs. As a consequence, all these risk events were included in the final risk ontology.

On the other hand, analysis of the interviews conducted indicated another 3 critical ERP exploitation risks that were not identified at previous stages of this project:

- ERP exploitation plan cannot be executed properly;
- ERP usage norms cannot be executed properly;
- Lose qualified system users.

It was felt that these new risks identified from the two case companies would be transferable to the other Chinese SOEs studied, considering the similar context that these companies engaged with. These additional ERP risks were thus added to the final risk ontology.

Consequently, by analysing and synthesising the findings of the questionnaire survey and the multi-case study, the researcher extended the original risk ontology and identified a set of 43 ERP risks that were important to the SOEs being studied. A final risk ontology is developed based on these identified risks, as presented below.

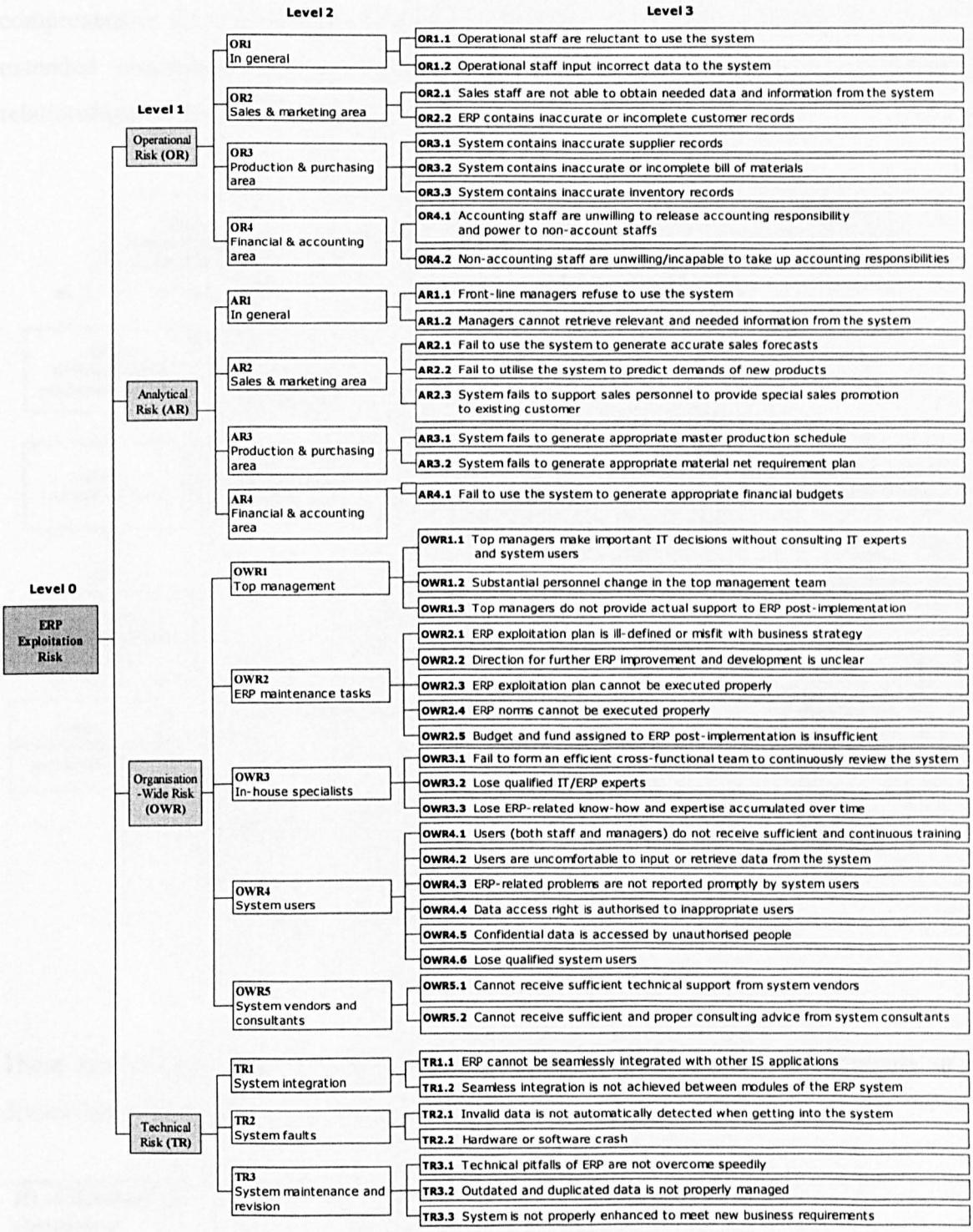

Figure 8.3: Final ontology of the identified ERP risks

8.5.6 Relationships of the identified ERP risks

A correlation map was developed in chapter seven (Figure 7.3) based on the questionnaire findings to highlight the correlations between the ERP risks identified. These correlations were further explored and validated in the multi-case study. Moreover, additional casual relationships between the ERP risks were identified from the interviews conducted. By synthesising the questionnaire and case study findings, a

comprehensive set of 23 relationships were found between the ERP risks identified. An extended conceptual map is therefore developed to highlight these identified relationships, as presented below.

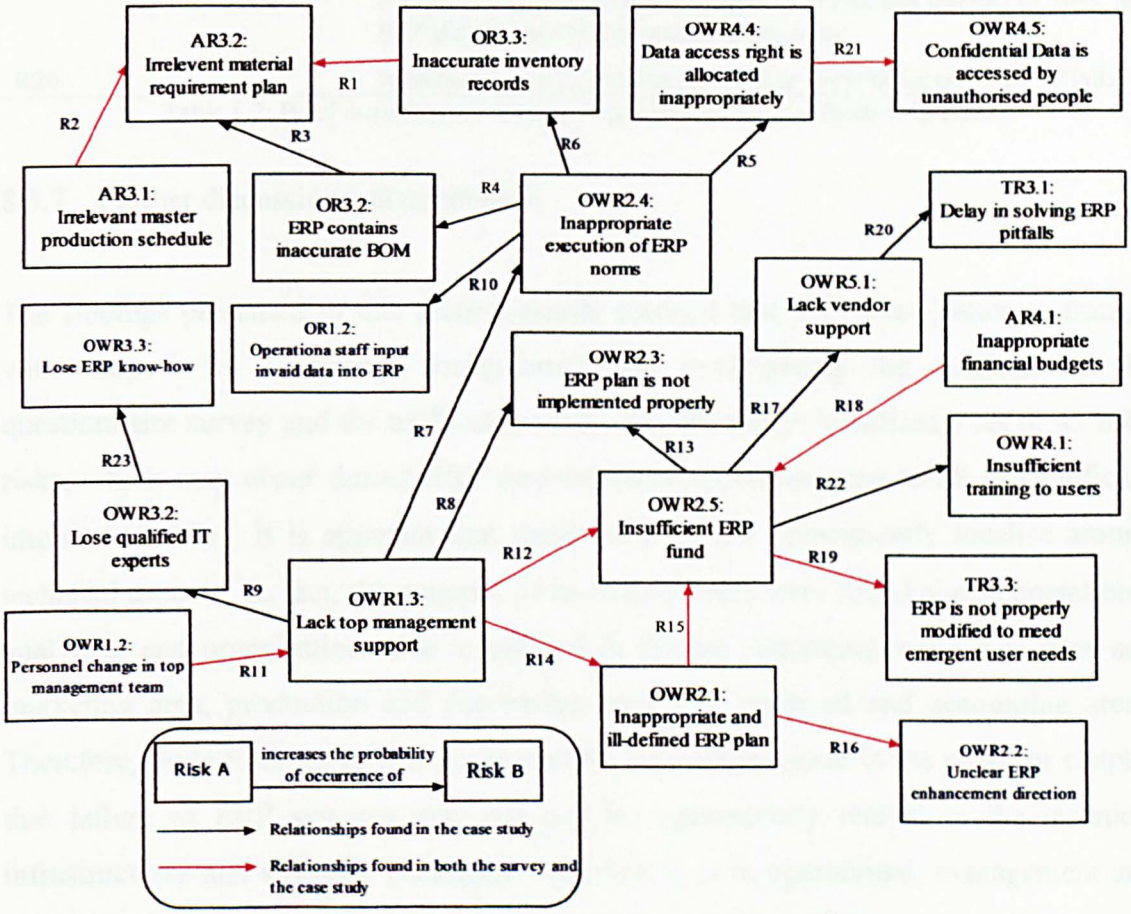

Figure 8.4: Conceptual map between the identified ERP risks

These relationships have been discussed in detail in above sections. A summary of discussion of these is given in the table below.

ID of Relationships Concerned	Brief Discussion
R1, R2 & R3	Inappropriate net material requirements plan is a result of inaccurate inventory record, inaccurate BOMs and inappropriate master production schedule.
R4, R5, R6, R7 & R10	ERP usage norms will not be executed properly without sufficient support from top managers, and thus causing a set of undesirable events, e.g. staff input invalid data into ERP, inaccurate BOM and inventory records, and inappropriate allocation of data access rights.
R21	Confidential data may be accessed by unauthorised people due to inappropriate allocation of data access rights.
R8, R9, R11, R12 & R14	Personnel change in top management team can result in discontinuous top management support. Without sufficient top manager support, many risk events may occur, e.g. lose qualified IT expert, insufficient ERP fund, ill-defined and inappropriate implementation of ERP plan.

R23	Lose IT experts can result in losing ERP-related know-how and knowledge.
R15 & R16	An ill-defined ERP plan can lead to unclear direction for ERP enhancement and insufficient fund to be assigned to ERP.
R13, R17, R18, R19 & R22	Insufficient fund will be assigned to ERP due to inappropriate financial budget and insufficient top manager support, and thus causing many risk events, e.g. lacks vendor support, insufficient training to users, and ERP plan cannot be implemented properly.
R20	Insufficient vendor support can lead to delay in solving ERP pitfalls.

Table 8.2: Brief discussion of relationships between the identified ERP risks

8.5.7 Further discussion and conclusion

The findings presented in this section clearly showed that ERP exploitation is fraught with risks. By analysing, triangulating and synthesising the findings of the questionnaire survey and the multi-case study, the researcher identified a set of 43 ERP risks, which may occur during ERP post-implementation and can result in significant impact in SOEs. It is apparent that these risks do not conveniently localise around technical aspects. In fact, the majority of these ERP risks were found across operational, analytical and organisation-wide levels and in diverse functional areas (i.e. sales and marketing area, production and purchasing area, and financial and accounting area). Therefore, these findings further confirmed the conclusion made in the previous chapter that failure of ERP systems may not just be conveniently related to the technical infrastructures and software packages. Actually, it is in operational, management and strategic thinking areas where the majority of risks were identified.

Moreover, as shown in the relationship map of risks, it became apparent that the majority of relationships occurred between the identified organisation-wide risks. Because these organisation-wide risks seem to be closely related with each other, the occurrence of these risks is much more difficult to manage, mitigate and contain. Technical risks that are very often seen as the main perpetrators in ERP failure seem to be important but not strictly related to other risks. On the other hand, it clearly emerged from this conceptual map that, organisation-wide risks are often the direct triggers for the operational and technical risks and indirect triggers for the analytical ones. It can therefore be concluded that organisation-wide risks are probably the most crucial type of ERP exploitation risk for SOEs, as they play a fundamental in potential failure of ERP due to the potential causal effects between them.

As a consequence, and in consonance with the conclusions for the barriers, SOEs should pay more attention to the organisation-wide risks identified, as properly managing this type of risk may help companies to prevent the occurrence of the other types of ERP risks or mitigate their impacts. In addition, as clearly shown in the ERP risk ontology, the 19 organisation-wide risks identified in this study were associated with 5 main categories, namely top management, ERP maintenance tasks, in-house experts, system users, and system vendor and consultant. These 5 categories should therefore be considered as 5 core organisational areas for identification and management of ERP exploitation risks. Substantial attention should be given to these 5 core areas in order to ensure long-term ERP success.

8.6 Relationships of the identified barriers and risks

ERP barriers existing in the current business context can often increase the probability of occurrence of potential ERP risks. Proper management of the current ERP barriers may help user companies to prevent potential crucial ERP risks from occurring. In order to do so, it is important for SOEs to clarify the causal relationships between the ERP barriers and risks identified.

8 correlations between the identified ERP barriers and risks were found from the questionnaire findings. These correlations were further explored and validated in the multi-case study, from which a set of additional relationships were identified. By comparing and synthesising the findings and evidence derived from both the questionnaire and the follow-up case study, a comprehensive set of 42 relationships were found between the ERP barriers and risks identified. A conceptual map is therefore developed to highlight these identified relationships, as presented below.

Moreover, these relationships have actually been presented and discussed in section 8.4 and 8.5. Nevertheless, the following table presents a summary of description and discussion on these.

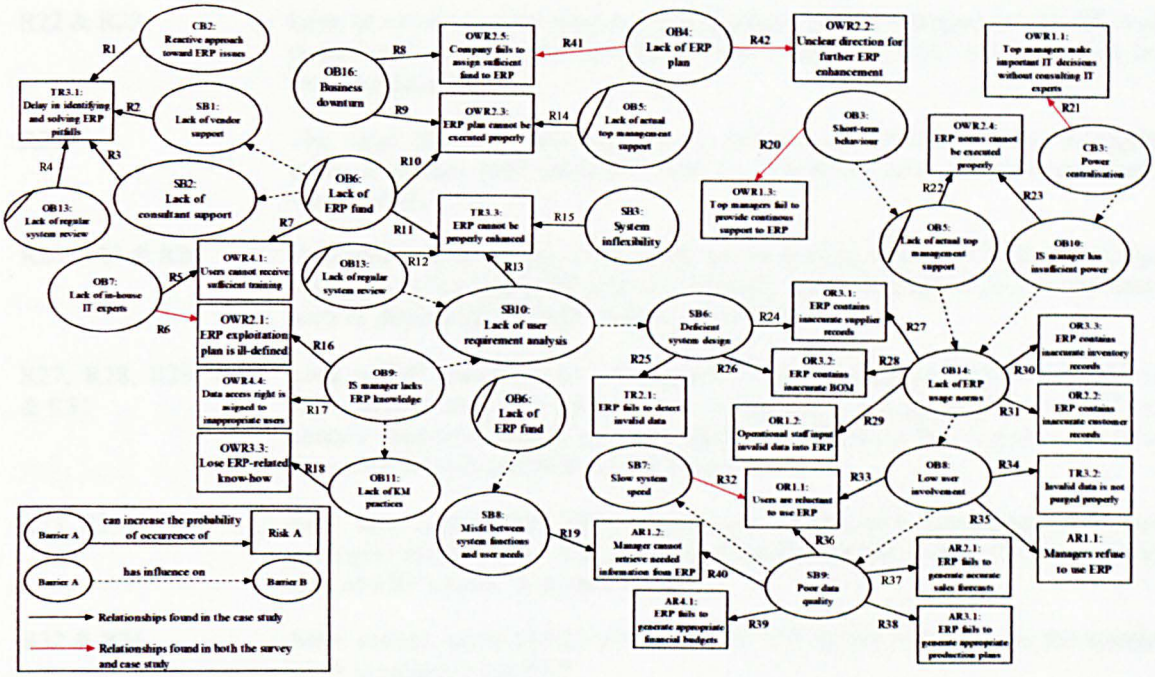

Figure 8.5: Conceptual map between the identified ERP barriers and risks

ID of Correlations Concerned	Brief Discussion
R1, R2, R3 & R4	Lack of vendor and consultant support, lack of regular system review and the reactive approach towards ERP issues can increase the probability of delay in identifying and solving ERP pitfalls.
R7, R10 & R11	Lack of ERP fund can increase the probability of occurrence of a variety of risk events, e.g. users cannot receive sufficient ERP training, ERP plan cannot be executed properly, and the installed ERP cannot be properly enhanced.
R8 & R9	Business downturn and poor business performance can increase the probability that the company fails to assign sufficient fund to ERP, and that ERP plan cannot be executed properly.
R14	Lack of actual support from top management can increase the probability that ERP exploitation plan is not be executed properly.
R12, R13 & R15	System inflexibility, lack of regular system review and lack of proper user requirement analysis can increase the probability that the installed ERP cannot be properly and continuously enhanced.
R5 & R6	Lack of in-house IT experts can increase the probability for user companies to have ill-defined ERP plan, as well as increasing the probability that users cannot receive sufficient and continuous ERP training.
R16 & R17	IS manager has insufficient ERP knowledge can increase the probability for data access rights to be assigned to inappropriate users, as well as enhancing the chance for user companies to have ill-defined ERP plan.
R18	Lack of knowledge management practices can increase the chance for losing ERP-related know-how, when highly-qualified IT experts leave the firm.
R19	Misfit between system functions and user needs can increase the probability that managers cannot find needed statistics and information from ERP.
R20	Short-term behaviour of top management can enhance the probability for them to provide insufficient support to ERP.

R22 & R23	Lack of actual support from top management and IS manager has insufficient power will increase the probability that established ERP norms cannot be executed properly.
R21	The issue of power centralisation can enhance the chance that top managers make important ERP decisions without consulting in-house IT experts and system users.
R24, R25 & R26	Deficient system design may lead to the occurrence of a set of risk events, e.g. ERP fails to detect invalid data automatically and ERP contains duplicated data, such as duplicated supplier records and BOMs.
R27, R28, R29, R30 & R31	Lack of ERP usage norms can increase the probability for operational staff to input invalid data into ERP. As a consequence, the probability for ERP to contain inaccurate data, e.g. inaccurate supplier records, customer records, inventory records and BOMs, will increase.
R33, R34 & R35	Low user involvement can increase the chance that operational staff and managers refuse to use ERP, as well as increasing the probability that invalid data of ERP cannot be purged properly.
R32 & R36	Slow system speed and poor data quality will increase the chance for system users to refuse to use ERP.
R37, R38, R39 & R40	Poor data quality will increase the probability for ERP to generate inappropriate sales forecasts/production plans/financial budgets, and thus result in that managers cannot retrieve needed reports and information from ERP.
R41 & R42	Lack of ERP plan can increase the probability that the company fails to assign sufficient fund to ERP, and that the firm has unclear direction for further ERP enhancement.

Table 8.3: Brief discussion of relationships between the identified ERP barriers and risks

A set of meaningful findings emerged from the above relationship map and the table of discussion. It is apparent that existing ERP barriers can lead to the occurrence of a wide range of ERP exploitation risks associated with diverse operational, analytical, organisation-wide and technical aspects. Nevertheless, it is shown in the conceptual map that the majority of relationships in the complex network are between organisational barriers and ERP risks. Additionally, as highlighted in the conceptual map, organisational barriers are also the main triggers of other ERP barriers, including the system ones. It therefore seems that current organisational barriers presented to be the most critical factors to potential ERP failure, as they are not just the causes of other crucial ERP barriers but can also increase the probability of occurrence of many ERP risk events.

8.7 Conclusions

By analysing, triangulating and synthesising the findings derived from both the questionnaire and the follow-up case study, the researcher revised and extended the original barrier and risk ontologies, which were established based on a critical literature

review. Consequently, this research project identified respectively a set of 31 ERP barriers and a set of 43 ERP risks that can prevent SOEs from achieving long-term ERP success.

In particular, the findings clearly showed that the identified ERP barriers and risks were not found around one category, namely not around the technical category. In fact, crucial ERP barriers were identified in a variety of cultural, organisational and system aspects in SOEs. On the other hand, the ERP risks were found across operational, analytical, organisation-wide and technical dimensions and in diverse functional usage areas (i.e. sales and marketing area, production and purchasing area, and financial and accounting area). Therefore, these findings further confirmed the previous declaration made in chapter seven that, failure of ERP systems can not just be conveniently attributed to system aspects, such as the software package and the ICT infrastructure. Actually, it is in organisational and business aspects where the majority of ERP barriers and risks were identified in the context of Chinese SOEs.

Moreover, the identified ERP barriers and risks seem to be interwoven and closely related with each other. By further investigating the list of correlations identified, it became apparent that organisational barriers were often the main triggers for the complex networks of ERP barriers and risks in the context of Chinese SOEs. Specifically, organisational barriers are not only the main triggers of other ERP barriers, but can also lead to the occurrence of a wide range of ERP risks. Organisational barriers therefore proved to be the most crucial problems for potential ERP failure in Chinese SOEs

Nevertheless, despite their importance and critical impacts, organisational barriers were often understated by Chinese respondents in the questionnaire and even in the interviews, mainly due to a lack of awareness or an unwillingness to address internal management shortcomings. Therefore, there may be a need for Chinese managers in SOEs to become more aware of the critical impacts associated with the current organisational barriers in order to ensure long-term ERP success.

These conclusions are further discussed and interpreted in the next chapter, which aims to provide a global and integrative discussion on the most important findings derived from this project.

Chapter Nine: Integrative Discussion of Findings

9.1 Introduction

Through the adoption and implementation of the QUAN and *qual* design that consisted of a questionnaire survey and a follow-up multi-case study component, this research project identified a large amount of meaningful and significant findings. Specifically, as presented and discussed extensively in chapter seven and chapter eight, a comprehensive set of ERP exploitation barriers and risks to Chinese SOEs were identified and explored. It is apparent from the findings reported in the previous chapters that, the identified ERP barriers and risks do not stand independently from each other. In truth, what the findings of this study confirmed is that these identified ERP barriers and risks are interwoven and closely related with each other, and there are very complicated causal relationships existed between them.

Although a large amount of results and findings were identified and reported in previous chapters, there is the need for a holistic and integrative analysis of the separate findings. Therefore, this chapter provides such a discussion on the findings discussed and presented in chapter 7 and 8. It aims at highlighting and demonstrating the most meaningful and critical messages involved in the findings.

9.2 Critical discussion of findings

9.2.1 Holistic discussion

The bivariate analysis of the questionnaire data identified that the existence of an ERP barrier can often lead to the occurrence of a set of ERP risks in the context of Chinese SOEs. Specifically, eight correlations between ERP barriers and risks were identified, as shown in Figure 9.1. This figure shows also the correlation coefficient (i.e. r) and the significance (i.e. **, correlation is significant at the 0.01 level; *, correlation is significant at the 0.05 level) of each correlation. A detailed interpretation on each of these correlations can be found in chapter seven, and thus is not further presented here.

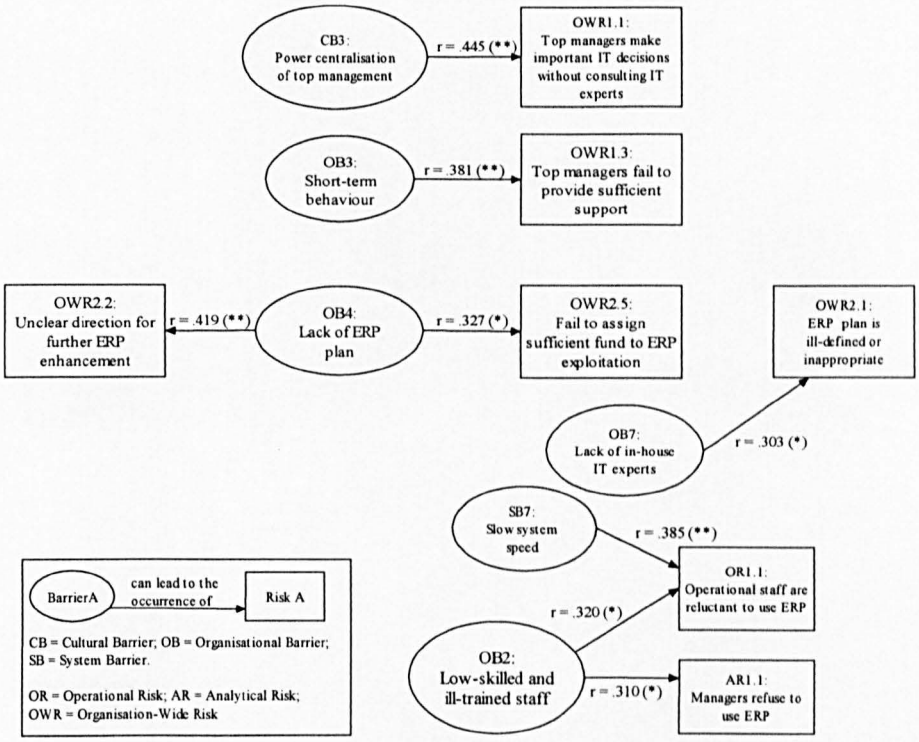

Figure 9.1: Correlation between ERP barriers and risks

By investigating this diagram, it is immediately apparent that, the majority of these correlations occurred between organisational barriers and potential ERP risks. In contrast, cultural and system barriers, which were also identified to be important ERP barriers in this study, do not prove to be the main triggers of ERP risks. As a consequence, it is evident from this diagram that, in comparison with cultural and system barriers, organisational barriers seem to be more dangerous barriers that can lead to the occurrence of many potential ERP risks.

On the other hand, the analysis of the questionnaire data also proved that the occurrence of an ERP risk can increase the probability of occurrence of other risks. Figure 9.2, which is extended from Figure 9.1, shows an additional set of correlations (with blue colour) between the identified ERP risks.

It is obvious from Figure 9.2 that, organisational barriers are often the triggers of ERP risks, which occurrence can in turn increase the probability of occurrence of other risks (as highlighted with blue colour). It can thus be concluded from Figure 9.2 that, organisational barriers can originate a large set of ERP risks, including the operational, analytical, organisation-wide and technical ones.

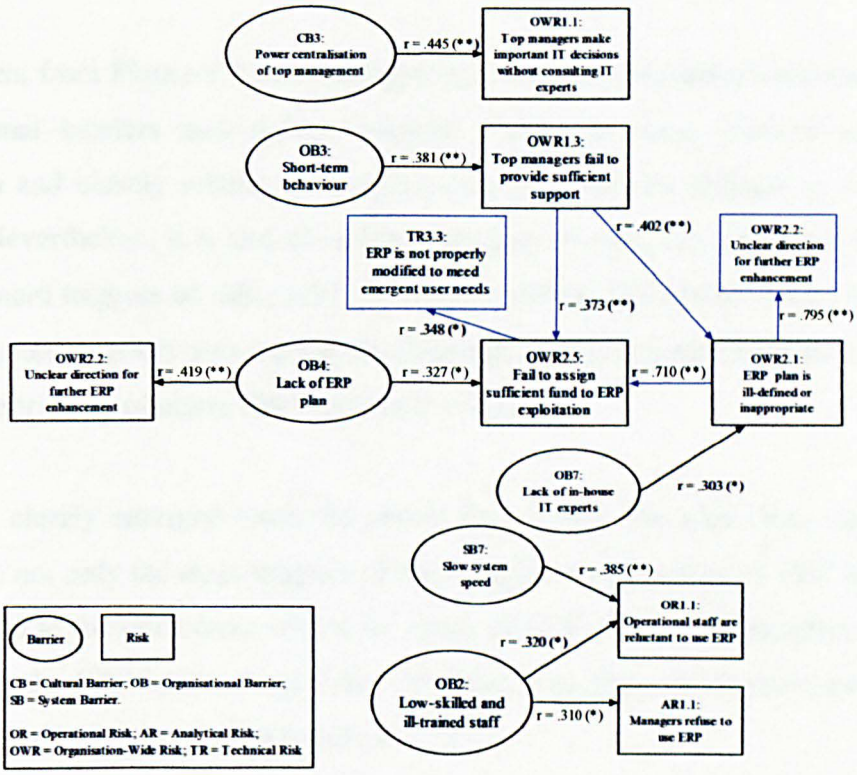

Figure 9.2: Correlation between ERP barriers and risks (extended from Figure 9.1)

Moreover, the existence of an ERP barrier may also often be related to the existence of other barriers. Figure 9.3, which is extended from Figure 9.2, shows (with blue colour) a further set of correlations identified between the ERP barriers.

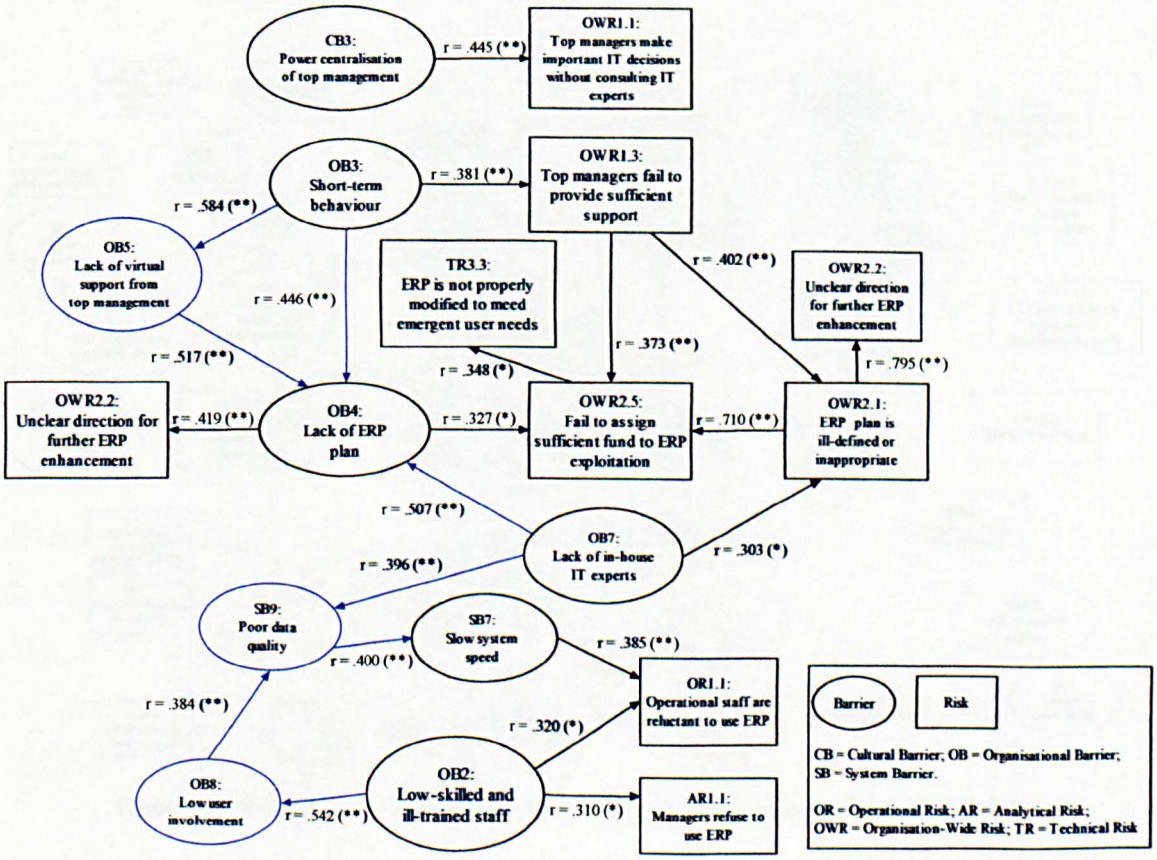

Figure 9.3: Correlation between ERP barriers and risks (extended from Figure 9.2)

It is apparent from Figure 9.3 that the highlighted barrier correlations occurred between organisational barriers and system barriers. Because these barriers seem to be interwoven and closely related with each other, they will be difficult to manage and remove. Nevertheless, it is also clear from the diagram that, organisational barriers are often the main triggers of other ERP barriers, including the system ones. In contrast, although system barriers also seem to be important in this diagram, they do not prove to be the main triggers of either ERP barriers or risks.

Overall, it clearly emerged from the above figures that the identified organisational barriers are not only the main triggers of the complicated networks of ERP barriers, but can also lead to the occurrence of a wide range of ERP risks. It is therefore concluded that, among the ERP barriers and risks identified, organisational barriers present to be the most crucial for potential ERP failure in SOEs.

This conclusion is supported by the follow-up case study. Specifically, anecdotal and qualitative evidence collected from the two case studies reinforces that, the identified organisational barriers may cause a much wider range of ERP barriers and risks in user companies, as exemplified in Figure 9.4 with blue colour.

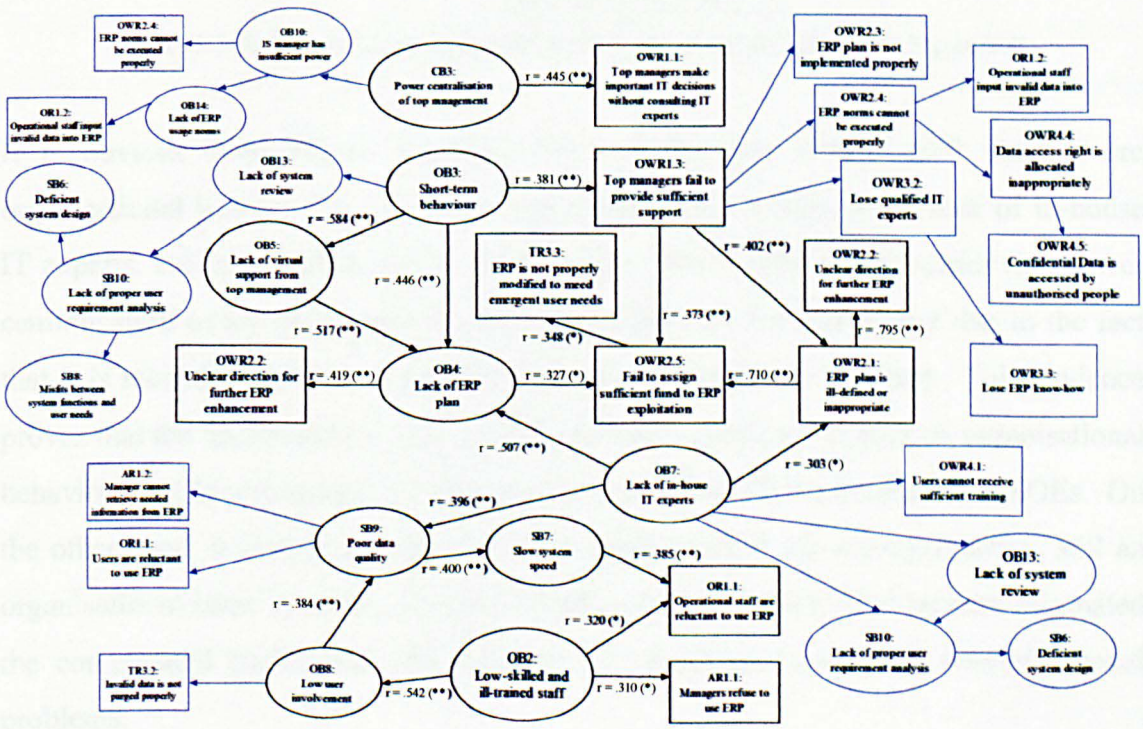

Figure 9.4: Relationships between ERP barriers and risks (extended from Figure 9.3)

In truth, by investigating Figure 9.4, it can be identified that the entire complicated network of barriers and risks is actually originated by four critical ERP barriers (as highlighted with red colour in Figure 9.5).

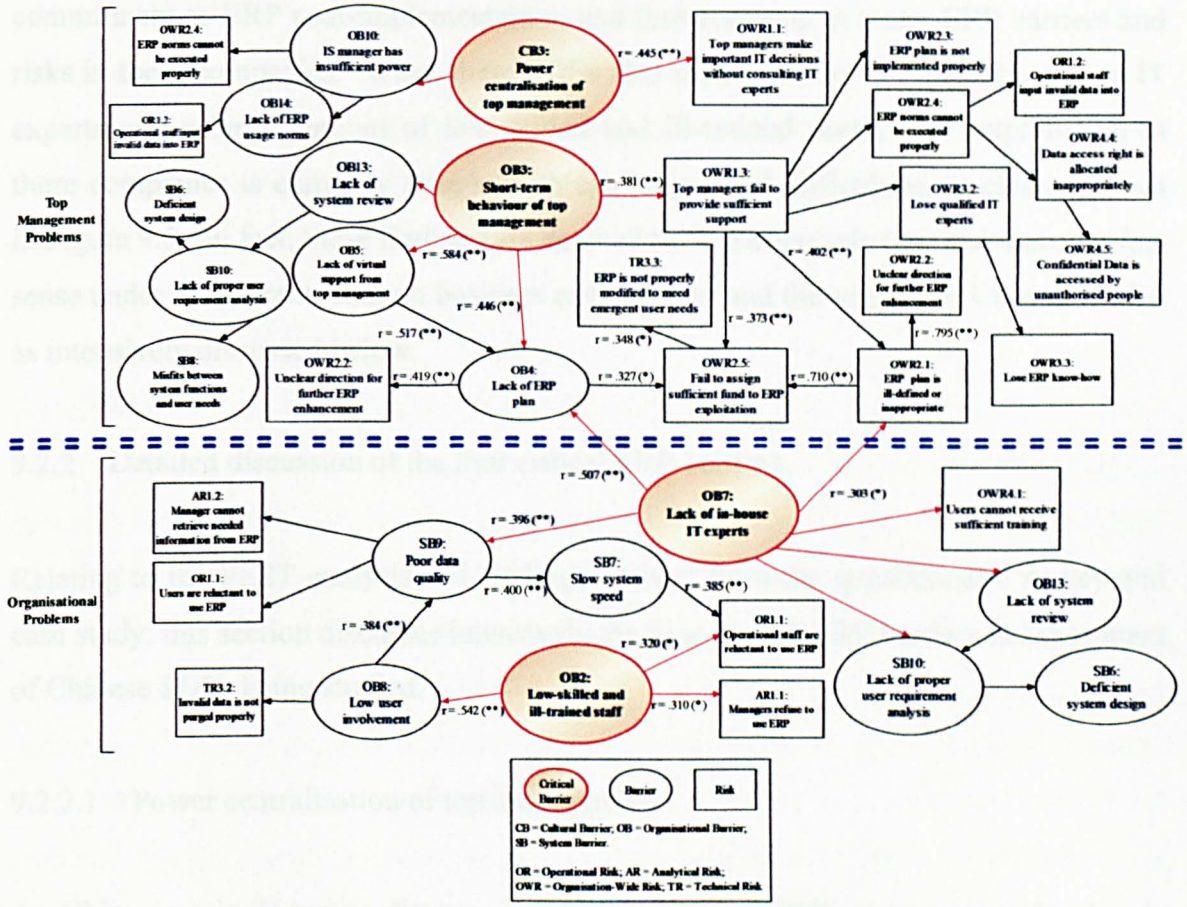

Figure 9.5: Relationships between ERP barriers and risks (modified from Figure 9.4)

It is obvious from Figure 9.5 that, three of the four critical ERP barriers are organisational barriers (i.e. short-term behaviour of top management, lack of in-house IT experts, and low-skilled and ill-trained staff). The fourth critical barrier (i.e. power centralisation of top management) was categorised as a cultural barrier due to the fact that it is related to the Chinese cultural feature of high power distance. This evidence proves that the traditional Chinese culture can have significant impact on organisational behaviour of Chinese managers, which in turn can affect ERP exploitation in SOEs. On the other hand, it is apparent that 'power centralisation of top management' is still an organisational issue in nature. In other words, the four critical ERP barriers originated the complicated barrier and risk network are all organisational and human-oriented problems.

Additionally, as highlighted with a double-dashed line across the middle of the diagram, the majority (about 2/3) of relationships are originated by the two barriers related to top management (i.e. power centralisation, and short-term behaviour). It can therefore be concluded that top managers in SOEs currently may not be ready for the long-term commitment to ERP post-implementation, and thus resulting in many ERP barriers and risks in these companies. When these SOEs also seem to have insufficient in-house IT experts and a large amount of low-skilled and ill-trained users, ERP exploitation in these companies is currently fraught with challenges and difficulties, as clearly shown in Figure 9.5. In fact, these findings are deemed to be particularly true and make perfect sense under the current Chinese business environment and the context of Chinese SOEs, as intensively discussed below.

9.2.2 Detailed discussion of the four critical ERP barriers

Relating to the PEST analysis and findings derived from the questionnaire survey and case study, this section discusses intensively the four critical ERP barriers in the context of Chinese SOEs being studied.

9.2.2.1 Power centralisation of top management

As China is a high power distance society (Hofstede, 1997), power centralisation is often mentioned as a long-standing issue embedded in the traditional Chinese culture (Martinsons and Hempel, 1998). As discussed before, power within Chinese firms is often centrally held by a few people, who often have autocratic and close to absolute power in the company (Martinsons and Hempel, 1998). The issue of power centralisation may be particularly obvious in Chinese SOEs, due to the special nature and historical background of this type of company. In particular, as identified in the PEST analysis, in the planning economy era China's SOEs were directly owned and controlled by the state. Top managers of SOEs in that period of time did not just hold the highest positions in the firm but were also representatives of the government. These top managers hence inevitably had absolute authority and power in the company. Although as identified in the PEST analysis the internal mechanism of modern SOEs has been significantly improved as a result of the economic and SOE reform, the issue of power centralisation did not currently seem to be substantially changed in the SOEs studied, probably due to two main reasons. Firstly, due to a long history of bureaucratic

intervention and control, Chinese SOE leaders may be inclined to hold ultimate power and control in the firm, while Chinese employees may be tolerant of such centralised management system. As a consequence, the issue of power centralisation may not be easily removed from Chinese SOEs, such as the SOEs studied. Secondly, although most modern SOEs experienced essential transformation under the national SOE reform policy, the government is still the owner or biggest shareholder of the firm and thus still has strong influence and intervention on these companies. Due to this reason, the bureaucratic characteristic of SOEs has not been completely changed. It can be argued that power centralisation may be a direct result under the hitherto bureaucratic environment in SOEs.

As a consequence, top managers of SOEs still seemed to hold ultimate power and control on most organisational aspects. As such, top managers, rather than IS managers, were often responsible for making final decisions on most important IS issues in these SOEs. It was identified from previous literature (e.g. Reimers, 2002; Martinsons and Hempel, 1998; Martinsons and Westwood, 1997) that as a result of power centralisation, Chinese leaders may traditionally be inclined to make centralised decisions on important IS issues without collecting and considering alternative ideas from a wider group of people (e.g. IT experts, system users). Nevertheless, findings of this study showed that the actual situation in SOEs was different from that mentioned in the literature reviewed. Specifically, this study identified that top managers of SOEs would often allow in-house IT experts and system users to make a substantial contribution in the process of IS decision making. For instance, in the two case companies top managers would make IS decisions based on proposals and suggestions given by IS managers, who in turn made their proposals based on the needs and comments of system users. This finding actually makes sense, considering the fact that top managers may often not be experts in IT and thus need to seek opinions from IT professional to make IS decisions. More importantly, SOE managers interviewed highlighted that, if top managers of modern SOEs were to receive full support and cooperation from their employees, then they had to take into account the opinions of their people. This finding actually shows an obvious difference between SOEs and traditional Chinese firms. In comparison to leaders in traditional Chinese firms, top managers of the SOEs studied seem to be less arbitrary and be more willing to listen to the voice of employees. This is certainly a positive change that has occurred in SOEs, and is deemed to be a result of

China's continuous effort of economic reform, SOE reform and opening up to the outside world during the last three decades.

Despite this improvement in top management attitude, power centralisation however still proved to have undesirable impact on ERP exploitation. In particular, when SOE leaders tend to hold strong control on diverse organisational aspects, they may not always be willing to share a substantial part of this power to their managers (e.g. the IS manager). More importantly, as identified from the case study, the actual power assigned to managers of the firm might not merely depend on their job positions, but would also depend on their personal relationship with the big boss (i.e. CEO). In other words, if IS managers do not have strong relationship with their bosses, they may often not be empowered. This evidence further supports that the bureaucratic characteristic of SOEs has not been completely changed. It is obvious that, when IS managers lack actual power in the firm, they will not be able to deal with routine ERP usage, maintenance and enhancement problems efficiently. This was found in this study as a substantial reason that led to difficulties in promoting ERP usage and related business changes in SOEs.

Overall, findings of this project identified that in contrast with leaders in traditional Chinese firms, top managers of SOEs were less arbitrary and be more open to alternative opinions from their employees. Nevertheless, they still held very strong power and control on diverse organisational aspects (e.g. IS aspects) under the current bureaucratic environment. Top managers of SOEs did not currently seem to be fully ready to empower their middle-level managers, such as IS managers. As a consequence, IS managers often lacked sufficient power and authority to deal with ERP exploitation issues (e.g. user resistance) efficiently. Faced with these problems, top management support to ERP proved to be particularly crucial to enable successful ERP use and exploitation in SOEs in the long-term. Unfortunately, as a result of short-term behaviour, lack of actual top management support was found to be another ERP barrier in SOEs, as discussed next.

9.2.2.2 Short-term behaviour of top management

As discussed in the PEST analysis, China is currently at its rapid development stage towards industrialism and modernization. It clearly emerged in the PEST analysis that,

in this unique period of time, political, economic, social and market environments of the country have changed quickly and constantly. In order to survive and compete in such fluid business environment, Chinese managers have to react fast to emergent market needs and changes. They may also often need to achieve short-term results and immediate benefits desperately, in order to secure the company's market position under the current economic pressure and the very hard business environments (Zhang, 2004). Short-term thinking has thus become a prevalent phenomenon in Chinese firms (Zhang, 2004). Nevertheless, it is widely recognised that short-term behaviour can actually lead to crucial organisational problems to companies (Zhang, 2004; Liu, 2004). In particular, when managers act to achieve short-term benefits, they may often neglect and overlook the associated impacts and problems that may arise to the company in the long-term (Liu, 2004).

From an IS perspective, short-term behaviour can be a substantial barrier to successful exploitation of ERP. As discussed before, ERP exploitation is a long-term investment process. It therefore requires continuous support of top management. Nevertheless, due to short-term thinking and also a lack of ERP knowledge, top managers may often perceive successful implementation of the system as the end of the ERP journey and thus may often not be ready to provide long-term commitment and support in ERP post-implementation. This was found to be particularly true in the SOEs studied. Specifically, it was identified in this study that top managers of SOEs would often just make verbal contributions by declaring the importance of ERP and encouraging staff to get involved in ERP exploitation, but would rarely make tangible and sustained efforts to enable this to happen. Additionally, it was also identified in this project that top managers of the SOEs studied often considered ERP adoption as a one-off investment. They were thus reluctant to make continuous investment on enhancing and maintaining the installed ERP systems. As a consequence, insufficient ERP exploitation funds were identified as a further ERP barrier in SOEs.

More importantly, as discussed earlier, top managers in SOEs often hold very strong power and authority in the company. Their attitudes and supports can thus significantly affect ERP usage in the firm, and determine whether or not the company can achieve long-term ERP success. Therefore, when top managers fail to provide tangible and continuous support to ERP due to short-term thinking, the system exploitation stage may inevitably be fraught with challenges and difficulties in Chinese SOEs. This is

exactly what has been shown in Figure 9.5 above. More than 2/3 of ERP problems shown in this diagram are originated by the two crucial barriers related to top management.

Overall, in order to receive the full range of potential benefits that ERP promises to bring to the firm, top managers must be ready for the long-term fight in ERP post-implementation. Nevertheless, this did not currently seem to be the case in SOEs, due to short-term thinking of top management. There thus may be a need for top managers of SOEs to become more aware of their roles and importance to ERP exploitation and provide more actual support to this long-term process.

9.2.2.3 Lack of in-house IT experts

As discussed before, IT staff can develop a wide range of skills and expertise (e.g. project management, system requirement analysis, business process redesign, etc) through the ERP implementation project. As a consequence, the process of ERP implementation is actually an invaluable learning process for all in-house IT experts. Nevertheless, the better the skills in-house IT staff acquire, the higher the probability that they may seek for a better job. On the other hand, as China is currently at its rapid development stage, market demands for various types of highly qualified experts have been extremely high in the country. This certainly provides the prerequisite for high-skilled IT experts to hunt for a better career. Additionally, as identified in the PEST analysis, private and foreign companies operating in China often have better profitability than SOEs, and thus may often be in a better position to attract highly qualified experts. As a consequence of these reasons, turnover rate of qualified IT professional may be very high in Chinese companies in general and in SOEs in particular. As a result of high turnover of IT experts, it was identified that SOEs often did not have sufficient in-house IT experts to get involved in ERP exploitation and maintenance.

It is obvious that efficient ERP maintenance and enhancement require continuous effort and contribution of a large amount of IT experts. Lack of in-house IT experts proved to be the cause for a range of ERP exploitation issues in SOEs. Specifically, it was identified that, due to a lack of IT experts, SOEs would rarely conduct system audit or review during ERP post-implementation. It is obvious that as user requirements of a

company may constantly change under highly dynamic and competitive market conditions, it is fundamental for user companies to continuously review the installed ERPs in order to identify any misfits between the system and user needs. Otherwise, the installed ERP system may gradually become inefficient in supporting emergent user requirements and business goals in the long-term. On the other hand, as SOEs did not have sufficient in-house IT staff, the implemented ERP might often not be maintained properly, redundant data of the system would often not be regularly purged, and existing ERP pitfalls might often not be speedily identified and resolved in these firms. Findings of this study proved that the occurrence of these problems could significantly affect system performance and also reduce user acceptance in SOEs.

In sum, turnover of high-skilled IT experts seems to be an unavoidable phenomenon under the current high market demands for this type of professional in China. High turnover rate of IT staff resulted in insufficient IT experts in SOEs, which in turn could lead to a variety of ERP maintenance problems and difficulties. Faced with this situation, SOEs may need to make a further effort to retain existing IT experts as well as to attract external IT professionals from the labour market.

9.2.2.4 Low-skilled and ill-trained system users

As identified in the PEST analysis, SOEs in the planning economic era were required to provide lifelong employment for urban citizens. A career in traditional SOEs was therefore highly secure, and was thus colloquially called an 'iron rice bowl'. As a result of this characteristic, many employees of SOEs have been working in the firm for a few decades. On the other hand, it was identified through the PEST analysis that China's education system had been completely broken down during the period of Cultural Revolution between 1966 and 1976. As a consequence, elder SOE workers, who had experienced the Cultural Revolution, may often be low-educated. This problem proved to be a critical barrier to successful use and exploitation of ERP in SOEs. Specifically, it was identified in this study that low-educated and elder staff members in SOEs often also had low IT literacy, and were more inclined to do their work by following the traditional manual way. These workers were thus found to be less willing to learn new skills (e.g. computer and IT skills) and adapt to a new working environment. As a consequence, this type of worker often had low incentives to accept and use the installed ERP. As discussed before, because these elder employees have been serving

in the company for many years, dismissing them will result in the firm having to pay an substantial amount of dismissal fees. Due to this reason, top managers of SOEs would often not be willing to dismiss elder workers of the firm. It was however identified in this study that, when elder workers recognised their jobs were highly secure, some of them might become indifferent to their work. Such indifference can certainly lead to further obstacle to ERP usage in SOEs.

As a consequence, extensive and continuous ERP training must be provided to this type of system user in order to enable ERP to be efficiently used and operated in the long-term. Unfortunately, insufficient ERP training was identified as another problem existing in SOEs. Specifically, it was identified that although some basic ERP trainings had been provided to system users in ERP implementation, further training offered in SOEs during ERP post-implementation were limited. This is certainly problematic, especially considering two reasons. Firstly, it was identified that when attending training sessions during ERP implementation, system users often could not fully understand the training contents and materials provided, due to a lack of actual experience in using the system at that moment. Therefore, it is important and essential for these system users to receive further and continuous training during ERP exploitation. Secondly, the installed ERP system may need to be constantly modified and improved during the system post-implementation stage. Thus, continuous ERP training should be provided, in order to ensure system users to use any newly installed ERP functions effectively. It was identified that insufficient ERP training in SOEs was a result of insufficient ERP exploitation fund, which was in turn attributed to short-term thinking of top managers in the firm. Moreover, as SOEs did not have sufficient IT experts, it was often difficult for them to render high-quality internal training to system users. Recruiting external trainers is obviously undesirable due to insufficient ERP funding issues. Therefore, training provided in ERP post-implementation in SOEs seemed to be very insufficient.

Consequently, low-skilled and ill-trained users often originated significant resistance for promoting ERP usage and related business changes in Chinese SOEs. Furthermore, IS managers of the firm lacked sufficient power and top managers of the company also failed to provide sufficient tangible support to ERP. The resulting user resistance proved to be very difficult to solve and manage in SOEs. Additionally, it was identified that when system users were resistant to use ERP, they might also often tend to be less

careful during daily use of the system. As a consequence, the probability for system users to make mistakes (e.g. inappropriate system operation, input incorrect data into the system, etc) increases.

Moreover, Chinese managers of SOEs also often failed to establish rigorous ERP usage rules or policies to regularise user activities, or these rules or policies might often not be executed properly. As a result, system users would not be restricted by systematic ERP policies, and also did not need to take any consequences if they had made significant ERP usage mistakes. This management shortcoming can certainly increase the probability of occurrence of user mistakes and inappropriate system usage. As discussed before, the integration nature of ERP determines that, one user's mistake can raise immediate impact and problems to the entire company and may disturb the operation of all functional divisions. In truth, inappropriate system usage can result in significant system and business disasters.

Overall, having a large amount of low-skilled and ill-trained staff proved to be a significant problem that SOEs were currently confronted with. Faced with this problem, there is a need for SOEs to provide further and continuous ERP training to system users during ERP exploitation. In order to ensure long-term ERP success, top managers and IS managers of SOEs need to put a substantial effort to manage and control current internal resistance raised by low-skilled and ill-trained users in the firm.

9.3 Conclusions of critical discussion

Consequently, based on all findings presented and discussed so far, an overall conclusion can be drawn from this project in the form of the following root definition:

> Potential failure of ERP cannot be conveniently attributed to system problems (e.g. software packages and ICT infrastructure), but more importantly should be attributed to organisational barriers and problems, in particular human problems that are related to top managers, IT experts and system users, in the context of Chinese SOEs.

This final conclusion is consistent with the general IS theories, as studied in chapter two. In particular, it was identified in chapter two that an ERP system does not represent the

entire IS; rather, an ERP is only a part of an IS, and needs to work together with people, hardware and network to achieve its intended goals. It was thus expected at the initial stage of this project that the success of ERP will not merely rely on technical aspects, but more importantly also depends on various human and organisational factors. The findings derived from this study confirmed that this original expectation is particularly true in the Chinese SOE context.

Nevertheless, despite their importance and critical impacts, organisational barriers and problems would often be underestimated by managers and users in Chinese SOEs, as discussed further below.

9.4 Understatement of organisational barriers

As discussed in the previous chapter, by analysing and comparing the findings of the questionnaire and the case study, it became apparent that organisational barriers were often understated by participants of the questionnaire and even the interviews. Qualitative evidence was found in the case study, as presented in chapter eight, to show that this underestimation was caused by a lack of understanding and awareness of Chinese managers in the SOEs studied. Additionally, through face-to-face interaction with Chinese managers in interviews, it was felt that this understatement might also be caused by an unwillingness of Chinese managers to face and deal with organisational and management shortcomings. As discussed before, under the bureaucratic environment in SOEs, Chinese managers may often be reluctant to address problems embedded in their organisational and management mechanism in order to avoid potential personal risks (e.g. job loss). These attitudes of Chinese managers may actually blind them to the complexity and importance of organisational barriers, which might be less obvious but proved in this study to be more difficult to resolve and more critical to long-term ERP success in SOEs. This phenomenon actually further confirmed the argumentation made in chapter two, that is, technical problems may often be handled explicitly in user companies, but human and organisational problems are always complicated and thus difficult to identify and manage. Therefore, there may be an imperative need for Chinese managers to become aware of the complexity and networked nature of organisational barriers, and also become more willing to face diverse types of existing internal shortcomings. In order to facilitate this, there seemed to be a need for top managers of SOEs to put a substantial effort to further regularise the

current organisational mechanisms and establish a more open climate which encourages employees to express their views.

9.5 Summary of discussion

Finally, the key findings discussed in this chapter are summarised as follows:

- In general, among the ERP barriers and risks identified in this study, organisational barriers present to be the most crucial factors that can lead to potential ERP failure in SOEs. As discussed above, the identified organisational barriers are not only the main triggers of various identified ERP barriers, but can also lead to the occurrence of a wide range of ERP risks.

- Specifically, the complicated network of ERP barriers and risks illustrated in figure 9.5, is originated by four critical organisational and human-related barriers, namely Power centralisation of top management, Short-term behaviour of top management, Lack of IT experts, and Low-skilled and ill-trained users. The final conclusion reached by this project hence is that, potential failure of ERP cannot be conveniently attributed to system issues, but more importantly should be attributed to organisational barriers and problems, in particular human problems that are related to top managers, IT experts and system users in the context of Chinese SOEs. This final conclusion supports and echoes the general IS theories, as presented and discussed in chapter two.

- Despite the importance of organisational barriers, Chinese managers in SOEs often underestimate these problems, due to a lack of awareness and an unwillingness to address internal management shortcomings. This further confirmed the argumentation made in chapter two that human and organisational problems are always more complicated and difficult to resolve than technical ones. Therefore, there is a need for Chinese leaders and managers of SOEs to become more aware of the crucial impacts associated with the current organisational barriers, as well as to take actions to address these critical problems, in order to ensure long-term ERP success in these companies.

Chapter Ten: Conclusions and Future Research

10.1 Introduction

This concluding chapter links the research findings back to the research questions established at the beginning of this thesis. It also highlights the contribution of this project. Subsequently, a reflection of the research design adopted in this study is given. This chapter, as well as the entire thesis, concludes by recommending a number of future research emerging from this project.

10.2 Response to research questions

This section summarises the research findings in response to the research questions established at the beginning of this study. Each research question is addressed individually.

Question 1

What are the barriers associated with ERP post-implementation in the selected Chinese SOEs?

Successful implementation of ERP is not the end of the journey but a new beginning. It was expected at the start of this project that a wide range of barriers embedded in the local business context and the system itself could often prevent user companies from successfully using, maintaining and enhancing their installed ERPs. The findings derived from this project confirmed that this initial expectation was true. Specifically, this project identified a set of 31 ERP barriers that Chinese SOEs might often encounter during ERP exploitation, namely 5 Cultural Barriers, 16 Organisational Barriers, and 10 System Barriers. While most identified system barriers (e.g. low flexibility of ERP) may also be experienced by Western companies, the identified cultural and organisational barriers are particularly relevant to the context of Chinese SOEs studied (e.g. user resistance caused by collectivism, 'iron rice bowl' issue of SOEs). It is apparent that ERP barriers were not found around one category, namely not around the system category. In fact, the more crucial and dangerous barriers were identified across diverse organisational and human aspects in SOEs.

Question 2

What are the causes and consequences of these barriers, and how these barriers correlated?

The findings derived from this project showed that there are very complicated causal relationships between the ERP barriers identified. Specifically, an ERP barrier may often be the cause or consequence of a set of other ERP barriers. By investigating the complicated networks of barriers established in this study, it became apparent that the causal correlations occurred not only between system barriers but also between cultural and organisational barriers. Because the identified cultural, organisational and system barriers seem to be interwoven and closely related with each other, they are difficult to manage and remove. Nevertheless, it clearly emerged from this study that, organisational barriers proved to be the main triggers for complex networks of ERP barriers, including the system ones. The findings thus indicated that organisational barriers were the most important type of barrier that could lead to potential ERP exploitation failure in Chinese SOEs.

Question 3

What are the risks associated with ERP post-implementation in the selected Chinese SOEs?

Existing business problems (e.g. inefficient communication between functional divisions) and unpredictable internal and external changes (e.g. loss of in-house IT experts, bankruptcy of system vendor, etc) can often raise risks to ERP exploitation in user companies. The occurrence of undesirable risks in the ERP post-implementation stage can turn the initial ERP success into a failure and may lead to system and business collapses. By analysing and synthesising the findings of the questionnaire survey and the multi-case study, this research project identified a set of 43 ERP risks that might occur in SOEs during ERP exploitation. These 43 ERP risks consisted of 9 Operational Risks, 8 Analytical Risks, 19 Organisation-Wide Risks and 7 Technical Risks. It is obvious that these identified risks did not cluster around a specific subset of the main categories. This means that ERP risks seem to be found across the organisational processes in SOEs and not conveniently localised around one category, namely not around the technical category.

Question 4

What are the causes and consequences of these risks, and how these risks correlated?

As shown in the findings of this project, there are very complicated causal relationships between the ERP risks identified. Specifically, the occurrence of a particular ERP risk may often be related to the occurrence of a set of other ERP risks. By investigating the complicated networks of risks established in this study, it became apparent that the majority of correlations occurred between the identified organisation-wide risks. Because these organisation-wide risks seem to be closely related with each other, the occurrence of these risks is much more difficult to manage, mitigate and contain. Technical risks, that are very often seen as the main perpetrators in ERP failure, seem to be important but not strictly related to other risks. On the other hand, it clearly emerged from this study that, organisation-wide risks are often the triggers for the other identified ERP risks, including the operational, analytical and technical ones. It is therefore concluded that organisation-wide risks are the most crucial type of ERP exploitation risk for SOEs.

Question 5

What are the causal relationships between the identified ERP barriers and risks?

The most important part of the findings analysis was to link together the identified ERP barriers and risks by exploring the causal relationships between them. The main question here was whether the existence of particular ERP barriers in Chinese SOEs could increase the probability of occurrence of certain ERP risks in these companies. The findings derived from this project proved that, there are very complicated causal relationships between the identified ERP barriers (i.e. cultural, organisational and system barriers) and ERP risks (i.e. operational, analytical, organisation-wide and technical risks). Nevertheless, investigating the list of correlations and relationships identified, it became apparent that organisational barriers were the main triggers for the complex networks of ERP barriers and risks. More importantly, after further investigation of the identified correlations and relationships, it was identified that the entire complicated network of ERP barriers and risks was actually originated by four critical organisational problems, namely:

- Power centralisation of top management;
- Short-term behaviour of top management;
- Lack of in-house IT experts;
- and Low-skilled and ill-trained staff.

As intensively discussed in section 9.2, these four critical barriers are not just the essential causes for various identified ERP barriers, but can also lead to the occurrence of a wide range of ERP risks. As a consequence, these four critical ERP barriers presented to be the most fundamental and significant causes for potential ERP exploitation failure in Chinese SOEs.

In sum, the findings would be summarised in the form of the root definition expressed in chapter 9 and repeated here for clarity:

> Potential failure of ERP cannot be conveniently attributed to system problems (e.g. software packages and ICT infrastructure), but more importantly should be attributed to organisational barriers and problems, in particular human problems that are related to top managers, IT experts and system users, in the context of Chinese SOEs.

Moreover, and as stated at the beginning of this thesis, the use of ERP often represents a business dilemma to user companies in China. Specifically, Liu Chuanzhi, former chairman and president of Lenovo, stated that in China "*not implementing ERP means inevitable failure, while implementation could possibly contribute to one's demise.*" (SAP, 2005). The findings of this project confirmed that Liu's statement is highly relevant to the current Chinese context. In particular, faced with the current competitive environment and economic pressure, implementing ERP is an imperative and even inevitable task for most Chinese firms. Nevertheless, leaders and employees in Chinese companies, especially SOEs, currently may not be fully ready to the long-term use and exploitation of ERPs. As a consequence, ERP exploitation in Chinese firms may often be fraught with undesirable barriers and risks. The existence and occurrence of these ERP barriers and risk events may not just affect system and business performance, but may even lead to demise of the company. Therefore, findings of this study suggested that there might be an urgent need for Chinese leaders and managers to become more aware of the potential barriers and risks that could lead to ERP failure, as well as to take

actions to address these problems, in order to ensure long-term ERP and business success.

10.3 Contribution to knowledge

Generally speaking, the research presented in this thesis added to the knowledge of ERP in general, and contributed to the research gap of ERP post-adoption barriers and risks in the Chinese context in particular. More specifically, this research has led to a set of significant contributions to knowledge, which can be divided into two categories, namely: contribution to the ERP research field, and contribution to research methods.

10.3.1 Contribution to the ERP research field

Regarding contribution to theory and the ERP research field, the following aspects should be highlighted:

- As discussed at the beginning of this thesis, current studies on ERPs focused mostly on system implementation and project management aspects (e.g. Zhang et al., 2005; Umble et al., 2003; Al-Mudimigh et al., 2001). In contrast, research studies focused on ERP post-adoption have only begun to appear in mainstream IS journals until recently. As one of the significant examples, the study about how interdependence and differentiation among sub-units of an organization can affect ERP performance after implementation, appears in MIS Quarterly (Gattiker and Goodhue, 2005). Moreover, Chou and Chang (2008) draw upon the study of Gattiker and Goodhue to explore how customisation and organisational mechanism can affect ERP benefits and performance in the post-adoption phase. However, these authors emphasised on a very limited number of variables and factors to study ERP post-adoption (Chou and Chang, 2008). No intensive and comprehensive studies on ERP post-implementation barriers and risks were identified from the literature reviewed. Therefore, this project contributed to this research gap. It represented a first attempt in producing a comprehensive study in its research area. The process of literature search during the period of this project could not return any other such studies.

- Despite a significant scarcity of studies on ERP post-adoption, IS researchers (e.g. Rucks and Ginter, 1982; Montazemi, 1988; Desai et al., 1998; Karahanna et al.,

1999; Roepke et al., 2000) have continued to stress a variety of organisational and technical barriers and factors to general IS success. These factors have been summarised and used to establish the initial barrier and risk ontologies, as presented in chapter six. While many studies (e.g. Reimers, 2002; Xue et al., 2005) proved that these general IS issues can affect ERP implementation, the findings of this study confirmed that these factors can also impact long-term ERP post-adoption.

In addition, while previous IS/ERP studies focused mostly on Western firms, this study emphasised on their Chinese counterparts. This study echoed the findings of Zhang et al (2005) by confirming that, IS/ERP problems identified in the Western context are also applicable to China. Most importantly, many Western IS researchers (e.g. Rucks and Ginter, 1982; Desai et al., 1998) argue that the promise of strategic use of MIS is often not fulfilled, owning to organisational issues rather than technical ones. This study confirmed that this statement is also true in the Chinese context. On the other hand, organisational and technical issues identified in this study may also be generalisable to ERP exploitation in Western firms, considering that these ERP issues were initially grounded from Western IS literature as discussed.

Besides, features embedded in the Chinese culture (e.g. high power distance, low uncertainty avoidance, and collectivism) were found to have implications to ERP exploitation in Chinese firms. These cultural issues may actually also be applicable to ERP post-adoption in other countries (e.g. other Asian nations), of which the culture features are similar to China. Interestingly, the study also identified that the Chinese culture seems to be gradually changing, probably due to China's continuous economic reform and opening up to the outside world. As a consequence, a number of typical cultural issues (e.g. trust personal intuition rather than system data to make decisions) identified in previous research (e.g. Martinsons and Westwood, 1997; Zhang et al., 2005), were not found to be problems in the Chinese SOEs studied.

- Finally, the ERP barrier and risk ontologies established in this project is an important contribution for practitioners. Specifically, these ontologies may be used by practitioners as a checklist to identify, prevent and manage ERP post-implementation barriers and risks in their workplaces. It is important to stress that

not all barriers and risks identified are equally important. For instance, impact, probability and frequency of occurrence of each risk event identified may be perceived differently in different organisational contexts. Additionally, as pointed out by Zhou et al. (2007), the usefulness and value of a checklist as the one proposed "may be questioned if the list is used monolithically and never improved". In truth, Vidalis (2003:20) reinforces that "nothing is staying stable in our world [...hence] having a generic list is a drawback, unless it is being updated constantly". Therefore, the established ontologies do not aim at being some definite and hierarchical sets of barriers/risks. Instead, it is hoped that these ontologies can undergo a process of re-examination and evolution through practice. Overall, it is suggested that, when using these ontologies in strategic planning and decision making, practitioners should select and focus on the ERP barriers and risks that are most concern with their working environment, and continuously improve and refine the lists with real-life experience.

10.3.1 Contribution to research methods

Due to contextual, cultural and political differences between China and the West, fundamental research issues and difficulties, which may not often be experienced and reported in the West, can arise when doing participative social science research in China. As discussed in this thesis, the researcher identified and experienced a set of contextual research problems when conducting this project (e.g. identifying an appropriate research sample in China, translating the survey instrument, retrieving an accurate company list, getting sufficient responses, and getting earnest responses from participants, etc). As discussed in early chapters of this thesis, in order to manage and overcome these research issues, a set of elaborated processes was conducted, namely narrowing the research context by using PEST and thus selecting a feasible research sample to base the study on, adopting a decentring approach in translating questionnaire instruments, and utilising a network of personal relationships in obtaining an accurate company list as well as maximising the response rate, etc.

It is obvious that disregarding these context specific issues can lead to either a complete failure of the research project or insignificant research findings (e.g. lack of response or meaningless responses to questionnaires). Nevertheless, and despite the increasing global research interest in investigating China, there is a scarcity of studies that aim at

reporting and resolving the issues and difficulties for doing research there. Therefore, the contextual research issues experienced in this project, as well as the elaborated processes conducted to address them, resulted in the publication of two full referred papers at the 6th and 7th European Conference on Research Methodology for Business and Management Studies (Peng and Nunes, 2007b; 2008a). The reflection on these research issues proved to be important contribution derived from this study to the research field.

10.4 Critical review of the research design

The research design adopted for this project contains two fundamental parts, namely the PEST analysis, and the QUAN and *qual* research strategy. This section provides a reflection on this research design.

10.4.1 Usefulness of the PEST analysis

As discussed in the thesis, identifying a representative and reasonable sample in China is probably the most significant research problem faced by researchers when doing social sciences research in this country (Manion, 1994; Roy et al, 2001). As demonstrated in the PEST analysis, this difficulty does not only follow from China's large size and number of potential respondents, but is also attributed to the fact that the environment of China is currently very fluid and complicated (Peng and Nunes, 2008a). It was therefore virtually impossible and infeasible for a PhD project to aim at studying China as a whole. As such, the most crucial problem faced by the researcher at the initial stage of this project was how to narrow the research context and identify and select a feasible set of Chinese companies to base the study on.

Consequently, and faced with the necessity of focusing the research, the researcher adopted a PEST analysis to narrow the scope of the study, as well as to focus research questions around feasible and meaningful business contexts. Specifically, as discussed in chapter four, the PEST analysis enabled the researcher to develop a profound understanding on the Chinese context. More importantly, PEST proved to be a valuable decision-making tool to select an appropriate region (e.g. Guangdong in China), an industrial sector (e.g. electronic and telecommunication sector), and a type of company (e.g. SOEs) in which to conduct the research. Overall, the use of PEST analysis in the

initial stage of this project resulted in the redefinition of research questions and in data collection contexts, thus providing a research setting that was more likely to produce useful, meaningful and significant findings.

10.4.2 Usefulness of the QUAN and *qual* design

As discussed in chapter five, a QUAN (i.e. questionnaire survey) and *qual* (i.e. case study) mixed-method design was adopted for this project.

As discussed before, because the researcher used PEST to identify and select a very specific set of companies in China to study ERP exploitation, findings that were generalisable to this specific context were considered to be not just essential but highly valuable and meaningful. The questionnaire survey conducted at the first stage thus proved to be an efficient method to collect responses from a representative sample (i.e. 84 respondents in 42 SOEs) to produce generalisable findings for the 118 Chinese SOEs.

On the other hand, as presented and discussed in chapter seven, a set of findings derived from the questionnaire were different from original expectation. The qualitative case study conducted at the second stage thus proved to be a valuable and significant component to further explore, validate and supplement the questionnaire findings. In particular, the semi-structured interview used in the case study enabled the researcher to seek in-depth human insights to further study and explore a specific set of questionnaire findings in the context of SOEs. As two different data collection methods were used to study and understand the same set of ERP exploitation problems in the Chinese SOE context, method triangulation was achieved, as discussed in chapter five.

Therefore, this QUAN and *qual* mixed-method design proved to be a rigorous, systematic and reasonable approach to generate a comprehensive set of in-depth, meaningful and significant findings to answer the research questions.

Nevertheless, due to a lack of experience in doing research in China, the data collection process of this project was not as straightforward as expected. In particular, as presented in chapter five, three months after the original questionnaire was sent out, only 2 valid replies were returned. Facing the failure of routine survey procedures, the researcher started using his own personal *guanxi* in the fourth month to get access to the

prospective respondents, and finally obtained valid and usable responses from a total of 42 SOEs in the fifth month, as discussed in section 5.6.5.3. In fact, by reviewing this process, it was felt that under the current context in China, the researcher should have actually started utilising his personal relationships to approach target SOEs soon after the questionnaire was posted to these companies. Therefore, the time spent on waiting for responses may have been significantly reduced and the data collection process may have been conducted more smoothly in this research. The realisation of this issue would enable the researcher to control and manage the data collection process more efficiently if a similar project is to be conducted.

10.4.3 A reflection of the questionnaire design

The questionnaire was carefully designed and pilot tested. However, it was identified with hindsight that, due to a lack of experience, the designed questionnaire was embedded with a number of deficiencies.

In particular, a list of negative statements was used in the questionnaire to examine the established barrier items. However, as pointed out by Saunders et al (2003), when giving a series of statements, both negative and positive statements should actually be included, in order to "ensure that the respondent reads each one carefully and thinks about which box to tick".

On the other hand, it was recognised with hindsight that some respondents might not have sufficient knowledge on all risk items given. The researcher however did not include any options of 'cannot answer' or 'don't know' in the risk section to address this particular issue. As a consequence, in order to give a 'safe' answer, some respondents might just simply select 'medium' for likelihood and impact of certain risk events that they might not be familiar with.

In fact, and as discussed in chapter one and five, most respondents of the survey were contacted through the use of personal relationships. They therefore might be put under pressure to respond, by the very relationships network used to reach them. However, when the above deficiencies existed, there might be a higher possibility that some respondents might not answer certain questions earnestly.

Furthermore, the questionnaire examined a large number of ERP barriers and risks. As discussed and explained in chapter five, since a large amount of factors were covered, each factor was measured by using a single question rather than multiple items. Otherwise, the questionnaire will become overlong. However, as pointed out by Fowler (1995:69-70) and DeVellis (2003:9), multi-item scales may often result in a better measurement, in terms of accuracy and reliability, than a single item. Moreover, without using multi-item scales, it was impossible for the researcher to use statistical techniques, like Cronbach's alpha, to test reliability or internal consistency of the responses, as discussed in chapter five.

Overall, these deficiencies in the questionnaire design may affect reliability of the findings. Finally, these issues might potentially increase the possibility of bias in the follow-up interviews, of which the instruments were designed based on the questionnaire findings.

Therefore, the researcher considers that there is a need to improve the questionnaire design, if the questionnaire is to be used in any further research. This may be done by:

- Using both negative and positive statements in the barrier section;
- Providing an extra option of 'cannot answer' for each risk item in the risk section;
- Concentrating on a smaller set of barrier and risk items, and thus using multiple questions to examine each established barrier and risk.

10.4.4 A reflection of the sample used for the questionnaire

It was considered that in comparison with operational staff, managers would possess more holistic views and insights regarding ERP issues in the company (Shang and Seddon, 2000). This project thus identified and selected managers as adequate stakeholders to respond to the questionnaire survey. However, as discussed in early chapters, results of both the questionnaire and the follow-up case study showed that managers in SOEs seemed to be less willing to disclose internal organisational and management issues to the researcher, probably in order to preserve the images of their firms and also to avoid potential career risks. As a consequence, many organisational issues examined in the survey were underestimated or hidden by these SOE managers.

It is therefore realised with hindsight that having only managers in the sample of the questionnaire is actually insufficient, and that the survey should also involve operational staff, who are also daily users of the ERP system and may offer different opinions to triangulate with their managers' responses. This realisation immediately shows an important direction for future research, as further discussed below.

10.5 Recommendations for Future research

This research has pinpointed a number of important areas for further research work, which particularly aiming to address the limitations of the current study:

- This research focused on identifying, assessing and exploring potential ERP exploitation barriers and risks in the context of Chinese SOEs. However, due to time limitation of the project, the study did not develop and provide detailed solutions and recommendations on how to resolve and mitigate the identified ERP exploitation problems. This certainly represents a clear and important direction for future research. Specifically, further research work should be carried out to identify and establish strategies and action plans to help SOEs to manage and mitigate barriers and risks that they are currently confronted with in ERP post-implementation. Moreover, it is widely acknowledged that risk can often hold opportunities for those who know how to manage it. Therefore, further research studies may also focus on how to turn identified ERP risks into opportunities and thus convert potential pitfalls into gains.

- A number of deficiencies associated with the current questionnaire design were identified and discussed above. It will be meaningful to improve the questionnaire design by following recommendations given above, and then repeat the study by using the revised questionnaire. In addition, in order to allow multi-item scales to be used, the revised questionnaire may concentrate around the most critical set rather than the full set of ERP barriers and risks identified in this study.

- Moreover, the questionnaire conducted in this project involved mostly SOE managers, who proved to be less inclined to disclose internal management shortcomings to researchers. It will thus be meaningful to further explore the questionnaire findings by repeating the study with an alternative sample involved

operational staff/users. It is expected that these daily system users, who have extensive experience in using ERP systems, may hold a different view from their managers, and thus leading to a more holistic picture on ERP exploitation issues in the context of Chinese SOEs.

- As discussed at the beginning of the thesis, since this project focused on a very specific set of Chinese firms (i.e. SOEs in the electronic and telecommunication manufacturing sector in Guangdong) to study ERP exploitation, the findings derived may only be generalisable to similar regions, company types and sectors as the ones studied. Nevertheless, it is certainly possible that these findings may be transferable to companies in a wider context. In fact, it is deemed that many organisational and technical issues identified may have generalisability beyond China (e.g. may also occur during ERP exploitation in Western firms), considering that these ERP issues were initially grounded from Western IS literature as discussed above. Moreover, the identified cultural barriers may also be applicable to other countries, which have similar cultural features to China. However, it would be desirable to conduct further research to investigate and explore the transferability of these findings. Therefore, it is hoped that the established barrier and risk ontologies may be used as a starting point for researchers to carry out further study in ERP exploitation in different research contexts. It will also be interesting if other researchers can then further refine and/or extend these ontologies through their studies.

- Additionally, and as mentioned in section 7.6, mainland Chinese differ with overseas Chinese in diverse cultural and economic aspects. It is expected that such contextual differences may result in different ERP barriers and risks between overseas and mainland Chinese firms. This thus emerges to be an additional but meaningful area for further investigation and exploration.

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Appendix 1: Cover Letter of Questionnaire

The University of Sheffield
英国谢菲尔特大学
Department of Information Studies
信息学院

2007 Survey of ERP post-implementation barriers and risks in Chinese SOEs

Dear Manager

Thank you in advance for participating in this PhD research project which is conducted in the University of Sheffield in the UK.

The aim of this research is to identify and investigate the barriers and risks that Chinese companies may encounter in ERP post-implementation. After completing an in-depth analysis in China, we selected state-owned enterprises (SOEs) in the electronic and telecommunication sector in Guangdong as the case companies for carrying out this research project. Among our intended outputs will be a report summarising our findings associated with recommendations for helping Chinese SOEs to better deal with the identified ERP barriers and risks. Companies, who participate in this research project, can request for a free copy of this report. Each respondent was selected from the company list provided by the Statistics Bureau of Guangdong Province. No individual or organisation name will be explicitly mentioned at any point of this research or mentioned in any research publication.

The research project is divided into two phases.

Phase 1: The first phase involves completing the questionnaire which can be done by completing the attached questionnaires and returning them to us in the pre-paid envelope or completing the on-line version at: `http://dagda.shef.ac.uk/alex`. The attached questionnaire is questionnaire A and is estimated to take 10 minutes to complete.

Phase 2: Data collected from phase 1 will be analysed and further explored in the second phase of the project which will involve a qualitative study composed by a set of semi-structured interviews with managers and staff of a subset of the SOEs that completed the questionnaire. At the end of the questionnaire, you will be asked whether you are willing to participate in the interview.

We hope you are able to help us and would be grateful if you can complete the enclosed paper-based questionnaire or its online version by **July 30th 2007**. We will contact you to confirm the receipt of the questionnaire and to discuss the interview arrangements. If you require any further information please do not hesitate to contact Mr. Guo Chao Peng (email: lip05gcp@shef.ac.uk).

Yours sincerely

Dr José Miguel Baptista Nunes
Project Supervisor

Mr. Guo Chao Peng
Researcher

Appendix 2: Questionnaire A

This questionnaire should be **FILLED IN BY THE OPERATIONAL MANAGER OR ONE THAT HAS EXTENSIVE KNOWLEDGE IN THE COMPANY'S OPERATION and** is estimated to take 10 MINUTES TO COMPLETE

SECTION 1 Organisation Characterisation

Q1 Has your company implemented or are your company implementing an ERP system?

1 ☐ Yes (please go to Q3) 2 ☐ No (please continue)

Q2 Please indicate, by ticking the appropriate box(es), the main reasons that your company does not implement an ERP system (please tick all that apply):

Do not know what an ERP system is	☐	1
Do not have sufficient knowledge about ERP	☐	2
Do not have sufficient fund to implement an ERP	☐	3
The ERP implementation project involves too many risks	☐	4
Have many legacy systems and no need to use an ERP	☐	5
Internal resistance from managers and staff	☐	6
May be implement it in the future but it is now not the right time	☐	7
Other, please describe below		
.....		8

SECTION 2 ERP Post-Implementation Barriers

Q3 The following statements describe a set of barriers that can prevent companies from achieving continuous success in the ERP post-implementation stage.
Pease tick √ one box for each statement to tell us whether you (1) strongly disagree, (2) disagree, (3) neither agree or disagree, (4) agree or (5) strongly agree with it.

*PLEASE TICK **ONE** BOX FOR EACH STATEMENT*	**Strongly Disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. My colleagues are inclined to use implicit form of communication, and thus tones, facial expressions and body languages should be taken into consideration in order to fully understand the meaning of what they said	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
b. Staff in my company are reluctant to discuss and communicate with each other regarding the problems and failures they made in their job	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
c. Important organisational decisions are centrally made by top managers	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
d. Our staff lack enough critical thinking skills (e.g. thinking creatively, making decisions independently, solving problems efficiently)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
e. Managers in my company do not like to use systematic procedures and explicit information to tailor forecasts and plans	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
f. As compared to data provided by the system, managers in my company trust and rely more on personal common sense to make decisions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
g. Establishment of relationships between my company and our business partners relies on personal relationships between people in our company and the partner company	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
h. Collaboration and communication between departments of my company is insufficient	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
i. Our people fear that the use of ERP system will let them lose power or lose job	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
j. People in my company show various types of short-term behaviour and are keen to achieve short-term results.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

k. If there are other issues/barriers preventing your company from achieving continuous success in the ERP post-implementation stage, please specify below

.....

SECTION 3 ERP Post-Implementation Risks

Q4 Here are some events that companies may encounter in the ERP post-implementation stage. For each event, please indicate:

1) Do you perceive this event is a risk that can impact the use and maintenance of ERP in your company? Please select '**Yes**' or '**No**'.
If you perceive this event is a risk, please indicate

2) How likely is this risk to occur in your company? **Please tick √ one box** to say whether its probability of occurrence is 'High' **(H)**, 'Medium' **(M)** or 'Low' **(L)**.

3) If this risk occurs in your company, what level of impact may it cause to ERP post-implementation?
Please tick √ one box to say whether its impact is 'High' **(H)**, 'Medium' **(M)** or 'Low' **(L)**.

4) How often may this risk occur in your company?
Please circle O one number from the scale: **Very often** 5 4 3 2 1 **Very rarely.**

Event	1) Is this event a risk		(If this event is a risk, please indicate)										
			2) Prob. of occurrence *Please tick ONE box below*			3) Impact *Please tick ONE box*			4) Freq. of occurrence *Please circle ONE number below*				
	Yes	No	H	M	L	H	M	L	Very often				Very rarely
a. Operational staff are unwilling to use the ERP system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
b. Operational staff input incorrect data into the system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
c. Sales staff are not able to obtain data and information they need from the system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
d. Customer info files contained in the ERP system are out-of-date or incomplete	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
e. ERP system contains inaccurate supplier records	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
f. ERP system contains inaccurate or incomplete bill of materials	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
g. ERP system contains inaccurate inventory records	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
h. Account staff are unwilling to release accounting responsibility and power to non-account staff	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
i. Non-account staff are unwilling and incapable to take up accounting responsibilities	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
j. Front-line managers refuse to use the ERP system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
k. Managers cannot retrieve relevant and needed information from the system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1

l.	Sales forecast generated by ERP is inaccurate and inappropriate	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
m.	Fail to use ERP in predicting actual demands of new products	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
n.	System fails to support sales staff to tailor special offers to existing customers	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
o.	Master production schedule generated by the ERP system is inappropriate	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
p.	System fails to generate appropriate material net requirement plan	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
q.	Fail to use the system to generate appropriate financial budgets	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1

Q5 If there are other risks may occur in your company in the ERP post-implementation stage, please specify below

.....

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE
Please also answer the following additional questions

Your company's full name is: .....

Your position in the company is: .....

Would you like to receive a copy of the research findings from this questionnaire survey?

☐ Yes (Please provide us with your contact information below)
☐ No

Name: ..... Tel: ..... E-mail: ..... @ .....

AND (Please tick one of the three options below)

☐ At a later date, I would like to further discuss with you about how ERP-related barriers and risks affect system and business performance. Please contact me to discuss arrangements for the interview.
(Please provide us with your contact information if it is different from above)

Name: ..... Tel: ..... E-mail: ..... @ .....

☐ I am not available to further discuss with you about how ERP-related barriers and risks affect system and business performance. But I do recommend that you speak with:

Name: …….. Position: ……..

Tel: …….. E-mail: …….. @ ……

☐ I am not available to discuss with you about how ERP-related barriers and risks affect system and business performance.

PLEASE RETURN BOTH QUESTIONNAIRE A AND B TO US BY USING THE PRE-PAID ENVOLOPE

THANK YOU FOR COMPLETING THIS SURVEY

Appendix 3: Questionnaire B

This questionnaire should be **FILLED IN BY THE IT MANAGER OR ONE THAT HAS EXTENSIVE KNOWLEDGE IN THE ERP SYSTEM** and is estimated to take 10 MINUTES TO COMPLETE

SECTION 1 Organisation Characterisation

Q1 Has your company implemented or are your company implementing an ERP system?

1 ☐ Yes (please go to Q4) 2 ☐ No (please continue)

Q2 Please indicate, by ticking the appropriate box(es), the main reasons that your company does not implement an ERP system (please tick all that apply):

1☐ Do not know what an ERP system is
2☐ Do not have sufficient knowledge about ERP
3☐ Do not have sufficient fund to implement an ERP
4☐ The implementation project involves too many risks
5☐ Have many legacy systems and no need to use an ERP
6☐ Internal resistance from managers and staff
7☐ May be implement it in the future but now not
8☐ Other, please describe below

.....

Q3 The ERP system of your company was implemented in ..... (year).

Q4 Please indicate, by ticking the appropriate box, the ERP system of your company is provided by:

1 ☐ Foreign ERP vendor 2 ☐ Domestic ERP vendor 3 ☐ Both

SECTION 2 ERP Post-implementation Barriers

Q5 The following statements describe a set of barriers that can prevent companies from achieving continuous success in the ERP post-implementation stage.

Pease tick √ one box for each statement to tell us whether you (1) strongly disagree, (2) disagree, (3) neither agree or disagree, (4) agree or (5) strongly agree with it.

PLEASE TICK ONE BOX FOR EACH STATEMENT		**Strongly Disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a.	Top management support to ERP is insufficient in my company	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
b.	My company lacks explicit and detailed ERP exploitation plan & strategy	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
c.	My company does not assign sufficient funds and resources to ERP post-implementation	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
d.	My company does not have sufficient in-house specialists (e.g. IT expert, specialists in diverse functional areas)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
e.	Our people has low involvement in using and improving the ERP system	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
f.	Staff in my firm have low quality and lack sufficient ERP training	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
g.	Supports and services provided by our system vendor(s) are insufficient	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
h.	We found system consultants recruited from external consulting firms generally do not have sufficient experience and skills	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
i.	ERP system can not be flexibly customised or reconfigured according to specific user requirements	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
j.	Our ERP system has low compatibility with other information systems	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
k.	Cost for ERP add-ons and further system development is too high and unaffordable	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
l.	Design of our ERP system is irrational and inflexible	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
m.	Response time of our ERP system is slow	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
n.	Functions of our ERP system are misfit with our requirements	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
o.	Data in our ERP system has poor quality (e.g. inaccurate, irrelevant, inconsistent, etc)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

p. If you encounter any other issues/barriers in the ERP post-implementation stage, please specify below

.....

SECTION 3 ERP Post-Implementation Risks

Q6 Here are some events that companies may encounter in the ERP post-implementation stage. For each event, please indicate:

1) Do you perceive this event is a risk that can impact the use and maintenance of ERP in your company? Please select '**Yes**' or '**No**'.

If you perceive this event is a risk, please indicate

2) How likely is this risk to occur in your company? **Please tick √ one box** to say whether its probability of occurrence is 'High' **(H)**, 'Medium' **(M)** or 'Low' **(L)**.

3) If this risk occurs in your company, what level of impact may it cause to ERP post-implementation?
Please tick √ one box to say whether its impact is 'High' **(H)**, 'Medium' **(M)** or 'Low' **(L)**.

4) How often may this risk occur in your company?
Please circle O one number from the scale: **Very often** 5 4 3 2 1 **Very rarely**.

Event	1) Is this event a risk		(If this event is a risk, please indicate)										
			2) Prob. of occurrence *Please tick ONE box below*			3) Impact *Please tick ONE box*			4) Freq. of occurrence *Please circle ONE number below*				
	Yes	No	H	M	L	H	M	L	Very often				Very rarely
a. Top managers make important IT decisions without consulting IT experts or system users	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
b. Substantial personnel changes in the top management team	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
c. Support from top managers to ERP post-implementation is insufficient	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
d. IS/ERP development plan is missing, ill-defined or misfit with business strategy	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
e. Direction for ERP improvement and further development is unclear	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
f. Insufficient resources and funds are assigned to ERP training, maintenance and enhancement	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
g. Fail to form an efficient cross-functional team to continuously review and revise the ERP system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
h. Lose qualified IT/ERP experts	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
i. Lose ERP-related know-how accumulated over time	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1

(Continued)

(Q6 continued)

Event	1) Is this event a risk		(If this event is a risk, please indicate)										
			2) Prob. of occurrence *Please tick ONE box below*			3) Impact *Please tick ONE box*			4) Freq. of occurrence *Please circle ONE number below*				
	Yes	No	H	M	L	H	M	L	Very often				Very rarely
j. ERP users (both staff and managers) are not receiving sufficient and continuous training	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
k. Users are uncomfortable to use the ERP system (e.g. input or retrieve data) in their daily jobs	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
l. ERP-related problems are not reported promptly by system users	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
m. Data access right to the ERP system is authorised to inappropriate users	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
n. Confidential data of the system is accessed by unauthorised people	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
o. We cannot receive enough technical support from system vendors	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
p. We cannot receive sufficient and proper consulting advice from system consultants	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
q. Seamless integration is not achieved between current modules or between current and new modules of our ERP system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
r. ERP system is not able to seamlessly integrate with legacy or new information systems in my company	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
s. Invalid data is not automatically detected when getting into the ERP system	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
t. Hardware or software crashes	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
u. Technical bugs of our ERP system is not speedily overcome	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
v. Outdated and duplicated data of our ERP system is not properly discarded	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1
w. ERP is not properly modified to meet new business requirements	1☐	2☐	3☐	2☐	1☐	3☐	2☐	1☐	5	4	3	2	1

Q7 If there are other risks may occur in your company in the ERP post-implementation stage, please specify below

.....

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Please also answer the following additional questions

Your company's full name is: .....

Your position in the company is: .....

Would you like to receive a copy of the research findings from this questionnaire survey?

- ☐ Yes (Please provide us with your contact information below)
- ☐ No

Name: ..... Tel: ..... E-mail: ..... @ .....

AND (Please tick one of the three options below)

☐ At a later date, I would like to further discuss with you about how ERP-related barriers and risks affect system and business performance. Please contact me to discuss arrangements for the interview.
(Please provide us with your contact information if it is different from above)

Name: ..... Tel: ..... E-mail: ..... @ .....

☐ I am not available to further discuss with you about how ERP-related barriers and risks affect system and business performance. But I do recommend that you speak with:

Name: ..... Position: .....

Tel: ..... E-mail: ..... @ .....

☐ I am not available to discuss with you about how ERP-related barriers and risks affect system and business performance.

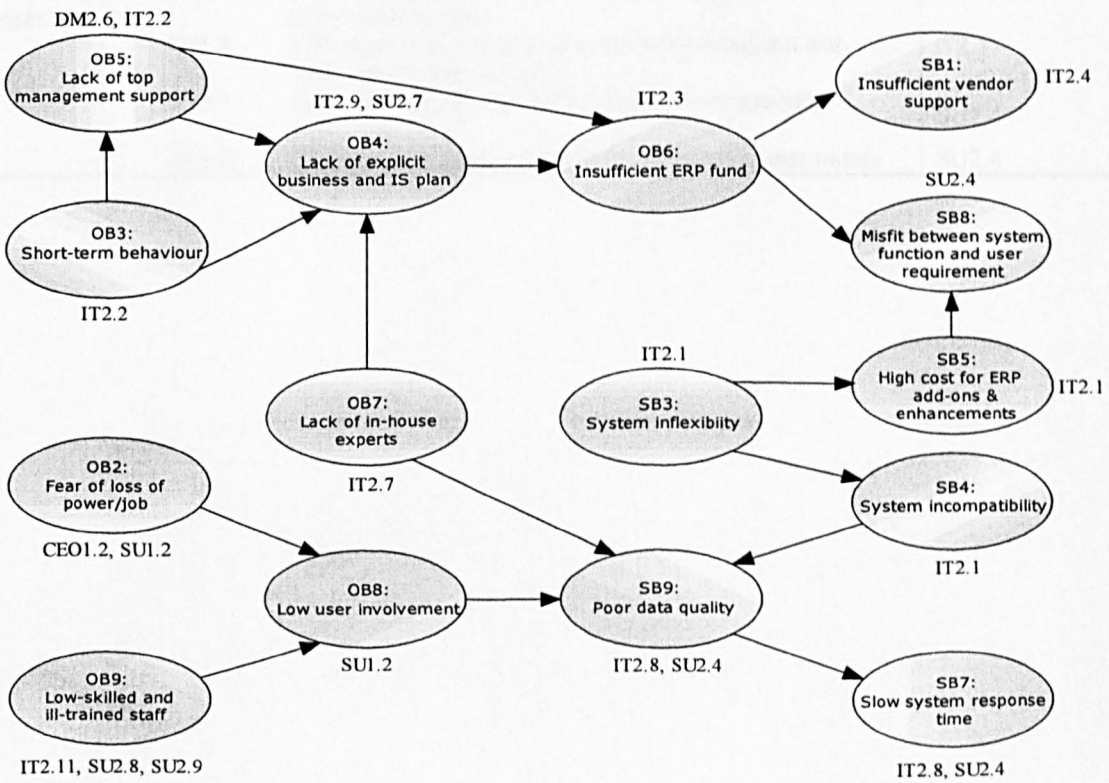
PLEASE RETURN BOTH QUESTIONNAIRE A AND B TO US BY USING THE PRE-PAID ENVOLOPE

THANK YOU FOR COMPLETING THIS SURVEY

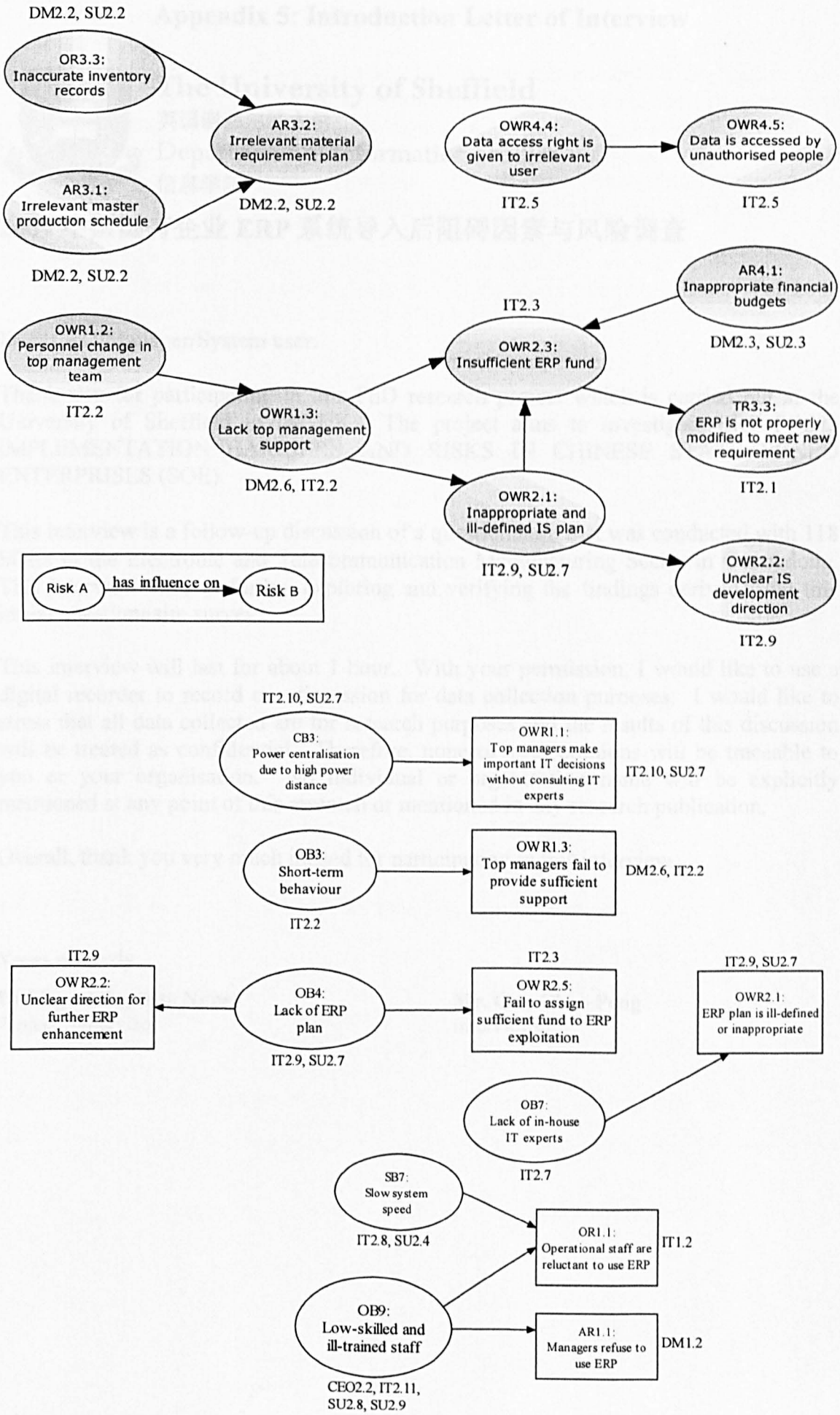
Appendix 4: Basics for Developing the Interview Scripts

Rank	ID	N = 42	Question no. in the instrument **
1	SB1	Insufficient supports and services from system vendors	IT2.4
1	CB3	Power centralisation and centralised decision-making	IT2.10, SU2.7
3	SB4	System incompatibility	IT2.1
4	SB3	System inflexibility	IT2.1
4	SB6	Irrational and inflexible design of the system	SU2.4
6	OB7	Lack of in-house specialists	IT2.7
7	SB7	Slow system response time	IT2.8, SU2.4
8	SB2	Inexperienced and low-qualified system consultants	IT2.6
8	SB5	High cost for add-ons and further system development	IT2.1
10	CB6	Trust personal common sense rather than system data	DM2.6, SU1.2
11	OB1	Inefficient collaboration between functional departments	DM2.5 & 2.8, SU2.6
12	OB4	Lack of explicit business and IS development plan and strategy	IT2.9, SU2.7
12	OB6	Insufficient ERP post-implementation funds and resources	IT2.3
14	SB9	Poor data quality	IT2.8, SU2.4
14	OB9	Low-skilled and ill-trained staff	CEO2.2, IT2.11, SU2.8 & 2.9
14	OB3	Short-term behaviour of companies	IT2.2
17	OB8	Low involvement of employees	SU1.2
17	CB4	Lack of critical thinking of employees	CEO2.2, DM2.9
19	CB5	Less inclined to use systematic procedures and explicit information to tailor forecasts and plans	DM2.7
19	OB5	Lack of top management support	DM2.6, IT2.2
21	SB8	Misfits between system functions and company requirements	SU2.4
22	CB7	Building inter-organisational relationships based on *guanxi*	IT2.4 & 2.6
22	OB2	Fear of loss of power and loss of job	CEO1.2, SU1.2
22	CB1	High context and implicit form of communication	DM2.8, SU2.6
25	CB2	Unwilling to disclose problems, faults and failures	SU2.5

** Instrument with CEO, IT Manager (IT), Departmental Manager (DM) and System User (SU)



Category	24 shortlisted ERP risk items		Question no. in the instrument
Operational risks	OR1.1	Operational staff are reluctant to use ERP	IT1.2
	OR2.1	Sales staff are not able to obtain data and information they need from the system	DM2.1, SU2.1
	OR2.2	Customer info files contained in the ERP system are out-of-date or incomplete	DM2.1, SU2.1
	OR3.2	ERP system contains inaccurate or incomplete bill of materials	DM2.2, SU2.2
	OR3.3	ERP system contains inaccurate inventory records	DM2.2, SU2.2
Analytical risks	AR1.1	Managers are reluctant to use ERP	DM1.2
	AR1.2	Managers cannot retrieve needed information from the system	DM1.2
	AR2.1	Sales forecast is inaccurate and inappropriate	DM2.1, SU2.1
	AR3.1	Master production schedule generated by ERP is inappropriate	DM2.2, SU2.2
	AR3.2	System fails to generate appropriate material net requirement plan	DM2.2, SU2.2
	AR4.1	Fail to use the system to generate appropriate financial budgets	DM2.3, SU2.3
Organisation - wide risks	OWR1.1	Top managers make important IT decisions without consulting the others	IT2.10, SU2.7
	OWR1.2	Personnel changes in top management team	IT2.2
	OWR1.3	Support from top managers to ERP post-implementation is insufficient	DM2.6, IT2.2
	OWR2.1	IS/ERP development plan is missing, ill-defined or misfit with business strategy	IT2.9, SU2.7
	OWR2.2	Direction for ERP improvement and further development is unclear	IT2.9
	OWR2.3	Insufficient resources and funds are assigned to ERP training, maintenance and enhancement	IT2.3
	OWR3.3	Lose ERP-related know-how accumulated over time	IT2.7
	OWR4.4	Data access right is given to inappropriate users	IT2.5
	OWR4.5	Data is accessed by unauthorised people	IT2.5
Technical risks	TR1.1	Seamless integration is not achieved between modules of the ERP system	IT2.1, SU2.4
	TR1.2	ERP system is not able to seamlessly integrate with other information systems	IT2.1
	TR3.1	Technical bugs of our ERP system is not speedily overcome	SU2.4
	TR3.3	ERP is not properly enhanced to meet new user needs	SU2.4


DM2.2, SU2.2
OR3.3: Inaccurate inventory records
AR3.2: Irrelevant material requirement plan
DM2.2, SU2.2
AR3.1: Irrelevant master production schedule
DM2.2, SU2.2
OWR4.4: Data access right is given to irrelevant user
IT2.5
OWR4.5: Data is accessed by unauthorised people
IT2.5
AR4.1: Inappropriate financial budgets
DM2.3, SU2.3
IT2.3
OWR1.2: Personnel change in top management team
IT2.2
OWR2.3: Insufficient ERP fund
OWR1.3: Lack top management support
DM2.6, IT2.2
TR3.3: ERP is not properly modified to meet new requirement
IT2.1
OWR2.1: Inappropriate and ill-defined IS plan
IT2.9, SU2.7
OWR2.2: Unclear IS development direction
IT2.9
Risk A
has influence on
Risk B
IT2.10, SU2.7
CB3: Power centralisation due to high power distance
OWR1.1: Top managers make important IT decisions without consulting IT experts
IT2.10, SU2.7
OB3: Short-term behaviour
IT2.2
OWR1.3: Top managers fail to provide sufficient support
DM2.6, IT2.2
IT2.9
OWR2.2: Unclear direction for further ERP enhancement
OB4: Lack of ERP plan
IT2.9, SU2.7
IT2.3
OWR2.5: Fail to assign sufficient fund to ERP exploitation
IT2.9, SU2.7
OWR2.1: ERP plan is ill-defined or inappropriate
OB7: Lack of in-house IT experts
IT2.7
SB7: Slow system speed
IT2.8, SU2.4
OR1.1: Operational staff are reluctant to use ERP
IT1.2
OB9: Low-skilled and ill-trained staff
CEO2.2, IT2.11, SU2.8, SU2.9
AR1.1: Managers refuse to use ERP
DM1.2

Appendix 5: Introduction Letter of Interview

The University of Sheffield
英国谢菲尔特大学
Department of Information Studies
信息学院

2007 中国国有企业 ERP 系统导入后阻碍因素与风险调查

Date: Feb 2007

Dear CEO/Manager/System user:

Thank you for participating in this PhD research project which is carried out at the University of Sheffield in the UK. The project aims to investigate ERP POST-IMPLEMENTATION BARRIERS AND RISKS IN CHINESE STATE-OWNED ENTERPRISES (SOE).

This interview is a follow-up discussion of a questionnaire that was conducted with 118 SOEs in the Electronic and Telecommunication Manufacturing Sector in Guangdong. This interview aims at further exploring and verifying the findings derived from this initial questionnaire survey.

This interview will last for about 1 hour. With your permission, I would like to use a digital recorder to record our discussion for data collection purposes. I would like to stress that all data collected are for research purposes and the results of this discussion will be treated as confidential. Therefore, none of your opinions will be traceable to you or your organisation. No individual or organisation name will be explicitly mentioned at any point of this research or mentioned in any research publication.

Overall, thank you very much indeed for participating in this interview.

Yours sincerely

Dr Miguel Baptista Nunes
Project Supervisor

Mr. Guo Chao Peng
Interviewer

Appendix 6: Interview with CEO

Good morning. My name is Guo Chao Peng and I am a research student at the Department of Information Studies at the University of Sheffield in the UK. Thank you very much for participating in this interview today. This interview is a follow-up discussion of a preliminary questionnaire that studied ERP post-implementation barriers and risks across 118 SOEs in the electronic and telecommunication manufacturing sector in Guangdong. This interview aims at further exploring and verifying a set of critical ERP barriers and risks identified from this initial questionnaire survey.

Before starting, I would like to ask if you would mind me using digital recorder this discussion for data collection purposes. I would like to stress that the results of this discussion will be treated as confidential and none of your opinions will be traceable to you or your organisation. You can also stop the digital recorder at any point of the discussion.

Section 1: General questions

1.1. As the CEO of the company, what is your daily routine?

1.2. What benefits do you perceive ERP can bring to your company?

Follow-up:

Does it improve operational/decision making/management efficiency, etc?
How satisfied are you with your current ERP system?
For what reasons and initiatives did your company implement ERP (e.g. management need/competition reason/government support)?
Do some of your staff fear that the adoption of ERP can result in job or power loss?

Section 2: ERP Barriers and Risks

2.1. How your organisational structure has been changed after the use of ERP?

Trigger questions:

Have some departments been combined/removed/created? If yes, which ones are affected?
Will traditional boundaries between departments become less important?

2.2. How satisfied are you with your subordinates and staff's capability?

Follow-up:

Do you perceive that some of your staff rely too much on superior's directives and lack sufficient independent thinking and problem-solving skills?
If yes, do you perceive that the proportion of this type of staff is high in SOEs?
What is the educational level of the majority of staff in your firm?
What kind of ERP training has been provided to system users?

2.3. How do you think your organisational culture has been changed due to the use of ERP?

Trigger question:

Has the way that people communicate with each other changed (e.g. communicate and exchange information by system rather than by person)?

Do you find operation of the firm has become more transparent, and therefore people in the firm can easily identify the operational situation of the entire company?

Have staff and employees been assigned with more power and responsibilities?

2.4. Do you perceive that turnover rate of qualified IT/ERP staff in your company is high?

Follow-up:

If yes – What do you perceive as the reasons causing high turnover rate of this type of professional?
What do you perceive as the impacts for losing qualified IT experts? (E.g. lose valuable ERP expertise accumulated over time when in-house IT experts left)

If no – What has your company done to retain high qualified IT staff?
What reasons may cause high turnover rate of this type of professional?
What do you perceive as the impacts for losing qualified IT experts?

2.5. What other noticeable issues, difficulties and problems have you encountered during the phase of ERP post-implementation?

Thank you very much indeed for participating in this interview

Appendix 7: Interview with Departmental Manager

Good morning. My name is Guo Chao Peng and I am a research student at the Department of Information Studies at the University of Sheffield in the UK. Thank you very much for participating in this interview today. This interview is a follow-up discussion of a preliminary questionnaire that studied ERP post-implementation barriers and risks across 118 SOEs in the electronic and telecommunication manufacturing sector in Guangdong. This interview aims at further exploring and verifying a set of critical ERP barriers and risks identified from this initial questionnaire survey.

Before starting, I would like to ask if you would mind me using digital recorder this discussion for data collection purposes. I would like to stress that the results of this discussion will be treated as confidential and none of your opinions will be traceable to you or your organisation. You can also stop the digital recorder at any point of the discussion.

Section 1: General questions

1.1. What is your role in the company?

Follow-up:

What is your daily routine?

Of your daily activities, which ones are concerned with ERP (e.g. use, maintenance, etc)?

1.2. What benefits do you perceive ERP can bring to your company?

Follow-up:

Does it improve operational/decision making/management efficiency, etc?

How satisfied are you with your current ERP system (e.g. does it satisfy all your information needs, can you retrieve relevant and needed information from the system)?

Section 2: ERP Barriers and Risks

2.1. What issues have your firm experienced when using ERP to support sales & marketing activities (e.g. process customer orders, maintain customer files, sales forecast)?

Trigger questions:

Does your ERP system contain analytical tools to facilitate sales forecasting?

If yes, will you use these tools? Do you find that sales forecast/plan generated by using ERP is inaccurate?

If no, how does your company carry out sales forecasting?

What other IS application have you used to facilitate sales forecasting?

Did demands of new product use to be under- or over-estimated? What other IS applications (e.g. CRM) have you used to support this task?

Did you ever find that customer files contained in ERP was out-of-date or incomplete?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.2. What issues have your firm experienced when using ERP in supporting production and logistics activities (e.g. manage inventory, maintain BOM, generate production plans)?

Trigger questions:

Did bill of materials contained in ERP use to be inaccurate and incomplete?

Did inventory records contained in ERP use to be inaccurate?

Did master production plan generated by ERP used to be inappropriate?

Did material requirement plan generated by ERP used to be inappropriate?

Follow-up:

What are the causes and consequences if these issues occur? (Iteration)

2.3. What issues have your firm experienced when using ERP to support financial and accounting activities (e.g. record payment and expenditure, maintain ledgers, set up financial budgets)?

Trigger questions:

Does your ERP system contain analytical tools to facilitate financial budgeting?

If yes, will you use these tools? Do you find that financial budgets generated by using ERP are inappropriate?

If no, how does your company carry out financial budgeting?

What other IS application have you used to facilitate the development of financial budgets?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.4. How your organisational structure has been changed after the use of ERP?

Trigger questions:

Have some departments been combined/removed/created? If yes, which ones are affected?

Will traditional boundaries between departments become less important?

2.5. How do you think your organisational culture has been changed due to the use of ERP?

Trigger question:

Has the way that people communicate with each other changed (e.g. communicate and exchange information by system rather than by person)?

Do you find operation of the firm has become more transparent, and therefore people in the firm can easily identify the operational situation of the entire company?

Have staff and employees been assigned with more power and responsibilities?

2.6. Do you perceive that personal experience and intuition is more useful than system data when making business decisions?

Follow-up:

If yes – Could you please explain the reasons why you think so?

Will you try to analyse a large amount of data before making the final decision?

If no – Do managers in your firm trust data (e.g. purchase and production quantities) provided by the ERP system?

Will they sometimes modify such quantities based on their experience?

What kind of support has been provided by top managers to facilitate ERP adoption and usage?

2.7. Will your company regularly generate (e.g. sales and production) forecasts and plans?

Follow-up:

If yes, is this a traditional activity conducted in your company or a result of the use of ERP?
Do you think such forecasts and plans are important/unimportant? Please explain why.

2.8. Do you perceive the use of ERP can help to improve collaboration and communication between functional departments?

Follow-up:

If yes – Could you please give some examples to illustrate such improvement?
If no – What collaboration and communication issues is your company facing?

Do you perceive that staff in your company are inclined to use implicit form of communication (e.g. need to consider their tones, facial expressions and body languages in order to fully understand the meaning of what they said)?
If yes, how this issue can affect the use of ERP?

2.9. How satisfied are you with your subordinates and staff's capability?

Follow-up:

Do you perceive that some of your staff rely too much on superior's directives and lack sufficient independent thinking and problem-solving skills?

If yes, do you perceive that the proportion of this type of staff is high in SOEs?

What is the educational level of the majority of staff in your firm?

2.10. What other noticeable issues, difficulties and problems have you encountered during the phase of ERP post-implementation?

Thank you very much indeed for participating in this interview

Appendix 8: Interview with IT Manager

Good morning. My name is Guo Chao Peng and I am a research student at the Department of Information Studies at the University of Sheffield in the UK. Thank you very much for participating in this interview today. This interview is a follow-up discussion of a preliminary questionnaire that studied ERP post-implementation barriers and risks across 118 SOEs in the electronic and telecommunication manufacturing sector in Guangdong. This interview aims at further exploring and verifying a set of critical ERP barriers and risks identified from this initial questionnaire survey.

Before starting, I would like to ask if you would mind me using digital recorder this discussion for data collection purposes. I would like to stress that the results of this discussion will be treated as confidential and none of your opinions will be traceable to you or your organisation. You can also stop the digital recorder at any point of the discussion.

Section 1: General questions

1.1. What is your role in the company?

Follow-up:
What daily duties will you involve?
Have you been involved in ERP implementation and maintenance in your firm?

1.2. For what reasons and initiatives did your company implement ERP (e.g. competition/ economic pressure/operational needs/government instruction/other reasons)?

Follow-up:
Which ERP areas you are using? Which new modules or tools will be added in the future?
How satisfied are you with your current ERP system?

Section 2: ERP Barriers and Risks

2.1. What technical shortcomings does your current ERP system have?

Trigger questions:

Can it be easily integrated with other information systems in the company?
Are modules of the ERP system seamlessly integrated?
Can invalid data be detected by the system automatically?
Can it be flexibly and continually customised as new business requirements arise?
Do you feel the cost for purchasing new ERP functions is too high?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.2. Do you perceive that top managers of your company provide sufficient support and attention to ERP adoption?

Follow-up:

If yes, what kind of top management support do they provide?
If no, what do you perceive as the disadvantage for insufficient top management support?
Do you perceive that top managers focus more on short-term results rather than on long term achievement? If yes, how do you perceive this behaviour can affect ERP exploitation?
What impacts do you perceive personnel changes in top management can bring to ERP usage and maintenance?

2.3. Does your company assign sufficient funds to ERP maintenance and upgrade?

Follow-up:

If no, what do you perceive as the disadvantage for having insufficient ERP funds?
what do you perceive as the causes for this issue?

2.4. Which ERP brand are you using? Why choose this brand?

Follow-up:

Do you feel that your company receives sufficient technical support from system provider?
If no, how insufficient after-sales support can affect system maintenance and enhancement?

Do you have a formal business contract/service agreement with your ERP provider/dealer?
If yes, will contents of the contract be executed properly and strictly?
If no, what do you perceive as the disadvantage for lack of such a formal business document?

2.5. What do you perceive as the impact if data access right is given to irrelevant users?

Trigger questions:

Will it cause confidential data to be accessed by unauthorised or inappropriate people?

Follow-up:

What do you perceive as the causes to this issue?

2.6. Have you recruited system consultants from external consulting firms during ERP implementation or maintenance?

Follow-up:

If yes – Do you consider these system consultants have sufficient expertise and experiences to provide you with valuable advices?
If yes – What are the consequences for recruiting low-qualified consultants?
If no – What do you perceive as the reasons for them to have insufficient expertise?
What are the consequences for recruiting low-qualified consultants?

Do you have a formal service contract/agreement with your system consultants?
If no, what do you perceive as the disadvantage for not having such a formal business document?

If no – What are the reasons for not recruiting external consultants (e.g. too expensive, don't think they can help)?
What do you perceive as the disadvantage for not recruiting system consultants?

2.7. Do you perceive that turnover rate of qualified IT/ERP staff in your company is high?

Follow-up:

If yes – What do you perceive as the reasons causing high turnover rate of this type of professional?
What do you perceive as the impacts for losing qualified IT experts? (E.g. lose valuable ERP expertise accumulated over time when in-house IT experts left)

If no – What has your company done to retain high qualified IT staff?
What reasons may cause high turnover rate of this type of professional?
What do you perceive as the impacts for losing qualified IT experts?

2.8. What do you perceive as the causes and impacts for the following system problems

a) Hardware or software crashes
b) Slow system response time
c) Poor data quality

Follow-up:
Has your company experienced any of these problems? What have you done to prevent it from happening again?

2.9. Does your company have a formal IS plan to guide future IS development, maintenance and enhancement?

Follow-up:
If yes – How do you establish this IS plan (e.g. in relation to the business plan)?
What contents will be involved in the IS plan?
How long does each IS plan last (e.g. one year, five year)?
Who are responsible for establishing this IS plan?
What do you consider as the disadvantage if a formal IS plan is missing?

If no – Why your firm does not develop a formal IS plan to guide future IS development and enhancement?
What do you consider as the disadvantage of not having a formal IS plan in your firm?

2.10. How decisions associated with IS/ERP issues (e.g. purchase additional ERP modules) are made in your company?

Trigger questions:

What kind of meeting and discussion will be conducted before coming up with a decision?
Who will be involved in the discussion and decision making?
Who has the power and responsibility to make the final decision?
Do you have an ERP champion or steering group?

Follow-up:

What do you perceive are the consequences if top managers in the firm make important IS decisions without consulting IT managers or experts?

2.11. Will your company provide continuous training to system users during ERP post-implementation?

Follow-up:

If yes – What kind of continuous training will your company provide?
Do you perceive system users of your company have sufficient skills to use the current system and any newly installed functions?
If no – How can system users develop sufficient skills to use any newly installed functions?

2.12. What other noticeable issues, difficulties and problems have you encountered during the phase of ERP post-implementation?

Appendix 9: Interview with System User

Good morning. My name is Guo Chao Peng and I am a research student at the Department of Information Studies at the University of Sheffield in the UK. Thank you very much for participating in this interview today. This interview is a follow-up discussion of a preliminary questionnaire that studied ERP post-implementation barriers and risks across 118 SOEs in the electronic and telecommunication manufacturing sector in Guangdong. This interview aims at further exploring and verifying a set of critical ERP barriers and risks identified from this initial questionnaire survey.

Before starting, I would like to ask if you would mind me using digital recorder this discussion for data collection purposes. I would like to stress that the results of this discussion will be treated as confidential and none of your opinions will be traceable to you or your organisation. You can also stop the digital recorder at any point of the discussion.

Section 1: General questions

1.1. What is your role in the company?

Follow-up:
What daily duties will you involve?
How will you use ERP in your daily job?

1.2. How satisfied are you with your current ERP system?

Trigger questions:
Do you trust the data provided by the system?
Do you think the use of ERP system can help you to improve your work efficiency?
Do some of your colleagues fear that the adoption of ERP can result in job loss?
Did it result in any job losses?

Section 2: ERP Barriers and Risks

2.1. What issues have you experienced when using ERP to support sales and marketing activities?

Trigger questions:

Did you ever find that customer files contained in ERP was out-of-date and incomplete?

Does your ERP system contain analytical tools to facilitate the development of sales forecasts? If yes, do you find that sales forecast/plan generated by using ERP is inaccurate? If no, how does your company carry out sales forecasting?

Did demands of new product use to be under- or over-estimated?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.2. What issues have you experienced when using ERP in supporting production and logistics activities?

Trigger questions:

Did bill of materials contained in ERP use to be inaccurate and incomplete?
Did inventory records contained in ERP use to be inaccurate?
Did master production plan generated by ERP used to be inappropriate?
Did material requirement plan generated by ERP used to be inappropriate?
Did you find supplier records of ERP were inaccurate?

Follow-up:

What are the causes and consequences if these issues occur? (Iteration)

2.3. What issues have you experienced when using ERP to support financial and accounting activities?

Trigger questions:

Do you find that financial budgets generated by using ERP are inappropriate?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.4. What technical shortcomings do you perceive your current ERP system has?

Trigger questions:

Do you find the design of the system is not flexible enough (e.g. cannot allow users to search and add inventory items while they are in the middle of creating a manufacturing order)?
Do you find system pitfalls are not overcome speedily?
Do you find the system do not match all your user requirements? (If so, please give examples)
Are modules of the ERP system seamlessly integrated?
Can ERP detect invalid data automatically?
Do you find inappropriate data are not properly purged? Do you find data quality is not high?
Do you find system response time is slow?

Follow-up:

What are the causes and consequences of these issues? (Iteration)

2.5. What will you do if you experience difficulty when using the ERP system? What will you do if you input some wrong data into the system by mistake but cannot revise it?

Trigger questions:

Will you try to solve the problem by yourself?
Will you report the problem to in-house IT staff or your subordinate immediately?

2.6. Do you perceive the use of ERP can help to improve collaboration and communication between functional departments?

Follow-up:

If yes – Could you please give some examples to illustrate such improvement?
If no – What collaboration and communication issues have you experienced in your company?

Do you perceive that your superiors or colleagues are inclined to use implicit form of communication (e.g. need to consider their tones, facial expressions and body languages in order to fully understand the meaning of what they said)?
If yes, what do you perceive as the impacts for this issue?

2.7. Does your company have a formal IS plan to guide future IS development, maintenance and enhancement?

Follow-up:

If yes – Who are responsible for establishing this IS plan?
Will this IS plan be executed properly?
Who has the power to make final decisions on important IS issues in your company?

If no – Why your firm does not develop a formal IS plan to guide future IS development and enhancement?
Who has the power to make final decisions on important IS issues in your company?

Would you like to be involved in the development of such plans?

2.8. Will your company provide you with continuous training during ERP post-implementation?

Follow-up:

If yes – What kind of continuous training will your company provide?
Do you feel comfortable to use the current system and any newly installed functions?

If no – What do you perceive as the disadvantages for not receiving continuous training?
Do you feel comfortable to use the current system and any newly installed functions?

2.9. Do you feel that turnover rate of qualified people in using ERP in your company is high?

Follow-up:

If yes – What do you perceive as the reasons causing high turnover rate of this type of skilled staff?
What do you perceive as the impacts?

If no – What has your company done to retain high qualified staff?

Thank you very much indeed for participating in this interview

Appendix 10: Initial Coding Scheme

Code	Definition
Power centralisation	Texts about power centralisation issue in SOEs
Reactive approach	Texts about managers adopt reactive approach towards ERP issues
Collectivism	Texts about collectivism in Chinese firms
Critical thinking skills of staff	Texts about critical thinking skills of staff
Guanxi	Texts about using guanxi to build up inter-organisational relationship
High context communication	Texts describe the issue of high context communication within Chinese firms
Trend to tailor forecasts	Texts describe whether Chinese managers are inclined to tailor forecasts & plans
Trust in common sense	Texts describe whether managers trust common sense more than system data
Unwilling to disclose problems	Texts describe whether staff are unwilling to disclose problems to the others
Business downturn	Texts about business downturn in SOEs
Collaboration issues between departments	Texts about collaboration issues between functional departments
ERP fund	Texts about fund assigned to ERP maintenance and enhancement
ERP training	Texts about ERP training provided to both managers and staff so far
'Iron bowl' issue in SOEs	Texts about the 'iron bowl' issue in SOEs
IT champion's ERP knowledge	Texts describe the level of knowledge and skill of IT champion/manager
IT champion's power	Texts about IT champion's power in the company
ERP exploitation plan	Texts about ERP/IS maintenance and enhancement plan of the company
In-house IT expert	Texts about whether the firm has sufficient IT experts and their turnover
Knowledge management practices	Texts about KM practices to capture and retain ERP related know-how
ERP regulations	Texts about regulations set up to regularize ERP usage
Regular system review	Texts about regular system review conducted during ERP exploitation
Top management support	Texts about top management support to ERP
User involvement	Texts about user involvement in using, maintaining and improving ERP
Short-term thinking	Texts about short-term thinking of Chinese managers
Low-skilled and elder staff	Texts about elder staff in Chinese SOEs
Enhancement and reconfiguration cost	Texts about costs of ERP add-ons and enhancement
System design	Texts about system design
Integration difficulty	Texts about ERP compatibility
User requirement analysis	Texts about user requirement analysis
Third party consultant support	Texts about support provided by third party consultant
Vendor support	Texts about support provided by system vendor
Misfit between sys. functions & user needs	Texts about misfits between ERP functions and user requirements
Data quality	Texts describe data quality issues
System speed	Texts describe response speed of the system
System inflexibility	Texts about flexibility of ERP
Operational staff input inappropriate data	Texts describe operational staff input incorrect data into the system
ERP contains inappropriate BOM	Texts describe ERP contains inappropriate BOM
ERP has inappropriate supplier records	Texts describe ERP contains inappropriate supplier records
System contains incomplete customer files	Texts describe ERP contains incomplete customer files
ERP contains inaccurate inventory records	Texts describe inventory records of ERP
Inappropriate sales forecast	Texts describe fail to use ERP to generate appropriate sales forecast
Inappropriate MRP	Texts describe fail to use ERP to generate appropriate MRP
Manager cannot get needed information	Texts describe why managers cannot retrieve needed information from ERP
Cannot receive vendor support	Texts describe the firm cannot receive sufficient/continuous vendor support
Unauthorised access to data	Texts describe confidential data is accessed by unauthorised people
Allocation of data access right	Texts describe data access right is not allocated appropriately
Execution of ERP exploitation plan	Texts describe whether ERP exploitation plan is executed properly
Lose ERP-related know-how	Texts describe how will the firm lose ERP-related know-how
Lose qualified IT staff	Texts describe how will the firm lose qualified IT staff
Lose qualified system user	Texts describe how will the firm lose qualified system users
Execution of ERP regulation	Texts about whether ERP regulations are executed properly
Do not have sufficient ERP fund	Texts about ERP fund
Personnel change in top management team	Texts about top manager changes
Users cannot receive sufficient training	Texts about user training
ERP plan is ill-defined	Texts about ERP plan is ill-defined
Delay in identifying & solving ERP pitfalls	Texts about delay in identifying and solving ERP & IS problems
Fragmentation of ERP system	Texts describe how the installed ERP system becomes fragmented
Duplicated data is not properly purged	Texts describe how duplicated data of ERP is purged
System crush	Texts describe system crush
System is not properly enhanced	Texts describe how the system is continually enhanced
System fails to detect invalid data	Texts describe ERP fails to detect invalid data
ERP cannot integrate with other ISs	Texts about integrate ERP with other IS applications
User dissatisfaction and resistance	Texts about user dissatisfaction and resistance
SOE reform	Texts about SOE reform

(Initial coding scheme continued)

Affect normal operation and production	Texts about how ERP-related issues can affect normal operation and production of the firm
Management difficulty	Texts about factors that can result in management difficulties
Usage difficulty	Texts about factors that can result in usage difficulties
Difficulty in promoting ERP usage and related changes	Texts about factors that can lead to difficulties in promoting ERP usage and related change
Inappropriate ERP decision	Texts about factors that will lead to inappropriate ERP decisions
High market demand	Texts about market demand for high qualified staff
Conflict within top management team	Texts about conflicts within top management team
Thinking behaviour	Texts about thinking behaviour of top management
Management style	Texts about management style of Chinese managers
Implementation time	Texts about time spent on ERP implementation
Maintenance difficulty	Texts about maintenance difficulty
Underutilise the system	Texts describe the system is underutilised
User negligence	Texts about user negligence and mistakes
Hardware	Texts about hardware used to run the ERP system
Dealing with customer inquiry	Texts describe how people deal with customer inquiries with the support of ERP
Market data	Texts describe difficulties in capturing market data
Capital utilisation	Texts about how inappropriate sales forecast can affect cash flow and capital utilisation
Customer lead time	Texts about how unfixed customer lead time can affect MRP
Supplier lead time	Texts about how unfixed supplier lead time can affect MRP
Staff turnover in vendor company	Texts about staff turnover in vendor company
Vendor bankruptcy	Texts about bankruptcy of system vendor
Data copies outside ERP	Texts about data copies stored outside ERP
Data access policy	Texts about data access policy and its execution
Human fraud	Texts about human frauds
Job amount	Texts about job amount assigned to in-house IT staff
System collapse	Texts about issues that can lead to system collapse
Internet virus	Texts about internet virus
Data purging difficulty	Texts describe difficulties in purging system data
Automation	Texts describe how ERP facilitates automation
Information acquisition	Texts describe how ERP facilitates information acquisition
Regularisation	Texts describe how ERP regularises company operation
Collaboration and communication	Texts describe how ERP improves collaboration and communication within the firm
Management efficiency	Texts describe how ERP improves management efficiency
Operational transparency	Texts describe how ERP improves operational transparency
Organisational climate	Texts describe how ERP improves organisational climate

Appendix 11: Final Coding Scheme

Theme	ID	Code of Barrier	Definition	Link with Code	
				Caused by	Result in
Cultural Barriers	B1	Power centralisation	Texts about power centralisation issue in SOEs		B16
	B2	Reactive approach	Texts about managers adopt reactive approach towards ERP issues		B21; R21
	B3	Collectivism	Texts about collectivism in Chinese firms		O1
	B4	Critical thinking skills of staff	Texts about critical thinking skills of staff	O11	
	B5	Guanxi	Texts about using guanxi to build up inter-organisational relationship		
	B6	High context communication	Texts describe the issue of high context communication within Chinese firms		
	B7	Trend to tailor forecasts	Texts describe whether Chinese managers are inclined to tailor forecasts & plans		
	B8	Trust in common sense	Texts describe whether managers trust common sense more than system data		
	B9	Unwilling to disclose problems	Texts describe whether staff are unwilling to disclose problems to the others		
Organisational Barriers	B10	Business downturn	Texts about business downturn in SOEs	O2	B12; R12, 25
	B11	Collaboration issues between departments	Texts about collaboration issues between functional departments		O3
	B12	ERP fund	Texts about fund assigned to ERP maintenance and enhancement	B10, 22	R23
	B13	ERP training	Texts about ERP training provided to both managers and staff so far		O4, 5
	B14	'Iron bowl' issue in SOEs	Texts about the 'iron bowl' issue in SOEs		O6
	B15	IT champion's ERP knowledge	Texts describe the level of knowledge and skill of IT champion/manager		O7
	B16	IT champion's power	Texts about IT champion's power in the company	B1	O6
	B17	ERP exploitation plan	Texts about ERP/IS maintenance and enhancement plan of the company	B15, 22	
	B18	In-house IT expert	Texts about whether the firm has sufficient IT experts and their turnover	O8	
	B19	Knowledge management practices	Texts about KM practices to capture and retain ERP related know-how		R13
	B20	ERP regulations	Texts about regulations set up to regularize ERP usage	B22	B33
	B21	Regular system review	Texts about regular system review conducted during ERP exploitation	B2, 18	R21
	B22	Top management support	Texts about top management support to ERP	O9; B24	O6
	B23	User involvement	Texts about user involvement in using, maintaining and improving ERP	B3, 13, 14	O6
	B24	Short-term thinking	Texts about short-term thinking of Chinese managers		B17, 21, 22
	B25	Low-skilled and elder staff	Texts about elder staff in Chinese SOEs	B14	B23
System Barriers	B26	Enhancement and reconfiguration cost	Texts about costs of ERP add-ons and enhancement		R25
	B27	System design	Texts about system design	B31	O5
	B28	Integration difficulty	Texts about ERP compatibility		
	B29	User requirement analysis	Texts about user requirement analysis	B18, 22, 31;O12	B32; O13
	B30	Third party consultant support	Texts about support provided by third party consultant	B12,15	R21
	B31	Vendor support	Texts about support provided by system vendor	B12	R21
	B32	Misfit between sys. functions & user needs	Texts about misfits between ERP functions and user requirements	B18, 27	O5, 14
	B33	Data quality	Texts describe data quality issues	B20,27; O15	B34; O1
	B34	System speed	Texts describe response speed of the system	B33; O16	O1
	B35	System inflexibility	Texts about flexibility of ERP		B32

Appendix 11: Final Coding Scheme

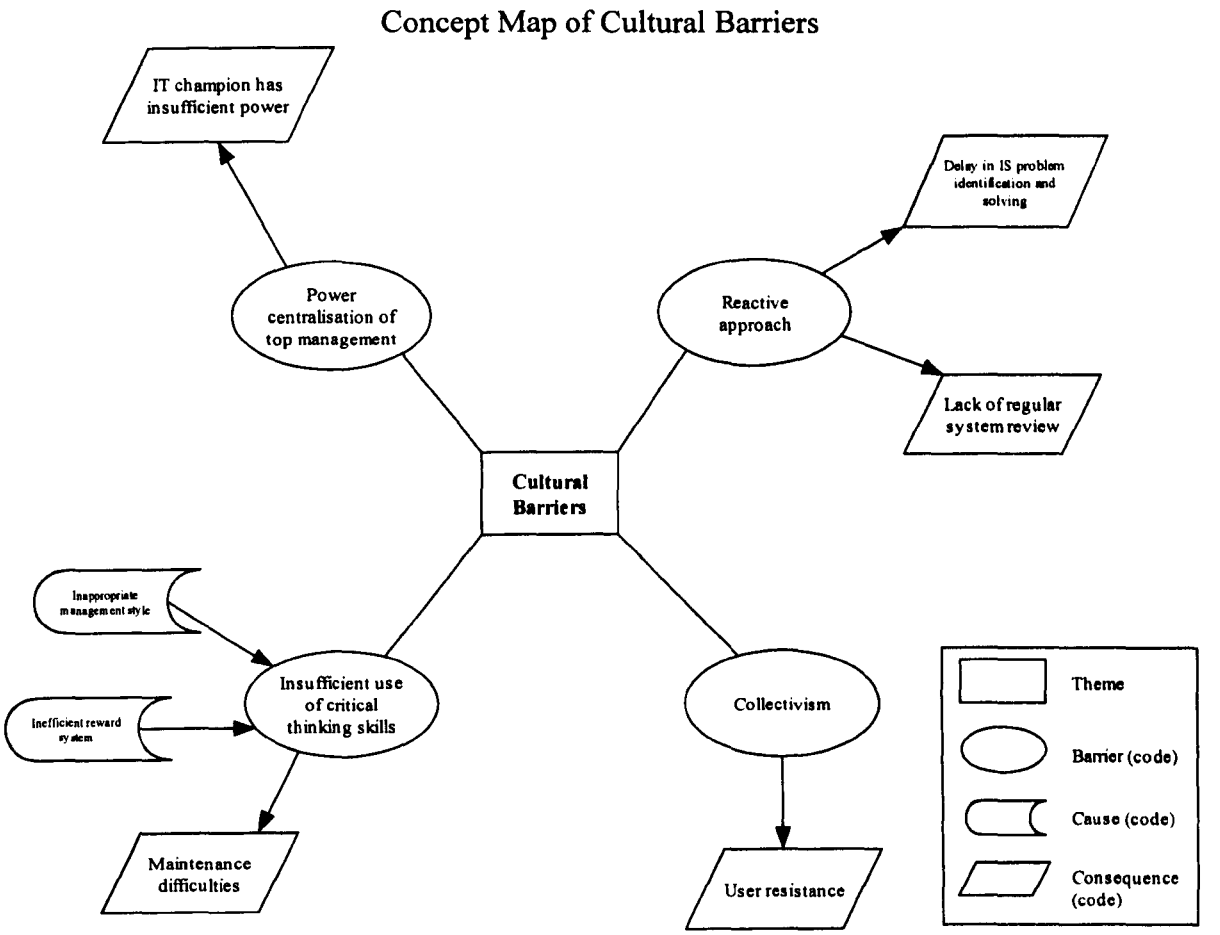
Theme	ID	Code of Risk	Definition	Link with Code	
				Caused by	Result in
Operation Risks	R1	Operational staff input inappropriate data	Texts describe operational staff input incorrect data into the system	B20;R16; O15	O3; R2, 3, 4
	R2	ERP contains inappropriate BOM	Texts describe ERP contains inappropriate BOM	O15	O3; R7
	R3	ERP has inappropriate supplier records	Texts describe ERP contains inappropriate supplier records	R16	O3
	R4	System contains incomplete customer files	Texts describe ERP contains incomplete customer files	R16	O17
	R5	ERP contains inaccurate inventory records	Texts describe inventory records of ERP	R16	O3
Analytical Risks	R6	Inappropriate sales forecast	Texts describe fail to use ERP to generate appropriate sales forecast	B33; O18	O19
	R7	Inappropriate MRP	Texts describe fail to use ERP to generate appropriate MRP	R2; O20,21	O3
	R8	Manager cannot get needed information	Texts describe why managers cannot retrieve needed information from ERP	B32, 33	O14
Organisation - Wide Risks	R9	Cannot receive vendor support	Texts describe the firm cannot receive sufficient/continuous vendor support	B12;O22,23	
	R10	Unauthorised access to data	Texts describe confidential data is accessed by unauthorised people	R11; O24	
	R11	Allocation of data access right	Texts describe data access right is not allocated appropriately	O25; B15	R10,23; O26
	R12	Execution of ERP exploitation plan	Texts describe whether ERP exploitation plan is executed properly	B10, 12, 22	
	R13	Lose ERP-related know-how	Texts describe how will the firm lose ERP-related know-how	B19; R14	
	R14	Lose qualified IT staff	Texts describe how will the firm lose qualified IT staff	O8, 28; B22	R13; O13
	R15	Lose qualified system user	Texts describe how will the firm lose qualified system users		O3, 5
	R16	Execution of ERP regulation	Texts about whether ERP regulations are executed properly	B22	B33
	R17	Do not have sufficient ERP fund	Texts about ERP fund	B10	O4
	R18	Personnel change in top management team	Texts about top manager changes		B22
	R19	Users cannot receive sufficient training	Texts about user training	B12,18	O1
	R20	ERP plan is ill-defined	Texts about ERP plan is ill-defined	B15, 18	
System Risks	R21	Delay in identifying & solving ERP pitfalls	Texts about delay in identifying and solving ERP & IS problems	B2,21,26,31	
	R22	Fragmentation of ERP system	Texts describe how the installed ERP system becomes fragmented		O29
	R23	Duplicated data is not properly purged	Texts describe how duplicated data of ERP is purged	B23; O31	
	R24	System crush	Texts describe system crush	O16, 30	
	R25	System is not properly enhanced	Texts describe how the system is continually enhanced	B10,12,21, 26, 35	
	R26	System fails to detect invalid data	Texts describe ERP fails to detect invalid data	B27	B33
	R27	ERP cannot integrate with other ISs	Texts about integrate ERP with other IS applications	B28	B33

Appendix 11: Final Coding Scheme

ID	Other Codes (that are causes or consequences of a barrier or risk)	Definition	Link with Code
O1	User dissatisfaction and resistance	Texts about user dissatisfaction and resistance	B3
O2	SOE reform	Texts about SOE reform	B4
O3	Affect normal operation and production	Texts about how ERP-related issues can affect normal operation and production of the firm	B10; R1, 2, 3, 7, 15
O4	Management difficulty	Texts about factors that can result in management difficulties	B8
O5	Usage difficulty	Texts about factors that can result in usage difficulties	B13, 27, 32; R15
O6	Difficulty in promoting ERP usage and related changes	Texts about factors that can lead to difficulties in promoting ERP usage and related change	B14, 22, 23
O7	Inappropriate ERP decision	Texts about factors that will lead to inappropriate ERP decisions	B15
O8	High market demand	Texts about market demand for high qualified staff	B18; R14
O9	Conflict within top management team	Texts about conflicts within top management team	B22
O10	Thinking behaviour	Texts about thinking behaviour of top management	B22
O11	Management style	Texts about management style of Chinese managers	B24
O12	Implementation time	Texts about time spent on ERP implementation	B29
O13	Maintenance difficulty	Texts about maintenance difficulty	B29; R14
O14	Underutilise the system	Texts describe the system is underutilised	B32
O15	User negligence	Texts about user negligence and mistakes	B33; R1,2
O16	Hardware	Texts about hardware used to run the ERP system	B34; R24
O17	Dealing with customer inquiry	Texts describe how people deal with customer inquiries with the support of ERP	R4
O18	Market data	Texts describe difficulties in capturing market data	R6
O19	Capital utilisation	Texts about how inappropriate sales forecast can affect cash flow and capital utilisation	R6
O20	Customer lead time	Texts about how unfixed customer lead time can affect MRP	R7
O21	Supplier lead time	Texts about how unfixed supplier lead time can affect MRP	R7
O22	Staff turnover in vendor company	Texts about staff turnover in vendor company	R9
O23	Vendor bankruptcy	Texts about bankruptcy of system vendor	R9
O24	Data copies outside ERP	Texts about data copies stored outside ERP	R10
O25	Data access policy	Texts about data access policy and its execution	R11
O26	Human fraud	Texts about human frauds	R11
O28	Job amount	Texts about job amount assigned to in-house IT staff	R14
O29	System collapse	Texts about issues that can lead to system collapse	R22
O30	Internet virus	Texts about internet virus	R24
O31	Data purging difficulty	Texts describe difficulties in purging system data	R23

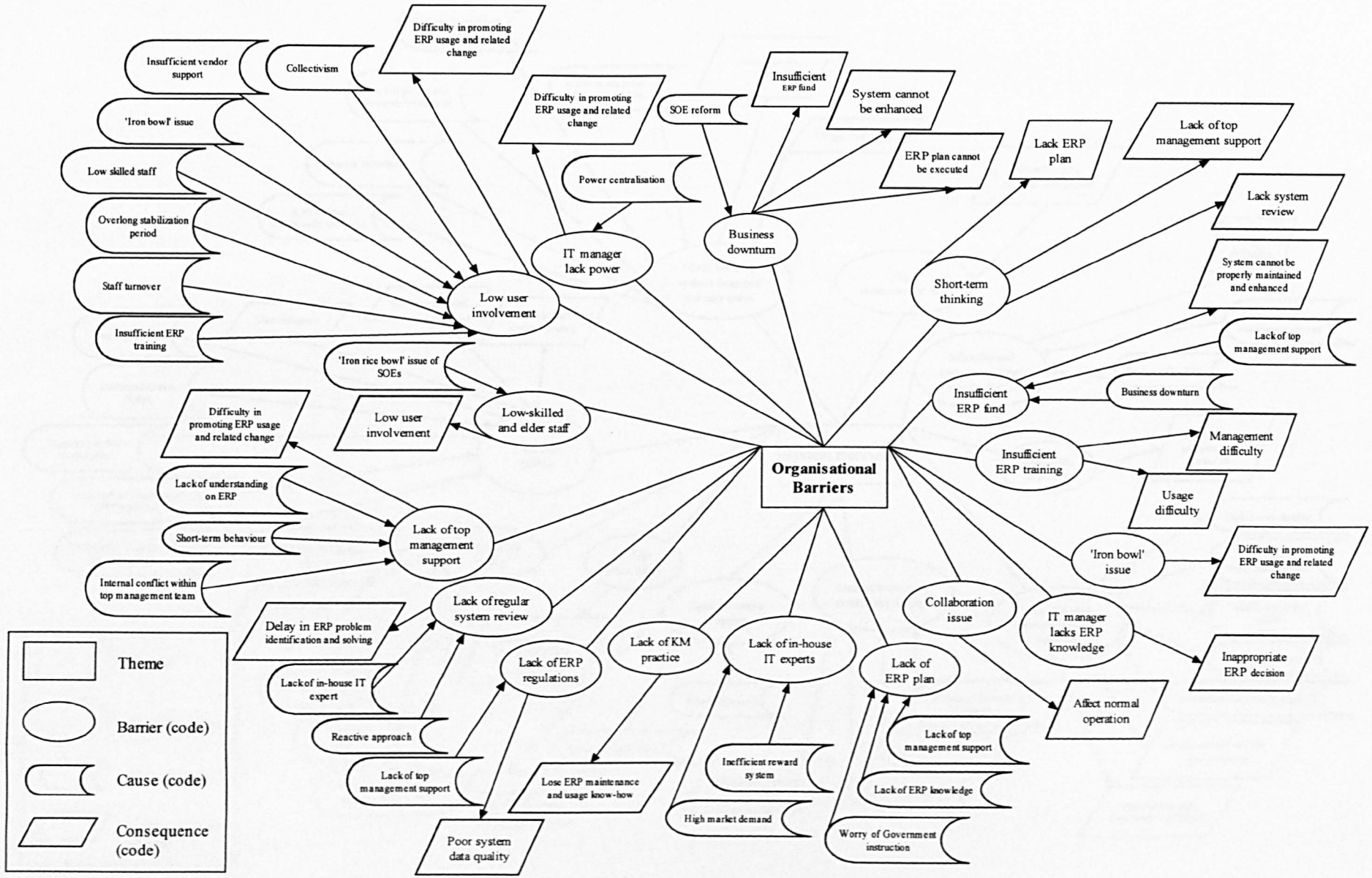
Code of ERP Benefit	Definition
Automation	Texts describe how ERP facilitates automation
Information acquisition	Texts describe how ERP facilitates information acquisition
Regularisation	Texts describe how ERP regularises company operation
Collaboration and communication	Texts describe how ERP improves collaboration and communication within the firm
Management efficiency	Texts describe how ERP improves management efficiency
Operational transparency	Texts describe how ERP improves operational transparency
Organisational climate	Texts describe how ERP improves organisational climate

Appendix 12: Concept Map of Interview Data Analysis

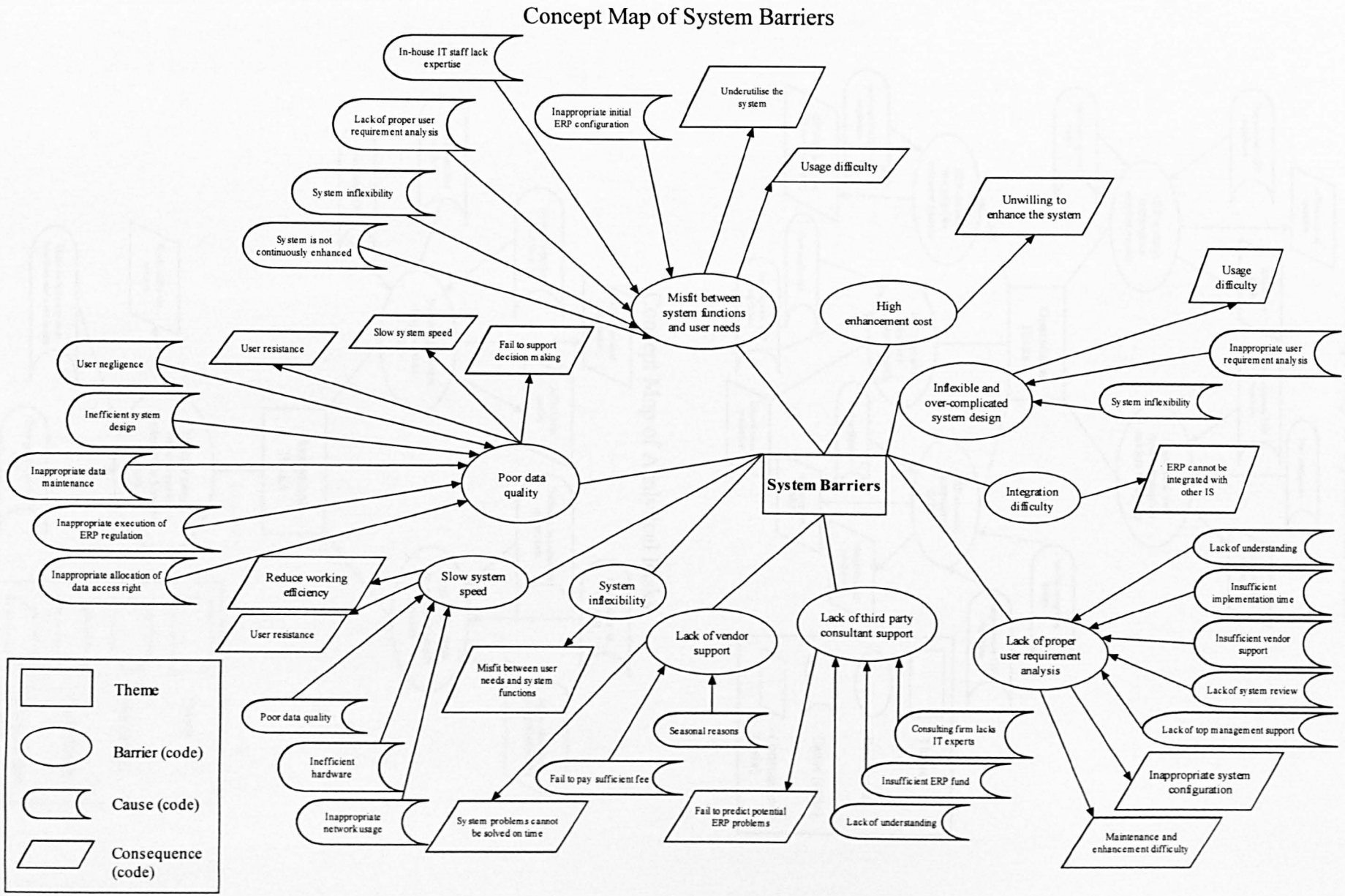


Appendix 12: Concept Map of Interview Data Analysis

Concept Map of Organisational Barriers

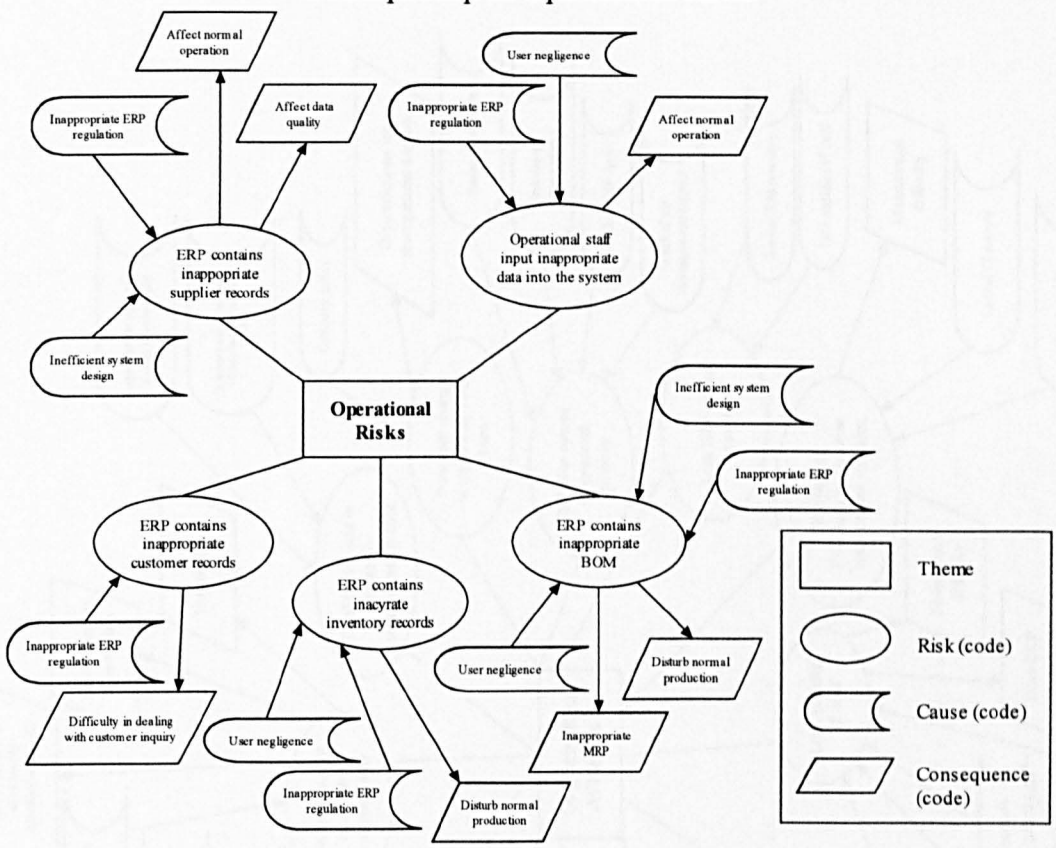


Appendix 12: Concept Map of Interview Data Analysis

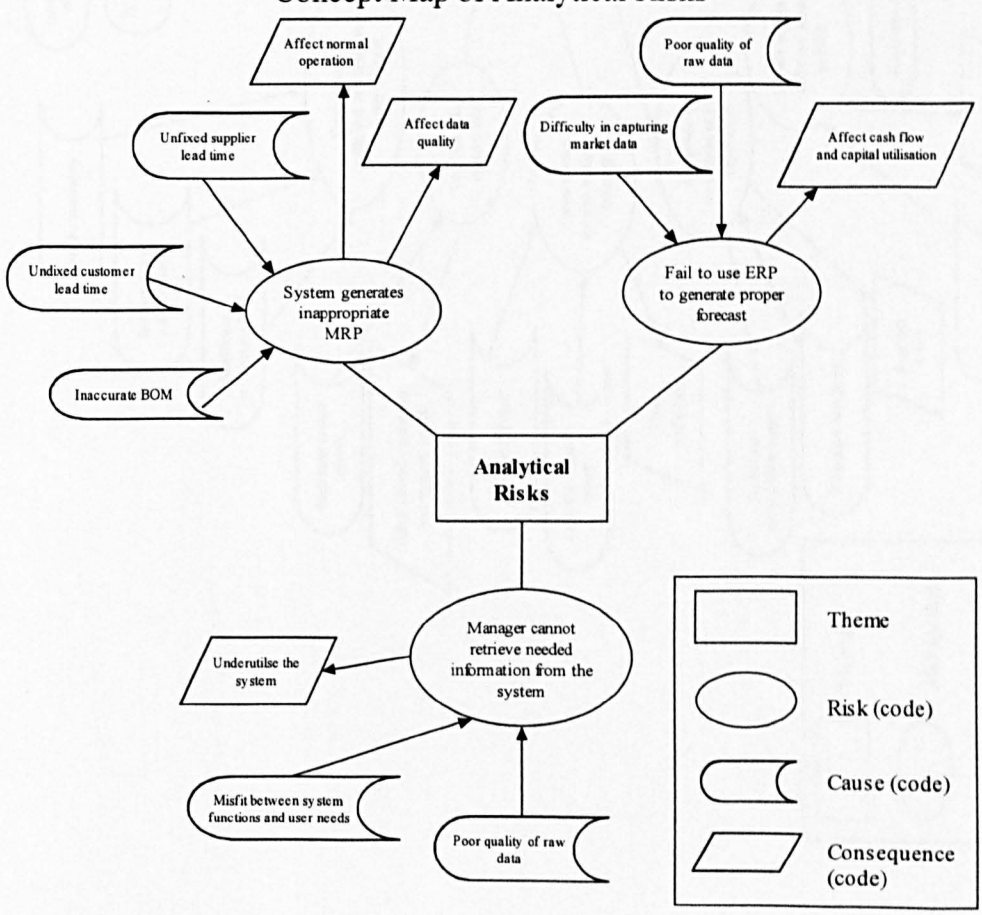


Appendix 12: Concept Map of Interview Data Analysis

Concept Map of Operational Risks

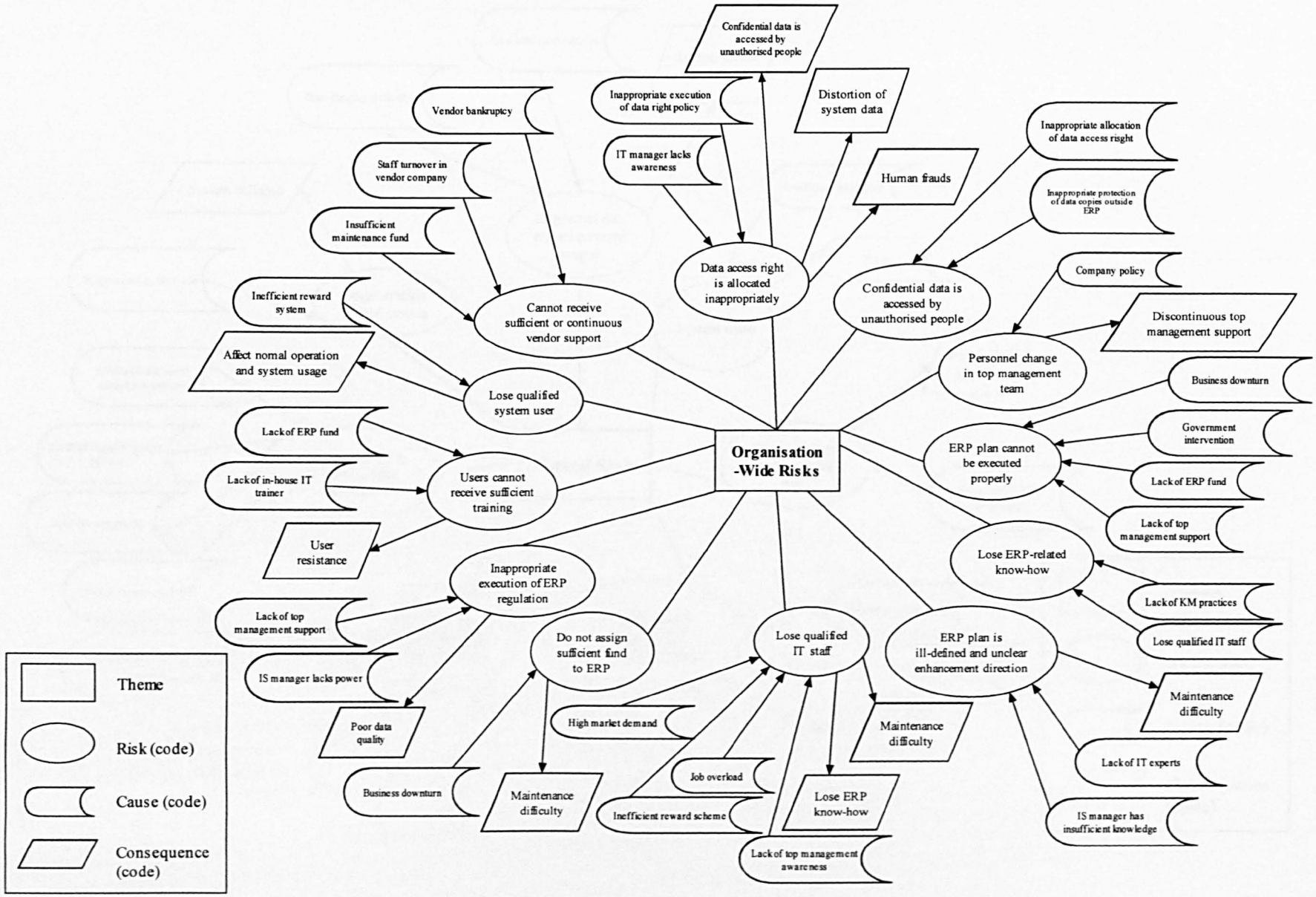


Concept Map of Analytical Risks



Appendix 12: Concept Map of Interview Data Analysis

Concept Map of Organisation-Wide Risks



Appendix 12: Concept Map of Interview Data Analysis