

Operational Effectiveness Measurement on ERP Implementation at PT ZZR

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ABSTRACT

Objective – To understand what impact ERP has on the company and help evaluate ERP implementation using the DeLone & McLean method.

Methodology – This research uses Quantitative method research distributed to 104 end users.

Findings – The results of the study found points that after measuring the effectiveness of ERP operational activities at PT ZZR and analysis of the data obtained, it can be concluded that the factors that affect the effectiveness of the implementation are the quality of the information produced, the level of user satisfaction is good and has a net benefit for ERP users.

Novelty – From the effectiveness measurement, it is expected that the company can find out that the costs and time spent are proportional to the effectiveness and benefits obtained by the company and assist the company in evaluating the implementation of ERP in the company.

Keywords: ERP; ERP modules; effectiveness; implementation; quantitative

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I. INTRODUCTION

ERP is an information system model That allows organizations to automatically implement and integrate the firm's business process (Amri et al., 2013). ERP can also be defined as a technique and concept that can be implemented for the integration of business management system It can be used to efficiently manage available resources, with the goal of increasing efficiency for the company (Kurniawati et al., 2015). According to definition of ERP as mentioned above, we can conclude that ERP is an information system concept that can support the main business process of the firm as well as the integration of various business function within it. ERP has the advantage in reducing the process of activities within the firm, facilitating the interaction between unit and/or division, enable easier access to real-time information while gathering reliable and accurate data from the system (Kurniawati et al., 2015). This is done by recording the flow of business resources and the status of business activities as new order, order in process, dan finished order.

Among the various types of information systems used within a firm, ERP is an investment that can be categorized as expensive in terms of the time consumed & costs involved in its implementation Enterprise Resources Planning (ERP) furthermore, such a costly investment does not guarantee that the company can obtain a system that matches with the expected quality and requirements that the firm needs (Martono, 2012). Oftentimes, the ERP that the firm acquired is far from their expectations (Nawawi, 2018). From this study, it can be known whether the costs and time expended by the company to implement ERP, is equivalent to the operational effectiveness that they expected from it.

Also, the researchers use DeLone & McLean method to measure the effectiveness felt by the ERP users of PT ZZR. This method originally contains 6 variables, which includes the quality of system, information quality, intention of use, user satisfaction, individual impact, organizational impact. However, in 2003, DeLone & McLean continued to develop and transform these variables, to become quality of system,

information quality, use, user satisfaction, service quality, net benefits. The formulation of problems that will be discussed in this study are: (1) What are the variables that are impacted by the ERP system implemented in PT ZZR? (2) How effective is the ERP system that PT ZZR uses?

II. LITERATURE REVIEW

Enterprise Resource Planning

ERP system is a combination of application modules that is used for accounting, distribution, sales & marketing, material management, human resources, logistic and many more ERP helps organizations in managing their business while increasing productivity and providing other benefits for the firm (Hidayat & Witjaksono, 2017). ERPs are both a concept and a system that, in theory, entail the integration of business processes inside an organization, resulting in enhanced order management and control, accurate inventory data, improved workflow and SCM, and better standardization of business and best practices (Nazemi et al., 2012). Benefits of using ERP system include helping the company system to become more integrated, to achieve better organisational decision making, to manage ongoing operations, to manage the implementation of business process, to facilitate better communication within the firm, internally & externally, and to help ease the usage of technology and application within by the firm (Amri et al., 2013).

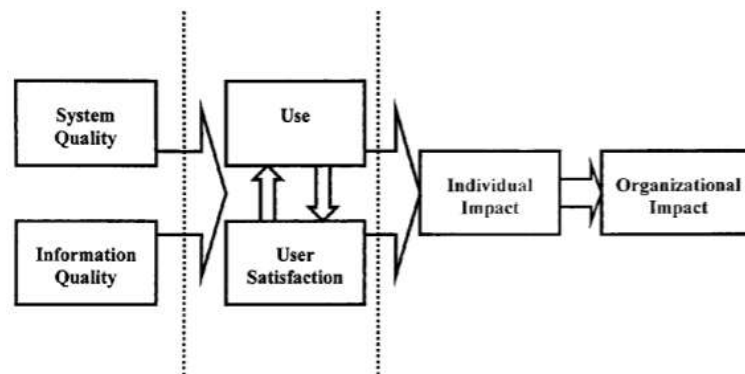


Figure 1. DeLone & McLean Information Systems Model

Measuring the Success of Information System

According to DeLone & McLean, a successful implementation of information system is shown in a framework that is known as the D&M IS Success Model that is shown in the figure below (Salim, 2014). These six characteristics of success are suggested to be interconnected rather than autonomous based on both procedural and causation factors with significant consequences for empirical studies on IS success assessment, analysis, and reporting (DeLone & McLean, 2003). According to a temporal process model, an IS is initially constructed, comprising numerous attributes that can be classified as varying degrees of system and information quality. The system's features are then experienced by users and managers, who are either satisfied or unsatisfied with the system or its information products. The individual user is then impacted or influenced by the system and its information products in the course of his or her work, and these individual impacts collectively result in organizational impacts. Figure 1 shows the D&M IS Success Model. The picture depicts DeLone & McLean's model which incorporates variables that are used to assess the success of an information system:

1. System Quality, to measure the quality of the system.
2. Information Quality, to measure the quality of information that is produced by the information system.
3. Service Quality, to measure the quality of customer service provided by the vendor.
4. Use, to measure the usage of the output from the information system, as well as user's interest and acknowledgement of the system's value.

5. User Satisfaction, to measure the response of users satisfaction towards the output from information system.
6. Net benefit, to measure the benefits of the information that is received by users, in terms of performance. The performance of information system refers to the goal of the system in increasing user's knowledge while facilitating better communication within the company.

III. METHODOLOGY

In this study, the total end-user listed in this study numbered 104 people. This amount of users satisfy the requirements of this study, which relies on the Slovin formula to determine the minimum number of participants needed, Questionnaires are made using Google Form, written in Indonesian, which are then distributed to users, by the IT head of division from PT ZZR.

The data is then extracted using SPSS, which is then subjected to (1) Validity Test used to state the extent to which the data contained in a questionnaire will measure what you want to measure. (2) Reliability Test. Determine the extent to which a measurement result is relatively consistent when the measuring instrument is used repeatedly. If the test results state that the data is eligible, then the data can then be processed. Data processing is done by recapitulating general data from the questionnaires given to respondents, recapitulating the assessment data of questionnaire results, finding success scores, and conducting correlation tests on each variable and dimension that exists with the help of the SPSS.

The next step involves the analysis of SEM data, where the linearity test will be used to identify the relationship between the dependent and independent variables, to see if it is already linear. Following this is the normality test to identify whether the data has been normally distributed. In the next step, the Outlier calculation is performed on the data while gathering observations with the help of AMOS software and the results of outlier test is explained Mahalanobis Distance or Mahalanobis d-squared. An outlier observation is made when the mahalanobis > chis square tabel or score $P1, P2 > 0.001$. The next step is to analyze Goodness of Fit where analysis is made using AMOS software. Afterwards, the causality test is performed with the purpose of knowing the accuracy of the variables and the relationship between the variables.

The data is gathered from a company that provides vehicles accidents insurance. The data contains the user's gender, age, department and management level. From the data gathered, it can be seen that out of 104 participants, there are 64.2% male, 35.8% females. Regarding the age of respondents, 23.6% are within 21-30 age, 45.3% is within 31-40 age, 23.6% is within 41-50 age, 7.5% is within 51-55 age. Regarding the department of respondents, about 15% comes from the department of Human Resources, 29% comes from the department of Finance, 22% respondent comes from department of Accounting, 16% comes from the department of Operations, and 18% respondents comes from department of Customer Service. Meanwhile, in terms of management level, the data gathered includes 67 staff, 14 head of department, 14 managers and 9 head of unit.

After filling in personal information, the respondents have to answer the questions within the questionnaire, concerning the ERP and the effectiveness of the ERP as perceived by the user, using the scale of 1-5 where 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, 5 strongly agree.

IV. RESULTS AND DISCUSSION

The initial stage involves the literature review. Literature review is used to solve certain problems in the study. The obtained results comes from previous study made by the DeLone & McLean model, which explains the size of population and sample used, the technique of sampling, questionnaire format, validity test & reliability test, and SEM (Structural Equation Modelling) analysis.

The formulation of the problem is made according to the problems that is discovered by literature review, where 1 company decides to implement an information system that costs plenty of time and financial resources.

Table 1. Measurement Table of Success Factors Value

Factors	N	Mean
System Quality	104	3.832
Information Quality	104	4.220
Service Quality	104	3.843
Use	104	4.470
User Satisfaction	104	4.200
Net Benefits	104	4.225

The minimal sample required for this study is 89 respondents, according to the Slovin formula, but 104 was acquired. The next step is the tabulation process of the data, where the results of the tabulation is displayed with the average gathered by each variable. Summary of the data can be seen from Table 1.

Table 2. Validity Test

Construct	Item	R-value	R-table	Description
System Quality	X1.1	0.671	0.1927	Valid
	X1.2	0.670	0.1927	Valid
	X1.3	0.711	0.1927	Valid
	X1.4	0.437	0.1927	Valid
	X1.5	0.678	0.1927	Valid
Information Quality	X2.1	0.834	0.1927	Valid
	X2.2	0.887	0.1927	Valid
	X2.3	0.857	0.1927	Valid
	X2.4	0.843	0.1927	Valid
Service Quality	X3.1	0.897	0.1927	Valid
	X3.2	0.920	0.1927	Valid
	X3.3	0.895	0.1927	Valid
Use	Y1.1	0.935	0.1927	Valid
	Y1.2	0.942	0.1927	Valid
User Satisfaction	Y2.1	0.907	0.1927	Valid
	Y2.2	0.905	0.1927	Valid
Net Benefits	Z1.1	0.950	0.1927	Valid
	Z1.2	0.950	0.1927	Valid

The validity test is performed with the goal of knowing whether the statement that shows R-value is bigger than the R table with alpha of 0.05, is true. The df value can be seen from the R-table with a value of a 0.05 which is $df = 102 = 0.1927$ (see Table 2).

Among the results of reliability test, only the Quality of System's Cronbach Alpha's value is below < 0.6, which indicates is unreliability, while the rest of the variables has values above 0.6 (see Table 3). This means that the results from the questions that falls under these categories can be used, while the Quality of System items will not be used.

Table 3. Reliability Test

Variable	Cronbach's Alpha	Description
Quality System	0.526	Not Reliable
Quality Information	0.878	Reliable
Quality Service	0.887	Reliable
Use	0.865	Reliable
User Satisfaction	0.782	Reliable
Net Benefits	0.891	Reliable

SEM analysis is performed when the data scored very high in validity and reliability tests. SEM analysis that is performed with SPSS software includes linearity test, normality tests, outlier tests, good of fit, and causality test. On linearity test, it can be concluded that there is a linear relationship between variables that are being tested. The results of normality tests can be seen in Table 4.

Table 4. Normality Test

Variable	min	max	skew	C.R.	kurtosis	C.R.
X2.3	3.000	5.000	-0.327	-1.361	-0.659	-1.371
X3.2	2.000	5.000	-0.098	-0.407	-0.787	-1.638
Z1.2	2.000	5.000	-0.446	-1.859	0.251	0.521
Z1.1	3.000	5.000	-0.269	-1.122	-0.698	-1.453
Y2.2	2.000	5.000	-0.558	-2.324	-0.019	-0.039
Y2.1	2.000	5.000	-0.730	-3.041	1.141	2.375
Y1.2	2.000	5.000	-0.899	-3.742	0.292	0.609
Y1.1	2.000	5.000	-1.302	-5.420	1.372	2.855
X3.1	2.000	5.000	-0.229	-0.951	-0.715	-1.488
X3.3	2.000	5.000	-0.280	-1.167	-0.436	-0.909
X2.4	2.000	5.000	-0.358	-1.491	0.247	0.514
X2.2	3.000	5.000	-0.147	-0.612	-0.563	-1.172
X2.1	2.000	5.000	-0.467	-1.942	0.465	0.969
Multivariate					58.251	15.040

Table 4 shows that the kurtosis value is 58.251 and the critical value is 15.040, which can be concluded that the research data is distributed normally and has multivariate properties. Therefore, it can be used for the next step, which is the modelling of SEM, as it has a kurtosis value that is larger than the critical value. The results of the outlier test is explained using the Mahalanobis Distance or the Mahalanobis d-squared. An outlier result can be observed when the mahalanobis > is bigger than the chi square table or the value of $P1, P2 > 0.001$. From the results of mahalanobis d-squared, it can be seen that the largest value is 47.404, which is smaller than the chi square value, which was 126.574. Therefore, it can be concluded that the data does not contain any outliers and it can proceed to the next step. From the model compatibility test, the results can be shown in Table 5.

Table 5. Model Compatibility Test

Criteria	Value	Calculation	Description
Chi Square	Expected Small	80.813	Good
Significance Probability	≥ 0.05	0.001	Not Good
RMSEA	≤ 0.08	0.090	Not Good
CMIN/DF	≤ 2.00	1.837	Good
TLI	≥ 0.90	0.936	Good
CFI	≥ 0.90	0.964	Good

Table 5 showed that the goodness of fit criteria has been fulfilled, as the results were shown to be mostly satisfy the given requirements, therefore the model that is used can be accepted for the model compatibility test. The causality test is used to identify the accuracy of the variable used and the correlation that exist between each of the variables. The test is performed using AMOS software. After confirming the suitability of the model, the path coefficient of the variables can be used to explain the relationship between the dependent and independent variables. The path coefficient is used to make the hypothesis in the study. The Standards Estimate (SE) value of the output used by AMOS showed that the coefficient value reveals a regression relationship between variables. The probability value shows the relationship between variables. The correlation is considered significant when there is a probability that is lower than 0.05.

Table 6 shows significant correlation between variables used. There is a positive correlation that is significant between variable Quality of Information (X2) and System Usage (Y1), which is proven by the path coefficient value of 0.638, C.R.value of 3,020, with the probability value of 0.003 which is smaller than $\alpha 0,05$. This means that hypothesis H0 is accepted, which explains a positive and significant relationship between quality of information (X2) and System Usage (Y1) was 0.638. No significant relationship was found between the variable Quality of Service (X3) and System Usage (Y1) as the path

coefficient was -0.006, C.R. value was -0.042 and the probability value of 0.966 which was larger than a 0.05. This showed that the H0 hypothesis is not accepted concerning the correlation between these 2 variables. There is a positive correlation that is significant between variable Quality of Information (X2) and User Satisfaction (Y2), which is proven by the path coefficient value of 0.598, C.R. value of 3.791, with the probability value of 0.000 which is smaller than a 0.05. This indicates that there exist a positive relationship between variables Quality of Information (X2) and User Satisfaction (Y2), which signifies the acceptance of the H0 hypothesis. No significant relationship was found between the variable Quality of Service (X3) and User Satisfaction (Y2) as the path coefficient was 0.238, C.R. value was 2.378 and the probability value of 0.017 which was larger than a 0.05. This showed that the H0 hypothesis is not accepted concerning the correlation between these 2 variables. There is a positive correlation that is significant between variable User Satisfaction (Y2) and System Usage (Y1), which is proven by the path coefficient value of 0.329, C.R. value of 3.595, with the probability value of 0.000 which is smaller than a 0.05. This indicates that there exists a positive relationship between variables User Satisfaction (Y2) and System Usage (Y1), which signifies the acceptance of the H0 hypothesis. No significant relationship was found between the variable Net Benefits (Z1) and System Usage (Y1) as the path coefficient was -0.164, C.R. value was -1.185 and the probability value of 0.236 which was larger than a 0.05. This showed that the H0 hypothesis is not accepted concerning the correlation between these 2 variables. There is a positive correlation that is significant between variable User Satisfaction (Y2) and Net Benefits (Z1), which is proven by the path coefficient value of 0.881, C.R. value of 6.431, with the probability value of 0.000 which is smaller than a 0.05. This indicates that there exist a positive relationship between variables User Satisfaction (Y2) and Net Benefits (Z1), which signifies the acceptance of the H0 hypothesis.

Table 6. Coefficient Test

Variable	Coefficient	C.R.	P	Description
Y1←X2	0.638	3.020	0.003	Significant
Y1←X3	-0.006	-0.042	0.966	Not Significant
Y2←X2	0.598	3.791	0.000	Significant
Y2←X3	0.238	2.378	0.017	Significant
Y2←Y1	0.329	3.595	0.000	Significant
Z1←Y1	-0.164	-1.185	0.236	Not Significant
Z1←Y2	0.881	6.431	0.000	Significant

Figure 2 shows the correlation between variables where the correlation of variables is shown by the bold connecting lines, while the non-correlation of variables is shown by light connecting lines. The Quality of Information (X2) variable has a positive correlation with the User Satisfaction (Y2) variable with a value of 0.598. The higher the value of the variable Quality of System (X1), it will cause the value of the variable User Satisfaction (Y2) to increase as well. The User Satisfaction (Y2) variable has a positive correlation with the Net Benefit (Z1) variable with a value of 0.881. The higher the value of the variable User Satisfaction (Y2), it will cause the value of the variable Net Benefit (Z1) to increase as well. The Quality of Information (X2) variable has a positive correlation with the System Usage (Y1) variable with a value of 0.638. The higher the value of the variable Quality of Information (X2), it will cause the value of the variable System Usage (Y1) to increase as well. The Quality of Service (X3) variable does not have a correlation with System Usage (Y1) variable, which indicates that any changes to Quality of Service (X3) variable will not affect the System Usage (Y1) variable. The Quality of Service (X3) variable has a positive correlation with the User Satisfaction (Y2) variable with a value of 0.238. The higher the value of the variable Quality of Service (X3), it will cause the value of the variable User Satisfaction (Y2) to increase as well. The System Usage (Y1) variable does not have a correlation with Net Benefit (Z1) variable, which indicates that any changes to System Usage (Y1) variable will not affect the Net Benefit (Z1) variable. From the previous explanation, it was discovered that variable User Satisfaction (Y2) variable has a strong correlation with Net Benefits (Z1) as the correlation value reaches 0.881.

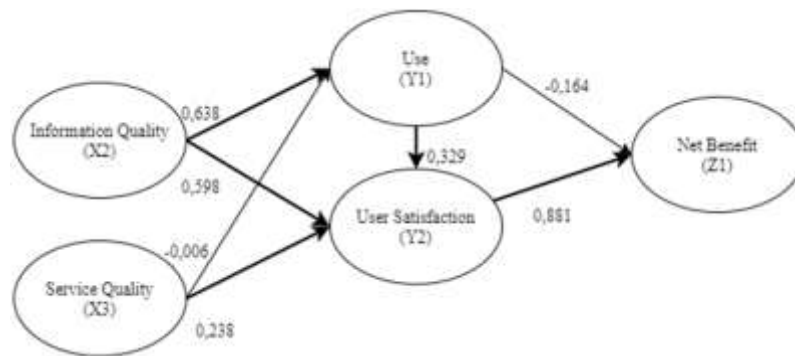


Figure 2. Framework Model

The highest mean value revealed the perception of the respondent that is based on the conditions of the current study, while the loading factor values showed the things that is needed to be done better, for the ERP to have greater benefits to PT ZZR. The User Satisfaction variable revealed that the respondent's answer to the question "Are you satisfied with the change brought about by the ERP implementation" has the highest loading factor and mean scores, which showed that the user is most satisfied regarding this variable. For the Net Benefits variable, the respondent's answer to the question "Do you feel that ERP has reduced the amount of time needed to perform job tasks?" reveals very high mean scores, which means that the users strongly felt that ERP has greatly reduced the amount of time needed to complete tasks. Meanwhile, the question "Do you feel that the ERP system increases your productivity in completing work tasks?" has the highest loading factor score, which means that this area has room for improvement in the future. Variables that are not correlated with other variables does not indicate a negative impact on the implementation of ERP. This can be seen from the tabulation of data from the results of the questionnaire where the average scores from the respondents showed that they highly agree towards every variable, with only a few questions producing low scores. There is a probability that this was caused by the lack of understanding of ERP users and it can also be caused by users who are only focused on their routine of using ERP, thus neglecting other variables, which includes system's quality and quality of service whose benefits have not been experienced by the users.

V. CONCLUSION

From the data that is gathered and then extracted to analyse the operational effectiveness that is felt from the implemented ERP system, as well as the results of the data extraction & data analysis of the researcher, it can be concluded that operational effectiveness from the ERP implementation in PT ZZR is influenced by the quality of information that is produced, level of user's satisfaction and the net benefits for the user. Also, the accuracy and completeness of information, represented by the Quality of Information variable has a large impact on the operational effectiveness. Finally, PT ZZR's ERP implementation can be considered as effective due to the supporting variables such as quality of information, user's satisfaction and net benefits.

According to the results of the discussions mentioned previously, the author suggests PT ZZR to increase the resources for the IT department, in terms of the number of IT personnel within the company as well as employing additional IT training for the employees to allow them to better adjust to the ERP system. In addition, it is recommended for the company to achieve better compatibility between the firm's daily business process and the business process provided by the ERP.

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