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RISKS ASSOCIATED WITH ERP POST-ADOPTION: THE CASE OF A LARGE MANUFACTURING FIRM IN CHINA

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Abstract

The study reported in this paper aims to identify, assess and explore ERP post-implementation risks in the context of large Chinese companies. The need for the research emerged from the growing awareness in the filed that there is a lack of studies addressing the organisational exploitation of ERPs after the implementation stage. The research took a large Chinese manufacturing firm as a case study. A theoretical ERP risk ontology, which was adopted from our previous research, was used to frame the study and generate data collection tools. Questionnaire was used to explore ERP risks in the selected case company, from which 42 valid responses were received and analysed. The study identified 37 ERP exploitation risks, of which seven were identified as the most critical to the case company. It concluded that, in contrast with technical risks, organisational and human-related risks are more crucial to potential ERP failures.

Keywords: ERP, Post-implementation, Exploitation, Risks, Large companies, China

1.0 Introduction

During the last three decades, China has experienced remarkable economic growth at an annual rate of over 9% (Keng, 2006), and has now become the world's third-largest economy behind the US and Japan. During this period of time, China's large-sized corporations have been playing an extremely crucial role in sustaining the country's continuous economic development. Specifically, according to the National Bureau of Statistics of China (2007), the country has 2,387 large-sized companies. Although these large firms account for only 0.9% of all industrial enterprises in China, they contributed to 41.2% of total sales revenue of the industry in 2006, and continue to absorb more than 42% of the total industrial assets of the country.

On the other hand, the continuous economic growth and entrance of foreign companies to the increasingly open Chinese business market, has significantly changed China's business status quo. Probably the most important change introduced is the very serious competition factors raised in the domestic market. In order to improve business efficiency and sustain business competitiveness under this competitive environment, China's large corporations have consistently invested heavily in information systems (IS) in general and in Enterprise Resource Planning (ERP) systems in particular (Wang, 2006).

ERP systems can be defined as "configurable information system packages that integrate information and information-based processes within and across functional areas in an organisation" (Kumar and Hillegersberg, 2000). The IS community (e.g. Gupta et al, 2004; Oliver et al., 2005; Bergstrom and Stehn, 2005) has continued to stress that the adoption of ERPs can bring a wide range of potential benefits to user companies, such as improve operational and management efficiency, reduce operational cost, and enhance organisational flexibility, etc.

Due to these potential benefits, large Chinese companies commonly set ERP at the centre of their IS development strategy, and perceive successful ERP implementation as a prerequisite for adopting other enterprise applications, e.g. Customer Relationship Management (CRM) systems (Wang, 2006; CCW Research, 2008). Consequently, under such national and organisational context, the majority of large companies in China have implemented ERP systems by 2007 (CCW Research, 2008). The large enterprise market for ERP systems has thus become saturated in China.

However, successful implementation of the system is only an important first step towards achieving ERP success (Willis and Willis-Brown, 2002). Our recent research study (Peng and Nunes, 2008) found that user companies will often encounter a wide range of risks when using, maintaining and enhancing ERP systems in the post-implementation phase. These risks will not only localise around technical aspects, but more importantly can also be found in diverse operational, management and strategic thinking areas (Peng and Nunes, 2008). The occurrence of undesirable risk events in ERP exploitation may not just turn initial ERP success into a failure, but can also lead to system and business disasters. Therefore, ERP post-implementation emerges to be

an increasingly important research topic, and is also considered by IS researchers (e.g. Yu, 2005; Willis and Willis-Brown, 2002) as the direction of the second wave ERP research. However, despite the imperative need of research in this area, there is currently a scarcity of studies on ERP post-implementation issues in general and in the context of large Chinese firms in particular.

Therefore, the research reported in this paper aimed at contributing to this research gap in the ERP literature, by investigating ERP post-implementation risks in large Chinese companies. In order to achieve this research aim, a case study approach was adopted. This paper is organised as follows: the next section presents and discusses the research question and research design. This is followed by a description, discussion and interpretation of the research findings, with conclusions drawn.

2.0 Research Methodology

2.1 Research Question

The main aim of this study was to identify, assess and explore potential risks that Chinese large companies may encounter during ERP exploitation. In attempting to address this research aim, the following research question was formulated:

> "What risks will Chinese large firms experience when exploiting their ERP systems?"

As part of the process of risk assessment, the research aimed to explore the impacts, probability of occurrence and frequency of occurrence of identified risk events, as well as to prioritise these risks. Consequently, this research attempted to identify a list of critical ERP exploitation risks that can be used by large Chinese firms as an important tool for risk prevention, management and control, as well as, for strategic planning and decision making.

2.2 Research Design

ERP post-implementation, which is a long-term endeavour, involves inevitable interactions between ERP systems and organisational contexts. In particular, the success of ERP usage and innovation is heavily dependent on the context of

application (Newell et al, 2000; Xue et al, 2005). Consequently, it is impossible to delineate an explicit line to separate ERP from its application context (Xue et al, 2005). According to Yin (2003:13), "a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Therefore, the features of ERP exploitation led the researchers to select and adopt a case study approach for this research. Moreover, as highlighted by Saunders et al. (2000: 94), case study is an approach particularly suited to generate answers to the "why", "how" and "what" questions. Therefore, case study is well suited to answer the research question of this study.

The research involved a single-case study of a prominent large Chinese corporation: Sha Steel Group, which is located in Zhang Jiagang, a port city in the Jiangsu province in China. Sha Steel Group is a privately owned enterprise, which was established in 1975 with self-financing of only 450,000 RMB. This company however has achieved remarkable development during the last three decades. It currently possesses total assets of over 43.7 billion RMB and employs about 26,700 staff (http://www.sha-steel.com). It also ranks 2nd in China's private companies after Lenovo, and is one of the ten largest steel producers in the world.

In 1997, Sha Steel Group purchased its first ERP solution from Oracle (Wang, 2003). However, after using Oracle's ERP package for five years, the company experienced a number of crucial ERP exploitation problems, e.g. the system failed to satisfy the firm's rapid expansion, and could not be integrated with other IS applications in the firm, etc (Wang, 2003). These ERP problems eventually led the company to shift its ERP vendor from Oracle to SAP in 2003 (Wang, 2003). Nevertheless, SAP's ERP solution still cannot satisfy all business requirements of the firm. Consequently, Sha Steel Group currently adopts and uses diverse ERP modules provided by SAP, Oracle and Ufida (a Chinese ERP vendor) to support its daily operation (Yu, 2006). Based on these facts, Sha Steel Group presents itself as a meaningful context for a study of ERP post-implementation. In truth, it was deemed that ERP exploitation experience and lessons learnt by this company would be of interest and importance, and may even be transferable, to other large corporations in China. Sha Steel Group was thereby selected to be the case company of this study.

Furthermore, in order to frame the study and generate data collection tools, the researchers adopted the theoretical ERP risk ontology (Figure 1), which was established and proposed in our previous research (Peng and Nunes, 2008). A review of the literature suggests that this ontology is the only comprehensive model available in its area. No other such models could be found through the process of literature review. As shown in Figure 1, this comprehensive risk ontology contained 40 potential ERP risks that user companies may encounter during ERP exploitation, including:

- *9 operational risks*. Operational staff are daily users of ERP systems. Operational risks refer to risks that may occur as operational staff use ERP systems to perform daily business activities.
- *8 analytical risks*. Front-line managers use ERP systems to generate plans and forecasts (e.g. production plan, sales forecast, etc) to predict and better manage the uncertain future. Analytical risks refer to risks that may occur as managers use ERP systems to carry out analytical tasks.
- *16 organisation-wide risks*. When using and maintaining ERPs in the post-implementation stage, companies may encounter a set of risk events in relation to various internal (e.g. system users, in-house IT experts) and external factors (e.g. system vendor, system consultants). Such risks may have impact to the entire company and therefore are referred to as organisation-wide risks.
- *7 technical risks*. A set of system and technical factors may result in risk events that can hinder the implemented ERP system to meet its intended functions and performance requirements. These risk events are identified as technical risks.

In order to explore potential ERP exploitation risks in Sha Steel Group by using this risk ontology, questionnaire was selected as the data collection method of this case study. It is apparent that, some of the 40 ERP risks contained in the ontology were related with business aspects, while the others focused on system-related issues. Thus, two different questionnaires (appendix) were designed and used to obtain perspectives respectively from business managers and ICT experts of the company.

For each of these 40 risk events, respondents were firstly asked to indicate whether or not they perceived it as a risk to ERP exploitation in the case company (1 = yes, 0 = no). Furthermore, in order to assess the importance of these ERP risks in the case company, respondents were also asked to provide their opinions on:

1) The probability of occurrence of each risk event (measured on a 3-point Likert scale, ranging from high [3] to low [1]);

2) The impact of each risk (measured on a 3-point Likert scale, ranging from high [3] to low [1]);
3) The frequency of occurrence of each risk event (measured on a 5-point Likert scale, ranging from very often [5] to very rarely [1]).

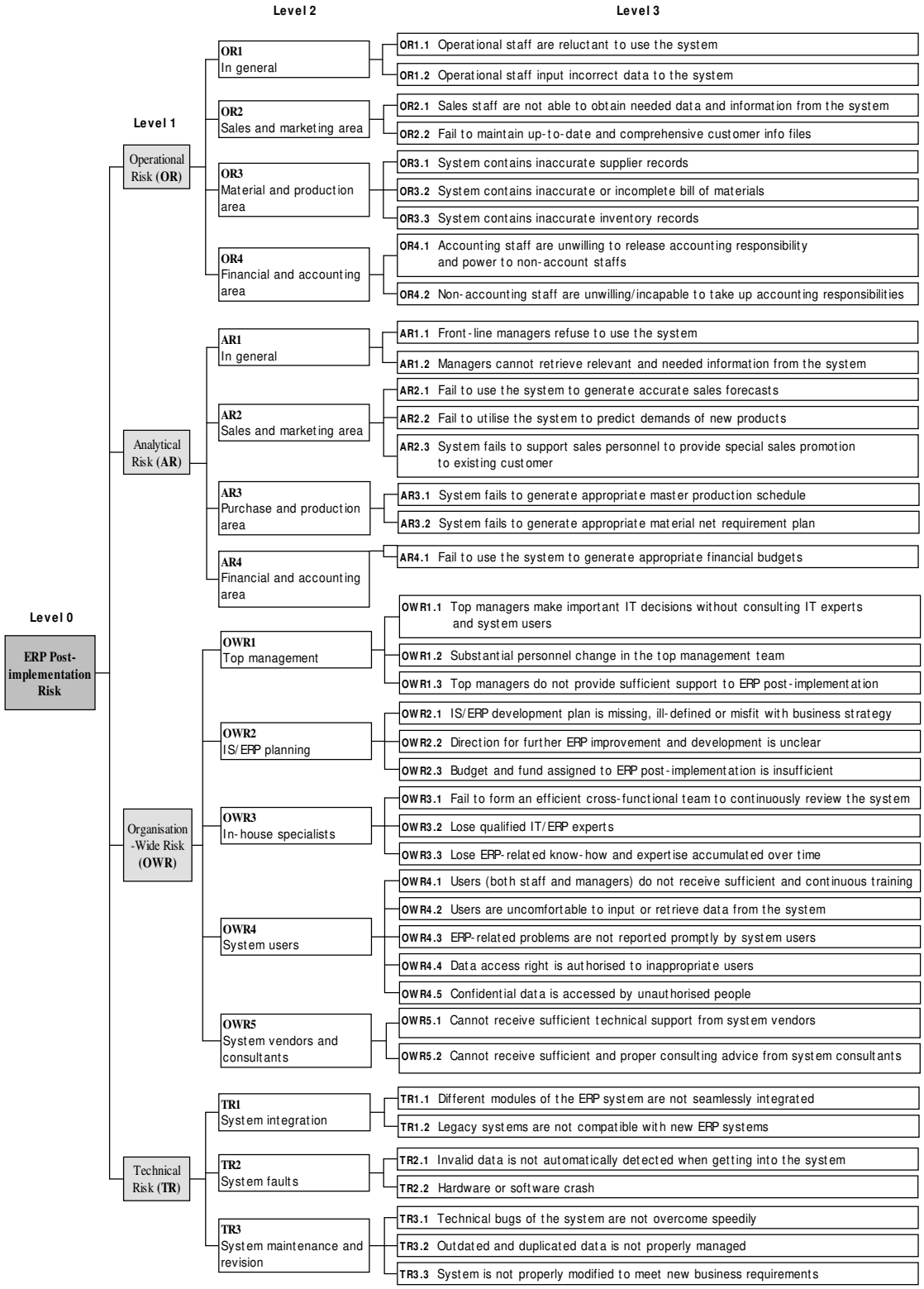

Figure 1. Potential risks to ERP exploitation (Source: Peng and Nunes, 2008)

Both questionnaire scripts were originally developed in English and then translated into Chinese. Substantial attention had been paid during the translation process in order to ensure that both the English and Chinese versions of the questionnaire were conceptually equivalent, and thereby ensure high internal validity.

Subsequently, with assistance and support from the CIO of Sha Steel Group, the researchers selected randomly a list of 50 business managers and IT experts in the company to participate in the study. The designed questionnaires were then emailed to these 50 prospective respondents, from which 42 valid and usable responses were received and analysed. This survey conducted within Sha Steel Group thus achieved a response rate of 85%.

Moreover, secondary data and documentations were also collected from the case company and from the literature, and were used to further understand and interpret the questionnaire findings, as presented below.

3.0 Data Analysis and Findings

3.1 General Findings

As discussed above, the survey asked respondents in Sha Steel Group to assess the importance of each risk from three aspects, namely probability of occurrence, impact and frequency of occurrence. From a risk management perspective, a risk event that has a high probability of occurrence may not have a high impact or a high frequency of occurrence. It is therefore not just necessary but indeed vital to take into account all the three risk aspects, when evaluating the importance of each of the 40 ERP risks examined. Consequently, the following formula was developed and used to calculate the risk score for each risk event:

$$\textit{Risk score of each ERP risk} = \Sigma\,[W^{*}(\textit{Probability} + \textit{Impact} + \textit{Frequency})]$$

This formula was developed in accordance with the structure and design of the questionnaire. Based on this formula, the calculation of the risk score for each identified risk event should go through the following 3 steps:

Step 1. *(Probability + Impact + Frequency)*: sum up the values given by each respondent for the three independent dimensions of a risk event, namely probability of occurrence (i.e. high = "2", medium = "1", and low = "0.5"), level of impact (i.e. high = "2", medium = "1", and low = "0.5") and frequency of occurrence (i.e. 5 values from very often to very rarely = "2", "1.5", "1", "0.75" and "0.5").

Step 2. *W*(Probability + Impact + Frequency)*: 'W' refers to whether or not the respondent perceived this risk event as an ERP risk, with '1' stands for 'yes' and '0' means 'no'. In case that the respondent did not perceive the given risk event as an ERP risk, the formula will turn the value generated from Step 1 into 0: W*(Probability + Impact + Frequency) = 0*(Probability + Impact + Frequency) = 0.
Step 1 and 2 thus generate the individual score that each respondent gave for a specific risk event.

Step 3. Σ *[W*(Probability + Impact + Frequency)]*: sum up the individual score that each of the 42 respondents of the survey gave for a particular risk event, and thus generate the total risk score that this risk event received.

By using this formula, the researchers calculated the risk scores for all of the 40 risk events examined, and then prioritised these risks based on their risk scores (as shown in table 1).

Level 1 category	Level 2 category	Level 3 Risk Item	N = 42	Risk Score	Rank
Operational Risk (OR)	Generic risk (OR1)	OR1.1	Operational staff are unwilling to use the ERP system	125.5	3
		OR1.2	Operational staff input incorrect data into the system	107.7	15
	Sales and marketing risk (OR2)	OR2.1	Sales staff are not able to obtain data and information they need from the system	98.4	28
		OR2.2	Customer info files contained in the ERP system are out of date or incomplete	96.9	29
	Production and purchasing risk (OR3)	OR3.1	ERP system contains inaccurate supplier records	81.5	36
		OR3.2	ERP system contains inaccurate or incomplete bill of materials	106.1	17
		OR3.3	ERP system contains inaccurate inventory records	101.1	21
	Fin. & acc. risk (OR4)	OR4.1	Account staff are unwilling to release accounting responsibility and power to non account staff	119.4	8
		OR4.2	Non account staff are unwilling and incapable to take up accounting responsibilities	77.9	39
Analytical Risk (AR)	Generic risk (AR1)	AR1.1	Front-line managers refuse to use the ERP system	81.1	38
		AR1.2	Managers cannot retrieve relevant and needed information from the system	108.2	14
	Sales and marketing risk (AR2)	AR2.1	Sales forecast is inaccurate and inappropriate	101.3	20
		AR2.2	Fail to predict actual demands of new products	79.9	37
		AR2.3	Fail to provide special sales offers and promotion to existing customers	97.9	30
	Production and purchasing risk (AR3)	AR3.1	Master production schedule generated by the ERP system is inappropriate	132.3	2
		AR3.2	System fails to generate appropriate material net requirement plan	127.2	6
	Fin. & acc. risk (AR4)	AR4.1	Fail to use the system to generate appropriate financial budgets	91.4	34
Organisation Wide Risk (OWR)	Top management risk (OWR1)	OWR1.1	Top managers make important IT decisions without consulting IT experts or system users	104.7	18
		OWR1.2	Substantial personnel changes in the top management team	76.1	34
		OWR1.3	Support from top managers for ERP post-implementation is weakened	117.8	9
	IS/ERP planning risk (OWR2)	OWR2.1	IS/ERP development plan is missing, ill-defined or misfit with business strategy	91.7	31
		OWR2.2	Downturn in ERP improvement and further development is unclear	100.1	19
		OWR2.3	Insufficient resources and funds are assigned to ERP training, maintenance and enhancement	96.9	29
	In-house IT experts risk (OWR3)	OWR3.1	Fail to form an efficient cross-functional team to continuously review and revise the ERP system	77.7	35
		OWR3.2	Lose qualified IT/ERP experts	134.6	1
		OWR3.3	Lose ERP related know-how accumulated over time	127.9	4
	System users risk (OWR4)	OWR4.1	ERP users (both staffs and managers) do not receive sufficient and continuous training	76.4	32
		OWR4.2	Users are uncomfortable to use the ERP system in their daily jobs	96.5	27
		OWR4.3	ERP related problems are not reported promptly by system users	91.1	33
		OWR4.4	Data access right for ERP is authorised to inappropriate users	96.1	23
		OWR4.5	Confidential data of the system is accessed by unauthorised people	101.4	13
	System vendors and consultant risk (OWR5)	OWR5.1	Cannot receive enough technical support from system vendors	127.9	5
		OWR5.2	Cannot receive sufficient and proper consulting advice from system consultants	119.3	11
Technical Risk (TR)	System integration risk (TR1)	TR1.1	Seamless integration is not achieved between modules of the ERP system	126.6	7
		TR1.2	ERP system is not able to seamlessly integrate with other information systems	117.5	10
	System failure risk (TR2)	TR2.1	Invalid data is not automatically detected when getting into the ERP system	79.2	36
		TR2.2	Hardware or software crashes	108.4	13
	System maintenance and revision risk (TR3)	TR3.1	Technical bugs of our ERP system is not soundly overcome	94.8	32
		TR3.2	Outdated and duplicated data of our ERP system is not properly discarded	71.1	37
		TR3.3	ERP is not properly modified to meet new business requirements	100.9	16

Table 1. Risk scores and ranking of the 40 examined ERP risks in Sha Steel Group

Moreover, as shown in this table, the risk scores of 3 ERP events are lower than 70, namely System fails to support sales staff to tailor special offers to existing customers,

Front-line managers refuse to use the ERP system, and ERP-related problems are not reported promptly by system user. In fact, more than 43% of respondents did not perceive these events as ERP risks to the case company. Therefore, these 3 events were removed from the original risk list.

On the other hand, the findings of the study showed that the remainder 37 ERP risks examined were important to Sha Steel Group. Particularly, the top seven ERP risks, of which the risk scores were all above 120, were identified as the most critical to the case company, as shown in table 2.

Rank	Critical ERP Exploitation Risks	Risk Score
1	Lose qualified in-house IT/ERP experts	164.4
2	Master production schedule generated by the ERP system is inappropriate	132.3
3	Operational staff are unwilling to use the ERP system	129.5
4	Lose ERP-related know-how accumulated over time	127.8
4	Cannot receive enough technical support from system vendors	127.3
6	ERP system fails to generate appropriate material net requirement plan	127.2
7	Seamless integration is not achieved between modules of the ERP system	123.8

Table 2. Critical ERP exploitation risks in Sha Steel Group

In relation to previous IS and ERP literature, the next section further discusses and interprets these seven critical ERP risks and their causes and consequences in the context of Sha Steel Group.

3.2 Discussion of Critical ERP Risks

Lose qualified in-house IT/ERP experts

Loss of qualified IT experts ranked 1st in critical ERP exploitation risks in Sha Steel Group. Findings of the study showed that 90% of respondents perceived the probability of occurrence of this risk event as high to medium, and 63% of respondents stated this event also had a high frequency of occurrence in Sha Steel Group. This finding seemed to confirm the fact that market demands for highly qualified IT experts have been extremely high in China under the recent rapid economic development (Zhao, 2001; Zhang et al, 2005). Consequently, turnover rate of qualified IT people would generally be high in Chinese firms. It is obvious that

efficient ERP maintenance, review and enhancement are dependent on continuous effort and contribution of a large amount of IT experts. Therefore, 82% of respondents perceived that loss of highly skilled and experienced IT experts could lead to significant impact on long-term ERP exploitation in their company. Moreover, losing qualified IT experts may also often lead to the loss of valuable ERP know-how and expertises accumulated over time, which was identified as another crucial ERP exploitation risk in Sha Steel Group.

Lose ERP-related know-how accumulated over time

In-house IT experts will be able to accumulate a large amount of know-how and expertise through the process of ERP implementation and exploitation (Scott and Vessey, 2000). However, such implicit and valuable knowledge and expertise may not always be captured and shared effectively across Chinese firms, owning to a lack of systematic knowledge management practices (Burrows et al., 2005) and staff's unwillingness to share information and knowledge freely with each other (Martinsons and Westwood, 1997). This risk event seemed to be very likely to occur (confirmed by 76% respondents) in Sha Steel Group, and could lead to a high to medium impact (70% of respondents). Therefore, there seemed to be a need for Sha Steel Group to make an effort to reduce the probability of occurrence of this critical risk, in order to ensure long-term ERP success.

Master production schedule generated by the ERP system is inappropriate

Master production schedule (MPS) is one of "the most important planning and control schedule[s]" generated by ERPs (Slack, 2005:489). It specifies "the quantity of each finished product required in each planning period; it is a set of time-phased requirements for end items" (Chen, 2001). The appropriateness of master production schedules may largely depend on the accuracy of sales forecasts, which are the main input used to generate such production plans (Zhou et al, 2005:101). However, more than 57% respondents of Sha Steel Group stated that the probability for them to have inaccurate sales forecasts was high to medium. As a consequence, the probability for this company to have inappropriate MPSs was also relatively high, as confirmed by 30% of respondents. Because the occurrence of this risk event may result in product

shortages and/or overages and thus directly influence costs and normal production (Chen, 2001), 80% of respondents said this risk can lead to a high to medium impact.

ERP system fails to generate appropriate material requirement plan

ERP systems use three types of inputs (i.e. Bill of materials, Inventory records, and MPS) to calculate the net requirement plan (NRP) of materials as outputs (Koh et al, 2000). User companies can then launch material production and procurement orders based on their NRPs. However, it can be expected that, if any of the three required inputs are inappropriate or inaccurate, the generated NRP will also be problematic. In Sha Steel Group, a significant amount of respondents perceived that there was a high to medium probability for them to have inaccurate bill of materials (77%), inaccurate inventory records (51%), and inappropriate MPS (30%). Consequently, 68% of the respondents stated that the probability for them to have inappropriate NRP was relatively high. Koh et al (2000) state that inappropriate NRP can result in material shortage or over-ordering/producing, which may lead to delay/cease of production and directly impact costs, customer delivery lead time and customer satisfaction. The occurrence of this risk event can thus result in extremely critical impacts to user companies, as confirmed by 59% of respondents in Sha Steel Group.

Operational staff are unwilling to use the ERP system

42% of respondents stated that it was frequent for their operational staff to show reluctance towards using the ERP system. A review of IS literature (e.g. Beatty and Gordon, 1988; Damodaran and Olphert, 2000; Sherer and Alter, 2004, etc) identified a number of factors that can trigger the occurrence of this event, including psychological anxieties of staff (e.g. unwilling to change and fear of loss of job), initial failures in system implementation (e.g. insufficient training), and system pitfalls (e.g. poor user interface and system design), etc. Moreover, as discussed above, Sha Steel Group purchased its first ERP package from Oracle in 1997. Since then, system users and internal IT people have been suffering from a set of ERP customisation, upgrading and maintenance problems (Wang, 2003). These ERP problems can certainly impact daily work and performance of operational staff in the company. Consequently, system users may loss confidence in the system and thus

become reluctant to use it. Overall, it seemed that managers and IT experts of Sha Steel Group may need to make a further effort to improve user satisfaction and acceptance towards the current ERP system.

Cannot receive enough technical support from system vendors

User companies may not always be able to receive sufficient and continuous post-implementation support from their ERP vendors, due to various reasons (e.g. user company fails to pay sufficient maintenance fees, conflicts with vendor, vendor company is short of IT people, vendor withdraws from the market for commercial reasons, vendor is acquired by another company, etc) (Lientz and Larssen, 2006). Additionally, in the case of Sha Steel Group, the current ERP system consists of modules provided by multiple vendors (i.e. SAP, Oracle and Ufida) (Yu, 2005). Therefore, it may be difficult for this firm to manage the very complex relationships with different vendors and receive sufficient support from them. Consequently, 49% of respondents stated that the probability for them to receive insufficient vendor support was high to medium. The occurrence of this risk event may inevitably result in delay in identifying and resolving technical pitfalls of the implemented ERP system. Thus, the majority of the respondents perceived the impact of this risk as medium (54%) or high (33%).

Seamless integration is not achieved between modules of ERP

As mentioned above, Sha Steel Group implements and integrates ERP modules provided by different system vendors to support the diverse needs of its business units. This is in fact a very common business practice adopted by many other large-sized companies, e.g. TCL in China, and GE in the West. However, this approach may potentially increase complexity and difficulty in harmonizing integration issues. In other words, the firm may face a risk that seamless integration may not be achieved between current modules or between current and new modules of the ERP system. 64% of respondents stated this risk event has a high to medium probability to occur. The occurrence of this risk event may lead to system fragmentation in the company, through the creation of technological islands which are very often totally isolated and

non-communicant. Therefore, 45% of respondents perceived this risk as extremely critical and dangerous to their firm.

3.3 Conclusions of Discussion of Critical Risks

By investigating the list of critical risks, it became apparent that, among the seven critical ERP risks, only one (i.e. seamless integration is not achieved between ERP modules) was related to technical aspect. The other six critical risks, faced by Sha Steel Group at the current moment, were actually found across organisational and human-related areas. In truth, it was concluded in our recent study (Peng and Nunes, 2008) that, "potential failure of ERP systems cannot be conveniently attributed to technical aspects, such as the software package and the ICT infrastructure […] it is in organisation processes and procedures that the more dangerous and difficult-to-manage risks can be found". The findings of this research thus seemed to echo and reinforce this conclusion. In other words, this study confirmed that, in comparison to technical issues, organisation-related risks and problems proved to be more critical to long-term ERP success in the context of Sha Steel Group.

4.0 Conclusions and Implications

This paper reported on an exploratory study, which investigated potential ERP exploitation risks in the context of a large Chinese corporation. The study identified 37 ERP exploitation risks, of which seven were identified as extremely critical to the case company. The causes and consequences of these critical risks have been discussed intensively in the paper. The findings of the study showed that most of the critical ERP risks identified were localised around organisational and business aspects, rather than on technical areas. This study thus echoed the findings derived from our previous research by concluding that, in contrast with technical risks, organisational and human-related risks seemed to play a more important role to potential ERP exploitation failures in the large Chinese firm studied.

The results of this study have important practical and research implications. Specifically, the identified ERP risks, especially the seven critical risks, can be used immediately by managers and IT experts of the case company, as a checklist for

managing and preventing potential ERP post-implementation risks and associated causes and consequences. In addition, the findings of this study may also be useful and beneficial to other large Chinese firms, which may currently be confronted with similar ERP exploitation challenges. It however should be acknowledged that as a single-case study, the ability to generalise the findings is limited. Nevertheless, with support from literature and experience of the case company, this study surely contributed to the knowledge of ERP in China in general, and provided valuable insights into ERP exploitation issues in Chinese large companies in particular. Further research studies in this field are strongly recommended in order to further explore the findings derived from this case study, as well as to establish strategies to address and mitigate the critical risks identified.

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(Appendix follows overleaf)

Appendix

Risk items involved in *Questionnaire A* for business managers

1. Operational staff are unwilling to use the ERP system
2. Operational staff input incorrect data into the system
3. Sales staff are not able to obtain data and information they need from the system
4. Customer info files contained in the ERP system are out-of-date or incomplete
5. ERP system contains inaccurate supplier records
6. ERP system contains inaccurate or incomplete bill of materials
7. ERP system contains inaccurate inventory records
8. Account staff are unwilling to release accounting responsibility and power to non-account staff
9. Non-account staff are unwilling and incapable to take up accounting responsibilities
10. Front-line managers refuse to use the ERP system
11. Managers cannot retrieve relevant and needed information from the system
12. Sales forecast generated by ERP is inaccurate and inappropriate
13. Fail to use ERP in predicting actual demands of new products
14. System fails to support sales staff to tailor special offers to existing customers
15. Master production schedule generated by the ERP system is inappropriate
16. System fails to generate appropriate material net requirement plan
17. Fail to use the system to generate appropriate financial budgets

Risk items involved in *Questionnaire B* for IT managers

1. Top managers make important IT decisions without consulting IT experts or system users
2. Substantial personnel changes in the top management team
3. Support from top managers to ERP post-implementation is insufficient
4. IS/ERP development plan is missing, ill-defined or misfit with business strategy
5. Direction for ERP improvement and further development is unclear
6. Insufficient resources and funds are assigned to ERP training, maintenance and enhancement
7. Fail to form an efficient cross-functional team to continuously review and revise the ERP system
8. Lose qualified IT/ERP experts
9. Lose ERP-related know-how accumulated over time
10. ERP users (both staff and managers) are not receiving sufficient and continuous training
11. Users are uncomfortable to use the ERP system (e.g. input or retrieve data) in their daily jobs
12. ERP-related problems are not reported promptly by system users
13. Data access right to the ERP system is authorised to inappropriate users
14. Confidential data of the system is accessed by unauthorised people
15. We cannot receive enough technical support from system vendors
16. We cannot receive sufficient and proper consulting advice from system consultants
17. Seamless integration is not achieved between current modules or between current and new modules of our ERP system
18. ERP system is not able to seamlessly integrate with legacy or new information systems in my company
19. Invalid data is not automatically detected when getting into the ERP system
20. Hardware or software crashes
21. Technical bugs of our ERP system is not speedily overcome
22. Outdated and duplicated data of our ERP system is not properly discarded
23. ERP is not properly modified to meet new business requirements