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Identification and Assessment of Risks Associated with ERP Post-Implementation in China

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Abstract

Purpose – The purpose of the study reported in this paper was to identify, assess and explore potential risks that Chinese companies may encounter when using, maintaining and enhancing their Enterprise Resource Planning (ERP) systems in the post-implementation phase.

Design/methodology/approach – The study adopted a deductive research design based on a cross-sectional questionnaire survey. This survey was preceded by a Political, Economic, Social and Technological (PEST) analysis and a set of Strength, Weakness, Opportunity and Threat (SWOT) analyses, from which the researchers refined the research context and selected the State-Owned Enterprises (SOEs) in the Electronic and Telecommunication Industry in the Guangdong province as target companies to carry out the research. The questionnaire design was based on a theoretical risk ontology drawn from a critical literature review process. The questionnaire was sent to 118 selected Chinese SOEs, from which 42 (84 questionnaires) valid and usable responses were received and analysed.

Findings – The findings identified a set of 40 ERP exploitation risks, which concentrate around operational, analytical, organisation-wide and technical issues. The top 10 identified ERP risks and associated causes and consequences are discussed extensively in this paper. The study also explored and identified 10 statistical correlations between the risks identified.

Research limitations/implications – This study contributed to the knowledge of ERP in general, and provided valuable insights into ERP exploitation risks in Chinese SOEs in particular.

Practical implications – The findings can be used by practitioners for management and prevention of potential risks in ERP post-implementation.

Originality/value – The need for the research emerged from the growing awareness in the filed that there is a scarcity of studies focusing on ERP post-implementation, in contrast with an over abundance of studies focusing on implementation and project management aspects.

Keywords ERP, Post-implementation, Exploitation, Risks, China, State-owned enterprises (SOEs).

Paper type Research paper

1. INTRODUCTION AND BACKGROUND OF STUDY

Since 1978, China has gradually reformed its economic system from the traditional planning economy to a more competitive market-oriented economy. After an effort of three decades, China has now become the world's fourth-largest economy behind the US, Japan and Germany (Reuters, 2006). Nevertheless, the continuous national economic reform and entrance of foreign companies hitherto closed Chinese business market, has significantly changed China's business status quo. Probably the most important change introduced is the very serious competition factor introduced in the domestic market, now free from central control. Faced with this competitive environment and economic pressure, thousands of Chinese companies have implemented Enterprise Resource Planning (ERP) systems in order to improve operational efficiency and enhance core competencies.

ERP systems can be defined as "configurable information system packages that integrate information and information-based processes within and across functional areas in an organization" (Kumar and Hillegersberg, 2000). ERPs originally aim to help companies achieve seamless data and business process integration in their back offices. Contemporary ERP systems even contain modules, such as Customer Relationship Management (CRM) and Supply Chain Management (SCM), to

integrate the company's back office with its front office. Thus, the ERP research community (e.g. Davenport, 2000; Gupta et al, 2004; Oliver et al., 2005; Sia et al., 2002) has illustrated that, successfully implementing ERP systems can bring companies a wide range of tangible and intangible benefits in operational, managerial, strategic and organizational level.

These attractive potential benefits associated with the system and ever-increasing market competition resulted in very high demand for implementing ERP in Chinese companies. China's ERP market size has therefore been increased rapidly in recent years. Data provided by a prominent Chinese consultancy firm (CCID Consulting), quoted by Xue et al (2005), shows that the ERP market size in Mainland China was around US$70 million in 2000 and grew to US$289.96 million in 2004. Another Chinese consulting firm, CCW Research (2008), recently reports that China's ERP sales reached RMB 7.1 (around US$1.04) billion in just the first half of the year in 2008.

Despite such apparent ERP success, the adoption of ERP is never an easy task and often represents a business dilemma to user companies. 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)

In reality, a review of previous literature identifies that the implementation of ERP is often fraught with challenges, difficulties and problems (Loh and Koh, 2004). However, even if the system is successfully implemented, the 'go-live' point of the system is not the end of the ERP journey (Willis and Willis-Brown, 2002). Very often, the system post-implementation or exploitation stage is where the real challenges will begin and more critical risks may occur (Willis and Willis-Brown, 2002; Buonanno et al, 2005).

A risk can be defined as "the occurrence of an event that has consequences for, or impacts on a particular project" (Kleim and Ludin, 2000:3). This definition implies a fundamental characteristic of a risk, namely uncertainty. Specifically, there is a probability that the risk event may occur and can result in an impact on the business processes that may imply substantial losses. For the purpose of this paper, the researchers slightly modified the above definition given by Kleim and Ludin, and defined a risk to ERP exploitation as:

> "The occurrence of any event that has consequences or impacts on the use, maintenance and enhancement of the implemented ERP system."

It is expected that user companies will inevitably encounter a wide range of risks during the ERP post-implementation phase. This is particularly true, considering three apparent facts. First, some failures of ERP implementation are prevail across the literature (e.g. insufficient user training), even when the implementation project itself is considered a successful one. Such early failures can cause severe problems in ERP post-implementation. Second, undesirable internal and external changes (e.g. loss of in-house IT experts, bankruptcy of system vendor, etc) may arise over time, and can directly impact the use of ERP. Third, internal and external barriers (e.g. inefficient communication between functional divisions) that are inherent to the business context may prevent companies from achieving long-term ERP success. The occurrence of undesirable risk events in the ERP post-implementation stage can turn initial ERP success into a failure and may lead to system and business collapses. Although many researchers recognize the importance of ERP post-implementation and even state that ERP post-implementation is the direction of the second wave ERP research (Yu, 2005), current research which focuses on ERP post-implementation is still extremely limited. No study in ERP post-implementation risks was identified in the literature reviewed.

This paper presents the results of an empirical study that aimed at addressing this significant research gap. An extensive systematic review was conducted at the early stage of the research. As a result of the systematic review, the researcher developed a theoretical risk ontology which consists of 40 potential ERP risks that Chinese companies may encounter during ERP exploitation. A questionnaire, which was constructed based on the theoretical risk ontology, was used to seek Chinese managers' perceptions of the 40 pre-defined ERP risks as well as exploring the correlations between these risks. This paper is structured as follows: the next section presents and discusses the research aims and research design; subsequently, results derived from the questionnaire survey are presented and discussed with conclusions drawn.

2. RESEARCH METHODOLOGY

2.1 Research aims and objectives

The main aim of the study reported in this paper was to identify, assess and explore potential risks that Chinese companies may encounter when using, maintaining and enhancing ERPs in the system post-implementation phase. As part of this 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 investigate the correlations between them.

This research attempts to generate a set of meaningful findings that can be used by practitioners as an important tool for risk prevention, management and control, as well as, for strategic planning and decision making. It is expected to be of particular interest to ERP researchers, practitioners and user companies, and even ERP vendors and system consultants.

2.2 Research design

Research design of this study consists of three main components, namely using PEST and SWOT to refine research context, establishing a theoretical risk ontology through a critical literature review, and testing the risk ontology by a deductive questionnaire survey.

2.2.1 Refining the research context by using PEST and SWOT analysis

At the initial stage of the study, the researchers attempted to undertake a national study of the whole of China. However, this soon proved to be extremely difficult and virtually impossible. This difficulty does not only follow from China's large size (e.g. has 31 regions and a geographical area of 9.6 million square kilometres in total) and number of potential respondents (e.g. has 301,887 firms in 31 industrial sectors by 2006), but is also attributed to the fact that China is by no means a homogeneous country (Peng and Nunes, 2008; Roy et al., 2001). Specifically, there are important changes occurring in coastal regions, whereas other parts of the country are still traditionally led by the central government. Moreover, there are significant variances in uptake of technology and IS and specifically of ERP in diverse industry sectors. There are also significant differences in organisational culture and information sharing in different types of organisations, namely between state-owned enterprises (SOEs) and newly created private and foreign-invested organisations. Consequently, it became clear that a nationwide study in China is not only unrealistic and potentially unfeasible, but may result in findings that are neither significant nor meaningful (Peng and Nunes, 2007a).

Faced with the necessity of focusing the research, the researchers adopted a Political, Economic, Social and Technological (PEST) analysis and a set of Strength, Weakness, Opportunity and Threat (SWOT) analyses as a combination to narrow the scope of the study, as well as to identify a type of Chinese company, an appropriate industry sector and a region on which to base the study. This rigorous approach was discussed extensively by the researchers at the 6th European Conference on Research Methodology for Business and Management Studies (ECRM) (Peng and Nunes, 2007a).

In brief, through the PEST analysis, the researchers developed an in-depth understanding of China's current context in terms of political, economic, social and technological dimensions. Based on this analysis, the researchers identified Guangdong (a southern province in China) as an ideal context for the study of ERP post-implementation. Guangdong is one of the pioneer regions of China's economic reform and one of the most important and fast-growing economic regions in the country. Consequently, the region has achieved high levels of ICT and IS uptake and presents itself as an ideal context where to study a phenomenon such as post-implementation of ERP. A second important conclusion of the PEST analysis was the realisation that SOEs hold more than 50% of the total industrial assets in China. SOEs play at the present moment a crucial role in sustaining the continuous development of China's national economy, in contrast with other types of companies (e.g. private companies and foreign companies) in the country. Therefore, Guangdong and SOEs were selected as ideal contexts for carrying out the project. Subsequently, a set of SWOT analyses was conducted to assess the strengths, weaknesses, opportunities and threats of SOEs operating in various key industrial sectors in Guangdong. As a result of the comparative examination of these SWOT

analyses, the electronic and telecommunication manufacturing sector was selected as the most ideal sector to conduct this study.

Overall, as a result of the PEST and SWOT analyses, the researchers identified and selected a reasonable and feasible set of Chinese firms for carrying out the research, namely *SOEs* in the *Electronic and Telecommunication Manufacturing Sector* in the *Guangdong* province of China. It should be stressed that the very effort of narrowing and focusing the research by using PEST and SWOT, means that generalisation of findings is now only possible for similar regions, company types and sectors as the ones studied. However, this was deemed particularly appropriate due to the complexity that characterises the Chinese economy at the moment. In truth, a study that focuses on producing generalisable statements about a specific regional context is more likely to result in meaningful and significant findings than one that focuses on China as a whole (Peng and Nunes, 2008). Moreover, Manion (1994) reinforces that findings derived from a regional sample cannot be applied to the entire country, but can often be used as the basis for social scientists to carry out further research on contemporary China.

2.2.2 Critical literature review

After a feasible set of companies was selected, the next step of the research was to establish explicit IS lens, in order to frame the study and generate data collection tools. In order to achieve this objective, a desktop study, based on the process of a critical literature review, was conducted by the researchers. This critical review followed the funnelled approach proposed by Saunders et al. (2003:44-50), and relied on surveying and using secondary and tertiary sources. Literature search for this critical review consisted of two phases.

At the first phase of literature search, the researchers attempted to locate and retrieve articles that are directly related to ERP post-implementation risks. This literature seeking process involved an exhaustive search of a variety of prominent MIS journals and databases by using a set of pre-defined search keywords and terms (as outlined in Appendix A). It was identified from this process that current research studies on ERPs focus mainly on implementation and project management aspects (e.g. Oliver et al, 2005; Motwani et al, 2005; Ehie and Madsen, 2005; Loh and Koh, 2004; Gupta et al, 2004; Huang et al, 2004; Yusuf et al, 2004). In contrast, research on ERP post-implementation is currently extremely limited. More specifically, the literature search process did not return any particular articles on ERP exploitation risks.

Faced with the current scarcity of studies on ERP post-implementation, a broader and more extensive critical review was conducted at the second stage. Instead of looking for specific studies on ERP post-implementation risks, this second attempt focused on general IS/ERP research papers, case studies, technical papers and theoretical articles. The aim here was to identify broadly any possible factors and issues that might lead to potential ERP exploitation failures. The same set of MIS journals and databases were searched, but an alternative set of search keywords were used at this stage (as shown in Appendix A). Moreover, in order to identify and explore as many issues as possible, the survey of literature at this stage relied not only on academic papers, but also on books, industrial white papers, articles on IT professional websites, and even grey literature in both English and Chinese.

With such efforts, the researchers successfully identified and retrieved a large amount of valuable literature, which addressed various IS, ERP and business issues and aspects. Subsequently, the retrieved articles and materials were systematically and critically analysed, compared and synthesised, in order to identify any possible risks that can occur when companies use, maintain or enhance their ERP systems. As a result of this analytical process, a total of 40 ERP post-implementation risks were identified and established. Moreover, potential causes and consequences of these identified risks were also analysed and explored, by using the retrieved literature as raw materials to construct and support argumentation (as exemplified in Appendix B). A risk ontology was then established to highlight the 40 identified ERP risks. This risk ontology represents a first attempt in producing a comprehensive model in its area. No other such models could be found from the literature reviewed.

2.2.3 The theoretical risk ontology

The established risk ontology (Figure 1) was proposed and discussed extensively by the researchers in the 2nd South East European Doctoral Student Conference (Peng and Nunes, 2007b), and was characterised by four main categories:

- *Operational risks (OR).* Operational risks refer to risks that may occur as operational staff use ERP systems on a daily basis to perform business activities.
- *Analytical risks (AR).* 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.
- *Organisation-wide risks (OWR).* When using and maintaining ERP systems in the post-implementation stage, companies may encounter a set of risk events in relation to various internal (e.g. system users) and external factors (e.g. system vendor). Such risks may have impact to the entire company and therefore are referred to as organisation-wide risks.
- *Technical risks (TR).* 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.

Furthermore, it was considered that operational and analytical risks occur in different functional divisions in a company and are therefore very different in nature. Their study needs to take into account diverse aspects and sometimes very disparate triggers. After identifying the operational and analytical risks in general, the researchers specifically selected and focused on three business areas for identification of operational and analytical risks, namely sales and marketing area, purchase and production area, and financial and accounting area (see level 2 of the risk ontology in Figure 1).

Additionally, the identified organisation-wide risks and technical risks were also rearranged into different categories: the sixteen organisation-wide risks were divided into five sub-categories, namely top management, IS/ERP planning, in-house specialists, system users, and system vendors and consultants; the seven technical risks were rearranged into three subsets, namely system integration, system faults, and system maintenance and revision (see level 2 of the risk ontology in Figure 1).

Moreover, it clearly emerged from the findings of the critical literature review that, the occurrence of an ERP risk may often be related to the occurrence of other risks. More specifically, it was identified that an identified ERP risk can be the cause or consequence of a set of other risks. Therefore, this risk ontology also highlights a number of potential causal relationships between the ERP risks identified, based on the results of the critical review. This provided initial directions for the researchers to explore correlations between the identified ERP risks at the next stage of the study, as further discussed in section 3.4.

2.2.4 The questionnaire survey

In order to achieve the research aims and examine the suitability of the risk ontology in the context of selected SOEs, a deductive research design based on a cross-sectional questionnaire survey was selected. The questionnaire was developed by using the risk ontology as the theoretical basis. From this ontology it became apparent that out of the 40 predefined risks, some were related with business aspects, while the rest focused on technical issues. This clearly indicated that two different questionnaires needed to be designed to obtain perspectives of both managers and ICT experts.

In addition, the researchers attempted to identify which of the 40 predefined risk events would be perceived by respondents as risks for ERP exploitation, as well as, to assess the importance of each identified risk according to its likelihood, impact and frequency of occurrence. In order to achieve these objectives, each of the 40 risk events was examined in the questionnaire through four questions:

1) Whether this event could be perceived as a risk to ERP exploitation (1 = yes, 2= no).
2) What the probability of occurrence of this risk event could be (measured on a 3-point Likert scale, ranging from high [3] to low [1]).
3) What level of impact this risk could result in (measured on a 3-point Likert scale, ranging from high [3] to low [1]).
4) What the frequency of occurrence of this risk event could be (measured on a 5-point Likert scale, ranging from very often [5] to very rarely [1]).

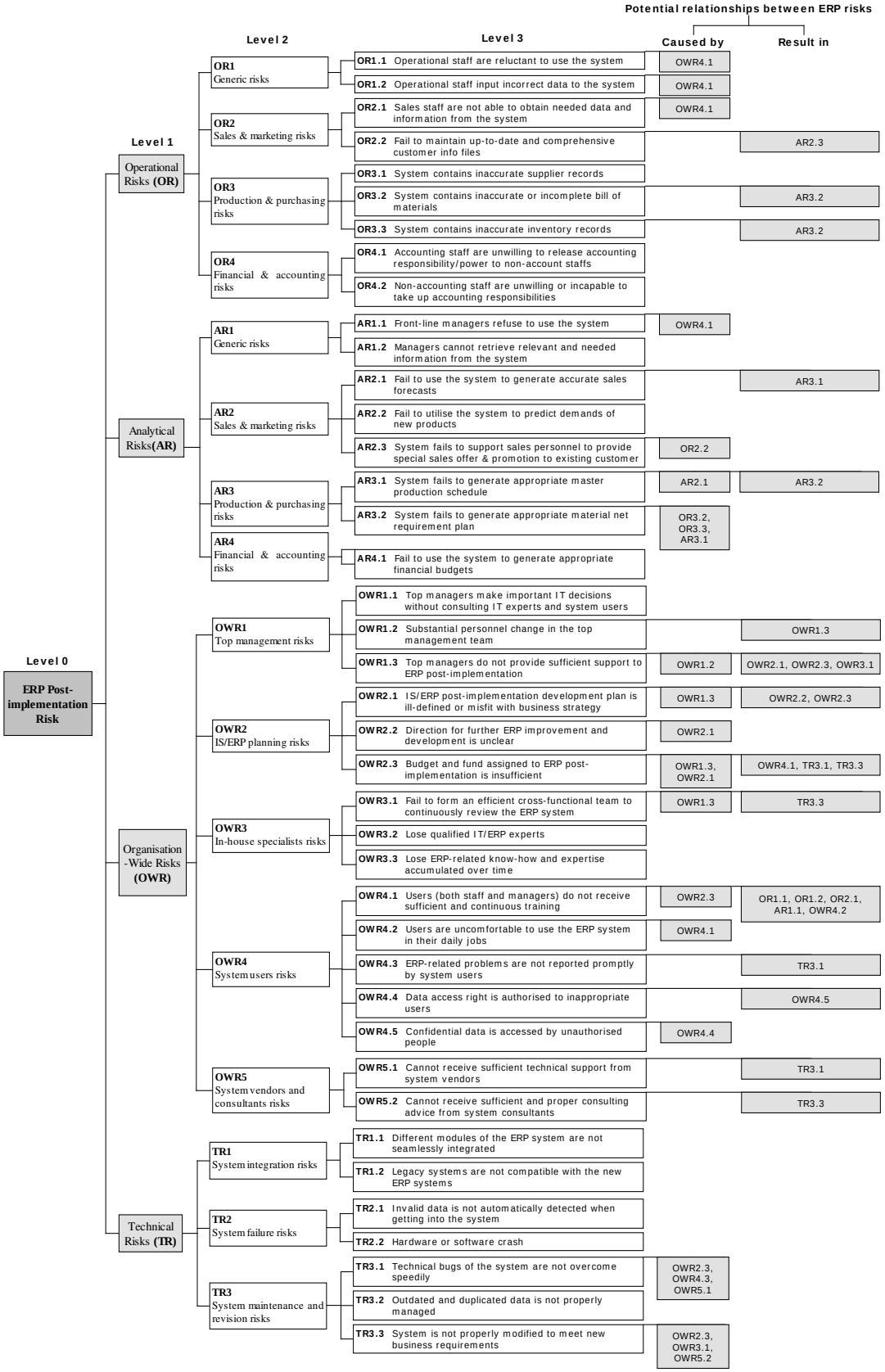

Figure 1: Risk in ERP Post-implementation Ontology

Both questionnaire scripts were originally developed in English and then translated into Chinese. The questionnaire could actually have been directly designed in Chinese, but since the literature review was undertaken in English as based mostly (90%) on English sources, the initial script was written in that language using its terminology. Furthermore, the study is based in an UK university and the entire research group uses English, so if the questionnaire questions were to be discussed and validated by both supervisor and colleagues, then the language would have to be English.

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. In order to further improve its validity, the Chinese version of questionnaire was pilot tested with a group of Chinese postgraduate students and researchers in the authors' department as well as Chinese managers working in one Chinese SOE. A number of corrections to the questionnaires were made according to the feedback received from the pilot test.

2.3 Respondents of the survey

According to statistical data provided by the local statistical bureau, there are 118 SOEs operating in the Electronic and Telecommunication Manufacturing Sector in Guangdong. A complete contact list of these companies was retrieved from the Guangdong Statistical Bureau. The questionnaires were posted to these 118 SOEs with a cover letter, which explained the purpose of the study, provided assurances about confidentiality, stressed importance of the research and encouraged recipients to reply. In order to increase the response rate, a web-based version of questionnaire was also developed. The URL of the web-based questionnaire was embedded in the cover letter. Respondents could thus either complete the questionnaire and return it by using the pre-paid envelope, or fill in the web-based version and submit it online. One month after the original questionnaire, a reminder was sent out. Personal relationships and contacts were used wherever possible in the study in order to gain access to more companies, secure response and increase reliability and quality of the answers provided.

The questionnaires were sent to the operation managers and the IT managers of the 118 target SOEs, from which 2*42 valid and usable responses were received and analysed. This survey thus achieved a response rate of 35.6%. As shown in figure 2, the vast majority of respondents of questionnaire A held managerial positions in the company, i.e. operation manager, general manager or CEO, manager in the general management team and IT manager. On the other side, respondents of questionnaire B held IT or managerial positions in the firm. Respondents of this survey thus prove to be suitable stakeholders to participate in the research.

Furthermore ERP system seems to be of interest and importance to the vast majority of target SOEs, because 37 out of 42 respondent SOEs have adopted ERP. 3 of the 5 respondent SOEs, that had not currently adopted ERP, stated they were scheduling to implement ERP in the future. Among the 37 SOEs that have ERP, 6 of them are using foreign ERP systems, 27 of them have adopted domestic ERP packages, and 4 of them combined the use of ERP components provided by both foreign and domestic vendors. Moreover, 73.8% of respondent SOEs have been using ERP for 2 to 6 years. These results further prove that, a research on ERP exploitation risk in Chinese SOEs at this present moment is a timely and meaningful study.

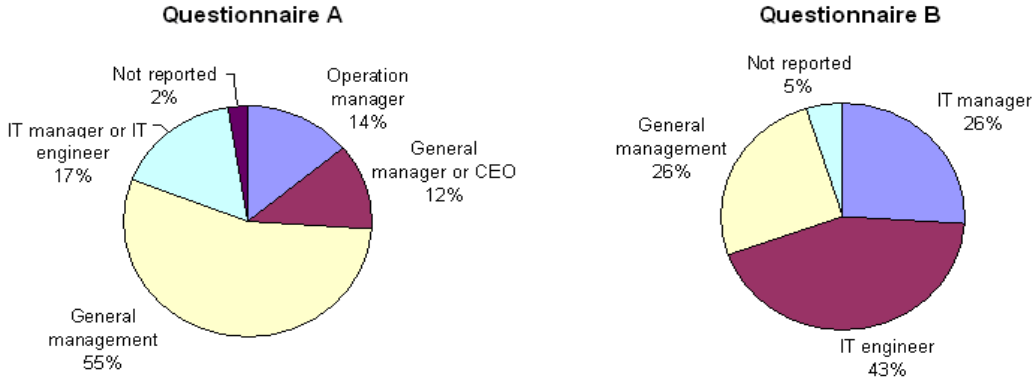

Figure 2: Positions of respondents

3. DATA ANALYSIS AND FINDINGS

3.1 General findings

The findings show that all of the 40 events, which were pre-defined in the theoretical risk ontology, were confirmed by the majority (80% or more) of respondents as risk events to ERP exploitation. However, perceptions of impact and probability of occurrence varied somewhat.

Specifically, the survey asked respondents to assess the importance of each risk from three aspects, namely probability of occurrence, impact and frequency of occurrence. The mean was used in this study to provide a summary of responses associated with the likelihood, impact and frequency of each risk identified (as shown in appendix C). Please note that in this paper we will use the term likelihood as a synonym to probability of occurrence of the risk event. The researchers subsequently prioritised the 40 identified risks based on their means of likelihood and means of impact. The top ten risks ranked by their means of likelihood are presented in table 1. The top ten risks ranked by their means of impact are presented in table 2. A third set of ranks based on the frequency of occurrence of each risk was neglected, because this seemed to be less important and relatively redundant.

Rank		Risk item	Mean of likelihood (L)
1	OWR5.1	Cannot receive enough technical support from system vendors	2.00
2	TR1.2	ERP system is not able to seamlessly integrate with other IS	1.98
3	AR1.2	Managers cannot retrieve needed information from the system	1.95
3	TR3.2	Outdated and duplicated data of ERP is not properly discarded	1.95
3	OWR5.2	Cannot receive proper consulting advice from system consultants	1.95
6	OR3.3	ERP system contains inaccurate inventory records	1.93
6	AR2.2	Fail to use ERP to predict actual demands of new products	1.93
6	AR4.1	Fail to use the system to generate appropriate financial budgets	1.93
6	TR1.1	Seamless integration is not achieved between modules of ERP	1.93
6	TR3.3	ERP is not properly modified to meet new business requirements	1.93

Table 1: Top ten ERP risks ranked by mean of likelihood

Rank		Risk item	Mean of impact (I)
1	OR1.2	Operational staff input incorrect data into the system	2.44
2	AR3.2	System fails to generate appropriate material net requirement plan	2.30
3	OWR4.5	Confidential data of the system is accessed by unauthorised people	2.29
4	OR3.2	ERP system contains inaccurate or incomplete bill of materials	2.28
5	OR3.3	ERP system contains inaccurate inventory records	2.27
5	AR3.1	Master production schedule generated by the ERP system is irrelevant	2.27
5	OWR1.1	Top managers make important IT decisions without consulting IT experts and system users	2.27
8	OWR2.1	IS/ERP plan is missing, ill-defined or misfit with business strategy	2.18
9	AR2.1	Sales forecast generated by ERP is inaccurate and inappropriate	2.17
10	OR2.2	Customer info files contained in ERP are out-of-date or incomplete	2.15

Table 2: Top ten ERP risks ranked by mean of impact

It is apparent that the top ten risks presented in table 1 are not the same as those listed in table 2. In other words, an identified risk that had a high mean of likelihood might not have a high mean of impact, and vice versa. This was to be expected and shows a clear awareness of the managers of the SOEs that there was a clear difference between frequency of a risk and critical impact of the same risk.

In fact, 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 individual risk aspects, when evaluating the magnitude of each of the 40 ERP risks examined. In order to do so, the following formula was developed and used to calculate the risk score for each risk event:

*Risk score of each ERP risk = Σ [W *(Probability + Impact + Frequency)]*

The structure of this formula is consistent with and clearly reflects the 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. 3, 2 or 1), level of impact (i.e. 3, 2 or 1) and frequency of occurrence (i.e. 5 to 1).

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 ERP risk events examined, and then re-prioritised these risks based on their risk scores (as shown in appendix D). The top 10 ERP risks ranked by their risk scores are shown in table 3. These top 10 risks were identified as the most critical to the SOEs being studied, and are thus selected to be discussed extensively in the next section.

Category		The top 10 ERP exploitation risks	Rank	Risk Score
Operational risks	OR2.2	Customer files contained in ERP are out-of-date or incomplete	6	246
	OR3.2	ERP system contains inaccurate or incomplete bill of materials	8	243
	OR3.3	ERP system contains inaccurate inventory records	1	263
Analytical risks	AR1.2	Managers cannot retrieve needed information from ERP	4	247
	AR2.1	Sales forecast generated by ERP is inaccurate or inappropriate	3	250
	AR4.1	Fail to use ERP to generate appropriate financial budgets	4	247
Organisation - wide risks	OWR1.3	Support from top managers to ERP exploitation is insufficient	10	242
	OWR3.3	Lose ERP-related know-how accumulated over time	2	252
Technical risks	TR1.1	Seamless integration is not achieved between modules of ERP	8	243
	TR1.2	ERP is not able to seamlessly integrate with other IS application	7	233

Table 3: The top 10 ERP exploitation risks

3.2 Discussion of the ten critical ERP risks

This section further discusses and interprets the questionnaire findings associated with the top 10 ERP risks identified. Moreover, possible causes and consequences of these risks are also discussed, with support of evidence drawn from the critical literature review process.

Customer files contained in ERP are out-of-date or incomplete

A review of previous literature identified that ERP systems can potentially facilitate companies to maintain more up-to-date and comprehensive customer information files (Vosburg and Kumar, 2001).

By analysing customer files, user companies can "ensure that relevant products and services are sold to the correct individual at the relevant point in their life" (Wright and Donaldson, 2002). However, 77.5% of respondents of the survey perceived that there was a medium likelihood for their ERP to contain out-of-date and incomplete customer files. In truth, this risk event may be triggered by a variety of reasons, e.g. inappropriate system usage due to insufficient user training, and deficient system design, etc (Vosburg and Kumar, 2001). Having outdated and incomplete customer files may lead to a set of undesirable outcomes to the company, e.g. not be able to target on valuable customers, not be able to tailor special sales offers to specific customer groups, etc (Wright and Donaldson, 2002). It thus may reduce customer loyalty and retention and result in loss of existing customers (Wright and Donaldson, 2002). Therefore, the majority of respondents considered the occurrence of this risk event could lead to either a high (22.5%) or medium (70%) impact.

ERP system contains inaccurate or incomplete bill of materials

The majority (75%) of respondents perceived that there was a medium to high probability for their ERP systems to contain inaccurate bills of materials (BOMs). A BOM is "a list of the component parts required to make up the total package for a product or service together with information regarding their level in the product or component structure and the quantities of each component required" (Slack et al, 2004). It is one of the main inputs required to calculate material requirement plans for production (Koh et al, 2000). As a consequence, an inaccurate BOM can often result in inappropriate material requirement plans. Consequently, materials required in production may not be ordered and delivered at the right time and/or in the right quantities, and thus disturbing normal production and business operation (Slack et al, 2004). This risk event was hence perceived by 87.5% of respondents to have a high to medium impact.

ERP system contains inaccurate inventory records

It is frequently mentioned in the literature that one of the main purposes for adopting ERP systems is to improve inventory recording and management (Umble et al., 2003). However, due to human mistakes and/or frauds, inventory records stored in ERPs may be mismatched with actual stock levels (Zhou et al., 2005). Findings of the survey showed that 68.3% respondents considered the probability of occurrence of this risk event as medium, and 12.2% said it had a high probability to occur. As a result of inaccurate inventory records, sales staff may not be able to inform customers about crucial stock information and availability. Without knowing the exact content of warehouses, production staff may be unsure of production schedules and issuing of procurement orders. Finally, account staff may be misled in their calculations of the actual value of current inventories. In short, operation of the entire company may be disturbed. The majority (90.3%) of respondents also confirmed this risk could result in a significant impact.

Managers cannot retrieve relevant and needed information from the ERP system

It is generally accepted that business managers will have different information needs according to their personal decision styles, experience, contexts and actual situations (Lucas, 1975). Formats and contents of reports generated by ERP systems thus should be flexibly changed and customised in accordance with the actual needs of managers (Sage, 2005). However, it is obvious that not all ERP packages available in the current market can be flexible enough to satisfy this user requirement. In addition, structures, formats and content of reports generated in a particular national context (e.g. USA) may not easily be used or even translate to other national contexts (e.g. China). Therefore, foreign ERP systems may not suit the needs of local companies due to cultural and political difference (Soh et al, 2000). As a consequence, it was expected that managers engaged in certain situation might not be able to retrieve needed information from the ERP system. This original expectation was confirmed to be true by the majority of the respondents, who perceived the probability of occurrence of this risk event as medium (85%) or high (5%). Furthermore, because the occurrence of this risk event may often affect decision making of managers, it was perceived to have a medium impact by 87.5% of respondents.

Sales forecast generated by ERP is inappropriate

Generating accurate sales forecast is frequently mentioned in the literature as a challenging task faced by modern companies (Doshi and Campbell, 2003). In truth, the process of sales forecast generation is very complicated, and requires the use of various types of inputs, e.g. historical sales data, estimates of sales staff, and external market information, etc (Ranard, 1972). Although ERP systems often contain a set of analytical tools to facilitate sales planning (Marnewick and Labuschagne, 2005), there is no guarantee that sales forecasts generated by ERPs will always be accurate due to inherent difficulties in predicting the fluid market. Moreover, it is widely acknowledged that market statistical data, which is available in the industry in contemporary China, typically lacks accuracy, reliability and currency (Lv, 2006). Inaccurate and unreliable market statistics can surely raise further forecasting problems to companies (Ranard, 1972). Therefore, the majority (78%) of respondents stated that the likelihood for their ERPs to generate inappropriate sales forecast was medium to high. As a result of inaccurate sales forecast, unreasonable sales quotas may be assigned to staff. Moreover, production plans and financial budgets generated based on inaccurate sales forecast may also be inappropriate or infeasible (Ranard, 1972). Overall, the occurrence of this risk event could result in significant impact to user companies, as confirmed by 90.2% of respondents.

Fail to generate appropriate financial budgets

Financial budget is a crucial analytical output generated by the financial module of an ERP system (Miranda et al., 2002:20). However, it can be expected that the appropriateness of financial budgets generated by ERPs may often be affected by various environmental factors in real practice, e.g. rapid market growth and unpredictable changes in market conditions. The majority of respondents thus perceived the likelihood of this risk event as medium (73.2%) to high (9.8%). Furthermore, financial budgets are important tools to be used to set up targets for staff for a given period of time (e.g. a year, a quarter or a month), and thus allowing top managers to control and evaluate staff performance (Ekholm and Wallin, 2000). 87.9% of respondents therefore stated that having inappropriate financial budget could lead to a significant impact in their firms.

Top managers do not provide sufficient support to ERP post-implementation

The attitude of top managers "will affect not only the flow of funds and information to the [ERP] project, but also the subordinates view the project" (Gargeya and Brady, 2005). Top management support is therefore frequently reported as one of the most crucial factors affecting the success of ERP implementation in companies (Gargeya and Brady, 2005; Loh and Koh, 2004; Sherer and Alter, 2004; Tsai et al., 2005). It can be argued that this factor is also crucial to the success of ERP post-implementation. However, 50% of respondents perceived that there was a medium to high probability for their top managers to provide insufficient support to ERP exploitation. This risk event may be caused by a lack of awareness and short-term thinking of top managers in SOEs (Zhang, 2004). 81% of respondents stated that this risk event could lead to a critical impact. This was to be expected, considering that insufficient top management support could always lead to a set of negative consequences to ERP innovation, e.g. conflicts and arguments between departments could not be solved efficiently, and funds assigned to ERP might be insufficient, etc (Gargeya and Brady, 2005).

Loss ERP-related know-how and expertise accumulated over time

It is commonly mentioned in the literature that in-house IT experts will be able to acquire and accumulate a substantial amount of know-how and expertise through the process of ERP implementation and exploitation (Scott and Vessey, 2000). 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. However, this may not always be the case, due to inappropriate information sharing behaviour and a lack of systematic knowledge management practices in user companies (Burrows et al., 2005). As a consequence, when highly skilled IT experts leave the company, valuable ERP knowledge and expertise that they possessed may also be lost. 85.7% of respondents considered this risk event had a medium probability

of occurrence. The majority of respondents also considered that this risk event could lead to a high (16.7%) to medium (76.2%) impact.

Different modules of the ERP system are not seamlessly integrated

Very often an integrated solution from one single ERP vendor may not satisfy all business needs of the company. Therefore, it is common for modern companies to procure suitable software modules from different system vendors to form their own ERP system (Currie, 2003; Brehm and Gómez, 2005). This approach however may increase complexity and difficulty in harmonizing integration issues. In other words, companies may face a risk that seamless integration may not be achieved between current modules or between current and new modules of the ERP system. Moreover, Sage (2005), one of the world's leading ERP vendors, reinforces that even all modules of the ERP system is provided by the same vendor, it does not mean they can achieve solid integration. Findings of the survey showed that a vast majority (87.8%) of respondents considered this risk event had a medium probability of occurrence in their firms. It can be expected that the occurrence of this event may lead to system fragmentation in the company, through the creation of technological islands which are very often totally isolated and non-communicant. 80.5% of respondents thus perceived the impact of this risk as medium, and 12.2% stated its impact was high.

ERP cannot be seamlessly integrated with other IS applications

A review of the literature identified that ERP systems are frequently criticised for having low compatibility and thus being difficult to integrate with other IS applications (Fletcher and Wright, 1995). The occurrence of this risk event may lead to poor data and business process integration and the creation of the same insulated technological islands discussed above. A vast majority (82.5%) of respondents considered this risk event had a medium probability of occurrence, and 7.5% said its probability to occur was high. 95% of respondents perceived its impact as medium to high.

3.3 Conclusion of discussion of critical ERP risks

It should be noted that the top ten ERP risks identified did not cluster around a specific subset of the main categories. This means that critical risks seem to be found across the organisational processes and not conveniently localised around one category, namely not around the technical category. Therefore, this study seems to confirm that failure of ERP systems may not just be conveniently related to the technical infrastructures and software packages. Actually, what this study confirms is that it is in operational, management and strategic thinking areas that the majority of risks were identified in the context of target SOEs. This conclusion was supported by a further bivariate analysis of the data, as presented and discussed below.

3.4 Correlations between the identified ERP risks

The study aimed at also investigating if the occurrence of particular risks was related to the occurrence of other risks. A set of potential relationships between the identified risks were initially grounded from the critical literature review process, and were highlighted in the risk ontology presented in section 2.2.3.

In order to examine these potential risk correlations in the context of target SOEs, a bivariate analysis was conducted. A bivariate analysis is a statistical technique that aims at identifying the correlation between two variables. Specifically, this study used bivariate analysis to explore if the probability of occurrence of a particular risk was related to the increase of the probability of occurrence of other risks. As illustrated earlier, Likert scales were used in the survey to examine the likelihood of each identified risk, data variables generated were therefore ordinal data sets. According to Field (2005:130-131) and Bryman and Cramer (2005:225), Spearman's rho (r_s) is the most common and appropriate approach to use to measure bivariate correlations between ordinal variables. As a consequence, Spearman's rho was adopted for this study. Moreover, one-tailed test was used to test the statistical significance (P value) of each directional correlation identified.

By following this approach, the researchers identified 10 statistically significant correlations between all the 40 identified risks. Figure 3 presents a conceptual map to summarise and represent these correlations. A full description of each of these correlations is presented in table 4.

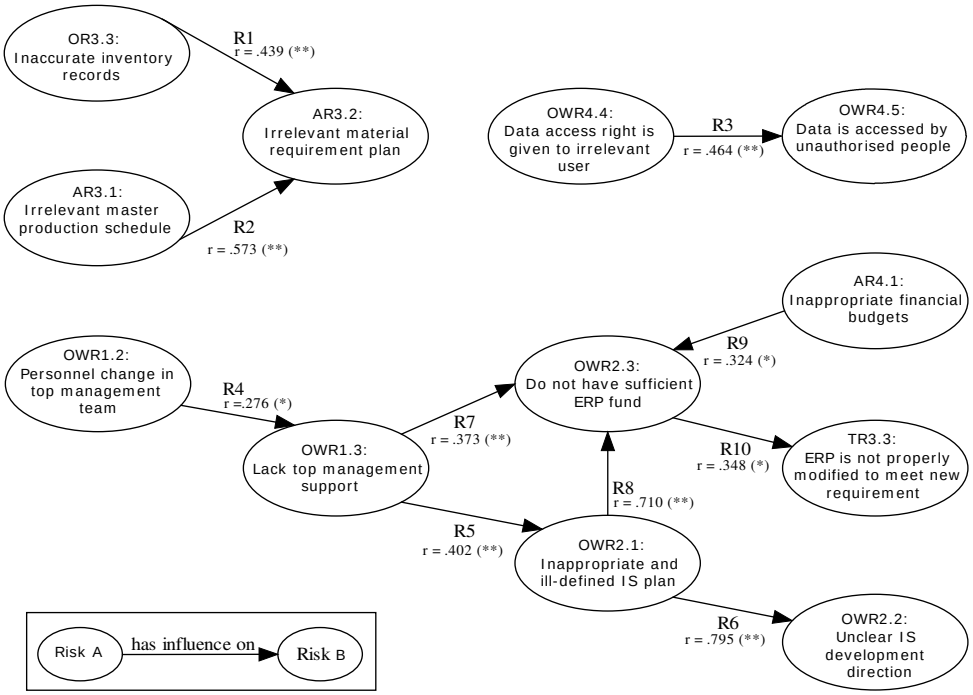

Figure 3: Conceptual map of correlations between identified ERP exploitation risks

	Correlation	r_s
R1	As the probability of having inaccurate inventory record increases, the probability of having inappropriate material requirements plan increases.	.439(**)
R2	As the probability of having inappropriate production schedule increases, the probability of inappropriate material requirements plan correspondingly increases.	.573(**)
R3	As the probability of assigning data access rights to irrelevant user increases, the probability unauthorised people accessing sensitive system data increases.	.464(**)
R4	As the probability of having personnel changes in the top management team increases, the probability of having insufficient top management support increases.	.276(*)
R5	As the probability of having insufficient top management support increases, the probability of having inappropriate and ill-defined IS plan increases.	.402(**)
R6	As the probability of having inappropriate and ill-defined IS plan increases, the probability of having unclear IS development correspondingly increases.	.795(**)
R7	As the probability of having insufficient top management support is higher, the probability of having insufficient ERP fund will be higher.	.373(**)
R8	As the probability of having inappropriate and ill-defined IS plan is higher, the probability of having insufficient ERP fund will be correspondingly higher.	.710(**)
R9	As the probability of having inappropriate financial budget increases, the probability of having insufficient ERP fund will correspondingly increase.	.324(*)
R10	As the probability of having insufficient ERP fund increases, the probability that the implemented system cannot be continuously modified will increase.	.348(*)

* Correlation is significant at the 0.05 level (1-tailed);
** Correlation is significant at the 0.01 level (1-tailed).

Table 4: Description of correlations identified

The findings of the bivariate analysis were quite illuminating. Investigating both the list of significant correlations and the conceptual map in Figure 3, it becomes apparent that the majority of the

correlations occurred between analytical and organisation-wide risks. This points out to a clear break with the traditional view of ERP failure. It is clear from the bivariate analysis, that the impact of analytical and organisational-wide risks plays a fundamental in potential failure of ERP due to the potential causal effects between risks. 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, analytical and organisation-wide risks seemed to be interwoven and closely related with other similar risks. Consequently, the occurrence of these risks is much more difficult to manage, mitigate and contain in the SOEs studied.

4. CONCLUSIONS AND FURTHER RESEARCH

This paper confirms that successful implementation of the system is not the end of the ERP journey but a new beginning. A wide range of risks and challenges are faced by companies when using, maintaining and enhancing their ERP systems in post-implementation. Many user companies, especially those at the beginning stage of implementing ERP, may perceive ERP systems as a panacea to all business problems. This however is not the case in reality. Specifically due to various external and internal reasons, a set of operational and analytical risks, that can affect business operation and decision making efficiency, can still occur even after ERP was adopted. On the other hand, due to the level of sophistication of ERP, the era of ERP post-implementation is often fraught with organisation-wide and technical risks, of which the occurrence can significantly impact system and business performance.

The study has led to several important conclusions. In particular, ERP system seems to be of interest and importance to the vast majority of SOEs studied. All of the 40 risk events predefined from an extensive literature review were perceived and identified by the majority of respondents as risks to ERP exploitation. Specifically, the study identified 10 top prioritised risks that were distributed across organisational processes and operation. Therefore, the study established that potential failure of ERP systems cannot be conveniently attributed to technical aspects, such as the software package and the ICT infrastructure, in the context of Chinese SOEs studied. In fact, the findings of the study suggest that it is in organisation processes and procedures that the more dangerous and difficult-to-manage risks can be found in these companies.

Moreover, it should be stressed that, since the research reported in this paper selected and focused on a very specific set of Chinese firms (i.e. the 118 SOEs in the electronic and telecommunication manufacturing sector in Guangdong) to study ERP post-implementation, the findings derived from this questionnaire may only be generalisable to similar regions, company types and sectors in China as the ones studied. Therefore, further research work in this area is strongly recommended. Further studies may reuse the risk ontology developed in this study to explore ERP exploitation risks in an alternative type of company, region or sector in the country. The results derived from such further studies may be used to compare with the findings of this research, and thus providing a more holistic picture on ERP post-implementation risks in the Chinese context.

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Appendix

(The appendices follow overleaf)

Appendix A: Further details of the literature search process

MIS journal searched	MIS database searched
MIS Quarterly	ScienceDirect
Journal of Management Information Systems	ACM Digital Library
Information Systems Research	Emerald Management Review
Communications of the ACM	IEEE Xplore
Industrial Management & Data Systems	JSTOR
Information & Management	Web of Science
Information Systems Journal	CSA Illumina
Journal of Enterprise Information Management	Etc.
International Journal of Information Management	
Etc.	

Table I: Journals and databases searched

For journal search	For database search
(searched within: title, abstract and/or full text)	
ERP post-implementation risks	ERP "AND" post-implementation "AND" risks
ERP exploitation risks	ERP "AND" exploitation "AND" risks
ERP risks	Enterprise systems "AND" post-implementation
ERP post-implementation	Enterprise systems "AND" exploitation
ERP exploitation	Information system "AND" post-implementation
Information system post-implementation	ERP post-implementation
Information system exploitation	ERP exploitation
Etc.	ERP risks
	Etc.

Table II. Keywords used for journal and database search at Stage One

For journal search	For database search
(searched within: title, abstract and/or full text)	
ERP failure	ERP "AND" failure
ERP issues	ERP issues "OR" risks "OR" challenges
ERP risks	ERP usage "OR" maintenance "OR" enhancement
ERP challenges	Information system "AND" failure
ERP usage	Information system issues "OR" risks "OR" challenges
ERP maintenance	IS usage "OR" maintenance "OR" enhancement
ERP enhancement	ERP adoption
Information system failure	Enterprise system adoption
Information system issues	Information system adoption
Information system risks	ERP "OR" information system "AND" sales marketing
Information system challenges	ERP "OR" information system "AND" accounting
Information system usage	ERP "OR" information system "AND" production
Information system maintenance	ERP "OR" information system "AND" purchasing
Information system enhancement	Etc.
Etc.	

Table III: Keywords used for journal and database search at Stage Two

Appendix B: Exemplification of the scheme used in the critical review process for identifying potential ERP exploitation risks

Categories	Risk ID	Potential risks	Potential causes	Potential consequences	Supported literature
Operational Risks (OR)					
In General (OR1)	OR1.2	Operational staff input incorrect data into the system	Insufficient training; Lack of experience; Human negligence; Human fraud, etc.	Poor data accuracy and quality; One user's mistake can raise immediate impact and problems to the entire company and disturb normal operation.	Scapens and Jazayeri, 2003; Fisher and Kingma, 2001; Vosburg and Kumar, 2001.
Sales and Marketing area (OR2)	OR2.2	Customer files contained in ERP are out-of-date or incomplete	Inappropriate system usage due to sufficient user training; Deficient system design.	Fail to target on valuable customers; Fail to maintain customer loyalty and good customer relationship; Lose existing customers.	Vosburg and Kumar, 2001; Wright and Donaldson, 2002.
Analytical Risks (AR)					
Sales and Marketing area (AR2)	AR2.1	Fail to use the system to generate accurate sales forecast	Rapid market growth and changes in customer needs; Lack of accurate and reliable market statistical data;	Sales staff are not assigned with reasonable sales quotas; Inappropriate production plan and financial budget.	Doshi and Campbell, 2003; Ranard, 1972; Zhou et al., 2005
Production and purchasing area (AR3)	AR3.2	ERP fails to generate appropriate material net requirement plan	Inappropriate master production schedule; Inaccurate BOM; Inaccurate inventory records.	Material or component shortage or over-ordering/producing; Production of end product is delayed or ceased.	Chen, 2001; Koh et al, 2000; Musselman et al., 2002.
Organisation-Wide Risks (OWR)					
Top management (OWR1)	OWR1.3	Top managers do not provide sufficient support to ERP post-implementation	Short-term thinking; Lack of awareness.	Low employee involvement; Conflicts and arguments related to ERP cannot be solved smoothly; Insufficient ERP fund.	Gargeya and Brady, 2005; Sherer and Alter, 2004; Tsai et al., 2005; Zhang, 2004.
System users (OWR4)	OWR4.5	Confidential data is accessed by unauthorised people	Poor data protection and access policy; Business crimes.	Information leakage; Financial loss; Business crisis.	Yosha, 1995; Wilding, 2003; Loh and Koh, 2004.
Technical Risks (TR)					
System faults (TR2)	TR2.2	Hardware or software crashes	Inappropriate system operation & maintenance; Poor system quality.	System has to be out of work for a period; Disturb normal operation.	Sherer, 2004

Appendix B (*continued.*)

Additional references (that are used in the above table but are not included in the reference list)

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Appendix C: Means of likelihood, impact and frequency of the 40 identified risks

Level 1 category	Level 2 sub-category	Level 3 risk item		Mean of likelihood	Mean of impact	Mean of frequency
Operational Risk (OR)	Generic risk (OR1)	OR1.1	Operational staff are unwilling to use the ERP system	1.45	2.03	2.03
		OR1.2	Operational staff input incorrect data into the system	1.12	2.44	1.61
	Sales and marketing risk (OR2)	OR2.1	Sales staff are not able to obtain data and information they need from the system	1.71	2.00	2.44
		OR2.2	Customer info files contained in the ERP system are out-of-date or incomplete	1.88	2.15	2.35
	Material and production management risk (OR3)	OR3.1	ERP system contains inaccurate supplier records	1.80	2.02	2.41
		OR3.2	ERP system contains inaccurate or incomplete bill of materials	1.83	2.28	2.15
		OR3.3	ERP system contains inaccurate inventory records	1.93	2.27	2.49
	Fin. & acc. risk (OR4)	OR4.1	Account staff are unwilling to release accounting responsibility and power to non-account staff	1.70	1.81	2.11
		OR4.2	Non-account staff are unwilling and incapable to take up accounting responsibilities	1.38	1.54	2.06
Analytical Risk (AR)	Generic risk (AR1)	AR1.1	Front-line managers refuse to use the ERP system	1.35	1.85	1.75
		AR1.2	Managers cannot retrieve relevant and needed information from the system	1.95	1.98	2.48
	Sales and marketing risk (AR2)	AR2.1	Sales forecast generated by ERP is inaccurate and inappropriate	1.85	2.17	2.29
		AR2.2	Fail to use ERP to predict actual demands of new products	1.93	2.10	2.38
		AR2.3	System fails to support sales personnel to tailor special sales offers to existing customers	1.73	1.71	2.10
	Material and production management risk (AR3)	AR3.1	Master production schedule generated by the ERP system is inappropriate	1.80	2.27	2.34
		AR3.2	System fails to generate appropriate material net requirement plan	1.85	2.30	2.33
	Fin. & acc. risk (AR4)	AR4.1	Fail to use the system to generate appropriate financial budgets	1.93	2.10	2.32
Organisation-Wide Risk (OWR)	Top management risk (OWR1)	OWR1.1	Top managers make important IT decisions without consulting IT experts or system users	1.46	2.27	1.90
		OWR1.2	Substantial personnel changes in the top management team	1.89	1.89	2.53
		OWR1.3	Support from top managers to ERP post-implementation is insufficient	1.60	2.05	2.12
	IS/ERP planning risk (OWR2)	OWR2.1	IS/ERP development plan is missing, ill-defined or misfit with business strategy	1.83	2.18	2.45
		OWR2.2	Direction for ERP improvement and further development is unclear	1.85	2.08	2.65
		OWR2.3	Insufficient resources and funds are assigned to ERP training, maintenance and enhancement	1.55	1.93	2.43
	In-house specialists risk (OWR3)	OWR3.1	Fail to form an efficient cross-functional team to continuously review and revise the ERP system	1.85	2.03	2.59
		OWR3.2	Lose qualified IT/ERP experts	1.83	2.05	2.57
		OWR3.3	Lose ERP-related know-how accumulated over time	1.90	2.10	2.43
	System users risk (OWR4)	OWR4.1	ERP users (both staffs and managers) do not receive sufficient and continuous training	1.80	1.83	2.59
		OWR4.2	Users are uncomfortable to use the ERP system in their daily jobs	1.89	1.82	2.53
		OWR4.3	ERP-related problems are not reported promptly by system users	1.83	1.98	2.50
		OWR4.4	Data access right to ERP is authorised to inappropriate users	1.24	2.12	1.76
		OWR4.5	Confidential data of the system is accessed by unauthorised people	1.29	2.29	1.64
	System vendors and consultants risks	OWR5.1	Cannot receive enough technical support from system vendors	2.00	2.05	2.59
		OWR5.2	Cannot receive sufficient and proper consulting advice from system consultants	1.95	1.98	2.46
Technical Risk (TR)	System integration risk (TR1)	TR1.1	Seamless integration is not achieved between modules of the ERP system	1.93	2.05	2.41
		TR1.2	ERP system is not able to seamlessly integrate with other information systems	1.98	2.04	2.48
	System failure risk (TR2)	TR2.1	Invalid data is not automatically detected when getting into the ERP system	1.83	1.98	2.28
		TR2.2	Hardware or software crashes	1.88	2.05	2.33
	System maintenance and revision risk (TR3)	TR3.1	Technical bugs of our ERP system is not speedily overcome	1.90	1.98	2.44
		TR3.2	Outdated and duplicated data of our ERP system is not properly discarded	1.95	1.98	2.46
		TR3.3	ERP is not properly modified to meet new business requirements	1.93	2.00	2.32

Appendix D: Ranking of the 40 identified risks based on risk scores

Rank		Risk item	Risk Score
1	OR3.3	ERP system contains inaccurate inventory records	263
2	OWR3.3	Lose ERP-related know-how accumulated over time	252
3	AR2.1	Sales forecast is inaccurate and inappropriate	250
4	AR1.2	Managers cannot retrieve relevant and needed information from the system	247
4	AR4.1	Fail to use the system to generate appropriate financial budgets	247
6	OR2.2	Customer files contained in the ERP system are out-of-date or incomplete	246
7	TR1.2	ERP is not able to seamlessly integrate with other IS applications	244
8	TR1.1	Seamless integration is not achieved between modules of the ERP system	243
8	OR3.2	ERP system contains inaccurate or incomplete bill of materials	243
10	OWR1.3	Support from top managers to ERP post-implementation is insufficient	242
11	OWR2.3	Insufficient resources and funds are assigned to ERP exploitation	241
11	OR2.1	Sales staff are not able to obtain data and information they need from ERP	241
13	OWR2.1	ERP development plan is ill-defined or misfit with business strategy	240
13	AR3.2	System fails to generate appropriate material net requirement plan	240
13	TR3.1	Technical bugs of our ERP system is not speedily overcome	240
16	AR2.2	Fail to predict actual demands of new products	238
16	OWR2.2	Direction for ERP improvement and further development is unclear	238
16	OR3.1	ERP system contains inaccurate supplier records	238
16	OWR5.1	Cannot receive enough technical support from system vendors	238
20	AR3.1	Master production schedule generated by the ERP system is inappropriate	237
21	OWR4.3	ERP-related problems are not reported promptly by system users	235
21	OWR3.1	Fail to form an efficient cross-functional team for ERP exploitation	235
23	OWR3.2	Lose qualified IT/ERP experts	233
23	OWR4.1	ERP users (both staff and managers) do not receive sufficient ERP training	233
23	TR3.2	Outdated and duplicated data of our ERP system is not properly discarded	233
26	TR2.2	Hardware or software crashes	232
27	OWR5.2	Cannot receive sufficient and proper support from system consultants	228
28	TR2.1	Invalid data is not automatically detected when getting into the ERP system	223
28	OWR1.1	Top managers make important IT decisions without consulting the others	223
28	TR3.3	ERP is not properly modified to meet new business requirements	223
31	AR2.3	Fail to provide special sales offers and promotion to existing customers	213
32	OWR1.2	Substantial personnel changes in the top management team	209
32	OWR4.2	Users are uncomfortable to use the ERP system in their daily jobs	209
34	OWR4.5	Confidential data of the system is accessed by unauthorised people	197
35	OR1.1	Operational staff are unwilling to use the ERP system	196
36	OWR4.4	Data access right to ERP is authorised to inappropriate users	192
37	OR1.2	Operational staff input incorrect data into the system	182
38	OR4.1	Account staff are unwilling to release accounting responsibility to other staff	166
39	AR1.1	Front-line managers refuse to use the ERP system	163
40	OR4.2	Non-account staff are unwilling and incapable to take up accounting duties	131