A FRAMEWORK FOR CLASSIFYING RISKS IN ERP MAINTENANCE PROJECTS

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Abstract: Enterprise resource planning (ERP) is one the most common applications implemented by firms around the world. These systems cannot remain static after their implementation, they need maintenance. This process is required by the rapidly-changing business environment and the usual software maintenance needs. However, these projects are highly complex and risky. So, the risks management associated with ERP maintenance projects is crucial to attain a satisfactory performance. Unfortunately, ERP maintenance risks have not been studied in depth. For this reason, this paper presents a framework, which gathers together the risks affecting the performance of ERP maintenance.

1 INTRODUCTION

ERP systems are defined as a single software system allowing the complete integration of information flow from all functional areas in companies by means of a single database and accessible through a unified interface and channel of communication (Davenport, 1998; Jacobs and Whybarck, 2000; Ng et al., 2003).

Companies have spent billions of dollars in ERP implementation. However, ERP projects are never finished: after the implementation process, the maintenance starts. Firms must manage organizational performance with ERP, fixing bugs, adapting ERP to unstable environments, supporting new user requirements, and so on. To achieve the ERP maintenance's expected results, the ERP and the business process have to be completely aligned. If this fails, it will have more damaging consequences.

An ERP maintenance project is considered successful when it is completed within time and budget and meets ERP users' expectations (Aloini et al., 2007) without damage ERP performance. Poor risk management of ERP maintenance projects often leads to failure, which can affect the system and the project outcome (Wallace et al., 2004). However, ERP maintenance failures can be prevented if the maintenance team manages risks projects properly.

In contrast, ERP maintenance risks research is scarce in the literature. In fact, the literature only brings together three risks in the maintenance phase and these derive from insufficient and inappropriate personnel. Specifically, these three risks are: "insuficient training and reskilling of the IT workforce in new technology", "insuficient 'internal' expertise" and "failure to mix internal and external expertise effectively" (Sumner, 2000).But, there are more risk factors that affect successful ERP maintenance projects.

To support the professionals' work, we have realized a formal study about risks which threaten the ERP maintenance process. Specifically, we have identified the risk that threatens the maintenance process of any ERP system. Subsequently, we have stated which ERP maintenance phase is threatened by each risk. The results indicate where the maintenance team must focus on treating and mitigating the risks and threats.

2 CREATING THE FRAMEWORK OF ERP MAINTENANCE RISKS

Different risks could affect the whole ERP maintenance project. The risks lists for IS/IT, software development and maintenance projects are not completely fit to ERP maintenance because the above frameworks are very general and do not take into account the features of ERP systems. Therefore, it is necessary to create an ERP maintenance risks

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classification. With this in mind, we followed the steps indicated in Figure 1.

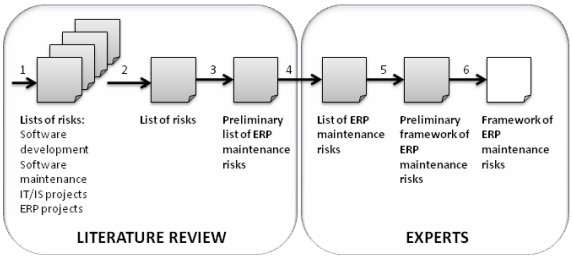

Figure 1: Steps followed in the creation of ERP maintenance risks framework.

Similar studies have used a variety of methodologies to identify risks. A critical literature review is a widely-used methodology in the literature. Steps 1, 2 and 3 are based on a broader literature review of software risk management. In step 1, we find papers about software development, software maintenance, IS/IT projects and the ERP projects which identify and/or classify risk factors. To do so, we consulted through databases such as IEEE-Xplore, ScienceDirect, Emerald Management Xtra., SpringerLink databases, among others. The criteria followed to select papers were:

1. The studies have to contain the term "Risk Management" in the title, abstract or keywords.
2. The studies have to contain one of the following expressions in the title, abstract or Keyword: "Project IT/IS", "Software Development", "Software Maintenance" or "ERP".
3. The studies have to identify the risks clearly.
4. The time horizon was not limited. Thus, all target studies were collected and reviewed.

Altogether 20 papers (Aloini et al., 2007; Batista et al., 2005; Boehm, 1991; Chen and Huang, 2009; Cule et al., 2000; Dekleva, 1992; Han and Huang, 2007; Huang et al., 2004; Houston et al., 2001; Keil et al., 1998; Lientz and Swanson, 1981; Lu and Ma, 2004; Mursu et al., 2003; Peng and Nunes, 2009; Scott and Vessey, 2002; Sherer, 1995; Sumner, 2000; Wallace et al., 2004a; Wallace et al., 2004b; Zhou et al., 2008) were found in the search. The sum of all risks identified in these studies added up to 681 risks. However, many risks are identified by several papers. So, in step 2, the risks factors were checked removing duplicates. The result was a list made up of 313 risks. In step 3, we eliminated those risks which do not affect ERP maintenance. For this purpose, we carefully analyzed the activities address to perform the changes required in the ERP system and the risks included in the list together. The preliminary list was made up of 25 risks. These were renamed and adapted to the study's scope.

Given the absence of studies on ERP maintenance risks, it was possible that the preliminary list of risks did not bring together all ERP maintenance risks. Moreover, the list had not been validated. So, we consulted 9 ERP maintenance experts. The optimal number of experts depends on the characteristics of the study itself. We can, however, say that the greater the heterogeneity of the group, the fewer is the number of experts recommended, 9 being a good size (Okoli and Pawlowski, 2004). The main selection criterion considered was recognized knowledge in the research topic and an absence of conflicts of interest. Figure 2 shows the profile of consulted experts.

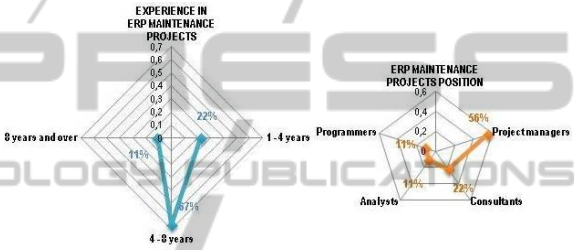

Figure 2: Experts profile.

In step 4, the experts checked the preliminary list and added 5 further risks. Thus, we obtained the list of ERP maintenance risks. In steps 5 and 6, the risks brought together in the list were categorized. This consists of grouping the risks identified according to their characteristics. The dimensions have been often fixed depending on the factor that causes the risks. Notwithstanding, it is also important to know what the risks affect.

The aim of this stage is to identify the risks that threaten the process of the ERP maintenance. Therefore, it is useful to classify them according to the process stage that is most likely to affect the risks identified. In other words, each risk was classified in the maintenance stage whose performance is threatened by it. To do so, in step 5 we classified the risks, according to the IEEE std. 1219 (IEEE, 1998). The result was a preliminary framework of ERP maintenance risks. Finally, in step 6, ERP maintenance experts reviewed and corrected the abovementioned preliminary framework. When all experts accepted it, we obtained the ERP maintenance risks framework.

3 FRAMEWORK OF ERP MAINTENANCE RISKS

Table 1 presents the framework created of ERP maintenance risks. No previous research have established a framework in which ERP maintenance risks are classified depending on the process phase whose performance can be affected. This result allows professionals to understand the situation better and to take action on every risk group.

Table 1: Framework of ERP maintenance risks.

PHASE	RISK
Problem/ modification identification, classification and prioritization	Unstable organizational environment
	Conflicting ERP requests
	Continuing stream of requirement changes
	Inadequate requirements prioritization
	Wrong management/selection/control external parties (consultants, ERP vendors, subcontractors)
	ERP system users are reluctant/reticent to the changes
Analysis	Evaluation of performance requirements
	Inadequate ERP maintenance manager
	Wrong ERP project resources/size estimates
	Wrongly-fit ERP system with pre-existing applications
Design	Miscommunications or misunderstanding of the requirements
	Conflict and non-cooperation between ERP maintenance team members
	Team members lack skills/ knowledge/experience required by ERP maintenance
	Short/null/poor/documentation
	Incorrect choice of the ERP modules
	Specific competence of ERP consultants
Implementation	Changing structure/processes/ tasks ERP-adopting organization
	High turnover within ERP maintenance team
	ERP maintenance team members are unmotivated/ not committed
	Inadequately-trained ERP maintenance team members
	Quality of original programming
	Poor establishment of standard process/ procedures /methodology
	ERP project milestones not clearly defined
	Excessively-complex procedures
Regression system testing	Inadequate measurements/ tools/technology for test/ simulation/evaluation
	Lack of proper tests
Acceptance testing	Managers and/or employees do not cooperate the maintenance project
	Poor establishment of ERP quality standards
Delivery	Lack of training of ERP users
	Poor documentation for support of ERP users

4 CONCLUSIONS

In recent decades, companies across the world have implemented ERP systems. Proper ERP implementation has been a much explored issue. Specifically, numerous papers have presented the critical success factors in these projects. But even when the implementation finished satisfactorily, success in ERP adoption is not guaranteed. It also depends on the effectiveness process in the post-implementation ERP systems.

The maintenance of the ERP is necessary to correct and prevent systems failures as well as to enhance its performance and adapt continuously to the system. Nevertheless, this is often managed intuitively and without taking into account the existing risks. In contrast, risks management in IT projects is a common practice because it decreases failure probability. In this sense, the managers need to know what risks threaten their maintenance projects. In spite of this, the risks that affect the maintenance of ERPs have not been studied previously.

Given this gap existing in the literature and the professional needs, the aim of this research was to identify the risk factors that threaten ERP maintenance performance. With this in mind, we devised a framework. It contains 30 risks factors classified according to the maintenance phase that they influence.

The findings of this study can also help the professional to achieve effective risk management in the whole ERP maintenance. But they should obtain more information about the risk in this purpose. Specifically, the professionals need to know which risks are critical, medium or marginal. To do this, we think that, in future studies, aspects of critical, medium and marginal risks of ERP maintenance should be identified. On the other hand, the professionals also need to know how the risks arise. In this sense, we believe that studies about the ERP maintenance risks dimensions are also necessary.

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REFERENCES

Aloini, D., Dulmin, R., Mininno, V. (2007). Risk management in ERP project introduction: Review of the literature. *Information & Management*, 44(6), 547-567.

Batista, K.P. de Olivera, K. M., Anquetil, N. (2005). A risk taxonomy proposal for software maintenance. In: *21st IEEE International Conference on Software Maintenance*, Budapest, pp. 453-461.

Boehm, B. W. (1991). Software risk management: principles and practices. *IEEE Software*, 8(1), 32-41.

Chen, J.-C., Huang, S.-J. (2009). An empirical analysis of the impact of software development problem factors on software maintainability. *The Journal of Systems and Software*, 82(6), 981–992.

Cule, P., Schmidt, R., Lyytinen, K., Keil, M. (2000). Strategies for Heading Off is Project Failure. *Information Systems Management*, 17(2) 1-9.

Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review,* 76(4), 121-133.

Dekleva, S. (1992). *Delphi study of software maintenance problems*. In: Conference on the Software Maintenance, pp. 10-17.

Han, W.-M., Huang, S.-J. (2007). An empirical analysis of risk components and performance on software projects. *The Journal of Systems and Software*, 80(1), 42-50.

Houston, D. X., Mackulak, G. T., Collofello, J.S. (2001). Stochastic simulation of risk factor potential effects for software development risk management. *The journal of Systems and Software*, 59(3), 247-257.

Huang, S-M., Hang, I.-C., Li, S-H., Lin, M-T. (2004). Assessing in ERP projects: identify and prioritize the factors. *Industrial management & data systems*, 8(8), 681-688.

IEEE, 1998. *IEEE Standard 1219 for Software Maintenance.* Institute of Electrical and Electronic Engineers, New York.

Jacobs, F. R., Whybarck, D. C. (2000). *Why ERP? A primer on SAP implementation*. McGraw-Hill, New York.

Keil, M., Cule, P., Lyytimen, K., Schmidt, R. (1998). A framework for identifying software project risk. *Communications of the ACM*, 41(11), 76-83.

Lientz, B. P., Swanson, E.B. (1981). Problems in application software maintenance. *Communications of the ACM*, 24 (1) 763-769.

Lu, X. N., Ma, Q. C. (2004). *Risk analysis in software development project with owners and contractors*. In: Engineering Management Conference, pp. 789-793.

Mursu, A., Lyytinen, K., Soriyan, H. A., Korpela, M. (2003). Identifying software project risks in Nigeria: an International Comparative Study. *European Journal of Information Systems*, 12(3), 182–194.

Ng, C. S. P., Gable, G. G., Chan, T. (2003). An ERP maintenance model. In: *36th Annual Hawaii International Conference on System Science*, Hawaii, pp. 1-10.

Okoli, C., Pawlowski, S. (2004). The Delphi method as a research tool: an example, design considerations and applications. *Information & Management*, 42(1), 15-29.

Peng, G. C., Nunes, M. B. (2009). Identification and assessment of risks associated with ERP post-implementation in China. *Journal of Enterprise Information Management*, 22(5), 587-614.

Scott, J. D., Vessey, I. (2002). Managing Risks in Enterprise Systems Implementations. *Communications of the ACM*, 45(4), 74-81.

Sherer, S. A. (1995). *The three dimensions of software risk: technical, organizational, and environmental*. In: 28th Hawaii International Conference, Hawaii, pp. 369-378.

Sumner, M. (2000). Risk factors in enterprise-wide/ERP projects. *Journal of Information Technology*, 15(4), 317-327.

Wallace, L., Keil, M., Arun, R. (2004a). How software project risk affects project performance: an investigation of the dimensions of risk and an exploratory model. *Decision Sciences*, 35(2), 289-321.

Wallace, L., Keil, M., Rai, A. (2004b). Understanding software project risk: a cluster analysis. *Information & Management*, 42(1), 115-125.

Zafiropoulos, I., Metaxiotis, K., Askounis, D. (2005). Dynamic risk management system for the modeling, optimal adaptation and implementation of an ERP system. *Information management & Security*, 13(3), 212-234.

Zhou, L., Vasconcelos, A., Nunes, M., 2008. Supporting decision making in risk Management through an evidence-based information Systems Project risk checklist. *Information Management & Computer Security*, 6 (2) 166-186.