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Information Technology Strategic in ERP Success Model

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Abstract: The high level of growth in the use of Enterprise Resource Planning (ERP) has attracted the attention of researchers. The question posed is whether the enormous investment costs for ERP will provide benefits for the company. Therefore, this study will examine the benefits of using ERP systems in several companies in Indonesia using information systems success model. In addition this study also tested whether the factors fit between business strategy and information technology strategy has an influence on organizational performance related to the use of ERP systems. Data were collected by conducting a survey using a questionnaire to 53 Indonesian companies that have been using the ERP system in 2012. The results of the analysis using the PLS method shows that the proposed model has a good validity and reliability. Besides the information system success model can be confirmed for ERP usage as well as the strategic alignment as a factors that have contributed to the organizational impact.

Key words: ERP systems, IS success model, strategic alignment, organizational impact, investment

INTRODUCTION

The high level of growth in the use of Enterprise Resource Planning (ERP) has attracted the attention of researchers. The question posed is whether the enormous investment costs for ERP will provide benefits for the company. Furthermore, the results of previous research indicates that in addition to bringing the successful implementation of ERP is also at risk of failure (Basoglu *et al*., 2007). Therefore, it is necessary for companies to determine the factors that influence success of the ERP implementation.

Previous ERP studies have been done in terms of its effect on the company's performance improvement (Poston and Grabski, 2001). Modifications have been made for e xample by adding a variable on the relationship between the implementation and performance (Hitt *et al*., 2002; Nicolaou, 2004; Matolcsy *et al*., 2005; Nicolaou and Bhattacharya, 2006). Besides, it has also been tested using the information system successful model proposed by Delone and McLean (1992, 2003) namely a study conducted by Lin *et al*. (2006), Ifinedo and Nahar (2007), Chien and Tsaur (2007).

One of the important factors related to the successful implementation of the system is the support of the company's information technology strategy to the business strategy. Given the huge investment in the ERP, the company's information systems strategy factor becomes important. Companies must define their strategy in the proper use of information technology in order to support business processes. In addition the company needs to do careful planning related to investments in information technology to fit the business strategy. Thus, the investment can be beneficial for organization.

Previous research Byrd *et al*. (2006), Chan *et al*. (1997) and Velcu (2010) indicate that the alignment between information technology strategy and business strategy is an important factor with use information technology. The alignment between the information technology strategy with business strategy can affect the overall performance organization. Furthermore, Dehning and Richardson shows that the business strategy to be the factor that moderate the relationship between use information technology and organizational performance. Based on the Dehning and Richardson framework, Velcu (2010) raised the issue of strategic alignment in relation to test the use of enterprise resource planning system with organizational performance. The result showed there is a positive relationship between strategic alignment and organizational performance.

Based on the results of previous studies, this study will examine the benefits of using ERP systems in several companies in Indonesia using information systems success model of DeLone and McLean (1992, 2003). The difference of this study with the previous is at the variable of the system usage which is in the previous studies the system usage measures the user intention in using system whereas in this study the system usage will measures the extent of the actual usage of ERP (Hitt *et al*., 2002; Ranganathan and Brown, 2006; Nicolaou, 2004; Karim *et al*., 2007). Moreover, given the importance of the

issues of information technology strategy for the achievement of the organization's goal, this study will examine the effect of the support of the company's information technology strategy in the ERP system usage and the influence toward the organization's performance.

Literature review: The theory underlying this study is the information systems success proposed by Delone and McLean (1992, 2003). The dimensions to be used system quality, information quality, the extent of ERP usage and the organizational impact. In addition following the assumptions of the contingency theory that the successful of information systems usage is depend on a variety of internal and external factors. This study also apply the conditional factors in assess the efficiency and the organizational impact in term of ERP usage, such as strategy, especially on IT investments that lead to a more effective system.

Previous ERP studies that use the IS Success models generally give the same conclusion that the system quality and information quality contributed to the successful implementation of ERP systems (Lin *et al*., 2006; Chien and Tsaur, 2007; Ifinedo and Nahar, 2007). Therefore, this study will adopt the variable of quality of system and quality of information as a mediating variable between the level of ERP usage and the organizational impact. Previous ERP studies indicate that the scope of use of different ERP will provide different benefits. The use of multiple ERP modules will provide a greater benefit than just using one type of module. Similarly, the use of cross-functional unit will give a greater benefit than the use of one functional unit.

Additionally scope describes the degree of use of the ERP system that will change the managerial autonomy, task coordination and integration processes in the organization's business units. These changes will eventually realize organizational benefits from the use of ERP systems. Besides high usage scope requires a higher authority and participation of the wider organization. Although the huge cost, longer of time of implementation and the possibility of failure is great but the results of previous studies indicate the scope of the ERP implementation greater will produce a positive relationship with the higher returns (Hitt *et al*., 2002; Ranganathan and Brown, 2006; Karim *et al*., 2007).

Based on the results of previous ERP studies related to the extent of ERP usage, this research would adopt the extent of ERP usage variable which is measure through the functional dimension, geographical and organizational (Karim *et al*., 2007). Thus, the formulation of the hypothesis of this study are as follows:

- H_1: There is a relationship between the level of ERP usage and the system quality
- H_2: There is a relationship between the level of ERP usage and information quality
- H_3: There is a relationship between the system quality and organisational impact
- H_4: There is a relationship between the information quality and organisational impact
- H_5: There is a relationship between the level of ERP usage and organisational impact

One of the key success factors of information technology usage is how information technology can support the company's strategic objectives (Al-Mashari, 2003; Papp, 1999; Venkatraman, 1989; Chan *et al*., 1997; Sabherwal and Chan, 2001). Companies that use information technology will gain a competitive advantage because of the support of information technology to their business strategy (Beard and Sumner, 2004). Every company needs to adjust their information technology strategic plan with the company's business strategy. If there is a match the expected use of information technology can affect the performance of the company. Conversely, if the information technology strategy and business strategy are not fit, the company will be unsuccessful in achieving a competitive advantage in the context of information technology investment (Henderson and Venkatraman, 1993).

The result of previous studies on information technology strategy and business strategy providing support to the statement that alignment between IT strategy and business strategy will be resulting in better corporate performance (Chan *et al*., 1997). Similarly in the ERP study gives the same results that a successful ERP project is determined by the alignment of the ERP strategy and organizational strategy (Velcu, 2008). Another study using a variable alignment strategy as a moderating variable indicates that the synergy of business and investment in information technology affect the company's performance. Companies that have alignment in information technology and business strategy can make additional investments in information technology resources and they have the opportunity to receive a great benefit to the organization (Byrd *et al*., 2006). Thus, it can be concluded that the use of information technology by the company must be in accordance with the business strategy in order to create a competitive advantage which in turn will affect the company's overall performance. Companies that successfully adjust business strategy with the strategy of the system, in this case the use of the ERP system will be able to achieve competitive advantage (Byrd *et al*., 2006; Chan *et al*.,

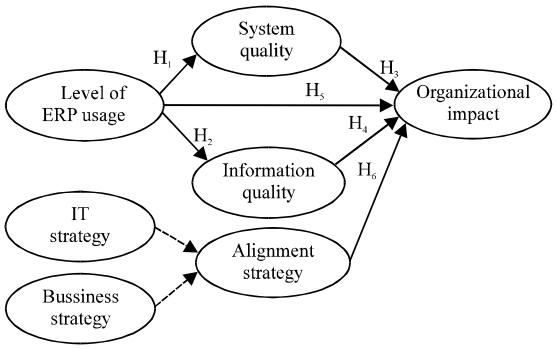

Fig. 1: Research model

1997). Based on these results the alignment of information technology strategy to the business strategy will be used as independent variables in testing the effects on organizational impact in addition to three other variables. Then the research hypothesis can be formulated as in Fig. 1.

- H_6: There is a relationship between the strategic alignment and organisational impact

MATERIALS AND METHODS

This study is an empirical research using primary data obtained through surveys using questionnaires to 53 Indonesian companies that have been using the ERP system in 2012.

Variabels and measurement

The Level of ERP Usage (LOU): The level of ERP usage is a variable that measures the level of ERP use by the company. This measurement was adopted from (Karim *et al*., 2007) which consists of the functional scope, organizational and geographical. This variable was measured using three dimensions. Functional scope, measured by the number of modules used by the organization. Organizational scope, consisting of 4 levels, namely:

- Level 1, for use in the scope of the department
- Level 2, for use in the scope of the division,
- Level 3, for use in all divisions of the company
- Level 4, for use in several companies, including subsidiaries

Geographic scope, consisting of four levels, namely:

- Level 1, if it is used in one region (single site)
- Level 2, if used in several areas (multiple sites
- Level 3, if used on a national scope
- Level 4, if used on the international sphere

System quality: System quality refers to the companie's perception about the quality of ERP system. This variable is defined with 11 statements adopted from Ifinedo and Nahar (2007):

- SQ_1: Our ERP has accurate data
- SQ_2: Our ERP is flexible
- SQ_3: Our ERP is easy to use
- SQ_4: Our ERP is reliable
- SQ_5: Our ERP allows data integration
- SQ_6: Our ERP allows for customization
- SQ_7: Our ERP is efficient
- SQ_8: Our ERP allows for integration with other IT systems
- SQ_9: Our ERP has good features
- SQ_{10}: Our ERP meets user's requirements
- SQ_{11}: Our ERP is easy to learn

The whole question items will be measured using a 7-point Likert scale where 1 is for strongly disagree and 7 for strongly agree.

Information quality: Information quality is a variable that measures companie's opinion related to the quality of information generated by the ERP systems consisting of the following 8 statements adopted from Ifinedo and Nahar (2007):

- IQ_1: Our ERP database contents is up-to-date
- IQ_2: Our ERP has timely information
- IQ_3: The information on our ERP is usable
- IQ_4: The information on our ERP is understandable
- IQ_5: The information on our ERP is important
- IQ_6: The information on our ERP is available
- IQ_7: The information on our ERP is relevant
- IQ_8: The information on our ERP is brief

Organizational impact: Organizational Impact is a variable that measures the benefits received by the company related to the use of ERP consisting of 7 items adopted from Ifinedo and Nahar (2007):

- OI_1: Reduces organizational costs
- OI_2: Improves overall productivity
- OI_3: Provides us with competitive advantage
- OI_4: Increases customer service/satisfaction
- OI_5: Facilitates business process change
- OI_6: Allows for better use of organizational data resource
- OI_7: Supports decision making

Strategic Alignment (SA): Strategic alignment is a variable that measures the degree of conformity between business strategy and information technology strategy of the company. This measurement was adopted from Velcu (2008) where the company's strategy is measured using a variable STROBE-Strategic Orientation of Business Enterprise (Byrd *et al*., 2006; Chan *et al*., 1997). While the company's information technology strategy STROEPIS measured using a variable-Strategic Orientation of the Existing Portfolio of IS application (Byrd *et al*., 2006; Chan *et al*., 1997). From the results of previous research these constructs are known to have good reliability as indicated by the numbers fit indicator above 0.90 and reliability indicators above 0.70 (Byrd *et al*., 2006). Both variables are measured using 8 dimensions (AGgressiveness (AG), Risk Aversion (RA), ANalysis (AN), Internal Defensiveness (ID), External Defensiveness (ED), FUturity (FU), PRoactiveness (PR) and INnovativeness (IN)) with a total of 27 items of statements. Assessment is done by using moderating effect between IT Strategy and Business Strategy (Fit as moderation, Venkatraman, 1989).

RESULTS AND DISCUSSION

Results of descriptive data processing for the observed variables such as the Level of ERP usage, strategy alignment condition and organizational impact are as follows in Table 1.

The actual ERP usage (USE): Number of ERP modules used by companies largely as much as 6 modules but there is still 1 company that uses only 1 module while companies that use >6 modules as many as 33 (62.3%) and only 2 (3.8%) companies that use more than 20 modules. Based on the organizational scope of most companies are at level 4, namely the scope of use in several companies. While geographically most of the companies in the scope of international sphere.

Organizational Impact (OI): Most companies assess each organizational impact on the average value 6 of 7, indicating that the perceived benefit is quite high by most companies except for the benefits of ERP in reducing organizational costs only scored 4 of the scale 7.

Strategic Alignment (SA): To determine the condition of alignment in strategy data analysis done by the paired sample t-test scores between the 2 strategies, SPSS output results as shown in Table 2 showed that there was no significant difference between business strategy and IT strategy for the company sample. To test the hypothesis, this study uses an alternative method of Structural Equation Model-Partial Least Square (SEM-PLS) with SmartPLS 2.0 program. The use of SEM with Smart PLS program in this study because in addition to the limited amount of data that must be processed (small sample) there is also a variable with a formative indicators. Thus our model does not allow mixed with covariance-based SEM are loaded with parametric assumptions and only for a variable with a reflective indicator. Analysis of data using PLS done in 2 stages; namely the evaluation of the measurement model (outer model) and the evaluation of the structural model (inner model).

Stage 1 the outer model: Outer models determine how each indicator associated with the block of its latent variables. Measurement model for variables with indicators reflective such as SQ, IQ, OI and strategic alignment (ITS×BS) will be evaluated by the convergent validity and discriminant validity of the indicators and the reliability of composite indicator blocks while for variable with formative indicators such as LOU, the validity of the measurement will be seen from its outer weight and it's significance (Ghozali, 2011). Convergent validity is a measurement that assesses the consistency between the various operational loading factor. Assessment is done by looking at 2 criteria, namely:

- Each item has a value of loading factor to construct a statistically significant is above 0.7
- Each construct has Averaged Variance Extracted (AVE) above 0.5 (Fornell and Larcker, 1981)

Results of analysis using SmartPLS 2 demonstrate the loading factor value of all indicators reflective >0.6 except for the OI^2 and the SQ_7. All indicators with a value of <0.6 were excluded from the analysis. Furthermore outer weight for formative indicator (LOU) provide a significant value for indicators all indicators (FSC, GSC and OSC). After all indicators are not significant removed, the results of analysis of the second step showed that all the indicators have value loading factor >0.6. Thus all indicators have good validity convergent as well as the value of outer weight of formative indicators have significant results (Table 3 and 4).

The next is to assess discriminant validity of the measurement model based on a cross-loading measurements with the construct because the value of the correlation entire construct and its measurement items is greater than the size on the other construct (Table 3), this indicates that the latent constructs predict the size of the block better than on the size of the other blocks. Thus the model has a good discriminant validity. Hereinafter, test

Table 1: Descriptive statistics for the level of ERP usage and organizational impacto

Laten/Indikator	Description	Mode	Min.	Max.
USE				
FSC	Functional scope	6	1	21
GSC	Geographic scope	4	1	4
OSC	Organisational scope	4	1	4
OI				
OI1	Reduces organizational costs	4	2	7
OI2	Improves overall productivity	6	3	7
OI3	Provides us with competitive advantage	6	3	7
OI4	Increases customer service/satisfaction	6	3	7
OI5	Facilitates business process change	6	3	7
OI6	Allows for better use of organizational data resource	6	4	7
OI7	Supports decision making	5	4	7

Table 2: Descriptive of strategic alignment variable

Strategies	BS	ITS	GAP	Mean	SD	t-value	Sig. (2-tailed)
PR	20.75	20.81	(0.06)	0.18750	1.29686	0.40893	0.69481
RA	19.58	22.04	(2.45)				
ID	17.34	17.25	0.09				
FV	15.62	16.15	(0.53)				
AG	17.04	16.11	0.92				
ED	23.28	21.45	1.83				
AN	17.44	16.43	1.00				
IN	16.93	16.24	0.68				

*BS = Business Strategy; ITS = Information Technology Strategy

Table 3: Convergent validity and discriminant validity stage 2 for reflective indicators

Variables	BS	Q	ITS	LOU	OI	SQ
AAG	0.878	0.645	0.775	0.813	0.723	0.743
AAN	0.875	0.586	0.778	0.804	0.659	0.638
AED	0.823	0.571	0.770	0.835	0.718	0.650
AFV	0.614	0.450	0.530	0.476	0.395	0.453
AID	0.826	0.693	0.712	0.887	0.637	0.696
AIN	0.851	0.578	0.796	0.843	0.697	0.636
APR	0.714	0.454	0.603	0.585	0.459	0.509
ARA	0.745	0.505	0.668	0.603	0.488	0.499
AAGIT	0.779	0.527	0.843	0.759	0.742	0.633
AANT	0.818	0.651	0.887	0.739	0.773	0.738
AEDIT	0.772	0.452	0.896	0.749	0.719	0.571
AFVIT	0.775	0.611	0.884	0.719	0.699	0.677
AIDIT	0.765	0.747	0.812	0.807	0.704	0.714
AINIT	0.748	0.602	0.838	0.683	0.695	0.665
APRIT	0.616	0.341	0.748	0.600	0.494	0.444
ARAIT	0.780	0.688	0.886	0.719	0.737	0.763
IQ1	0.548	0.822	0.512	0.513	0.566	0.753
IQ2	0.653	0.891	0.629	0.643	0.592	0.801
IQ3	0.533	0.697	0.411	0.495	0.425	0.634
IQ4	0.568	0.855	0.525	0.539	0.567	0.782
IQ5	0.511	0.731	0.584	0.530	0.584	0.692
IQ6	0.629	0.817	0.599	0.686	0.642	0.738
IQ7	0.650	0.908	0.606	0.636	0.634	0.798
IQ8	0.570	0.850	0.630	0.542	0.607	0.810
OI2	0.530	0.589	0.548	0.604	0.824	0.671
OI3	0.629	0.506	0.755	0.612	0.837	0.602
OI4	0.546	0.516	0.586	0.585	0.841	0.644
OI5	0.575	0.346	0.714	0.556	0.749	0.499
OI6	0.565	0.517	0.513	0.534	0.614	0.619
OI7	0.700	0.768	0.678	0.658	0.740	0.763
SQ1	0.627	0.853	0.642	0.621	0.714	0.873
SQ10	0.575	0.871	0.627	0.581	0.640	0.856
SQ11	0.566	0.852	0.554	0.551	0.514	0.804
SQ2	0.528	0.605	0.588	0.506	0.593	0.738
SQ3	0.536	0.515	0.517	0.474	0.526	0.660
SQ4	0.514	0.684	0.463	0.526	0.537	0.743
SQ5	0.544	0.506	0.509	0.525	0.706	0.645
SQ6	0.486	0.518	0.539	0.438	0.512	0.674
SQ8	0.627	0.701	0.524	0.658	0.502	0.653

Table 3: Continue

Variables	BS	Q	ITS	LOU	OI	SQ
SQ9	0.621	0.565	0.677	0.532	0.743	0.681
FSC	0.812	0.558	0.760	0.815	0.646	0.599
GSC	0.778	0.552	0.748	0.835	0.676	0.616
OSC	0.795	0.643	0.672	0.867	0.632	0.648

Table 4: Outer weight value for formative indicators

Variables	Original sample (O)	Sample Mean (M)	SD	SE	t-statistics (|O/STERR|)
FSC->LOU	0.258	0.255	0.087	0.087	2.975
GSC->LOU	0.426	0.439	0.105	0.105	4.053
OSC->LOU	0.501	0.486	0.107	0.107	4.672

Table 5: Reliability and R^2 test result

Variables	AVE	↓AVE	Composite reliability	R^2	Cronbachs alpha
BS	0.633	0.796	0.932	-	0.916
IQ	0.679	0.824	0.944	0.492	0.931
ITS	0.724	0.851	0.954	-	0.945
ITS×BS	0.785	0.886	0.996	-	0.996
LOU	-	-	-	-	-
OI	0.595	0.771	0.897	0.797	0.860
SQ	0.543	0.737	0.922	0.549	0.904

Table 6: Path coefficient value

Variables	Original sample (O)	Sample Mean (M)	SD	SE	t-statistics (|O/STERR|)
BS->OI	0.112	0.128	0.204	0.204	0.550
BS*ITS->OI	-0.858	0.824	0.430	0.430	1.999
IQ->OI	-0.297	0.290	0.120	0.120	2.470
ITS->OI	0.926	0.901	0.305	0.305	3.035
LOU->IQ	0.701	0.714	0.048	0.048	14.752
LOU->OI	0.653	0.640	0.105	0.105	6.243
LOU->SQ	0.741	0.756	0.036	0.036	20.324
SQ->OI	0.757	0.737	0.142	0.142	5.349

is to test the reliability of measurements seen from the composite reliability block indicator. Composite reliability measure a assessed reflexive construct of internal consistency. Results of analysis using SmartPLS2 shows the model has a good internal consistency for all the variables have composite reliability values >0.7 (Table 5).

Stage 2 the inner model: After assessing the outer model, the second stage is to assess the structural model or inner models by looking at the value of R^2 for latent constructs and the value of the path coefficients. The results of the analysis using SmartPLS2 provide the value of R^2, respectively to OI, SQ and IQ of 0.797, 0.549 and 0.492. This shows that the three exogenous variables SQ, IQ and the interaction of ITS and BS together explained 79.7% of the variation of the OI (Organizational Impact). This value indicates the strength of a substantial explanation by Chin (1998) and this means that the endogenous variables OI could significantly explain the variation of the models that shape it. The model of path analysis and research hypothesis testing can be seen in Fig. 2.

Second information obtained through the coefficient parameter relationships among latent constructs as well as

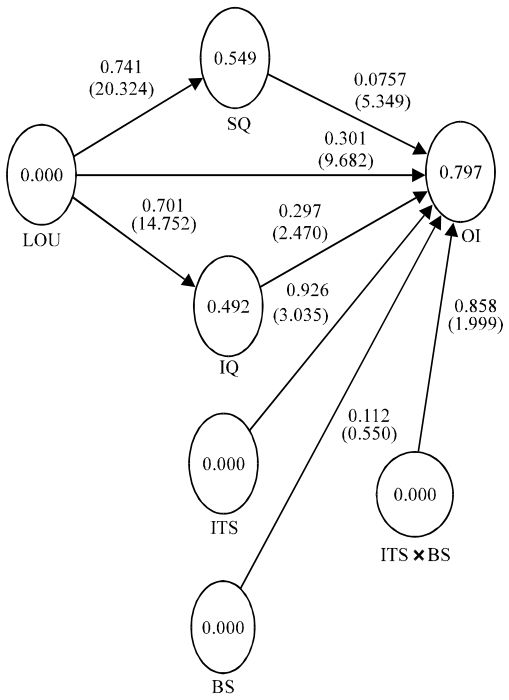

Fig. 2: Full model

the significance of the coefficient values. By doing bootstrapping procedure generated path coefficient value that indicates the strength of relationship between the two constructs. Path coefficient values as shown in Table 6 indicate that all path coefficients provide significant value (>1.96). This means that all exogenous variables SQ, IQ, LOU and ITS×BS affect the endogenous variables OI. Thus the whole hypothesis proposed is acceptable.

Based on the results of the data analysis, it was found that the level of ERP use by companies is still low at only 6 modules of 21 modules of ERP. This gives an opportunity for ERP vendors that there are still opportunities for expanding the use of other modules for companies that have implemented ERP. Furthermore, regarding the company's internal conditions related contingency factors namely factor alignment between business strategy and information technology strategy of the company. The results of data analysis showed that most of the companies have reached the fit between the two strategies because the results of the analysis showed no significant difference between the two strategies. This means that companies that have implemented the ERP already have information technology strategy that supports their business strategy.

In accordance with the IS Success Model Theory, the success of information systems is influenced by the quality of the system and the quality of information, the results of this study provide empirical support for such relationships. Further that the level of actual use of information systems has a positive influence on the quality of the system and the quality of information produced. So that the use of different levels will have different impacts on the benefits for the company. Thus the successful of ERP systems usage in this study consisted of the level of the use which is represented by the number of modules used broad geographic reach by the ERP and the range of organizations using ERP, the quality of the system, the quality of information and the factors that moderate the relationship between the use of the system and the benefits to the organization is the strategic alignment.

The results of this study provide empirical support for the model of the IS Success and the research results of Byrd *et al*. (2006). These results indicate that the strategic alignment of the investment in the information technology has an impact on company performance. Similarly, Velcu (2008) who found that the enterprise resource planning projects that have been successfully determined by their alignment in the strategy of Enterprise Resource Planning and organizational strategy.

Dehning and Richardson clearly shows that the business strategy becomes an important factor in the use of information technology so that, it can affect the performance of the organization. Similarly, the results of this study support by Chan *et al.* (1997). Where Chan *et al.* (1997) supports the notion that a company with a high strategic alignment has a better performance. While, the research results Bergeron showed that the alignment in business strategy, organizational structure and information technology strategy as well as information technology structure is positively related to company performance. Thus, the empirical evidence give the same direction to the relationship between the alignment of business strategy and information technology strategy of the company. Where strategic alignment has a role as a moderating factor in assessing the efficiency and performance of the organization in the use of Enterprise Resource Planning systems.

The results of this study contribute to the research related to the use of the enterprise software and its impact for the company. The strategic factor in the use of the information systems or the information technology becomes important, since the implementation of a system will make an impact for the organization. Similarly, the level of the different ERP usage will give a different effect in terms of the benefit received by the company. The higher the level of ERP usage provides flexibility in the processing of the information will thus create greater benefits for the company.

Some of the limitations contained in this study and potentially reduce the justification of the results is the data used is not random. Besides filling the entire item questionnaire based on the opinion of one person representing the company in understanding the entire item in question. A small number of samples in this study does not allow for confirmation model of research that led to the use of partial least square method. As a consequence use of the partial least square can only present a prediction model and not for estimate the value of the parameter. Thus resulting in justification of the research results can not be generalized to the overall population's behavior.

Given the limitations of this study, it is suggested for further research in addition to evaluating strategicalignment measurement related to the use of Enterprise Resource Planning systems. Additionally conduct group discussion techniques in addition to interviewing techniques to obtain the information related to the level of the ERP usage, business strategies and strategies for information systems or information technology companies.

This is done considering the scope of the use of the ERP system wide. Besides considering the size of companies vary on this study that the scale of use, it is necessary also evaluated the effect of company size on the level of use of Enterprise Resource Planning system and its influence on the company. Based on the results of previous studies also indicated the existence of a factor that determines the success of the implementation and contribute to organizational performance. This is because the required implementation time vary from one company to another company or between types of vendors with each other vendors.

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