CONCEPTUAL REFERENCE FRAMEWORK FOR SUCCESSFUL ENTERPRISE RESOURCE PLANNING (ERP) IMPLEMENTATION IN GLOBAL ENVIRONMENT

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Abstract

Enterprise resource planning (ERP) is a core-required part in managing supply chain successfully. It has been considered a useful tool in connecting all the tiers through the entire supply chain by transferring the information, involving all the tiers into developing new products, proposing innovation and focusing on the demand of customers. This paper reviews previous frameworks in implementing ERP to identify core elements in deploying ERP. Base on the critical aspects a conceptual framework for implementing ERP in global environment is proposed. I conclude with a discussion of future research and application in this area.

Key words: *enterprise resource planning, operation management, supply chain management, managing multi-organization enterprises*

1. Introduction

Business environment has been become more and more competitive because of higher customer requirements, competition of rivalries and market changes. In order to exist and develop, enterprises have been facing many issues involving in reducing manufacturing and operation cost, customizing products, responding customer demands, improving logistics and delivery and producing high-quality products. As a result, companies need to make information flow between both supply chain (suppliers) and demand chain (retailers and customers); furthermore, relationships with suppliers and business partners must be improved so that all members in production chain will share common goal. Consequently, enterprise resource planning (ERP) systems have been applied more and more widely.

ERP systems will bring benefits in workflow improvement through seamless integration between cross-functional processes, standardization of business practice and access to updated and real-time data. Therefore, ERP system implementation

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projects are complex and challenging; and so, companies must spend a lot of time and money on them (Davenport, 1998; Koh and Simpson, 2007; Yusuf et al., 2004). Many case studies of successful and failed ERP implementation are review by Deutsch (1998) and Nelson and Ramstad (1999).

While Loh and Koh (2004) analyse critical elements for a successful ERP implementation through four phases, Somers and Nelson (2004) rank the importance of players and activities across six stages in a life cycle of ERP implementation. Besides, the challenges of ERP implementation were investigated by Davenport (1998), McAfee (1998) focused on ERP operations and Pan et al. (2011) looked into ERP post-implementation risks. Although there are researches studying on many aspects of ERP projects including risks, few have been provided general view from the beginning to the end of ERP projects. This paper will propose a conceptual reference framework for ERP implementation.

The remainder of this paper is divided into parts.

Firstly, critical elements are identified through previous researches about ERP implementation. Next, frameworks for ERP implementation are reviewed. Then a conceptual reference framework in which content and material from literature review are used is proposed. Finally, the proposed framework will be discussed according to its advantages and disadvantages.

2. Literature review

Critical elements for ERP implementation

In order to implement ERP successfully, there are many elements that need to be taken into account. Loh and Koh (2004) found 10 critical success factors, 9 critical people and 21 critical uncertainties across four phases of ERP implementation including chartering phase, project phase, shakedown phase and onward and upward phase. Following this point, it is clear that small- and medium-sized enterprises must focus on all critical elements at each phase to achieve the final goal of ERP implementation. According to Somers and Nelson (2004), ERP implementation is divided respectively into 6 stages: initiation, adoption, adaption, acceptance, routinization and infusion. Through these stages, the authors identify 8 key players including top management, the project champion, the steering committee, implementation consultants, the project team, vendor-customer partnership, vendors' customization tools and vendor support; and 14 important activities (1) user training and education, (2) management of expectations, (3) careful package selection, (4) project management, (5) customization, (6) data analysis and conversion, (7) business process reengineering (BRP), (8) architecture choices, (9) dedicating resources, (10) change management, (11) clear goals and objectives, (12) education on new business processes, (13) interdepartmental communication, (14) interdepartmental cooperation. However, it leads to problems concerning about cost and difficulty in training and other requirements identified by Aladwani (2001). On the one hand, the effectiveness of ERP systems is very clear and necessary for enterprises; on the other hand, an organization needs to spend time and money in processing ERP including huge storage needs, massive networking requirements and training.

Critical success factors are also identified in other previous studies. Nine critical

success factors including commitment by top management, project management, implementation team, strategic goals, organizational change management, training, performance measurement, multi-site issues and data accuracy have been taken into account by Umble et al. (2003). Another study devoted to successful ERP implementation is conducted by Malhotra and Temponi (2009). The authors point out six key factors including project team structure, implementation strategy, database conversion strategy, transition technique, risk management strategy and change management strategy. Taxonomy for critical factors has been developed by Al-Mashari et al. (2003). In this research, these factors have been classified according to three phases (1) management and leadership, and visioning and planning in the ERP setting up stage, (2) ERP package selection, training and education, communication, system integration, project management, system testing, legacy system management, process management, cultural, and structural changes in the ERP implementation, (3) performance evaluation and management in the evaluation phase.

Aloini et al. (2007) figures out top five risk factors in the list of ten frequent risk factors including improper strategic thinking and planning, unsuitable project management techniques, inadequate ERP selection, ineffective change management and bad managerial conduct. The research of Pan et al. (2011) bases on 40 potential risks containing 9 operational risks, 8 analytical risks, 16 organization-wide risks and 7 technical risks during ERP exploitation by Peng and Nunes (2009a, b). In the case study about a large Chinese manufacturing group, it points out respectively seven critical risks affecting ERP post-implementation: losing qualified in-house IT/ERP experts, inappropriate master production schedule (MPS) generated by the ERP system, unwillingness to use the ERP system of operational staff, losing ERP-related know-how accumulated over time, lack of technical support from system vendors, failing to generate appropriate material net requirement plan and failing to achive seamless integration between modules of ERP system. The recent study of Dey et al. (2010) produces a matrix of generic risk factors for ERP implementation following project phases and risk categories. In more details, an ERP project is considered three phases including planning, implementation and hand-over, evaluation and operation when risks have been classified into three categories named project management processes, organizational transformation and IT.

3. Frameworks for ERP implementation

Similar to other project management frameworks, frameworks for ERP implementation are processed through phases. However, the number of phases depends on approach method of each study. Loh and Koh (2004) propose a conceptual framework for a successful ERP implementation through 4 phases. In each phases, remarkable uncertainties are pointed out and explained what they are and why they need to be focused. They also suggest other critical elements such as people and factors which can significantly affect an ERP implementation in order to provide general view in implementing ERP projects. Although critical elements for ERP projects are identified, the method to analyse them has not been proposed by authors. Moreover, critical uncertainties have not been classified, and so, risk response guide is

difficult to provide. Consequently, the study becomes more conceptual than practical.

Dey et al. (2010) approach to ERP risk management through three phases – the planning, the implementation, and hand-over, evaluation and operations. In more details, they classified risks into three categories: project management processes, organizational transformation and IT before applying five steps of the framework – identifying risk, logging risk, reviewing risk, managing risk and closing risk – to deal with ERP implementation risks. The authors use risk assessment scoring to analyse impact and probability of realized risks then based on the information to respond these risks. This research is clear in identifying phases; in addition, categorizing risks into relevant group along with proposing risk analyse method help project members more easily calculate risks and mitigate them. However, the role of important activities and people has not been mentioned in the framework; and so, the general view has not been provided in theoretical.

Proposed framework and discussion

The literature review in this paper led to the development of a conceptual reference framework for ERP implementation. Figure 1 shows the conceptual reference framework for ERP implementation, particularly for small- and medium-sized enterprises. Although there are many ways to divide an ERP project into phases, this paper follow the traditional method containing three stages: pre implementation (the planning), implementation and post implementation so that overlapping between phases can be avoided. The framework illustrates three main critical elements including critical people, important players and activities, and critical uncertainties (risks). They are considered to be the key on the success of an ERP project according to three phases identified above.

Critical people

According to Loh and Koh (2004), there are 9 critical people in an ERP implementation project. In the authors' framework, an ERP project is divided into 4 phases – chartering phase, project phase, shakedown phase, and onward and upward phase – while in the proposed framework, there are only three phases. However, the second and the third phases in their framework focus on ERP installation, software development and software testing; and so, they have the similar perspective with the implementation phase in the proposed framework. Therefore, critical people in the second and the third phase of the old framework become critical people in the second phase of the new conceptual reference framework.

Important players and activities

Somers and Nelson (2004) identify 8 key players and 14 important activities through 6 stages of ERP project life cycle. Based on definitions about these players and activities, it is clear that they include critical factors for successful ERP implementation. This is the reason why the proposed framework does not mention about critical success factors for ERP implementation like previous conceptual reference frameworks. In the authors' view, ERP implementation has been processed through 6 stages: initiation, adoption, adaption, acceptance, routinization and infusion. Based on authors' explanation about these stages, the first two – initiation and adoption – are similar to pre implementation; the next two – adaption and acceptance – have

the same perspective with implementation phase; and the last two are considered post implementation. According to the opinion of Somers and Nelson, all 22 critical factors involve in 6 stages of ERP life cycle; but the importance of each factor in each stage which are classified into high (0.6), medium (0.3) and low (0.1) are different. Therefore, only factors with high importance will be picked into the proposed framework. However, in the study of Somers and Nelson, there are only one factor – user training on software – is identified highly important in the last two; so in these stages, factors are marked more than 0.5 are considered highly important.

Critical uncertainties

Critical uncertainties in this conceptual reference framework are based on studies of Dey et al. (2010) and Pan et al. (2011). Risks in the pre implementation phase and implementation phase are identified according to Dey et al. (2010). There are 8 risks contained of 3 project management process risks, 3 organizational transformation risks and 2 IT risks in the pre implementation phase. The next phase is suffered from 3 project management process risks, 2 organizational transformation ones and 6 ones from IT. In the last phase, Pan et al. (2011) identified 7 main risks from the list of 40 potential risks based on the research of Peng and Nunes (2009a, b). The majority of these risks (6 out of 7) are more involved in organizational culture and business aspects than IT and technical areas. The method that Pan et al. use to find out critical risks is risk scoring based on probability of occurrence, impact and frequency of occurrence while Day et al. analyse risks through risk assessment scoring calculated by probability and impact.

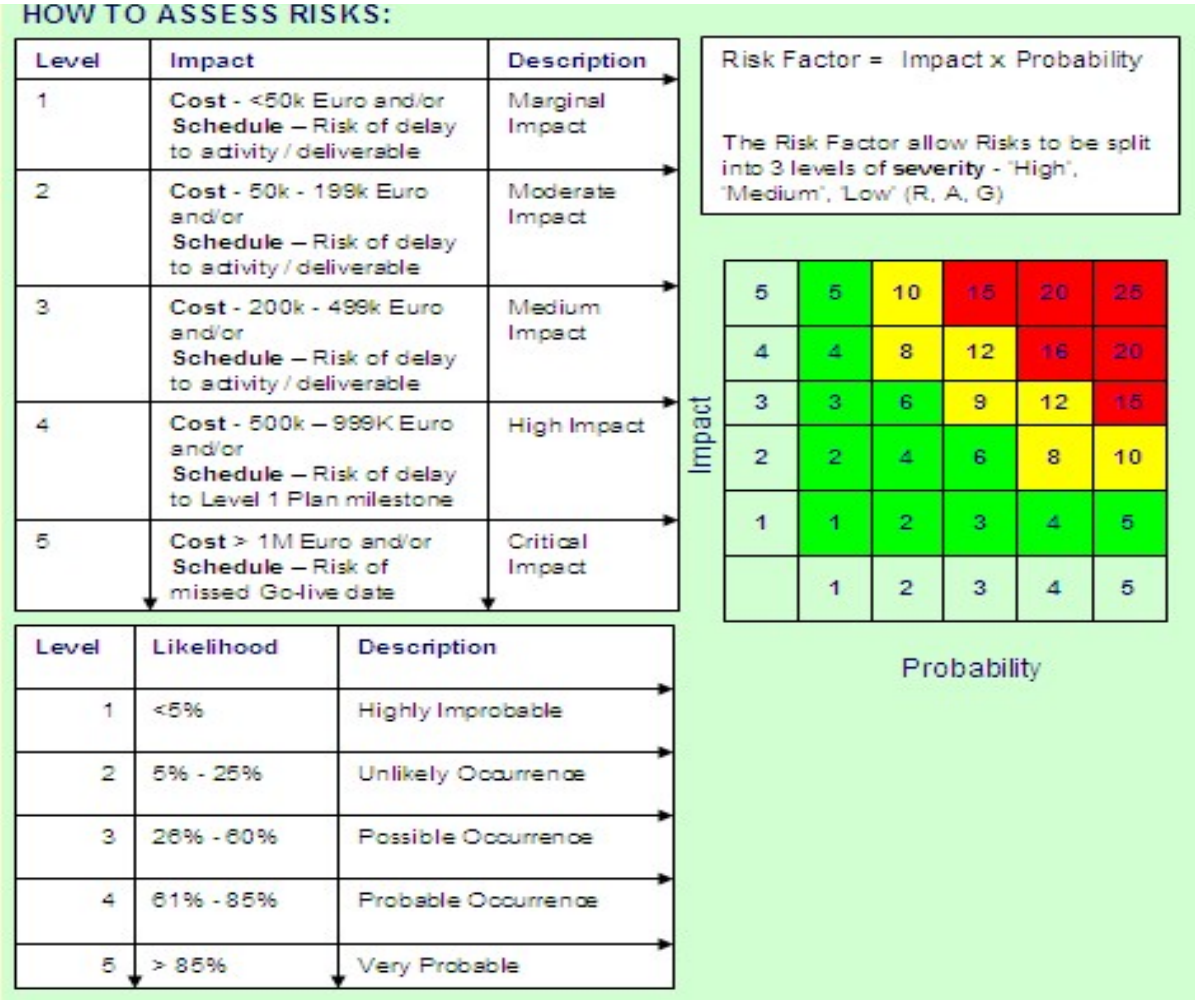
Figure1: Conceptual reference framework for a successful ERP implementation

	Pre implementation	***Implementation***	***Post Implementation***
Critical people	- Vendors - Consultants - Companies executives - IT specialists - Operation Manager - End user (representatives) - IT support personnel	- Vendors - Consultants - Company executives - IT specialists - Project manager - Project team members (mainly from business units and functional areas) - Operation Manager - End user (representatives) - IT support personnel	- Vendors - Consultants - Operation Manager - End user (representatives) - IT support personnel

Important players and activities	- Use of steering committee - Vendor support - Careful selection of package - Architecture choices - Use of vendors tools - Clear goals and objectives - Inter departmental communication - User training on software - Change management - Project champion - Top management support	- Change management - Use of vendors tools - Top management support - BRP - Use of steering committee - Clear goals and objectives - Project management - Interdepartmental cooperation - Dedicated resources - Data analysis and conversion - Project team competence - Project champion - Use of consultants - Education on new BRP - Interdepartmental communication - User training on software	- User training on software - Interdepartmental cooperation - Interdepartmental communication - Top management support - Use of consultants
Critical uncertainties (risks)	- Inappropriate business case - Unclear objectives - Weak implementation team - Lack of management/ executive commitments and leadership - Lack of synergy between organizational strategy and IT strategy - Unclear change - Lack of communication with end users - Inadequate training plan for users.	- Inappropriate management of scope - Lack of communication between implementation team, vendors and users. - Poor contract management - Inappropriate management of change - Inappropriate management of culture and structure - Lack of BRP ability - Lack of ERP installation ability - Unsuitable selection of ERP software - Failing to integrate system modules - Inaccurate data - Lack of user training	- Losing qualified in-house IT/ERP experts - Inappropriate PS generated by the ERP system - Unwillingness to use ERP system of operational staff - Losing ERP-related know-how accumulated over time - Lack of technical support from system vendors - Failing to generate appropriate material net requirement plan - Failing to achieve seamless integration between modules of the ERP system

Figure 2: An example of risk assessment scoring according to Impact and Probability (R, A, G stand for Red, Amber and Green respectively)

(Source: Dey et al., 2011)



Risk analysis

For critical people, and important players and activities, they just need to be identified in order to be noticed in each phase of an ERP implementation project. Risks are also taken into account; however, when risk happens the consequence can be cost or time overrun. Therefore, risks must be measured so that they can be avoided or mitigated. The potential impact and probability of risk are analysed and responded like an example in Figure 2. Each risk is evaluated in the same way with one standardised score set so that risk scoring is objective and is not affected by assessors. Figure 2 shows 5 levels of Impact and Likelihood (Probability); however, the number of levels and dividing method are customized according to characteristics of each project.

Discussion

One advantage of this framework is providing general view contained of critical aspects of an ERP project from the beginning to the end. The study partly inherits strong

points of previous researches about critical elements for ERP implementation. Following this framework, this can be a general guide for ERP implementation team. Next, by dividing an ERP project into three phases, this framework can be applied to many ERP implementation projects. However, on the other side, it becomes improper for projects which should be divided into many small phases. Although an ERP implementation project in the proposed framework is divided into three phases in order to deal with previous studies easier, there are few contents overlapping between them. For example, a previous research may have 4 stages and the second one contains information of both the pre implementation phase and the implementation phase of the proposed framework; and the information cannot be split completely to suit the new framework. Additionally, an important content in the new framework is based on more than one previous research; consequently, this content seems not to be completely compatible. For instance, critical uncertainties part of the proposed framework is built from two different studies of Dey et al. (2010) and Pan et al. (2011). While Dey et al. measure risks according to their impact and probability, risks in Pan et al.'s research are scored through probability, impact and frequency. However, the conceptual reference framework tries to solve this problem by applying one standardized method for risk assessment. Another point is this framework is built from secondary information of many papers studied in different period of time, and so, it is not a totally up-to-dated and compatible product.

4. Conclusion

This paper found three critical elements, namely critical people, important players and activities, and critical uncertainties that enterprises, especial small- and medium sized one, must consider in order to implement ERP successfully. Based on previous researches and divided an ERP implementation project into three phases, a conceptual reference framework with critical elements was developed. The final goal of this paper is providing a general view across ERP implementation for project team and stakeholders. And so, from that view they can create a plan to achieve successful ERP implementation.

For further research, the framework will be updated with primary information. After that, the new framework will be applied in relevant case studies to find the gap between conceptual ideas and practical knowledge. Then, it will be improved again to ensure that it can be a practical guide to ERP implementation projects as the initial purpose of the author.❑

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