

The Risk Analysis of System Selection and Business Process Re-Engineering Towards the Success of Enterprise Resource Planning Project for Small and Medium Enterprise

Nazli Sadat Safavi, Nor Hidayati Zakaria and Mahyar Amini

Department of Information System, Faculty of Computing, Universiti Teknologi Malaysia

Abstract: This paper contributes to the discussion on Enterprise Resource Planning (ERP) implementations in the context of small and medium size enterprise (SME). The ignorance of ERP implementation risks would be the major for SME. Several risk factors have been identified to help enterprises to better manage their ERP. SME needs to contemplate about numerous things, primarily the cost factors of implementation before taking the first step in implementation ERP system. SME has restricted resources, budgets and great sensitivity to costs so ERP implementation is so huge for small enterprise. This study chooses the critical adequate system selection risk and business process re-engineering risk of the ERP implementation, the purpose of this study is to identify and assess relation among these risk factors of ERP through the SME that impact to cost reduction and other hand cost reduction on project success. The instrument used for data collection is questionnaire. Respondents are staffs that have knowledge of the ERP and data from questionnaire analyzed with SmartPLS software.

Key words: ERP • ERP Risk • ERP Implementation • SME

INTRODUCTION

The environment of business is drastically changing. Globalization tests, international rivalry, technological difficulty and growing customer focus are what enterprises today are confronted with. Firms must expand product portfolio, decrease time-to-marketplace, reduce product-life cycles and generate better quality productions by a quick reply, reduce costs and more customization to meet market requires [1-3]. As a result, companies are more and more focusing on Enterprise Resource planning (ERP) systems to fulfill these objectives. Enterprise system determined as a: “commercial software packages that enable the integration of transaction-oriented data and business processes throughout an organization” and perhaps eventually throughout the entire inter organizational supply chain [4]. In the case that ERP systems are successfully performed, all the functions of an enterprise are linked together. These functions comprise human resources, order management, manufacturing, financial systems and

distribution with customers and external suppliers into a tightly merged system with shared visibility and data [5, 6]. On the other hand all the resources, information and activities required to complete business processes are coordinated by ERP, which is an information stem designed for this [7, 8].

The utilization of ERP by SME has increased in recent years. Hence, the confirmation of elements that have an effect in the implementation of ERP has become the middle of consideration [9-11]. Implementation of ERP creates an increase in operational competence and efficiency although it involves enormous costs. SME has restricted resources, budgets and great sensitivity to cost [12-14]. SME needs to contemplate about numerous things, primarily the cost factors of implementation before taking the first step in implementation an ERP system. Risk and cost can be huge for ERP implementation, implementation phase involves enormous of hidden costs that impact on project success during the ERP life cycle [15-17], so making a decision about implementing ERP has to be considered prudently.

SMEs and larger enterprises are substantially different in principal ways, which affect their information seeking practices that impact ERP [18, 19]. Complex and prolix process of the ERP accomplishment usually encounter the company in many difficulties forcing it to eliminate different obstacles to project success [10, 20].

ERP projects may signify new obstacles and present new risk factors that have to be handled in a different way. An ERP project is a significant and precarious exercise for any size of enterprise, but, risks are more for SME as the cost overruns during implementation may cause financial pressure on the firm and hence significantly affect the firm's performance [12, 21]. Formerly, different ways of improvement of the success rate of ERP introduction were proposed with no significant effect unfortunately. Risk factors and strategic need for the project, repetition of failed experience, innovation and etc define the nature of IT project risk [22].

This study is leaded by the efforts that have been made earlier by researchers and critiques. In summary, this study, by combining four concepts including ERP implementation, risks *et al.* three-level framework and two elements of risk factors in ERP implementation, adequate ERP system selection risk and adequate business process re-engineering risk model efforts to make a more coherent model to measure effective cost reduction on ERP project success. The objectives of developing such a framework are threefold: 1) To identify the relation among risk factors of system selection and BPR risk on cost reduction in ERP implementation based on SMEs 2) To identify the relation between cost reduction and ERP implementation success. Choosing the most important criteria's of ERP implementation risk factors. For this investigation, SMEs are selected as representation of a developing country. SMEs, which follow essential rules in economic issues, are focused in the research. SMEs firm are the sample of this research that is agreeable or in the process to implement the ERP has been implementing the ERP.

Theoretical Perspective: ERP is a new class of packaged application software that has been appeared through the past decade. These packaged software solutions tries to complete the range of a business's functions and process to be able to present a whole view of the business from singular information technology architecture [23, 24]. The ERP system can be of great help in leveraging the two other key aspects of the management organizations. Adam [25] and Haddara [22] founded to reach the

resulting scale Lower stock levels, Increase in productivity, Reduction of delivery times, Reduction of planning cycle, Reduction of production times, Reduction of late deliveries.

It has been found that an ERP project is risky and intricate to implement in business enterprises [25]. Risk is inevitable for most companies when launching a new product or innovating themselves [21, 24]. ERP implementation is important for companies thus they should focus on risk of ERP project to make ERP project implementation successfully [25].

For SMEs, risk is higher as the cost over runs during implementation may put financial strain on the firm and thus substantially impact firm performance. ERP implementation fail is enormous for SMEs and they have minor chance for recovering as compared to larger organizations [21, 22, 26]. ERP systems are huge and complex systems and warrant careful planning and execution to ensure their successful implementation. The higher chance of success is based on choosing a better ERP selection [27]. In the implementation project, the selection of an ERP system becomes crucial [28].

The selection process involves a consideration of the investment from various perspectives such as vendor, price, support, adaptability and implementation time as shown by the evidence. Choosing the most ideal software package solution is a chief concern: if wrong decisions are made, the company will be confronted with either a mismatch between the package and business processes and approaches, or the need for major alterations, which are time-consuming, expensive and dangerous. So implementation of a wrong project could result in it failing or weaken so much that it is enough to affect the company's performance [27, 29]. Technical software competencies must be analyzed before implementation matters and their effect on business processes evaluated [10].

Packaged software is incompatible with the organization's needs and business processes. The consequence is software modification, which is expensive and costs heavily in maintenance, or restructuring of the organization's business processes to fit the software. To neglect business processes redesign is a risk in ERP project; ERP implementation and BPR activities. To reap the full benefits of ERP systems, it is imperative that business processes be aligned with the ERP systems, since the literature on both reengineering and ERP implementation have shown that, ERP cannot improve firm performance unless the firm reengineers its business processes for the ERP systems [5, 29, 30].

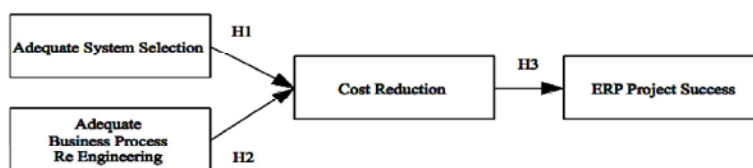


Fig 1: Purposed Frameworks for Investigate the Relationship between Risk, Cost Reduction and ERP Success

When ERP has been successfully implemented, it links all organizational functions which include “order management, manufacturing, human resources, financial systems and distribution with external suppliers and customers into a tight integrated system with shared data and visibility [5, 16].

Research Model: Figure 1 depicts the research model illustrating the hypothesized relationships. It proposes a model in which two elements of risk factors on ERP implementation on cost reduction and on the other hand cost reduction on ERP project success.

The ERPs marketed are expensive and smaller organizations cannot afford them [30, 31]. Implementing an ERP system requires a thorough strategic thinking that allows companies to gain better understanding of their business processes. It is important for companies to be aware of risk issues affecting ERP implementation and give careful considerations to the issues which would lend themselves to smooth rollouts and timely implementation of ERP systems [30]. An ERP system is still an expensive task, even more so in small firms. The company’s inadequate information about the cost feasibility structure may make or break its decision to either continue or abandon an ERP implementation. Many small businesses either do not have sufficient resources or are not willing to commit a huge fraction of their resources due to the long implementation times and high fees associated with ERP implementation [2]. On the other hand company should pay attention to the costs that come from risk of ERP implementation phase, identify the cost factor in ERP implementation are influential and hence their understanding is critical to success [19, 32]. The success of an ERP project also largely depends on how well SME can manage risk factor to reduce the cost [21]. Also important is attention to budget, those that exceeded cost budgets Showed lower success rates [33]. According to Al-Fawaz *et al.* [19], Päivi Iskanius [5], Malhotra *et al.* [2], Tsai *et al* [34] and Peslak [33] this study has chosen cost reduction and ERP project success as significant criteria. For that reason this research is chosen adequate business process re engineering as a risk of ERP implementation because of significant result that mention in above.

Research Hypotheses: Determination of specific elements which are essential for a business to run is one of the fundamental methodologies particularly for smaller firms in software selection [27]. According to literature several researcher investigate on risk of ERP implementation. Aloini *et al.* [24], Boehm [35], Somers & Nelson [36] were mentioned that ERP system selection is most critical for Company. Based on this argue this study is chosen adequate system selection as risk of ERP implementation. Selecting the most suitable software package solution is a key concern, if wrong choices are made; the company will be faced with either a mismatch between the package and business process and strategies, or the need for major modifications, which are time consuming, costly and risky. The implementation of an ERP software package involves a mix of business process change and software configuration to align the software with the business processes [21].

Hypotheses 1: Adequate system selection risk positively leads to cost reduction of ERP implementation.

Implementing ERP and BPR should be done together. On the other hand Business process integration is more costly [37]. However, due to the complexity of BPR and its high costs, this might not be an easy way to do so. In addition, it needs organizational resources to be put under two continuous projects. Packages of ERP provide best business practices which are even able to be included as one of BPR parts [37]. Tsai *et al.* [32] highlighted that ERP implementation includes establishment suitable business process changes as well as information technology changes to significantly develop quality, flexibility, performance, responsiveness and cost. Hence, in this research, BRP considered as an element that has a meaningful significance in organizational risk. Therefore, the second hypothesis could be as below:

Hypotheses 2: Adequate business process re engineering risk positively leads to cost reduction in ERP implementation.

Among the quantifiable measures that would have presented a greater realizing of the success of ERP implementation are for example actual versus projected implementation time, actual versus projected cost of implementation such as cycle time decrease, return on investment on the ERP project and increased market profits [30]. An ERP system is still an expensive task, even more so in small firms. The company's inadequate information about the cost feasibility structure may make or break its decision to either continue or abandon an ERP implementation. Many small businesses either do not have sufficient resources or are not willing to commit a huge fraction of their resources due to the long implementation times and high fees associated with ERP implementation [2, 22]. On the other hand company should pay attention to the costs that come from risk of ERP implementation phase, identify the cost factor in ERP implementation are influential and hence their understanding is critical to success [19, 32]. The success of an ERP project also largely depends on how well SME can manage risk factor to reduce the cost [21]. Also important is attention to budget, Those that exceeded cost budgets showed lower success rates [33]. According to Malhorta and Temponi [2], Al-Fawaz *et al.* [19], Tasi *et al.* [32], Paivi Iskanius [21] and also Peslak [33] the last hypothesis could be defined as:

Hypotheses 3: Cost reduction positively leads to ERP project success.

MATERIALS AND METHODS

The study design used for this research was Structural Equation Modeling (SEM). The population of interest was chosen from employees of small and medium enterprises in Iran. The respondents were familiar with ERP who have worked for the SME. This was a survey research. A questionnaire was developed after extended literature review. The questionnaire was given to 150 employees which in order to understand their perception and their attitude towards using the ERP. Data collection is a process of a fundamental step at the start of any improvement activity. This process will ensure that research can efficiently compare data to measure and establish a foundation of current state. Without accurate and relevant information improvement of research can be in doubt. Questionnaire helps to cover a large number of respondents. Questionnaires are distributed to staff in SME in Iran.

RESULTS

Demographic Factors: Demographic information is characteristics of a collection per area. Demographic information was collected from 150 employees, which have worked with ERP. This information was shown the number and characteristics of employee, which can use in assess of the employees population. Data indicates (33%) are less than 30 years age and more than half of the respondents (61%) are between 31 and 41 years ages the remaining (6%) are older than 41 years age and forty-four percent (58%) of the respondents are male and 42% are female. Forty-two (42%) percent of the respondents have less than 5 years cooperation experience, 46% five to ten years and 12% more than ten years. 5.5 8% of the respondents have diploma, 58% undergraduate and 34% Postgraduate. In addition based on respondents, data indicates department of participants, 13% financial, 11% human resource, 17% information technology, 11% manufacture, 16% marketing, 4% procurement, 14% sales, 3% service and 11% store.

Statistical Analysis: We used Partial Least Square (PLS) for data analysis. Indeed, even a casual glance at the IT literature suggests that Structural Equation Modeling (SEM) has become necessary in validating instruments and testing linkage between constructs [38]. The PLS procedure, as one of the SEM techniques, has been gaining interest and use among researchers in recent years because of its ability to model latent constructs under conditions of non-normality and small to medium sample sizes. It allows the researchers to both specify the relationships among the conceptual factors of interest and the measures underlying each construct. The logical analysis was running by using smart partial least squares (Smart PLS 2.0), which adopted the structural equation modeling (SEM) technique. The PLS technique can be very helpful to obtain measures about the internal reliability and validity of the research model. These measures can show the level of relationship's strength between the defined constructs in the model. These three concepts are as the requirements the model proposed that should be acquired. Thus, in order to confirm the reliability and validity of the research model, this paper has shown the results from the internal reliability perspective and the validity perspective for the constructs [38].

Table 1: Reliability and Validity Statistics for the Questionnaire Items

	Average Variance Extracted (AVE)	Composite Reliability	Cronbachs Alpha
Adequate System Selection	0.555	0.881	0.837
Business Process Re-Engineering	0.506	0.876	0.835
Cost Reduction	0.570	0.887	0.856
ERP Project Success	0.512	0.862	0.808

Reliability and Validity: Validity is displayed when each measurement item related strongly to its assumed theoretical construct. These two validities capture some of the aspects of the goodness of fit model, i.e., how well the measurement items relate to constructs. When factorial validity is acceptable, it means each measurement item correlates strongly with the one construct it is related to, while correlating weakly or not significantly with all other constructs. Smart PLS also shows the validity. Establishing discriminant validity requires an appropriate Average Variance Extracted (AVE) analysis. We examined to check whether the square root of every AVE (there is one for every latent construct) is much larger than any correlation among any pair of latent constructed. As a rule of thumb, the square root of each construct should be much larger than the correlation of the specific construct with any of the other constructs in the model and should be at least 0.5 [39] (Table 1).

Internal consistencies of all variables are considered Fornell and Larcker [39] acceptable since they exceed 0.70, signifying tolerable reliability. Smart PLS also shows the composite reliability. Table 1 illustrates the results of the reliability and validity analysis of different constructs of the questionnaire.

The acceptable values for composite reliability would be the same as the researcher sets for Cronbach's alpha. The composite reliability should be greater than 0.60 for exploratory purposes [40]. The composite reliability of this study is greater than 0.80 for all measurements. The internal consistency was measured using Cronbach's alpha (α) [41]. Alpha should be greater or equal to 0.80 for a good scale, 0.70 for an acceptable scale and 0.60 for a scale for exploratory purposes. In this study, all measurements have a value greater than 0.80. According to, establishing discriminant validity requires an appropriate AVE analysis that must be at least 0.50 [39]. In this study, all measurements had values much higher than 0.50 (Table 1). We found adequate internal consistency between items in the questionnaire; adequate system selection, adequate business process re-engineering, cost reduction and ERP project success (Figure 1).

Hypotheses Test: For preceding the study, according to the evaluation and prediction of the structural model, some data about the path coefficients (β), T-values (T), P-values (P) and squared R (R^2) are identified in details.

Path coefficients (β): Path coefficients (β) show how strong and significant the associations between dependent and independent variables are [42]. It means that, a path coefficient reveals the immediate influence of a variable (considered as cause) that is supposed to result in a different variable (considered as effect). Since a Path coefficient can be identified based on the correlation, it is standardized while a path regression coefficient cannot be considered standardized.

T-Value: According to Reddy and Chin (1998), for conducting the hypothesis testing the path significance can be determined via t-tests values by using the bootstrapping procedure. Commonly, the acceptable value for T-values larger than two (T-value > 1.96) means significant level [43].

P-value: The P-value can be considered as a quantitative measure of the numerical importance of testing a hypothesis. Furthermore, regarding the studies conducted formerly, P-value < 0.05 implies the significance of the related hypothesis (e.g., [44]).

Squared R (R^2): The R^2 shows the expected effect of the model of dependent variables through estimating the percentage of a construct's variance in the model [44].

The results of the study confirmed that the organizational identification positively impacted on perceived usefulness ($\beta = 0.536$, $p < 0.001$). Therefore, hypothesis H1 was supported (see table 2). This result also supports the second hypotheses of this study. The results for the effect of business process re-engineering on cost reduction in ERP implementation showed positively impacted on satisfaction ($\beta = 0.4638$, $p < 0.001$). Therefore, a hypothesis H2 was supported. This result also support third hypothesis of this study.

Table 2: Summary of the Results

Hypotheses	Causal path	Path Coefficient	t-value	Remarks
H1	Adequate ERP System Selection → Cost Reduction	0.536	10.067	Supported
H2	Business Process Re-Engineering → Cost Reduction	0.463	8.465	Supported
H3	Cost Reduction → ERP Project Success	0.927	70.663	Supported

As shown in table 2 for the third hypothesis cost reduction on ERP project success ($\beta = 0.9277$, $p < 0.001$). So a hypothesis H3 was supported.

In summary, the formulated hypotheses were supported by the data. The contribution of adequate system on cost reduction is more than 90% ($R^2: 0.929$). This indicates that criteria are very significant and important in terms of to reduce the ERP implementation cost which is the main concern among SMEs. The data analysis shows that there is a positive relationship between cost reduction and ERP project success. The R^2 value indicates the amount of variance in dependent variables that is explained by the independent variables. Thus, a larger R^2 value increases the predictive ability of the structural model. Based on Smart PLS algorithm (table2) R^2 for cost reduction in this model is 0.861 and for ERP project success is 0.861 that means more than 80% cost reduction leads to ERP project success.

CONCLUSION

This study investigates on two elements of risk factors on ERP implementation cost reduction and also ERP implementation success in context of SME. This study tries to concentrate on the business goals without focus on software. The ERP implementation leads firms to rising in operational productivity and competences but ERP implementation involves enormous cost so risk of ERP implementation can be determined as a potential difficulty [13, 22, 23]. There are some contributions have been identified from this study and highlighting implications for research and practice. First, many researchers have explored about ERP implementation phase in large company, smaller numbers have concentrated on SME [21, 22, 26, 27, 31]; findings regarding implementation risk of ERP in specific appeared to be essentially based on literature review [24, 29]. Since there is strong evidence that SME function differently from big organization, this research provided specific direction to risk of SME in implementation phase and cost reduction contemplating implementation of ERP [21, 24, 28, 29, 35]. This was done by identifying two

factors of implementation risks that were considered critical to ERP implementation success in the SME.

Second, in relating this study to prior researches, it looks that this study detection appeared to approbate with the literature, but others appeared to be either innovative or counter to existing knowledge. In particular, study detection confirms that factors such as adequate system selection and adequate BPR were significant success of ERP implementation at SME [10, 29, 45]. This study concurred with prior researches that both risk and cost reduction might be considered ERP implementation; however this study further characterized their nature in the SME environment.

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