

# A Study on ERP Package Assessment Model in Business Firms

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**Key words:** ERP, package, buying criteria

## Abstract

Many IT specialists say that ERP (Enterprise Resource Planning) is the best way to manage resources in enterprise effectively. Lots of companies are using ERP solutions in the hope of getting competitiveness and employing global standard business practice. Wishing to take advantage of ERP S/W, companies have a preference for purchasing it and outsourcing ERP project.

This paper focuses on ERP Package assessment model in business firms. This paper finds out what differences there are in purchasing ERP S/W for organization characteristics and building characteristics, and suggests some guidelines of S/W development to vendors. The results would be strong implications for ERP vendors. Especially this paper identifies what the reasons and the checkpoints are when firms introduce ERP S/W. To do this, this paper uses empirical data obtained from companies in South Korea and analyzes it using statistical software.

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## I . Introduction

In today's increasingly complex business environment, we have seen that lots of firms are trying to build an effective information system. Amid mounting concern over getting competitiveness and employing global standard business practice, business firms are building ERP, which makes them more competitive in their markets. Wishing to take advantage of ERP S/W, companies have a preference for purchasing it and outsourcing ERP project. Implementing an Enterprise Resources Planning (ERP) solution in business firms is a major challenge. It requires flexibility of mind from both the client company and the vendors [Kumar and Hillegersberg, 2000; Soh et al, 2001].

ERP package is a set of applications that automate finance and human resources departments and help manufacturers handle jobs such as order processing and production scheduling. ERP systems are notoriously complex, and installing the software often force users to change their internal processes. Recently ERP vendors are branching out into applications such as supply chain management, sales force automation, and CRM.

The goal was a simple implementation of ERP S/W to meet the company's key business drivers, providing definite improvements over the current systems in

key areas. But lots of companies were still doubtful at the end of the evaluation process whether the systems had resulted in any significant positive financial benefits for the business [Kennerley and Neely, 2001].

ERP S/W needs to allow the consultants to cut down quickly the scope of the product to the required functionality and shows the client what their model will look like. The goal is to implement a system that supports the business and becomes virtually invisible.

The difficulties of ERP implementations have been widely cited in the literature but research on the critical factors for initial and ongoing ERP implementation success is rare and fragmented [Nah et al., 2000].

This paper focuses on ERP S/W assessment. This paper finds out what differences there are in ERP S/W assessment by organization characteristics and adoption characteristics, and suggests some guidelines of S/W development to vendors. Especially this paper identifies what the reasons and the checkpoints are when firms introduce ERP S/W. Data for this study was obtained from 232 companies in South Korea and analyzed by statistical software.

## II . Assessment Criteria and Checkpoints

## 1. Assessment Criteria

Most major organizations use at least one and sometimes several enterprise application packages, sometimes purely for financial and human resource applications, often for core customer management and transactional purpose [Sprcott, 2000].

Many ERP vendors have a strategy to implement the clients. The vendors have to invest in new technologies and methodologies to make it feasible for the re-seller to offer short project lead times and make simple implementations for the company.

Clients must recognize that they have to steer clear of heavy customization when it comes to mapping ERP systems to their companies' business processes. One reason why ERP implementations often fail is that enterprises try to adapt the software to fit unworkable or inefficient business processes.

If lots of up-front programming effort is required to make an ERP system works with a company's processes, chances are the processes should be revamped.

Enterprises need to analyze their business processes with intercompany collaboration in mind, and then optimize them to work cleanly in such an environment. They should be looking to move toward commonly structured business practices and standards such as those of RosettaNet, which defines common methods of executing individual processes.

They might also consider implementing individual modules of an ERP system as business needs dictate—even on a vendor mix-and-match basis, if that affords greater flexibility. United Parcel Service, one of the world's premier technology users, has adopted this approach, its CIO told InternetWeek.

Clients must not look to any piece of software, whether it's monolithic ERP, a big database or a set of personal productivity applications, as a cure-all for problems within a company. Software is nothing more than a tool to help achieve an overriding business objective. If the core strategy and the processes behind it aren't sound, the software implementation will only become more difficult, and the process will become more flawed.

The success of an ERP solution depends on how quick the benefits can be reaped from it. This necessitates rapid implementations, which lead to shortened ROI periods. Traditional approach to implementation has been to carry out a Business Process Re-engineering exercise and define a 'TO BE' model before the ERP system implementation. This led to mismatches between the proposed model and the ERP functionality, the consequence of which was customizations, extended implementation time frames, higher costs and loss of user confidence.

## 2. Assessment Checkpoints

Historically, a common problem when adopting package software has been the issue of misfits, that is, the gaps between the functionality offered by the package and that required by the adoption organization [Soh et al., 2000].

An International Data Corp. (2000) survey reported “users who had implemented ERP systems identified the ability of a vendor to deliver on time and on budget as the most important issues. They also identified the scalability and flexibility of an ERP solution as important. The report stated “ERP vendors aren’t establishing relationships with prospective clients”. But vendors believe that building relationships is an essential part of the solution for clients. Confidence in the solution and the solution provider is an integral part of the buying criteria.

Some of the major players in the ERP software market are devising new approaches to serve the changing business market place, both by improving the ease with which their products can be implemented and by also increasing the flexibility of their product and services packaging. Especially, lots of ERP vendors started to have concern over supplying the Small and Medium Enterprises.

ERP systems have functionality to tackle many areas of a business, as it is the vendor’s goal to make the product as broad as possible, to meet all market needs.

In an SME implementation a strong focus

on the pre-defined goals is needed, as the versatility of the systems makes it all too easy to do things because they are possible rather than necessary. Many areas of ERP systems that are appropriate for large companies with several people functionally responsible for various tasks do not make sense to computerize in a small company where one person is doing the job.

There are various ERP vendors available today such as SAP AG, Oracle, BaaN, Infosystems, People Soft , which offer slightly different features in their products. Some important points to be kept in mind while evaluating an ERP software include:

- Functional fit with the company’s business processes
- Degree of integration between the various components of the ERP system
- Flexibility and scalability
- Complexity; user friendliness
- Quick implementation; shortened ROI period
- Ability to support multi-site planning and control
- Technology; client/server capabilities, database independence, security
- Availability of regular upgrades
- Amount of customization required
- Local support infrastructure
- Availability of reference sites
- Total costs, including cost of license, training, implementation, maintenance, customization and hardware requirements.

### III. Research Model and Hypothesis

ERP package has emerged to offer an integrated IT solution. It is suggested that ERP could facilitate achieving compatibility between task characteristics and technology characteristics [Chung and Snyder, 2000]. ERP package is the dominant strategic platform for supporting enterprise wide business processes. However, it has been criticized for being inflexible and not meeting specific organization and industry requirements. Therefore, it is important to find out ERP package that is suitable for companies.

Bernroider and Koch (2001) found out that a total of 29 different ERP selection criteria have been identified through application of the Delphi method together with students, practitioners and researchers from the Institute of Information Processing at the Vienna University of Economics and Business Administration. Furthermore, they explored that differences in the weights attributed to 12 criteria between small to medium sized and large organizations.

Everdingen et al. (2000) suggested that European midsize companies tend to focus on product characteristics rather than on characteristics of the ERP supplier of the product. The way in which most

organizations select and manage applications is on the basis of business features and functionality [Spratt, 2000].

Therefore, organization characteristics are expected to have influence on the reason of ERP package purchasing and ERP package assessment checkpoints.

**Hypothesis 1.1:** There is no difference in the reason of ERP package purchasing among organization characteristics

**Hypothesis 1.2:** There is no difference in ERP package assessment checkpoints among organization characteristics

As has been argued in Montazemin et al. (1996) and Willcocks and Sykes (2000), the participation of the people, project initiator, decision maker might have influence on software package assessment and adoption. Willcocks and Sykes (2000) suggested that chief information officer (CIO) and the information systems (IS) department had to transform themselves in dealing with the challenges of adopting enterprise-wide systems like ERP to the specific needs of their organization. Furthermore, effective IT-based innovations require a high level support and a project champion.

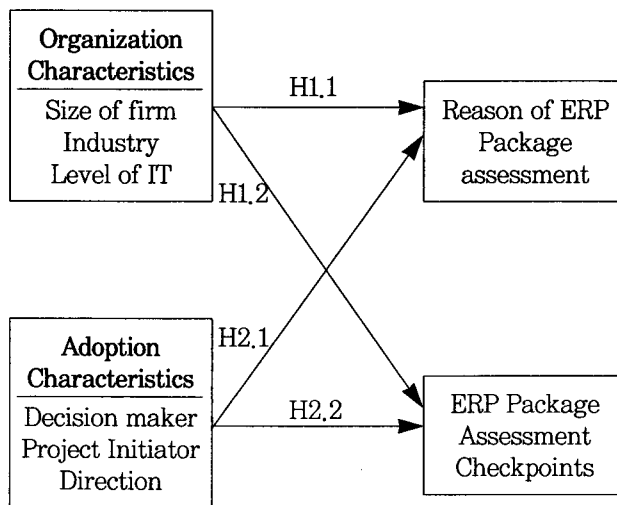
Thus, adoption characteristics is expected to be associated with the reason of ERP package purchasing and ERP package assessment checkpoints.

**Hypothesis 2.1:** There is no difference in the reason of ERP package purchasing among adoption characteristics

**Hypothesis 2.2:** There is no difference in the reason of ERP package purchasing among adoption characteristics

concerning ERP package assessment and develop research instrumentation. The second phase was a survey of key participants in ERP projects for a number of different business firms. They could be executives, managers, administrative

Figure 1 ERP Package Assessment Model



## IV. Research Methodology

This research questions were developed based on ERP related literature and the opinions of field managers knowledgeable in ERP. These questions are aimed at finding out the scope and domain of the factors that influence ERP package purchasing decision.

This study was completed in two phases. The first phase consisted of expert interviews to help identify salient features

personnel, IT personnel, and any other individual involved in ERP project.

### 1. Questionnaire Development

The format for the expert interviews was made from information provided by a group of professors in interview formulation and information gained from a review of ERP literatures. Based on the information collected, an interview format was derived and used to elicit responses from ERP-related expert. And a panel of experts

consisted of 3 people possessing knowledge in ERP in business reviewed the interview format.

Interview topic were ERP concept, the use of ERP as a innovation enabler, methodology of ERP adoption to business firms, influences on organization culture, top manager and personnel's attitude to new technology. The interview focused on identifying and evaluating items of interest for the study. The collection of these items provides content validity in developing the instrument for the items of this study.

The development of the questionnaire resulted from the information collected in the literature review and a content analysis of expert interviews. Based on the interview, a list of preliminary items to include the questionnaire was prepared. And three colleagues who do organizational and IT strategy research reviewed a draft of the questionnaire for clarity, content, and appropriateness of the questions. Experts in Kwnagju-Chonam ECRC (Electronic Commerce Resource Center) reviewed the complete list of preliminary items to eliminate redundant items. A resulting list of items was determined to be the appropriate set of items for the questionnaire.

Based on the resulting list of items, a set of statements of items was developed that reflected the extent that the respondent agreed that an item associated with the purchasing an ERP software. Questionnaire

items formatted as a 5-point Likert Scale. The scale intensity ranged 1(strongly disagree), 2(disagree), 3(neutral), 4(agree), 5(strongly agree) indicating the extent to which the individual agreed that the item actually influenced purchasing ERP software.

To ensure instrument readability and that the research instrument was understandable, a pretest of the questionnaire was conducted using staffs and instructors in the Kwnagju-Chonam ECRC. The recommendations and opinions by these participants in the pretest were evaluated and incorporated into improvements in the questionnaire.

Next pilot study was conducted using practitioners of 30 small companies at Internet Business Incubator and IT-related five small companies. They contained a sample size large enough to provide quality feedback on the format, content, relevancy, clarity, and meaningfulness of the questionnaire. Based on the information gathered from responses to the survey instrument at the pilot study company, a limited amount of additional changes were made to the wording in the cover letter and some of the items on the questionnaire.

## 2. Sample Survey

The population for the survey consisted of participations who were in charge of IT related department and might be able to

influencing on ERP project decision in companies in Korea. Target survey company were identified from the Directory of Korean Business Firms in 2001. A survey was conducted in the summer of 2002 by sending it to a systematic random sample of 978. 232 firms from sampling population responded for this study.

### 3. Profile of respondents

After data from respondents were gathered, it was analyzed using a lot of statistical analysis techniques. Initial descriptive statistics like frequency, basic statistics, Chi-square were used to summarize, consolidate, and report the basic information.

#### (1) Industry Type

The largest number of responses came from the machinery industry, followed by logistic and chemical. Table 1 shows response rate for business firms relative to their primary industries.

#### (2) Firm size

Large firms in which employees are over 300 made up 55.2% of the respondents and medium firms with more than 50 up to 299 employees comprises 24.1% of all respondents. Table 2 details how the frequency for firms' size is.

#### (3) Current level of IT

89.4 of the sampling firms are currently using LAN and WAN to communicate. Most of the companies (85.4%) are interested in the computerization of management and using telecommunication network.

### 4. Factor Analysis and reliability

Before analyzing the reasons and the checkpoints, this paper ran the factor analysis and reliability tests. To further confirm the construction validity of the reasons and the checkpoints, factor analysis was performed. Factor analysis is a method for determining the number and the nature of the underlying factors among larger numbers of measures (scales,

Table 1. Respondent Classification Type of Business (%)

Food & Beverage	Chemical	Machinery	Electronics	Logistics	Construction
5.2	20.7	34.5	8.6	20.7	10.3

Table 2. Number of Full-time Employees (%)

Less than 49(Small Firms)	50 to 299(Medium Firms)	300 or more (Large Firms)
20.7	24.1	55.2



variables). The factor loadings indicate the extent to which each scale is associated with an underlying factor.

During factor analysis, factors with Eigenvalues of at least 1.0 were used to access the number of factors to extract because factors with Eigenvalues of at least 1.0 were considered acceptable [Straub, 1989]. In addition, scree plots were examined to determine the plausible number of factors resulting from the analysis. This plots is applicable when there is a clear last substantial difference between adjacent Eigen values [Cureton, and D' Agostino, 1983]

Two criteria were used to evaluate the factor items: significance of item loadings and simplicity of factor structure. Dimensionality of each of the factors was accessed by examining factor loading. Items with factor loadings of at least 0.4 on factors with which they were hypothesized to load were considered adequate indicators of that factor [Sethi and King, 1991]. The

second criteria caused the elimination of items loading on multiple factors.

Factor analysis was conducted without pre-specifying the number of factors. To achieve a simpler factor structure that can be meaningfully interpreted, an orthogonal rotation was performed in this study because oblique rotations are more complex and is not very clear-cut. And to get a factor structure resulted in each factor representing a distinct construct, the extraction method used in this analysis was Principal Component Analysis with VARIMAX rotation with Kaiser normalization. VARIMAX rotation has a factor structure in which each variable loads highly on one and only one factor. That is, given variable should have a high loading on one factor and near zero loading on other factors [Sharma, 1996].

To extract factors from study variables, factor analysis used orthogonal rotation of VARIMAX as shown in Table 3 and Table 4.

Employing a cutoff level of 0.5, the result

Table 3. Rotated Factor Matrix of the Reasons of Purchasing ERP S/W

Factor	Variable	Factor Loading	Eigen Value	% of Factor	Cumulative %
Employing Global Standard & Increasing Efficiency	Employing Advanced Practice	.890	3,199	39.993	39.993
	Easiness of Upraising Operating Manpower	.890			
	Acquisition of Top-notch IT	.817			
	Saving Building Cost & Minimizing Operation Cost	.706			
	Easiness of SI and Interface	.591			
Maintenance & Stability	Easiness of Maintenance	.917	2,132	26.645	66.638
	Stability	.896			
Project Lead Time	Shortening Project Lead Time	.942	1,282	16.028	82.666

Ballett = 412.091(p=0.000)

in Table 3 show a 3-factor structure with 8 variables loading at that level. The first factor draws from scales related to the Employing Global Standard & Increasing Efficiency. The second factor contains scales related to the Maintenance & Stability i.e. easiness of maintenance and stability. The third factor represents the Project Lead Time. These 3 factors explained 82.666% of all variables. All factor loadings are over 0.5 and all Eigen values are over 1.0.

For this data set, the Bartlett's test statistics is highly significant ( $p < 0.000$ ), implying that), implying that the correlation matrix is not orthogonal i.e. the items are correlated among themselves and is, therefore, appropriate for factoring.

At this factor analysis on the checkpoints in ERP S/W assessment, 3 factors also were extracted from 8 variables. They were named Easiness & Performance, Vendor, and Suitability. These 3 factors explained

84.546% of all variables. All factor loadings are over 0.8 and all Eigen values are over 1.0.

For this data set, the Bartlett's test statistics is highly significant ( $p < 0.000$ ), implying that), implying that the correlation matrix is not orthogonal i.e. the items are correlated among themselves and is, therefore, appropriate for factoring.

To test internal reliability of factors, this paper used Cronbach alpha. Cronbach alphas of at least 0.65 were used to identify factors with high degree of internal consistency of the constructs [Moore and Benbasat, 1991; Straub, 1989]. The composite measure of the reasons and the checkpoints had reliabilities of 0.8 in this sample as shown in Table 5. The six factors were then subjected to the Cronbach coefficient alpha test to determine internal reliability. Four factors were deemed acceptable with coefficient alphas of at least 0.65.

Table 4. Rotated Factor Matrix of the Checkpoints in ERP S/W assessment

Factor	Variable	Factor Loading	Eigen Value	% of Factor	Cumulative %
Easiness & Performance	Easiness of Introducing ERP S/W	.882	3.055	38.185	38.185
	Performance of ERP S/W	.865			
	Success References	.836			
	Business Showings of Supply	.823			
Vendor	Size of Supplier	.940	1.936	24.206	62.391
	Market share	.893			
Suitability	OS	.922	1.772	22.155	84.546
	Use of existing IT resource	.890			

Bartlett = 403.829( $p=0.000$ )

Table 5. The results of Reliability Test

	Factor	Mean Value	Standard Deviation	Crombach alpha
Reasons	Employing Global Standard & Increasing Efficiency	3.9059	.6487	.8820
	Maintenance & Stability	3.5294	.9055	.8908
	Project Lead Time	3.4700	.9800	-
	Easiness & Performance	4.1029	.5468	.9026
Checkpoints	Vendor	3.8235	.5715	.8602
	Suitability	3.8889	.5188	.8372

## V. The Reasons and the Checkpoints

To find out the characteristics of ERP S/W, data obtained was analyzed by a computer statistical package. Especially to analyze the roles of supporting organizations, this paper used frequency and ANOVA. Statistics are presented for exploratory, descriptive, hypothesis testing purpose.

Many business firms are introducing ERP S/W as a tool for strengthening competitiveness and improving customer satisfaction. Many vendors need to make sure why lots of companies want to assess ERP S/W when they build ERP system. And

they also want to know what criteria firms use when they evaluate ERP S/W. The purposes and the checkpoints would be the guidelines that ERP S/W vendor could review when they develop ERP solutions.

### 1. The reasons of ERP S/W assessment

Finding out the reasons of ERP S/W assessment would be a good way to suggest many ERP vendors the direction of developing ERP solutions to meet clients' needs. So, this paper found out the reasons of ERP S/W assessment for the organization and the building characteristics as shown in Table 6 and Table 7.

Table 6. The Reasons of P ERP S/W assessment for Organization Characteristics (Mean Value)

Factor		Employing Global Standard & Increasing Efficiency	Maintenance & Stability	Project Lead-time
Size of Firms	Small	3.7333	3.8333	4.0000
	Medium	4.2500	4.0000	2.7500
	Large	3.8200	3.2500	3.6000
	F Value	3.227**	5.357***	7.625***
Industry	Chemical	4.2000	3.6000	3.2000
	Machinery	3.7000	3.4375	3.5000
	Logistics	3.8000	3.5000	3.6700
	Construction	4.4000	4.0000	4.0000
	F Value	3.731**	.503	1.060
Level of IT	Using PC	4.0000	4.0000	4.0000
	LAN	3.8250	3.6875	3.1300
	WAN	3.9714	3.2143	3.7100
	F Value	.468	3.508**	4.389**

Significance level \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Table 7. The Reasons of ERP S/W assessment for Building Characteristics (Mean Value)

Factor		Employing Global Standard & Increasing Efficiency	Maintenance & Stability	Project Lead-time
Decision Maker	CEO	3.7000	3.45000	3.5000
	Vendor	5.0000	4.5000	1.0000
	Person in Charge	4.0000	4.0000	4.0000
	F Value	8.230***	3.590**	24.790***
Project Initiator	Project Team	4.1333	4.1667	3.6700
	Computer Center	3.8000	3.3750	3.1300
	General Affair	3.6000	3.7500	4.0000
	F Value	1.589	3.769**	3.259**
Direction	Utilization	3.6500	3.3750	3.5000
	Speedy Implementation	4.1000	3.7500	4.0000
	Total Optimization	3.8857	3.7143	3.1400
	F Value	1.192	0.8.3	2.520*

Significance level \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

If the level of significance is relaxed somewhat (i.e.,  $\alpha=0.10$ ), significant differences were founded among firm sizes regarding 3 factors. This finding appears that the reasons of ERP S/W assessment is different for firm sizes. Employing Global Standard & Increasing Efficiency among industries was significantly different at the 0.05 level and Construction shows the highest mean value of 4.4000.

Significant differences are founded among Computerization Level regarding Maintenance & Stability and Project Lead-time. Maintenance & Stability and Project Lead-time among department was significantly different at the 0.05 level.

The result of Table 7 indicates statistically significant reasons for some of the Building Characteristics.

All the reasons differ significantly for decision-makers. When the decision-maker is vendor, they consider Employing

Global Standard & Increasing Efficiency and Maintenance & Stability as the most important reasons of purchasing ERP S/W.

Significant difference was found in Project Lead-time for the ERP driving direction. When users want speedy implementation, they identified the Project Lead-time as the most important purchasing reason.

## 2. The checkpoints in ERP S/W assessment

Table 8 presents the checkpoints in ERP S/W assessment for Organization Characteristics. Medium sized firms identified the Suitability as the most important checkpoint. When project team propels ERP project, they considered Easiness & Performance and Vendor as the most important checkpoint

Table 8. The Checkpoints in ERP S/W assessment for Organization Characteristics (Mean Value)

Factor		Easiness & Performance	Vendor	Suitability
Size of Firm	Small	3.9167	3.5000	3.8333
	Medium	4.2500	3.8750	4.2000
	Large	4.1000	3.9000	3.7500
	F Value	1.287	2.447*	5.785***
Industry	Chemical	4.0500	3.6000	4.2000
	Machinery	4.0625	3.8125	3.6875
	Logistics	4.1667	4.0000	3.6667
	Construction	4.5000	4.5000	4.5000
	F Value	0.873	3.664**	6.545***

Level of IT	Using PC	4.0000	4.0000	4.0000
	LAN	4.0313	3.6875	4.0000
	WAN	4.2143	3.9286	3.7143
	F Value	0.997	1.803	2.720*
Department	Project Team	4.5000	4.1667	3.8333
	Computerization Center	3.9375	3.6250	3.9444
	General Affair	3.8750	3.2500	3.7500
	F Value	4.864**	10.130***	0.569

Significance level \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Table 9 summarizes the checkpoints for decision-maker, project initiator, and direction, in terms of the mean value of 3 factors. When S/W suppliers propel ERP project, Suitability is an integral part of the buying criteria. When the project initiator is project team, clients considered vendor and

easiness and performance as important checkpoints. When clients consider speedy implementation as important ERP adoption direction, they identified Easiness & Performance and Suitability as an integral part of the checkpoints.

Table 9. The Checkpoints in ERP S/W assessment for Building Characteristics (Mean Value)

Factor		Easiness & Performance	Vendor	Suitability
Decision Maker	CEO	4.0500	3.7000	3.7727
	S/W Supplier	4.2500	4.0000	5.0000
	Person in Charge	4.0000	3.5000	4.0000
	F Value	0.236	1.152	17.095***
Project Initiator	Project Team	4.5000	4.1667	3.8333
	Computer Center	3.9375	3.6250	3.9444
	General Affair	3.8750	3.2500	3.7500
	F Value	4.864**	10.130***	0.569
Direction	Utilization	3.6875	3.6250	3.7000
	Speedy Implementation	4.7500	3.7500	4.2500
	Total Optimization	4.0714	3.7143	3.9286
	F Value	11.781***	0.184	3.799**

Significance level \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

## VI. CONCLUSIONS AND IMPLICATIONS

Changing market conditions have shifted the focus of ERP providers toward a more service-oriented approach [Kremers and Dissel, 2000].

The results shown in this paper has strong implications for ERP vendors. The reason of ERP S/W assessment is different for firm sizes. Especially medium sized firms are building ERP in an attempt to employ global standard, increase efficiency, and enhance maintenance and stability. Firms in chemical and construction industry are trying to introduce ERP S/W

to employ global standard and increase efficiency.

Medium sized firms identified the Suitability as the most important checkpoint. When project team buys ERP project, they considered Easiness & Performance and Vendor as the most important checkpoint. When S/W suppliers propel ERP project, Suitability is an integral part of the buying criteria. When the motivation is enterprise optimization, clients considered vendor and suitability as important checkpoints. When clients consider speedy implementation as important ERP building direction, they identified Easiness & Performance and Suitability as an integral part of the checkpoints.

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