

EVALUATION OF SUCCESSFUL ERP-BASED INFORMATION SYSTEMS WITH DELONE AND MCLEAN INFORMATION SUCCESS MODEL

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ABSTRACT

Private companies in case studies are engaged in companies that provide goods and services in the field of IT (Information Technology) and use ERP (Enterprise Resource Planning) as a solution to carry out the company's operational activities. The private company that is the site of a new case study was established in 2015 and only has about 60 employees. The costs incurred by the company for ERP implementation are significant, while the implementation results have never been evaluated or measured. Therefore, it must be re-evaluated to find out what factors can affect the success of the implementation with the expected results of ERP as a basis to add new modules if needed. DeLone and McLean's success measurement method is used as a modelling in researching with six measurements: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organization Impact. The sample that will be the object of the research is as many as 30 people, and the data taken is processed using SmartPLS. The results showed that four hypotheses were rejected, and four theories were accepted. The research indicates that ERP Information Quality has a significant influence on Use, ERP Information Quality has a considerable influence on ERP User Satisfaction, ERP User Satisfaction has significant power on the Individual Impact of ERP, and Individual Impact of ERP has a substantial effect on the Impact of ERP Organizations on private companies.

Keywords: *Evaluation, ERP, DeLone McLean, Information Systems, SmartPLS.*

1. INTRODUCTION

The application of information systems is expected to provide convenience for its users today. Companies with complex business processes or many tasks will undoubtedly consider implementing information system-based applications that aim to make the work faster to computerized than being done squinting modifier, which will surely take longer again. Enterprise Resource Planning (ERP) is an integrated information system that aims to accommodate the needs of companies present in various modules according to the ERP implementation [1]. The presence of ERP is a solution for companies that have problems processing so much company data every day.

ERP has proven that an integrated system has succeeded in providing significant improvements in supporting company productivity that produces information faster and with quality satisfactory [2].

A Private Company is engaged in a company that provides goods and services in the IT (Information Technology) field and uses ERP (Enterprise Resource Planning) application to carry out company operational activities. ERP is an application consisting of several modules that are separate from each other. Still, integration can be done to connect from one module to another [3]. ERP operated using the internet network with various modules such as the Accounting Module, Human Resources Module, Sales Module, Inventory Module, Purchase Module, and many other modules [4].

As for Private Company in IT (Information Technology) consulting company founded six years ago and had only been using ERP since 2020, the Private Company uses the Inventory Module, Purchase Module, and Accounting Module. These modules can be adjusted according to your needs to be appropriately used without unused modules in the implemented ERP application. It is hoped that

this implementation can help operational activities at Private companies so that the data processed into information becomes faster and the data produced is of high quality.

Considering how much cost and time is spent investing or implementing an ERP system, a Private Company requires an assessment to measure the success rate of implementing an ERP-based information system to ensure the costs and time spent are balanced with the results provided [5].

The evaluation results that will be carried out aim to provide material for private companies to develop or add modules to the ERP, considering that developing an ERP module requires a lot of costs and a long time. Hence, it takes consideration of valid data. Therefore, the evaluation carried out is expected to assist the Private Company in making decisions to provide or upgrade any modules for ERP.

There is a method of measuring. DeLone and McLean are here to help companies measure success to become evaluation materials. DeLone and McLean's success measurement method, there are 6 (six factors) measures of information system success [6]. The six factors are System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organization Impact.

Previous studies also use DeLone McLean to measure the success of information system implementation, but there are different variables used. The variables are intention to use, service quality and also the company's image [5].

The method used in measuring the success of DeLone and McLean to be carried out is Field Research with the following stages, gathering Literature Studies, making a list of questions, carry out data collection. Analysis of data collected, Discussion of analyzed data, and Conclusions and suggestions [7].

Research Question

1. Does the ERP System Quality have a significant influence on ERP Use at Private companies?
2. Does ERP System Quality have a significant influence on ERP User Satisfaction at Private companies?
3. Does ERP Information Quality have a significant influence on ERP Use at Private companies?

4. Does ERP Information Quality have a significant influence on ERP User Satisfaction at Private companies?
5. Does ERP User Satisfaction have a significant influence on ERP Use at Private companies?
6. Does the Use of ERP have a significant influence on the ERP Individual Impact at Private companies?
7. Does ERP User Satisfaction have a significant influence on ERP Individual Impact at Private companies?
8. Does the ERP Individual Impact have a significant influence on the ERP Organization Impact at Private companies?

The objective of this research is:

1. To provide information to Private companies, whether ERP has shortcomings that will reduce the success of its implementation based on six ERP success factors in information systems by DeLone and McLean's.
2. It can be considered for other companies that will implement ERP.

2. THEORETICAL FRAMEWORK

2.1 Information System

Information System (IS) is a system that exists in an organization that processes some data, which can be in the form of daily transactions from the organization to achieve the vision and mission of the organization where the system produces information that can become a report for stakeholders or stakeholders both inside and outside the organization [8]. In implementing an Information System in an organization, planning is needed or commonly called an ISP (Information System Planning) which contains the stages in implementing an information system in an organization. It also has the goal of defining the organization's needs for the Information System implemented so that it can run in balance with the vision and mission of the organization [9]. There are 4 (four) core levels will be used to solve organizational problems in implementing information systems. These levels are:



Figure 1: Information System Planning Level [9]

2.1 ERP

ERP (Enterprise Resource Planning) is a technology of information systems used to assist organizations in carrying out work. For example, helping to manage financial transactions and manage organizational assets with several modules tailored to the organization's needs [10]. The modules will work together and be integrated into a database (database) which is helpful to increase organizational productivity [10]. ERP performs system integration from the internal and external scope of the organization as a whole which covers all areas of the organization's business processes from accounting to inventory, and data from each part of the organization so that it can be collected and become helpful information [2].

2.2 DeLone & McLean IS Success Model

To measure the success or success of implementing an information system in the presence of six main dimensions as benchmarks, namely system quality, information quality, use, user satisfaction, impact on individuals, and the impact on the organization [11].

The individual impact can be measured on the perceived effect of the Use of the information system applied to its users. The organizational impact refers to the organizational impact generated by the implemented information system [12].

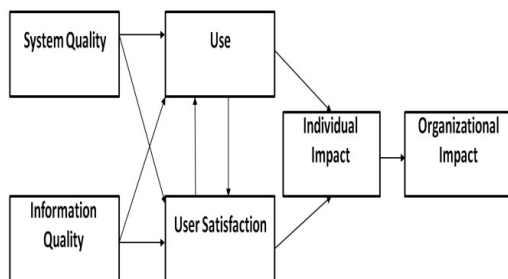


Figure 2: DeLone McLean IS Success Model[5]

2.3 System Quality

The system's quality is one indicator of something expected from an information system that is applied. These include the capability or ability of a plan to provide information according to the needs of its users [13]. Examples of indicators of the system's quality are an easy-to-use information system,

the speed at which it is accessed, and the information system's security [13].

2.4 Information Quality

The quality of information is the best-expected goal produced from the output in the form of helpful information for its users from an applied information system [13]. Several indicators assess the quality of data generated from an information system, such as the completeness of the information produced, the format in presenting the report, the accuracy of the data generated, and the duration or timeliness in creating news [13].

2.5 Use

Use relates to how often or how much the information system is used by its users. In other words, Use is also associated with how the information system is used correctly by its users to produce helpful information [14]. The indicators used to calculate usage are the frequency or amount of system use, the purpose of Use, and accuracy in using the system [14].

2.6 User Satisfaction

User satisfaction is a form of response from users using information systems that are applied with the resulting output [13]. User satisfaction can be measured by several indicators such as user satisfaction with the information system used, satisfaction with the information generated and satisfaction with the services provided by the information system [13].

2.7 Individual Impact

The individual impact is one tangible form of the success of an information system that is implemented. If the information system positively impacts individuals, the information system implemented is successful [9]. The indicators that can measure individual impacts are the performance of users (individual) and speed in individual decision-making [9].

2.8 Organization Impact

Like individual impact, an organizational impact is also a tangible form of success or failure in implementing information systems [9]. Indicators that can measure organizational impact achieve the organization's vision, increased organizational performance, and effectiveness in making decisions [9].

2.9 SmartPLS

SmartPLS is a tool or application that can be used to analyze data that will be the research material [15] and has two models for measuring data or analyzing research data.

The two models are the Outer Model and the Inner Model [15].

3. RESEARCH METHODOLOGY

The first stage begins with identifying the problems that exist in Private Companies. At this stage, a mini-research is carried out, which aims to find out what obstacles are still felt by ERP users and the perceived impact of these problems. After identifying the problem, collect theories from various references that will be the basis for conducting research. The cause of the ideas used is also to support and validate the hypotheses compiled and tested. Furthermore, collecting theories related to research, then from the results of a mini-research conducted on ERP users, then a problem formulation is carried out in which these problems are included in the evaluation model that you want to use in research.

3.1 Models and Methods of Analysis

The model used is DeLone McLean, which is taken from the theories of various sources that have been collected. After formulating the problem, the next step is to evaluate DeLone McLean's success. The six factors measuring DeLone McLean's success are used as variables that will be combined with the formulation of the problem into indicators or (as a research instrument) in the form of a list of questions distributed to respondents. After the data from the evaluation is available, the analysis of the evaluation results is carried out. The research is done by doing several tests such as Outer Model and Inner Model. The results of the research will make conclusions and suggestions for improvement for Private Companies.

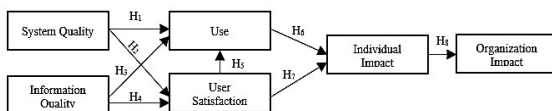


Figure 3: Research Model

3.2 Variables and Indicators.

Variables and indicators in research are critical components. From the variables defined, a list of questions will be formed, distributed to respondents in which the data collected will be used as material for analyzing into SmartPLS. Meanwhile, when determining the most critical variable, it is during formulating several concepts of events in an organization that occur in case studies that will become research material [16]. Variable data to be taken at Private Companies is as follows.

1. Variable System Quality. Indicators used:

- ERP applications process the data appropriately entered [13].
- ERP application integrates data from each division well [13].
- Data/transactions that are inputted into the ERP application are processed quickly [13].

2. Information Quality. Indicators used:

- ERP applications provide real-time information [14].
- ERP applications provide accurate information [14].
- The flow of information in the ERP application is running well [14].

3. Use. Indicators used:

- ERP applications are used every day [14].
- Making a faster decision with ERP [14].
- ERP applications have an attractive appearance [14].

4. User Satisfaction. Indicators used:

- ERP applications are easy to use [13].
- Each ERP module has met the needs of each Division in business processes [13].
- ERP applications provide satisfaction from the information/reports generated [13].

5. Individual Impact. Indicators used:

- The Use of ERP adds insight that has benefits in doing work [9].
- ERP applications help complete work even though the divisions are far apart [9].

6. Organization Impact. Indicators used:

- ERP applications can reduce costs in running a company's business [9].
- ERP can achieve daily, monthly, and annual transaction input targets [9].

3.3 Hypothesis

The hypothesis in the research is as follows.

H₁: ERP System Quality has a significant influence on ERP Use.

H₂: ERP System Quality has a significant influence on ERP User Satisfaction

H₃: Information Quality ERP has a significant influence on ERP Use

H₄: Information Quality ERP has a considerable effect on User Satisfaction ERP

H₅: User Satisfaction ERP has a significant influence on ERP Use

H₆: Use of ERP has considerable power on the Individual Impact

H₇: User Satisfaction ERP has a substantial effect on the Individual Impact

H₈: Individual Impact ERP has a substantial influence on Organization Impact

4. RESULTS AND DISCUSSION

4.1 Respondent Identification

The questionnaire that has been designed distributed to entities in the private companies' business process as many as thirty respondents with a processing period of about two weeks until the completion of the data collected will be processed into SmartPLS. The respondent's data is divided into four categories: position, division, age, and gender.

1. Category by position and division

Respondent data by position is divided into 3, namely Staff with 20 respondents, Supervisor with 6 respondents, and Manager with 4 respondents. For Respondents, the division has divided into Finance 5 respondents, Accounting four respondents, Procurement 3 respondents, Project 10 respondents, HR & GA 4 respondents, and IT and Infra Support 4 respondents.

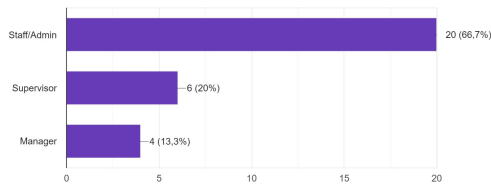


Figure 4: Graph of Respondents by Position

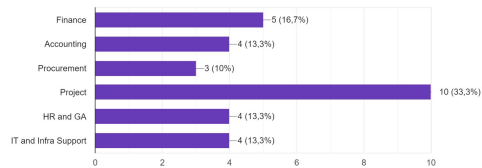


Figure 5: Graph of Respondents by Division

2. Category by Age

Data respondents by age are divided into four categories, <20-27 years with a total of 6 respondents, 28-35 years as many as 16 respondents, 36-40 years as many as three respondents, and 41-45 years as many as five respondents.

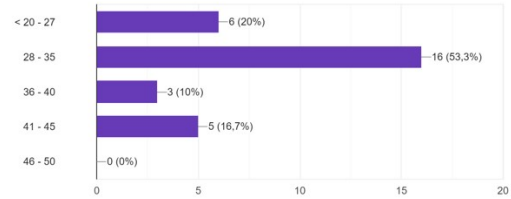


Figure 6: Graph of Respondents by Age

3. Category by Gender

Respondent data by gender is divided into 14 Female, 16 Male.

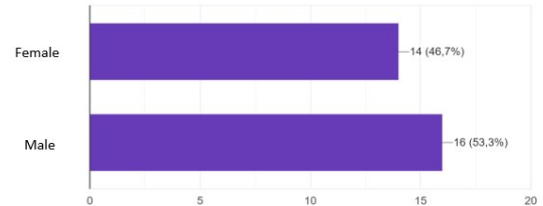


Figure 7: Graph of Respondents by Gender

4.2 Outer Model Evaluation

After getting the data, the results will be tested for reliability and validity tests that aim to prove or confirm that the variables that have indicators in the form of several statements have the requirements and standards so that they are feasible to be used for hypothesis testing concluding. Validity Test and Reliability Test are processed using the SmartPLS. SmartPLS has a standard or benchmark commonly referred to as "Composite Reliability," which is set as a standard or reference in conducting further evaluations to prove whether the measurement model with these variables and indicators is reliable and can be continued for appropriate hypothesis testing [17]. The standard value of Composite Reliability is set to meet the requirements, > 0.7, and with an AVE (Average Variance Extracted) value > 0.5 from the variables that have been defined at the beginning and will be tested [17].

4.2.1 Validity test

The validity test aims to determine whether a questionnaire is valid or not and will be said to be useful for used if the questionnaire can show the aims and objectives to be achieved [18].

In conducting the validity test, it can be seen from the value of Factor Loading (Outer Loadings) contained in each statement (questionnaire) [19]. The factor loading value is high and is considered valid if it has a loading value of more than 0.7 [20].

Table 1: Validity test

Variable	OL	OLS	Desc.
System Quality (X11)	0,539	0,7	Invalid
System Quality (X12)	0,890	0,7	Valid
System Quality (X13)	0,779	0,7	Valid
Information Quality (X21)	0,794	0,7	Valid
Information Quality (X22)	0,655	0,7	Invalid
Information Quality (X23)	0,851	0,7	Valid
Use (X31)	0,803	0,7	Valid
Use (X32)	0,535	0,7	Invalid
Use (X33)	0,778	0,7	Valid
User Satisfaction (X41)	0,982	0,7	Valid
User Satisfaction (X42)	0,851	0,7	Valid
User Satisfaction (X43)	0,806	0,7	Valid
Individual Impact (X51)	0,824	0,7	Valid
Individual Impact (X52)	0,728	0,7	Valid
Organizational Impact (X61)	0,746	0,7	Valid
Organizational Impact (X62)	0,809	0,7	Valid

Description:

- OL: Outer Loadings
- OLS: Outer Loadings Standard
- Desc.: Description

Table 1 Validity Test shows that there are 3 Invalid indicators because they have an Outer Loading value below 0.7 which is a standard to be considered very valid as an indicator in research [20]. So, the System Quality indicators (X11), Information Quality (X22), and Use indicators (X32) are invalid and must be removed from the next Validity Test.

Table 2: Second Validity Test

Variable	OL	OLS	Desc.
System Quality (X12)	0,928	0,7	Valid
System Quality (X13)	0,835	0,7	Valid
Information Quality (X21)	0,809	0,7	Valid
Information Quality (X23)	0,879	0,7	Valid
Use (X31)	0,899	0,7	Valid
Use (X33)	0,888	0,7	Valid

Variable	OL	OLS	Desc.
User Satisfaction (X41)	0,986	0,7	Valid
User Satisfaction (X42)	0,832	0,7	Valid
User Satisfaction (X43)	0,826	0,7	Valid
Individual Impact (X51)	0,845	0,7	Valid
Individual Impact (X52)	0,702	0,7	Valid
Organizational Impact (X61)	0,730	0,7	Valid
Organizational Impact (X62)	0,823	0,7	Valid

Description:

- OL: Outer Loadings
- OLS: Outer Loadings Standard
- Desc: Description

It can be seen from Table 2, Second Validity Test, that all indicators have an Outer Loading value above 0.7 so that all of these indicators are valid and can be tested further.

4.2.2 Reliability

Reliability testing aims to obtain questionnaires or research instruments that are consistent and have high accuracy to prove or test the hypotheses that have been made [21]. The reliability test can be divided into Cronbach's Alpha and the composite reliability values [21]. Cronbach's Alpha has a standard test value that is lower than Composite Reliability, so to get a good deal and provide higher accuracy, it is recommended to use Composite Reliability as the standard of the reliability test that will be used. The standard value so that the variable is reliable, the Composite Reliability value must be > 0.7 [21].

Table 3: Reliability Test

Variable	CR	SCR	Desc.
System Quality	0,876	0,7	Realible
Information Quality	0,833	0,7	Realible
Use	0,888	0,7	Realible
User Satisfaction	0,915	0,7	Realible
Individual Impact	0,751	0,7	Realible
Organizational Impact	0,753	0,7	Realible

Description:

- CR: Composite Reliability
- SCR: Composite Reliability Standard
- Desc.: Description

From Table 3, it can be seen that all the variables have a Composite Reliability value > 0.7, which means that all of the above variables meet the standards and prove that the measurement model proposed and used is valid and reliable, which can then be tested for hypotheses.

4.3 Inner Model Evaluation

After evaluating the Outer Model, an evaluation of the inner model is carried out starting with the bootstrapping process of data on SmartPLS by entering a subsample of 500.

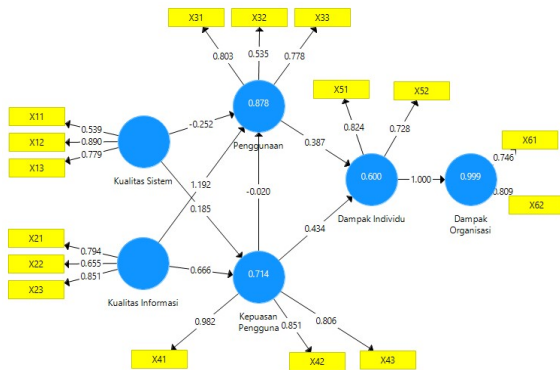


Figure 8: Path Diagram

This outer model evaluation aims to display and provide information about the relationship between several latent variables in the research model used to measure by looking at the T-Statistic value that must be greater than the T-Table value > 1.96 [21].

Table 4: Inner Model Test Results

Path	OS	T Statistics	Desc.
Individual Impact -> Organizational Impact	1,000	2851,774	Significant
User Satisfaction -> Individual Impact	0,417	2,006	Significant
User Satisfaction -> Use	-	1,243	Not significant
Information	1,290	5,924	Significant

Path	OS	T Statistics	Desc.
Quality -> User Satisfaction			
Information Quality -> Use	2,396	2,257	Significant
System Quality -> User Satisfaction	-	1,535	Not significant
System Quality -> Use	-	1,339	Not significant
Use -> Individual Impact	0,423	1,698	Not significant

Description:

- OS: Original Sample
- Desc.: Description

Based on Table 4, the relationship between individual impacts and organizational impacts has a T-Statistic value of 2851.774 which means > from T-Table value of 1.96. So, it can be concluded that the relationship between user satisfaction variables on the use variable has a significant influence. The relationship between the user satisfaction variable on the individual impact has a T-Statistic with a value of 2.006 which means > from the T-Table value of 1.96, so it can be concluded that the relationship between the variables of user satisfaction with the individual impact has a significant influence.

The relationship between the variables of user satisfaction with Use has a T-Statistic with a value of 1.243 which means < from the T-Table value of 1.96, so it can be concluded that the relationship between variables of user satisfaction with Use is not significant. The relationship between the information quality variable on user satisfaction has a t-statistic with a value of 5.924 which means > from the T-Table value of 1.96, so it can be concluded that the relationship between information quality variables on user satisfaction has a significant influence.

The relationship between information quality variables has a T-Statistic value of 2.257, which means $>$ from the T-Table value of 1.96. It can be concluded that the relationship between information quality and Use of the variable is significant. The relationship between the system quality variable on user satisfaction has a T-Statistic with a value of 1.535 which means $<$ from the T-Table value of 1.96, so it can be concluded that the relationship between the system quality variables on user satisfaction is not significant.

The relationship between system quality and use variables has a T-Statistic with a value of 1.339 which means $<$ from the T-Table value of 1.96. It can be concluded that the relationship between the variables of system quality and use is not significant. The relationship between the variables of Use to individual impact has a T-Statistic with a value of 1.698 which means $<$ from the T-Table value of 1.96, so it can be concluded that the relationship between the variables of Use to individual impact is not significant.

From the inner model testing results in Table 4, the inner model testing results can be seen in the accepted and rejected hypotheses by looking at the t-statistic value $>$ 1.96. If the t-statistic value $<$ 1.96, then the hypotheses are rejected.

To find out whether the hypothesis is accepted and rejected, it can be seen from the results of bootstrapping and then looking at the P-Value with the standard value for an acceptable hypothesis or the significance level of P-Value $<$ 0.05 [22].

Table 5: Hypothesis Testing Results

	Path	P-Values	Desc.
H ₁	System Quality -> Use	0,181	Rejected
H ₂	System Quality -> User Satisfaction	0,125	Rejected
H ₃	Information Quality -> Use	0,024	Accepted
H ₄	Information Quality -> User Satisfaction	0,000	Accepted
H ₅	User Satisfaction -> Use	0,215	Rejected
H ₆	Use -> Individual Impact	0,090	Rejected

	Path	P-Values	Desc.
H ₇	User Satisfaction -> Individual Impact	0,045	Accepted
H ₈	Individual Impact -> Organization Impact	0,000	Accepted

Description:

- Desc.: Description

Based on Table 5 Hypothesis Testing Results, it can be seen that there are 4 (four) rejected hypotheses and 4 (four) accepted hypotheses with P-Value $<$ 0.05.

- 1) H₁ (System Quality -> Use) states that the system quality variable has no significant effect on the use variable. The value of the T-Statistics results is 1.339, which mean that the value is smaller than 1.96 and has a P-Values of 0.181, which states that the value is more significant than 0.05. It can be concluded that system quality on Use has no significant effect, then H₁ rejected.
- 2) H₂ (System Quality -> User Satisfaction) states that the system quality variable has no significant effect on the user satisfaction variable. The value of the T-Statistics results is 1.535, which states that the value is smaller than 1.96. With a P-Values of 0.125, which mean that the value is more significant than 0.05, so it can be concluded that system quality on user satisfaction does not have a significant effect, then H₂ is rejected.
- 3) H₃ (Information Quality -> Use) states that the information quality variable significantly influences. The value of the T-Statistics results is 2.257, which states the value is more significant than 1.96. With a P-Values of 0.024, which mean that the value is less than 0.05, it is concluded that the quality of information on Use has a significant influence, then H₃ is accepted.
- 4) H₄ (Information Quality -> User Satisfaction) states that the information quality variable has a significant influence on the user satisfaction variable. The value of the T-Statistics results is 5.924, which

- mean that the value is greater than 1.96. With a P-Values value of 0.000 which states that the value is smaller than 0.05, it can be concluded that information quality on user satisfaction has a significant influence, then H_4 accepted.
- 5) H_5 (User Satisfaction \rightarrow Use) states that the user satisfaction variable has an insignificant effect on the use variable. The value of the T-Statistics results is 1.243, which mean that the value is smaller than 1.96, and the P-Values is 0.215, which states that the value is more significant than 0.05 so that it is concluded that user satisfaction with Use does not have a significant effect, then H_5 rejected.
 - 6) H_6 (Use \rightarrow Individual Impact) states that Use has an insignificant effect on the individual impact variable. The value of the T-Statistics results is 1.698, which mean the value is smaller than 1.96 and with P-Values of 0.090, which states that the value is more significant than 0.05, so it can be concluded that the Use of individual impacts does not have a significant effect, then H_6 rejected.
 - 7) H_7 (User Satisfaction \rightarrow Individual Impact) states that the user satisfaction variable significantly influences the individual impact variable. The value of the T-Statistics results is 2.006, which mean that the value is more significant than 1.96. The P-Values is 0.045, which states that the value is less than 0.05. It is concluded that user satisfaction on individual impact has a significant effect, then H_7 accepted.
 - 8) H_8 (Individual Impact \rightarrow Organizational Impact) states that the individual impact variable significantly influences the organizational impact variable. The value of the t-statistics results is 2851,774, which mean that the value is more significant than 1.96. With a P-Values of 0.000 which states that the value is less than 0.05. It is concluded that the individual impact on organizational impact has a significant influence, then H_8 is accepted.

Previous Research

Several previous studies discuss the evaluation of information systems applied to an organization or company. The research from [9] provides information that the quality of the data produced by the Information System does not give a sense of satisfaction for the data recipients. Further reviews must be carried out on the factors causing user dissatisfaction with the information system produced. The quality of the method used can be even better to support operational work in Ministry agencies and institutions that use information systems.

Research from [13] shows that the quality of the system, the quality of information and the quality of the services provided affect the satisfaction of Information Systems users. And also, the research shows that the quality of the data generated from Information Systems has the most influence in seeking user satisfaction, followed by the quality of the system and the last is the quality of the services provided.

5. CONCLUSION

Based on the research and data processing results, it can be concluded that the success of ERP implementation is influenced by several interrelated factors, where these factors are taken from each hypothesis indicators research that has been defined at the beginning.

The data processing results show 4 out of 8 accepted hypotheses. These results can also be concluded that Information Quality is influenced by Use and User Satisfaction. Individual Impact influences user satisfaction, and Individual Impact affects Organizational Impact. While the rejected hypothesis is the System Quality does not affect the Use and does not affect User Satisfaction. User satisfaction does not affect Use, and Use does not affect Individual Impact.

There are limitations to this research. The research only uses DeLone McLean modelling to measure the success of ERP implementation, so it is hoped that future research can use another success model to add references and be useful for companies that will implement ERP.

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