

Measuring ERP Implementation Success with a Balanced Scorecard

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Full Paper

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Abstract

The study develops a model for large scale ERP implementation success with the balanced scorecard indicators. Large scale ERP implementation success factors consist of project management competence, knowledge sharing, ERP system quality, understanding, user involvement, business process re-engineering, top management support, organization readiness. Business process re-engineering is the most important factor for achieving the ERP implementation success. It has the significant impact on enhancing organization learning, improving the business process, enhancing employee satisfaction, and obtaining financial benefits. Project management competence is essential to enhance employee satisfaction and financial benefit. Knowledge sharing has the positive impact on learning and financial benefits to the organization. The ERP system quality has a significant effect on improving the internal process of business and enhancing employee satisfaction. Surprisingly, top management support of large-scale ERP project is not related to achieve organization learning and financial benefits.

Keywords

Balanced scorecard, implementation success, large-scale ERP.

Introduction

Many organizations expect to use enterprise resource planning system (ERP) to support business process growth and provide strategic information to their managers. The ERP systems encompass software products that support accounting and other functional operations and improve management decision-making ability (Costa et al. 2016). Large-scale ERP (e.g. Oracle, SAP) implementation requires more budget, human resources, and time. High investment in large-scale ERP system does not always guarantee benefits to the firm (Ram and Corkindale, 2014; Vidyaranya and Cydnee, 2005), especially in Thai culture and management style (Prachit and Chookhiatti, 2005).

To fulfill long-term performance of the organization, large-scale ERP implementation success requires both financial and non-financial measures (e.g. employee satisfaction, process improvement, learning and innovation). The balanced scorecard (BSC) provides a comprehensive measurement framework which consists of four perspectives: financial, internal processes, customer, and innovation and learning (Kaplan and Norton 1992; Kaplan and Norton 1993; Martinsons et al. 1999). The balanced scorecard is worthwhile to adapt to examine the ERP implementation success factors in Thai context as the balanced scorecard has the major objective to transform organizational mission into strategies, objectives and measurements.

Previous studies of ERP implementation have paid little attention to develop the framework to measure business value of ERP implementation. Rosemann and Wiese (1999) evaluated only project management effectiveness of ERP implementation with the balanced scorecard. Huang et al. (2006) used the balanced scorecard to evaluate performance of information security management.

Specifically, a careful review finds that no studies have included an assessment of ERP implementation success or large-scale information technology investment and implementation with the integrated

framework of the balanced scorecard. As a result, the objective of this research is to assess the relationship of large-scale ERP implementation success factors with the balanced scorecard indicators. The results can enhance the understanding and implication of large-scale ERP implementation success factors which can really improve the whole organization performance and business value in the Thai management context.

Literature Review

Balanced Scorecard

Kaplan and Norton (2001) suggested that financial measures should be complemented by adding measurements that reflect customer satisfaction, internal process improvement, and learning. Martinsons et al. (1999) applied the BSC to evaluate information technology investments in an organization. Huang and Lee (2006) used BSC to evaluate the performance of information security projects.

In the case of information systems, Martinsons et al. (1999) has contributed a more in-depth theoretical view of applying BSC in the information system scorecard (IS scorecard). For instance, the IS scorecard replaced the customer satisfaction view with the end-user within the organization. Moreover, the IS scorecard measures business value instead of financial perspective. The reason is that information system is a service providing in the organization users, not explicitly a revenue generator unit. In addition, Hans and Tibbits (2000) used the BSC framework to determine strategic management of electronic commerce. In addition, ERP is normally developed for use within the organization, the appropriate measure of customer satisfaction should use the internal customers such as ERP users' satisfaction instead of external customers satisfaction. The success of ERP implementation depends greatly on perception of ERP users within organization. Moreover, internal customer satisfaction should be measured from a variety of employees who have been involved and used the ERP system. Due to the nature of the study, internal customers in this research consist of multiple levels of informants ranging from operational to the management level who have ever been involved the implementation of large-scale ERP. The rationale for the multiple level informants is to understand the critical issues for the entire processes of ERP implementation. Hence, the customer perspective in this study is based on the perceptions from internal employees from both operational and management levels.

ERP Implementation Success

Top management support: One of the ERP implementation success factors is top management support (Costa et al. 2016). Top management should allocate sufficient valuable resources to support and make the objectives of ERP implementation achieved. A steering committee of ERP implementation should be set up to communicate the scope and objectives of the project, to engage the ERP project team, and to monitor the ERP implementation progression.

Project management competence: Project management ability of the organization plays an important role in ERP implementation success. Effective project management includes an implementation plan that defines project activities, personnel and a committed project team to support implementation activities. Competent ERP service provider or ERP consultant capability is important to alleviate the problems during implementation process and can enhance the implementation success (Markus et al. 2000). Knowledgeable consultant fluently in business functions, ERP project competency is the major key success of ERP implementation (Tarhini et al. 2015).

Business process re-engineering: Prior studies indicate that business process redesign is one of the most important factors for ERP implementation success (Ruivo et al. 2014). Many organizations change business process to match or fit with the ERP software to avoid modifying the ERP software and to reduce the gap between current business process and ERP software.

User involvement: Users involvement in identifying ERP system requirement can create commitment of employees toward the new ERP system implementation (Wu and Wang, 2006). User involvement is important and can enhance the perceived benefit through participating in the ERP implementation process, which decreases users' resistance of the new developed ERP systems (Wang and Chen, 2006).

Knowledge sharing: Knowledge sharing among the key players of ERP project management is one of the importance success factors (e.g. ERP vendor, consultants, IT specialists, and business users) (Ampairatana and Rotchanakitumnuai, 2008; Shao et al. 2012). Knowledge sharing can be explicit knowledge or tacit knowledge among management / operational staff, vendors, and consultants during the implementation process (Nonaka and Takeuchi, 2005).

Organization Readiness: Organizational readiness of information technology usage intensity and knowledge of personnel are major success factors of new information system implementation (Chircu and Kauffman, 2000). The usage intensity of information technology of firms assists organizations to adopt new technology more than less experienced ones. In addition, new system implementation requires complex understanding, knowledge, and experience to utilize ERP capability. Firms need to recognize the impact of selecting the right employees or managers with the right skill set, e.g. having knowledge of the business functions, having experience in information systems, having interpersonal skills, and being able to work with people (Shao et al. 2012; Zhang et al. 2005). Lack of organization readiness is the most important factor that leads to large-scale ERP implementation failure.

ERP system quality

The ERP system should fit the firm's requirements and achieve the project objectives. The inappropriate ERP systems with errors can increase implementation time and cost overruns. ERP system with accuracy, ease of use, and timeliness output indicate the ERP system quality that can enhance organization end users satisfaction (Kanellou and Spathis, 2013).

Communication with Understanding

A clear understanding of the objectives and importance ERP implementation has to be communicated throughout the organization, especially to users who will use the ERP system. Communication helps employees recognize how ERP affects current operations. Organization communication comprises the formal announcement of top management and ERP project manager. ERP implementation progress needs to advertise to all levels and functions of the organization (Shao et al. 2012).

Effective implementation of ERP systems requires extensive adaptation of the employee's current business processes to be able to fully utilize the capability of the new systems. New skills and new processes needed when organizations redesign things to use ERP systems require employees to learn new things. New technology sometimes requires complex understanding and mental capabilities that may be difficult to manipulate due to the limited capability of human employees (Chircu and Kauffman, 2000).

ERP users need to be trained to improve knowledge of the ERP system specification and understand how to use the ERP system efficiently (Costa et al. 2016). Specific to ERP project implementation, one major problem of ERP implementation is losing experienced personnel after the project was complete. Hence, the organization can provide education and training to create expertise and knowledge of the personnel within the organization in several aspects; such as understanding the features, and training how to implement the systems.

Research Framework

Previous studies have proposed various frameworks to identify the outcome of ERP implementation success. Information system performance assessment has become essential as it can identify worthwhile of the investment. For instance, Zhang et al. (2005) determined the individual task performance improvement

or user satisfaction from ERP adoption. In addition, DeLone and McLean (2003) measured the IS performance with organization performance level, operating cost, overall productivity improvement, and customer service level. Markus and Tanis (2000) measured ERP implementation success with project metric, operational metric and long-term business result. Ruivo et al. (2014) measured the ERP implementation success with project perspectives (e.g. cost, time, performance, and benefit). However, in the current competitive business environment, the ERP success evaluation should seek to use the improvement and effective measurement as the balanced scorecard, which supports the measurement from various perspectives; financial, customer, internal process, and organization learning. Moreover, the advantage of measuring success with the BSC is that many organizations adopt the BSC to implement business strategy, which information technology investment needs to support and align with business strategy.

Prior work revealed that ERP project team competence, ERP system product quality, vendor knowledge sharing, user involvement, degree of training and communication business process re-engineering, and organization readiness can enhance ERP system success (Wu and Wang, 2006, Bradford and Gerard, 2015). To date, the literatures have been painted a fragmented view about the impacts of ERP implementation success factors on the four key measurements of the BSC. The qualitative pilot research indicates that ERP success factors have the positive impact on each measurement of the BSC, which have similar relationship with the study of Zhang et al. (2005).

The success of ERP implementation can create organization learning and innovation (Nwankpa and Roumani, 2014). The first hypothesis is:

H₁: The higher level of ERP implementation success factors, the higher level of organization learning and innovation.

ERP implementation success factors can enhance internal process improvement. For instance, business process re-engineering during ERP implementation can enhance internal process improvement (Bradford and Gerard, 2015). The second hypothesis is:

H₂: The higher level of ERP implementation success factors, the higher level of internal process improvement.

Success factors of ERP implementation enhance employee satisfaction. For instance, Kanellou and Spathis (2013) determined user satisfaction from ERP adoption. The third hypothesis is:

H₃: The higher level of ERP implementation success, the higher level of employee satisfaction.

Ruivo et al. (2014) revealed that the ERP implementation success can decrease operational cost and increase organizational benefit. The fourth hypothesis is:

H₄: The higher level of ERP implementation success factors, the higher level of financial benefits to the organization.

Methodology

Survey research was applied to collect data from large private and public companies that have already implemented large scale ERP (e.g. SAP, ORACLE). The questionnaire content was divided into three sections. In section one, the questions about ERP implementation success factors are measured by a Likert's scale ranging from 1 = strongly unimportant to 6 = strongly important. Section two consists of questions to measure the balanced scorecard of the ERP implementation results by a Likert's scale ranging from 1 = strongly disagree to 6 = strongly agree. The sample selection method is judgment sampling, with respondents chosen from large private and public companies. Data collection proceeded by calling the targeted manager from each firm in order to inform them about the study and to encourage

them to respond. 290 questionnaires were sent out. Consequently, a total 275 questionnaires were collected with 94% response rate. Table 1 indicates the characteristic of respondents. The average ERP usage duration of ERP products (e.g. Oracle, SAP, As400 etc.) is about 5.96 years.

Characteristics	N	%
Organization type		
Private	196	71.3
Public	51	18.5
Government	28	10.1
Work department		
Accounting	66	24.0
Finance	22	8.0
Marketing	14	5.1
Production	9	3.3
Sales	22	8.0
Administration	8	2.9
IT	79	28.7
Human resources	28	10.2
Others (e.g. logistic, purchasing)	27	9.8
Position		
Top management	7	2.6
Middle management	28	10.3
Primary management Level	89	32.8
Operation level	147	54.2
ERP product		
Oracle	87	31.6
SAP	155	53.0
AS400	2	0.7
DANAOS	13	4.8
People Soft	6	1.4
Others	2	0.8
Average ERP usage duration = 5.96 Years		

Table 1. Respondent Profile

Analysis

Exploratory factor analysis was conducted in order to examine the ERP implementation success factors. The result showed eight success factors: project management competence, ERP knowledge sharing, ERP system quality, communication with understanding, user involvement, business process re-engineer, top management support, and organization readiness of adopting ERP (Table 2). Table 3 shows the four constructs of the balanced scorecard indicators. The measurement items of each construct showed reliability with high value of Cronbach's Alpha coefficients (Table 2 and Table 3).

Factor score was used to assess the relationship of ERP implementation success factors and the four balanced scorecard indicators. The regression analysis result showed that business process re-engineering and knowledge sharing factors have the positive impact on learning whereas top management support has a negative impact on enhancing organization learning and innovation. Top management support of ERP project is not strong enough to achieve organization learning, especially in the ERP implementation process. Findings show that a higher level of positive management support needs to be employed (Table 4).

Measuring ERP Implementation Success

Factor/Item	Factor Loading	Mean	SD.
Project management competence (Cronbach's Alpha=.816)			
-ERP implementation project leader competence	.766	5.02	.919
-ERP implementation team competence	.650	4.94	.871
-A clear ERP implementation project management Plan	.638	5.16	.820
-Problems anticipation continuously	.627	5.15	.788
-Careful selection of vendor and software package for ERP implementation	.584	4.93	.843
-ERP software consultants have successfully experiences in ERP Implementation	.528	4.69	.893
Knowledge sharing (Cronbach's Alpha=.852)			
-Knowledge transfer from ERP consultant experiences to the ERP user	.841	4.63	.960
-Knowledge transfer from consultant to project team members by ERP implementation manual	.745	4.74	.858
-Knowledge transfer from consultant s ERP implementation experiences to the project management team	.703	4.70	.903
- Knowledge transfer from project management team to user by ERP implementation manual	.598	4.73	.910
ERP system quality (Cronbach's Alpha=.861)			
-ERP system is able to serve user needs	.796	5.13	.886
-ERP system is able to create report as expected	.783	5.11	.858
-ERP system is easy to use	.753	4.96	.875
-ERP system is generated accuracy data	.706	5.53	.726
Communication with Understanding (Cronbach's Alpha=.784)			
-Communication to Stakeholders to make an understanding of the ERP benefits	.718	4.99	.776
-Communication to stakeholders to aware of the organizational change	.704	5.12	.746
-Communication to Stakeholders to create a positive attitude for the use of ERP	.673	4.92	.799
-Training ERP users to have ability to use	.500	5.07	.784
User involvement (Cronbach's Alpha=.816)			
-User involvement in defining ERP process	.781	4.61	.942
-User involvement in indicate reports requirement	.767	4.83	.826
-User involvement in defining organization's ERP system needs	.730	4.83	.880
Business process re-engineer (Cronbach's Alpha=.810)			
-Reduce process to make organization work faster	.799	5.00	.914
-Improvement of customer service process	.798	4.97	.862
-Reduce process to acceleration of reports generating	.700	4.89	.863
Top management support (Cronbach's Alpha=.750)			
-Top management support throughout the ERP implementation	.808	5.14	.784
-Change management support by top management	.694	5.23	.767
-A clear policy specific to ERP implementation	.664	5.27	.770
Organization readiness (Cronbach's Alpha=.777)			
-Evaluation of IT infrastructure readiness for ERP Implementation	.671	4.89	.806
-Evaluation of employee capability for the use of ERP	.669	4.47	.830
-Evaluation of IT personnel capability for solving anticipation in ERP adoption	.643	4.77	.824

Table 2. ERP implementation success factors

Factor/Item	Factor Loading	Mean	SD.
Organization learning and innovation (Cronbach's Alpha=.862)			
- help employee initiate new idea for process improvement by using IT	.852	4.51	.865
- create new working relationships and information sharing among employee for the use of IT effectiveness	.822	4.46	.767
- encourage employee to continue learning new things	.799	4.31	.904
Internal process improvement (Cronbach's Alpha=.877)			
- support management information to help top management in planning and decision-making	.707	4.85	.887
- accelerate report generating	.861	4.70	.970
- reduce work process	.776	4.67	1.012
Satisfaction (Cronbach's Alpha=.860)			
- create management satisfaction	.873	4.64	.814
- create employees satisfaction	.654	4.58	.917
- create users satisfaction	.659	4.43	.924
Financial benefit (Cronbach's Alpha=.936)			
- create sustainable profitability	.883	4.46	1.103
- reduce costs of business	.834	4.28	1.117
- increase organization revenue	.880	4.22	1.121

Table 3. The Balanced Scorecard indicators

Path from independent variables	Path to dependent variable			
	Organization Learning & Innovation	Internal process	Employee satisfaction	Financial benefit
Project management competence	.074	.050	.234**	.436**
Top Management support	-.163**	-.059	-.061	.272**
Understanding	.096	.067	.072	-.154
User involvement	-.004	-.032	-.025	-.050
Business process re-engineer	.241**	.422**	.219**	.279**
Knowledge sharing	.224**	.081	.115	.254**
ERP system quality	.098	.286**	.159**	.138
Organization readiness	.067	-.068	.036	.001
R ²	.292	.305	.252	.182

** Sig $p < .05$

Table 4. Impact of ERP implementation success factors on the Balanced Scorecard indicators

In the internal process improvement, the results indicate that business process re-engineering and ERP system quality factors have significant effects on improving the internal process of business. Business process re-engineering has the higher impact on internal process improvement. The result of process re-engineering can help a firm to operate more efficiently. Moreover, good project management, business process re-engineering, and ERP system quality can create satisfaction to management, customer, and internal employees. Finally, the contribution of good project management, business process re-engineering, ERP system quality, and knowledge sharing can provide financial benefit to the organization.

There was no significant relationship between organization readiness and the four BSC measurements. User involvement and understanding were also not significantly related to the BSC measurement.

Conclusion and Implications

Large-scale ERP implementation success is very important as the ERP system consolidates accounting and business information across the organization units and enables organization to increase productivity and make effective decisions. The result indicates that large-scale ERP implementation success consists of eight factors. Project management competence consists of a clear ERP implementation project management plan, problems anticipation continuously, ERP implementation project leader competence, ERP implementation team competence, careful selection of vendor and software package for ERP implementation, and ERP software consultants with successful experience in ERP implementation. Knowledge sharing are measured using two explicit and two implicit knowledge items: knowledge transfer from the consultant to project team members by using ERP implementation manual, knowledge transfer from project management team to user by using ERP manual, knowledge transfer from consultant's ERP implementation experience to the project management team, and knowledge transfer from consultant's ERP implementation experiences to the ERP user. ERP system quality is determined by ease of use, the ability of providing accurate data, serving user needs, and creating required reports. Communication with understanding consists of training users to be able to use ERP system more efficiently and communication to organization stakeholders, such as communication to stakeholders to create a positive attitude for the use of ERP, to aware of the organizational change, and benefits of adopting ERP. Three items pertaining to user involvement are user involvement in defining organization's ERP system needs, indicating reports requirement, and defining business process.

In addition, business process re-engineering is determined by three items: business process reduction to make organization work faster, improvement of customer service process, and faster report generation. Management support is identified by top management support throughout the ERP implementation, a clear policy specific to ERP implementation, and change management support by top management. Finally, organization readiness is classified by the evaluation of IT infrastructure readiness for ERP implementation, IT personnel capability for solving anticipation in ERP adoption, and employee capability for the use of ERP. The findings from the study suggest several management issues for organizations that implement large-scale ERP system.

Business process re-engineering is an important factor for achieving the ERP implementation success based on the four BSC indicators. The business process re-engineering factor has a significant impact on creating organization learning, improving business process, enhancing satisfaction, and generating organization long term profit.

Re-engineering business processes requires top management support so that the ERP project team can restructure the business process to achieve the objectives of the ERP investment. This study showed that negative top management support reduced the potential of organization learning dimension of the BSC. This weak point is a concern because of both economic and policy issues. The tangible issue is financial support. The budget for ERP implementation sometimes was not sufficient to cover the software cost, implementation costs, and the development costs of add-on solutions.

Project management competence is also essential. The Project plan must be well defined and with clear milestones. Project team member leader needs high experience and active human resources. Project management should consider selecting the appropriate ERP vendor and consultants so that the ERP implementation can be developed within the schedule and budget. Good project management can determine success based financial benefits and client satisfaction.

In practice, ERP project implementation limits the customization of software, the ERP system development process was sometimes done concurrently with the business process improvement. Hence, the ERP system must be implemented according to the users' needs. The outcome of ERP system must

have suitable modules of business functions, provide accurate and timely information and reports to users at all levels.

Finally, this study integrates prior research on ERP implementation success including an additional factor knowledge sharing. Knowledge sharing has a major impact on enhancing organization learning. Past research observed the effects of knowledge enterprise factors on system implementation (e.g. Shao et al. 2012). Sharing knowledge to relevant users can assist the organization to reduce cost and generate profits in the long run. Implicit knowledge sharing of ERP implementation project needs to be transmitted in the organization. The transfer of knowledge supports organization to become a learning organization.

Although this study was conducted in a context where the respondents are from large organizations, the results provide some valuable suggestions to any firm currently implementing small scale ERP or are considering using the large-scale ERP in the future. Future research can extend the study to SMEs and apply cross-industry samples to broaden the coverage of the study. Research framework can be expanded with constructs driving the ERP implementation success, such as, organization fit and organizational culture influences.

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