

Influence of IS Planning and Change Management on ERP Implementation Success

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ABSTRACT

Enterprise Resource Planning (ERP) system is one of key information technology to shape doing business. ERP adoption characteristics like IS planning and change management before ERP implementation are rising in importance, because of gaining competitive advantage. The purpose of this study is to analyze the impact of the characteristics of ERP adoption on ERP implementation success. From previous researches on ERP adoption and implementation, two characteristics of ERP adoption such as IS planning and change management, and 2 dependent variables such as process innovation and business performance, are identified.

From data collection processes, 122 samples are collected. The results of hypothesis testing show that organizations with IS plan have higher implementation performance than organizations without IS plan. Also, organizations with the process of change management have higher implementation performance than organizations without the process of change management. Also, The interaction effect between IS planning and change management shows bigger impact in ERP implementation success.

Key words : Enterprise Resource Planning, IS planning, change management, ERP implementation success.

1. Introduction

Enterprise Resource Planning (ERP) systems are a key information technology (IT) to shape doing business. ERP systems, sometimes called enterprise systems, are commercial software systems that automate and integrate most of business processes[4]. However, most companies fail to reconcile the organizational or technological imperatives of ERP systems with the business needs of the enterprise

itself[21]. The problem is exacerbated because ERP implementation is more complex due to cross-functional integration, data standardization, adoption of the underlying best practice, compressed implementation schedule, and the involvement of a large number of stakeholders[18].

The organizational reach of ERP systems is wide, and therefore an ERP implementation requires dealing with a very large portion of the business operations of the organization. Since implementing an ERP system is an expensive venture, the technical and managerial challenges of implementing ERP systems are widely researched and analyzed in prior literatures[3][22].

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Some Researchers have identified several key factors that may contribute to a successful ERP implementation [2][7]. However, the problem of assessing the benefits of ERP systems is less well studied and understood despite the observation that the difficulties experienced in measuring the organizational performance of ERP systems are not atypical of most IT projects.

Another important issue about the reason for ERP failures is that the implemented ERP systems did not fit organizational needs[7][15][19][22]. From previous literature, several factors that impact ERP adoptions and implementations were identified[2][10]. Even though some ERP vendors argue that their ERP package can suit and customize most organizations, all information systems are not equal, nor are all ERP packages customized equally. Previous studies suggest that the benefit an organization derives from using IT is dependent on the characteristics of the organization[15]. One major impediment to ERP adoption is the lack of organizational readiness to motivate their employee to use the ERP system. Organization readiness for ERP implementation, defined as the availability of the needed organizational resources[8], is internal ingredient to facilitate the implementation of an ERP system. The lack of organizational readiness to implement an ERP system is critical because of the important factor it motivate the employee participate in the process of ERP implementation and use the ERP system after implementation. For example, when one employee finishes with the order it is automatically routed via the ERP system to the next employee. To streamline the business processes related to order processing, organizational readiness, like IT skill and participation of employee, seems more important than implementing ERP system in an organization.

This paper addresses three key questions: (1) Is it important to prepare IS planning as organizational characteristics for adopting an ERP system? (2) Is it important to perform change management as organizational characteristics for implementing an ERP system? (3) Is it different in organizational performance between organizations that did not IS planning and change management, and organizations that performed IS planning and change management? To examine

these issues, we reviewed past conceptual and empirical studies on ERP adoption and implementation, formulated a research framework to investigate the relationship between the impact factors of IS planning and change management on ERP implementation success, and tested its validity with survey data.

2. Theory and Hypotheses

2.1 Literature Review

According to Willcocks and Sykes[23], effective ERP is about a transforming involving clarifying business strategy and objectives, and designing integrated processes, technologies, information systems and skills to deliver on ERP implementation. Since implementing an ERP system within an organization is a difficult and expensive venture, the technical and managerial challenges of implementing ERP systems have been widely researched and analyzed in several IT theories. Most of this research can be classified ERP related literatures into three kinds of IT research areas.

First of all, Diffusion of Innovation (DOI) theory[17] was applied to ERP studies[3], DOI research has evolved from a focus on variables affecting the adoption or nonadoption of its application[20] to its diffusion with in an organization[14][16]. In the research of ERP system implementation, Bradford and Florin[3] suggest a model that draws upon DOI theory and ERP implementation literature to examine the success factors of ERP systems. Their results show that degree of consensus in organizational objectives and competitive pressure are significantly related to perceived performance. Also, the complexity of the system, training, competitive pressure, and top management support are significantly related to the satisfaction of users using the ERP systems. Competitiveness and top management support for ERP implementation is the important variables that have been consistently identified as the most important factor for IT growth in an organization. Therefore, competitiveness and top management support, from previous studies in DOI theory[3][8], were included in

our research framework as one of the main explanatory factors for ERP implementation.

Second, Organizational Information Process (OIP) theory[5] was applied to ERP studies[6]. OIP research has focused that IT need and capability for resolving uncertainty is the central task in organizational design. In the research of ERP system implementation, Gattiker and Goodhue[6] applied ERP systems to other plants in a firm with various sources or type of uncertainty, including interdependence and differentiation. They suggested that greater interdependence among organizational sub-units is associated with greater benefits from ERP, and that differentiation among organizational sub-units can lead to some significant ERP-related costs. Several factors that facilitate ERP implementation were identified. Among these, IS planning and change management for ERP implementation is the important variables that have been consistently identified as the most important factor for IT capability for resolving uncertainty in an organization. Therefore, IS planning and change management, from previous studies in OIP theory[6], were included in our research framework as one of the main explanatory factors for ERP implementation.

Third, since a review of the IS contingency research, few researcher studying ERP related topics found that the better the fit among contingency variables, the better the performance[7][22]. In particular, as indicated by the misfit examples, there is a need to recognize the unique Asian context when adopting an ERP system, since the embedded business models typically reflect a bias toward western practices[18][22]. The grounded categorization and identification of misfit provides a more accurate basis to budget for contingency funds and allows related change management issues to be adequately planned for[18]. While these perspectives make important contributions to understanding various facets of ERP implementation, there is a need to study more explanation ability of independent variables associated with dependent variables by adopting the factor facilitating the ERP system implementation. Doing so not only gives us a descriptive perspective on the organizational impact of ERP system, but also helps us understanding the context important for ERP

implementation success. Therefore, IS planning and change management were included in this research framework as contingent variables to influence on the extent of ERP implementation success.

2.2 Research Model and Hypotheses

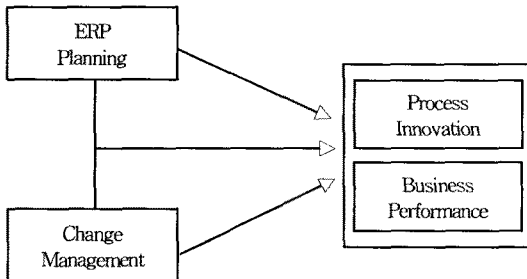
There are two related but distinct research questions: (1) can we achieve the ERP implementation success through IS planning and change management? and (2) can we use IS planning and change management as internal facilitators of ERP implementation to improve the organizational performance of ERP systems? The model we propose in this study and presented in Figure 1 states that IS planning and change management chosen from DOI and OIP literatures and organizational readiness as a moderating variable will influence the balanced organizational performance from four perspectives of the balanced scorecard. In the following sections, we develop hypotheses to support the research model within corporate ERP implementation environment.

IS planning

An industry's competitive environment has a great impact on the firm's strategic decisions to retain competitive advantage within the industry. Information technology is changing the way companies operate and affecting the entire business processes by which companies create their products (Porter and Millar, 1985). An ERP system is a capability that provides the infrastructure to manage information and coordinate activities within the firm to develop more efficient operations and to take advantage of new opportunities. The need to develop and sustain a competitive advantage in the industry is what chooses successful business strategies.

IS planning is one of the most widely cited reasons to implement an ERP system Resource-based view of the firm posits that firms develop unique internal capabilities to gain competitive advantage[1]. When a firm embarks upon an ERP implementation, other firms within same industry prepare better IS plan to eliminate their competitor's advantage as soon as possible[13]. IS

planning increases the likelihood of process innovation and improves information processing capability within an organization. Therefore, organizations with IS plan would feel higher organizational performance than organizations without IS plan, after completing an ERP system to gain a competitive advantage.



<Figure 1> Research Model

H1: Organizations with IS plan will have higher ERP implementation success than organizations without IS plan.

Change Management

In the implementation of an ERP system, the greater the number of modules selected, the greater the integration benefits. However, companies fail to reconcile the technological imperatives of the ERP system with the business needs of the organization itself. ERP can deliver great rewards, but the risks they carry are equally great[4]. Good change management is essential because success in most of ERP implementation projects, is commonly evaluated based on the degree to which time and budget requirements are met[10]. According to Nah et al[10], change management in ERP implementation is about overcoming the issues of difficulty and complexity arising from the use of an ERP system and the resistance of organization members.

Change management in ERP implementation is recognized as one of the greatest factors to influence the behavior of other organizational members and in resource allocation[22]. Organizations with better change management will realize greater organizational performance, because an ERP project begins with clear and concise expectations of what the ERP system will

do for them. Therefore, organizations with change management process would feel higher organizational performance than organizations without change management.

H2: Organizations with change management process will have higher ERP implementation success than organizations without change management.

Interaction Effect of IS Planning and Change Management

In the search for competitive advantage, companies often differ in competitive scope or the breadth of their activities[12]. If a company rushes to install an ERP system without first having a clear understanding of the business implications, the dream of integration can quickly turn into a nightmare[4]. The great appeal of ERP application is that employees enter data only once that information is then available to all the enterprise-wide systems. This means everyone in the company can make decisions based on common, real-time information. In the implementation of ERP software package, it is required to adapt some of its organizational processes to fit the standardized best practices embedded in ERP packages[9].

Before implementing the ERP system, the need to develop and sustain a competitive advantage in an organization is to link business strategy into IS plan and to motivate organizational members to use an ERP system. IS planning and change management is essential to increase the possibility of process innovation and improves information processing capability within an organization. Therefore, organizations with IS plan and change management process would feel higher organizational performance than organizations without IS plan and change management.

H3: Organizations with IS planning and change management will have higher ERP implementation success than organizations without IS planning and change management.

3. Data Analysis

3.1 Data Sampling

In order to include only those firms that were most likely to have implemented an ERP system, the sample was chosen from the firms list supported ERP funds from Small and Medium Business Agency (SMBA) in Korea. The SMBA is the government agency overseeing the promotion of IT use to improve their productivity and competitiveness in all sectors of business in Korea. Through two or three calls we contacted with ERP managers of those firms, we mailed to 450 randomly selected firms implemented an ERP system. Because they had experienced an ERP installation for their own firm, they are appropriate to answer to the questionnaire.

<Table 1> Sample Characteristics

Item	Samples	
Industry	Electronics	48
	Metal/Mechanic	29
	Fabric/Chemistry	11
	Others	31
	Missing	3
Employee	under 50	15
	50 to 100	27
	100 to 300	32
	over 300	48
Sales (million US\$)	under 10M	26
	10M to 50M	37
	50M to 200M	21
	over 200M	37
Job Position of Respondent	Supervisor	5
	Manager	33
	General Manager	61
	Director/Executive	23
ERP Implementation Time	under 3 months	3
	4 to 6 months	26
	7 to 12 months	60
	over 12 months	33

Based largely on the measures from existing literatures, the questionnaire was constructed. We identified the questionnaire items as suitable for the ERP implementation of this study. The final version of the questionnaire was verified and refined by two IS executives who have led their company's ERP project

and two consultants who have extensive experiences in ERP implementation consulting. This procedure made it some modifications of the wording of several survey items. A total of 131 responses were received from an original mailing and a follow-up mailing. Nine responses were eliminated due to missing data, yielding a final sample of 122 employed in the data analysis. The response rate was 29.1 percent. Demographic features of the sample population are in <Table 1>. Two contingent variables were measured as nominal scale and two dependent constructs were measured as multi-item scale, using Likert-type scale, ranging from 1 = strongly disagree to 5 = strongly agree.

3.2 Data Analysis

Instrument validation is a prior and primary process in empirical research. Where possible, constructs were measured using previously developed instruments and multiple indicator items to strengthen validity. The items used for measuring the various constructs were tested for validity and reliability using factor analysis and Cronbach-Alpha test procedure. While validity measures the extent to which the indicator measures the underlying construct, reliability measures the stability of the scale[11].

Content validity of the constructs, which evaluates if all the dimensions of the construct are being measured, was established through the various phases of the pilot testing. Construct validity was evaluated using factor analysis to determine if all the items measuring the construct cluster together and measure a single construct. Initially, the correlation matrix of the items measuring the construct was analyzed to identify outliers that have very low interitem correlations.

Reliability, which measures the internal consistency of the instrument, was assessed using Cronbach-alpha. The alpha values along with the descriptive statistics for all the constructs are given in <Table 2>. As results of reliability test for each construct, the value of Cronbach-alpha test was higher than 0.8. Two dependent variables had a value more than a cutoff value 0.6, which is commonly accepted for empirical research in social science.

<Table 2> Two Factors of ERP Implementation Success

Factor	Measures	Factor Load.	Var.	Mean (Std. Dev)	Cronbach alpha
Process Innovation	Integrated Business Process	.88	82.1%	3.61 (0.75)	0.8317
	Improved Planning and Analysis	.83			
	Reducing Processing Time	.82			
Business Performance	Creating New Customer	.91	75.2%	2.83 (0.74)	0.8896
	Improving Market Share	.89			
	Increasing Profitability	.86			

The characteristics of the sample are shown in <Table 3>. Responses were classified into two groups such as organizations with IS plan and organizations without IS plan, also, organizations with change management and organizations without change management. It provides the meaning to analyze the difference of subgroups by ERP adoption characteristics.

<Table 3> IS Planning and Change Management

Var.	Subgroup	Freq.	%
IS Planning	Org. with IS plan	85	69.7
	Org. without IS plan	37	30.3
Change Management	Org. with Change Mgt.	83	68.0
	Org. without Change Mgt.	39	32.0

3.3 Hypothesis Testing

This study tests three sets of hypotheses: the difference by IS plan, the difference by change management, the difference by interaction between IS plan and change management. In order to test H1, the hypothesized difference of IS plan on ERP implementation success. As a result of t-test analysis, it supports the acceptance of hypothesis 1 at the significance level of 95%. This study tested H2 which are hypothesized the difference of ERP implementation success by a contingent variable such as change management in ERP implementation. As a result of t-test analysis, it supports the acceptance of hypothesis 2 at the significance level of 99%.

<Table 4> t-test Analysis

Subgroup	N	ERP Process Innovation		ERP Business Performance	
		Mean (Std.Dev)	t-value (p)	Mean (Std.Dev)	t-value (p)
Org. with IS plan	85	3.78 (0.63)	4.02 (0.00)*	2.94 (0.74)	2.54 (0.01)*
Org. without IS plan	37	3.21 (0.86)		2.58 (0.71)	
Org. with Change Mgt	83	3.74 (0.67)	2.78 (0.00)*	2.96 (0.74)	2.97 (0.00)*
Org. without Change Mgt	39	3.34 (0.84)		2.55 (0.68)	

* P < 0.5 ** P < 0.01

Subgroup analysis was employed to test H3. First, the entire sample was divided into four sets of two subgroups, according to IS planning and change management positivity. For each set, the corresponding values were considered together so that a similar number of observations could be assigned to each subgroup. Thus, this study proposed a two-dimension box to classify the sample organizations into four type of subgroups, by applying the interaction between IS plan and change management, as shown in Table 5.

To test H3, the four types of organizations, which were classified by interacting between IS plan and change management were identified. This study used GLM procedure for the unbalanced ANOVA and Duncan's multiple range test to distinguish among four groups. GLM procedure for regression analyses provides useful information on significant differences in the relationship among variables. Duncan's test identifies two distinguishable groups for the classified four groups.

<Table 5> Subgroups by Interaction of IS Planning and Change Management

Type	CM	No CM	Total
ISP	Type 1 (n=64)	Type 2 (n=21)	85
	Type 3 (n=19)	Type 4 (n=18)	
No ISP			37
Total	83	39	122

* Chi-Square Test (Value: 6.79, P < 0.01)

The mean values for four types of organizations, are shown in Table 6. Organizations in Type 1 have higher

values than other groups overall. This means that organizations with IS plan and change management have higher business performance than organizations without IS plan and change management. Also, organizations in Type 2 have higher performance than organizations in Type 3 and Type 4. As a result of ANOVA analysis, it supports the acceptance of hypothesis 3.

<Table 6> Subgroups Difference Analysis by Interaction of ISP and CM

Type	Organization Characteristics	N	ERP Process Innovation ¹		ERP Business Performance ²	
			Mean (Std.Dev)	Duncan Test	Mean (Std.Dev)	Duncan Test
Type 1	ISP and CM	64	3.81 (0.67)	A	3.04 (0.72)	A
Type 2	ISP and No CM	21	3.68 (0.52)	A	2.65 (0.73)	AB
Type 3	No ISP and CM	19	3.48 (0.63)	A	2.72 (0.78)	AB
Type 4	No ISP and No CM	18	2.94 (0.98)	B	2.43 (0.60)	B

1) F-value (p-value) : 7.39 (<0.00)**

2) F-value (p-value) : 4.02 (<0.00)**

* Duncan's Multiple Range Test (Alpha: 0.05)

This study has a number of limitations. First, because of small sample size in this study, our findings provide limited implications for testing the hypotheses of implementing an ERP system, thus the generalizability of our results is limited accordingly. Second, two factors like IS plan and change management, which are considered as critical factors for ERP system implementation, are essential to ERP implementation success. However, it needs to develop new construct to manage ERP implementation issues.

This study has implications for IT practitioners and IS researchers in that it provided some explanations of the contingent factors that can influence the achievement of benefits of ERP implementation. Therefore, this ERP related issues need to refine further validation. Because few empirical studies have examined the impact of ERP implementation on organizational performance, there are remained many issues for further research, with the extensions of this study. Because ERP related research is so huge and an interesting area in IS research, it needs to more refine these causal relationships of ERP implementation on the organizational performance.

4. CONCLUSIONS

Based on theories from the organizational information processing (OIP) and diffusion of innovation (DOI) literature, this study developed a model that investigate the difference of ERP implementation success. This study tested the relationship between impact factors of ERP implementation and the ERP implementation success. Results of hypotheses testing showed, in direct effect of research model, that IS plan and change management is significantly related to ERP implementation success. Most importantly, the interacting effect of IS plan and change management revealed that organizational readiness is one of determinants to enhance the balanced organizational performance. These findings lead to the proposal of new construct for future research that integrates OIP and DOI theories into a moderated model of ERP implementation.

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