Analysis of the maintainability and portability of ERP host to host system using ISO 9126 model

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Abstract. Telecommunication industry in Indonesia that have a complex system and interconnected for the payment transaction to each vendor. the quality of the system is very influential on each division in the company and the goals are to analyzed host to host quality system. The implementation process of the new system in terms of internal portability and also in terms of the quality system if changes are made, according to the requirements of certain conditions in this case including in terms of internal maintainability, in this case, to be in line with the company that is helping companies in managing business processes according to with company goals and able to carry out operational activities more efficient and more effective. In the process, the analysis of system quality this time was carried out in the system. To analyze the quality system, it was carried out with the ISO 9126 standard as a model and to analyze the internal variables are using Maintainability and Portability. In the analysis, the process is using SPSS 25 and SMARTPLS 3 as processing tools. The results of this analysis process are in the form of recommendations in terms of stability contained in internal maintainability and portability testing, which is taken from the results of the hypothesis and also measurement testing for each related variable. The recommendations proposed are the Improvement System, from the existing SAP ECC 6.0 to SAP S / 4 HANA which has advantages in system stability.

1. Introduction
In this era of globalization, the role of information technology has become an important thing that should exist in the company. In terms of its application, the strategic plan of information technology should be adapted to the needs of the company in question, so applying the concept of technology that can be effectively used. In increasing the efficiency of business processes in the company we need a system that is integrated in terms of information needs so that data is not faced with an error at the moment handled by another unit whose task Catch [1]. In this case, the company must also consider the quality of the existing system. With that the company can maximize performance efficiently and also more effectively in its solution [2]. System quality is a process of analyzing information systems that focus on the results of user and system interactions. System quality has attributes such as equipment availability, equipment reliability, ease of use, and response time is a determining factor why an information system is used or not used. According to (Nielsen, 2000) in journals [2], system quality has several usability principles, namely online environment, namely,
navigation, response time, credibility, and content. From various literature that there are four dimensions of system quality, namely: navigation, ease of use, response time, and security. According to (McKinney et al., 2002) in journals [2], suggesting that there are three dimensions of system quality, the three dimensions are: access, usability, and navigation. The quality of the system can be measured by looking at the functional part of usability. Usability is part of the principle of interaction between human computers that provides a collection of important clues about learning design. According to (Nielsen, 2000) in journals [2] argues that usability consists of four basic principles in online activities, namely: navigation, timelines, credibility, and content. argues that some important elements in the use of the system are consistency, ease of use, clarity in interaction (clarity of interaction), ease of reading (easy to read), information settings (information arrangement), speed and UI design of the system.

With the increasing technological needs of companies that have good quality systems in terms of performance, Enterprise Resource Planning (ERP) is a system concept that has a resource management system that exists in the company. Enterprise Resource Planning (ERP), which apply appropriately in the company, will integrate existing information data on each of the business processes are better and more effective, and can also provide analysis of reports required by the Department and Module Also Integrated into other faster and timely, as a well-supplemented database and reporting, is also sharing the management [3]. ERP-System strongly supports operations with any existing activities such as sales, Marketing, production, logistics, accounting, and personnel [4]. In this research researchers chose Maintainability and portability as the variables that became the focus of the Research. Researchers choose maintainability as the variable in this research, because maintainability is included in the internal variable that analyzes the system if there is a change in conditions in the system, then what will happen if the system is changed, will have a positive effect of the user and also the quality of the system [5]. Maintainability as a variable used to be able to correct defects or causes, analyze improvements or replace a system with a new system, prevent unexpected working conditions on existing systems, maximize the benefits of a system, maximize efficiency, reliability, and analyze environmental influences that changes [6]. Researchers choose portability as the variable in this research, because portability is included in the internal variable that analyzes the new system if it is placed in a different environment and different conditions, according to the environment applied, then what will happen if the system is changed, will have a positive effect for the user and also the quality of the process of the system [5]. Portability is a set of Variable or Characteristics that supports the ability of a system to be applied in a different environment, with sub-variable Adaptability, conformance, Stability, Instability and Replaceability [7]. Its aim to analyze the the development of existing IT needs to support financial activities that exist.

2. Literature Review

2.1. Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) is a software system that supports logistics, planning, finance, manufacturing, procurement, human resources, project management, distribution, accounting, service maintenance, and transpiration [8]. An ERP system is software that must integrate and coordinate the activities of organizational units. ERP systems help various parts of an organization to share data and knowledge, reduce costs and improve business process management.

Purpose of applying Enterprise Resource Planning (ERP) is a multi-module, business-packing solution application that allows organizations to integrate the business and performance processes of the company, distribute public data, manage resources and provide access to actual information [9]. While there is an ERP role in your organization/company to:

- Increase quality and Efficiency.
- Decrease the cost.
- Decision Making.
- Company agility

Enterprise Resource Planning or ERP is frequently abbreviated or from English terms, Enterprise Resource Planning is the information system for a manufacturing or service company that integrates and automates business processes related to aspects of the work, production as well as distribution in the company concerned.

ERP is often referred to as the Back-Office System indicating that customers and the public are not involved in this system. In contrast to Front, Office System Deal directly with customers such as the system for E-commerce, Customer Relationship Management (CRM), e-government and others.

There are several benefits found in the use of ERP systems [10], namely:

a. ERP is a system that is integrated in one company, so that the process that can run more effectively.

b. ERP can be integrated globally, so that for different currencies, Language and culture can also be synchronized automatically, so that data can be integrated.

c. ERP can be customized so that it is not just inputting data.

d. ERP helps launch the implementation of supply chain management with the ability to combine them.

2.2. System Application and Product (SAP)

SAP is software that is developed to meet the needs of a company in carrying out operational activities to be more efficient and effective. In the company, SAP it is used in planning and carrying out daily activities related to data processing and is integrated between one module and another module [11].

2.3. Quality System

System quality is a process of analysing information systems that focus on the results of user and system interactions, System quality has attributes such as equipment availability, equipment reliability, ease of use, and response time is a determining factor why an information system is used or not used. According to (Nielsen, 2000) in journals [2], system quality has several usability principles, namely online environment, namely, navigation, response time, credibility, and content. From various literature that there are four dimensions of system quality, namely: navigation, ease of use, response time, and security. According to (McKinney et al, 2002) in journals [2], suggesting that there are three dimensions of system quality, the three dimensions are: access, usability, and navigation.

2.4. ISO 9126 Model

The ISO-9126 model was developed by the International Organization for Standardization (ISO). This organization was founded in 1946 while the ISO-9126 Model was developed in 1991 to provide quality-enhanced work support software, and this model proves six variables as test standards for analyzing systems.[12]. The highest level of this structure consists of the quality characteristics and the lowest level consists of the software quality criteria. The model specifies six characteristics including Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability; which are further divided into 21 sub-characteristics and ISO 9126 quality in use model has 4 factors, namely effectiveness, productivity, Satisfaction, and satisfaction.
In this research the internal variables used are Maintainability and Portability and for Quality in use is Satisfaction. The following is an explanation of each variable.

a. **Maintainability** as a variable used to be able to correct defects or causes, analyse improvements or replace a system with a new system, prevent unexpected working conditions on existing systems, maximize the benefits of a system, maximize efficiency, reliability, and analyze environmental influences that changes. [13].

b. **Portability** is “a set of attributes that supports the ability of a system to be applied in a different environment”. This factor consists of four sub-variables, Adaptability is the opportunity to adapt applications to different environments. Instability the ability of software to be installed inside different environments [1].

c. **Satisfaction** a variable in Quality in Use that analyses customer satisfaction with the system used, so that the user can have an effective and efficient impact on the quality of a process in the company.

3. **Systematic Research**

Systematic research is a detailed explanation of the research steps and it would be running well. This research is conducted by collecting the necessary data from the company. Systematic research of this study can be observed in the figure, as a follow:
4. Analysis and Discussion

4.1. Validity and Reliability Testing
According to [14] Validity is the process of selecting specific question indicators to be proposed based on the conceptual model, by checking one by one the question data on each specific question indicator, in order to go the next process of checking reliability for each variable. Validity is the process identify, discretization and algorithm selection, computer programming, and numerical solutions as pivotal activities that all contribute to potential errors and uncertainties which is in each variable and also sub-variable. To calculate whether the difference is significant or not, the calculated \( r \)-count needs to be compared with the \( r \)-table value. Then: \( r \)-count > \( t \)-statistic, then the instrument is valid \( r \)-count < \( t \)-statistic, then the instrument is invalid.

Reliability comes from the word reliability which has the meaning to what extent the results of a measurement can be trusted. Test is said to be reliable if it always gives the same results when tested on the same group at different times or opportunities. To find out the value of consistency with the Alpha model (Cronbach's Alpha). If the Cronbach’s Alpha value is less than 0.6, it is not good, while the Cronbach’s Alpha value is between 0.6 and 0.7, then it is accepted and if the value of Cronbach’s Alpha is more than 0.8 is good.
4.2. Analysis of Outer Model
Outer model is a measurement model that shows latent variable indicators to be measured. That way the measurement of inner model will be more accurate [15]. In this case the outer models tested are reliability > 0.7 and strengthened by Cronbach Alpha > 0.6, convergent expected values > 0.7, Average Valiance Extracted (AVE) expected value is > 0.5 and discriminant validity is the value of cross loading factor is useful to determine whether the construct has adequate discriminant by comparing the loading value to the intended construct must be greater than the value of loading with other constructs [16].

4.2.1 Convergent Validity
Convergent validity is used to measure whether the two instruments are highly correlated in measuring a concept. The value of convergent validity is the value of loading factors in latent variables with their indicators. The expected value is > 0.7 so a value below 0.7 indicates that the indicator is invalid. The following is the result of convergent validity on each variable used to determine the significant effect between indicator items. There are PO4 that indicators do not meet the expected value of convergent validity so that the 1 indicators are deleted.

4.2.2. Composite Reliability
Composite reliability is used to measure a construct that can be evaluated by internal consistency or internal consistency reliability. For measurement of composite reliability on smart pls use composite reliability value. The recommended value is > 0.7 All latent variables in this research were declared reliable because all of them had reliability composite values > 07. Result composite reliability variable (Table 1).
Table 1. Result of Composite Reliability Testing

| Variable | Composite Reliability | Description |
|----------|-----------------------|-------------|
| AD       | 0.848                 | Reliable    |
| AN       | 0.835                 | Reliable    |
| CH       | 0.889                 | Reliable    |
| CO       | 0.867                 | Reliable    |
| IN       | 0.860                 | Reliable    |
| MA       | 0.869                 | Reliable    |
| PO       | 0.858                 | Reliable    |
| QS       | 0.902                 | Reliable    |
| RE       | 0.878                 | Reliable    |
| SA       | 0.873                 | Reliable    |
| ST       | 0.803                 | Reliable    |
| TE       | 0.840                 | Reliable    |

4.3. Analysis of Inner Model

The structural model or inner model is a measurement to show the strength of estimation between latent variables that will produce estimates of path coefficients and significance levels used to test hypotheses [16]. At this time the inner model measures the determination of endogenous variables (R²) with the expectation that 0.75 is categorized as strong, 0.50 is categorized as moderate and > 0.25 is categorized as weak. Path coefficient value is minimal T-Statistics to assess the significance of the relationship between latent variables and other latent variables depending on the significance value used, namely the 10% significance level of the T-Statistics value of at least 1.65, a 5% significance level of T-Statistics minimum of 1.96, and for the 1% significance level the T-Statistics value is at least 2.58. This research uses a 5% significance level so that the minimum T-Statistics limit is 1.96. Predictive relevance (Q2) the expected value is > 0, indicating that the value is well constructed. And the last effect size (F²) expected value is 0.035 has a strong influence on research, 0.15 is categorized sufficient and 0.02 is categorized as weak [15].

Table 2. Hypothesis

| Original Sample (O) | T Statistic (O/STDEV) | P Values | Hypothesis | Inference | Description |
|---------------------|-----------------------|----------|------------|-----------|-------------|
| AD -> CO            | 0.124                 | 1.394    | 0.164      | H9        | Positive and indirect significant Not Accepted |
| AD -> IN            | -0.008                | 0.061    | 0.951      | H4        | Negative and indirect significant Not Accepted |
| AD -> PO            | 0.525                 | 6.579    | 0.000      | H17       | Positive and Significant Accepted |
| AD -> RE            | 0.209                 | 1.676    | 0.094      | H12       | Positive and indirect significant Not Accepted |
| AN -> CH            | 0.030                 | 0.260    | 0.795      | H1        | Positive and indirect significant Not Accepted |
| AN -> MA            | 0.127                 | 0.287    | 0.774      | H13       | Positive and indirect significant Not Accepted |
| AN -> ST            | 0.156                 | 1.981    | 0.048      | H7        | Positive and indirect significant Not Accepted |
|                  | Original Sample (O) | T Statistics (|O/STDEV|) | P Values | Hypothesis | Inference | Description |
|------------------|---------------------|-----------------|----------|------------|-----------|-------------|
| AN -> TE         | 0.960               | 112,080         | 0.000    | H11        | Positive and Significant | Accepted   |
| CH -> MA         | 0.234               | 1,834           | 0.067    | H14        | Positive and indirect significant | Not Accepted |
| CH -> ST         | 0.638               | 11,614          | 0.000    | H2         | Positive and Significant | Accepted   |
| CH -> TE         | 0.013               | 0.404           | 0.686    | H8         | Positive and indirect significant | Not Accepted |
| CO -> PO         | 0.119               | 1,140           | 0.255    | H19        | Positive and indirect significant | Not Accepted |
| CO -> RE         | -0.145              | 0.839           | 0.402    | H6         | Positive and indirect significant | Not Accepted |
| IN -> CO         | 0.727               | 15,763          | 0.000    | H5         | Positive and Significant | Accepted   |
| IN -> PO         | -0.015              | 0.149           | 0.882    | H18        | Positive and indirect significant | Not Accepted |
| IN -> RE         | 0.126               | 0.691           | 0.409    | H10        | Positive and indirect significant | Not Accepted |
| MA -> PO         | 0.382               | 4,408           | 0.000    | H21        | Positive and Significant | Accepted   |
| MA -> QS         | 0.453               | 4,798           | 0.000    | H25        | Positive and Significant | Accepted   |
| MA -> SA         | 0.263               | 3,572           | 0.000    | H22        | Positive and Significant | Accepted   |
| PO -> QS         | 0.562               | 3,823           | 0.000    | H26        | Positive and Significant | Accepted   |
| PO -> SA         | 0.704               | 11,707          | 0.000    | H23        | Positive and Significant | Accepted   |
| RE -> PO         | -0.002              | 0.031           | 0.975    | H20        | Positive and Significant | Not Accepted |
| SA -> QS         | -0.100              | 0.620           | 0.535    | H24        | Positive and indirect significant | Not Accepted |
| ST -> MA         | 0.019               | 0.122           | 0.903    | H15        | Positive and indirect significant | Not Accepted |
| ST -> TE         | 0.027               | 0.712           | 0.477    | H3         | Positive and indirect significant | Not Accepted |
| TE -> MA         | -0.326              | 0.807           | 0.420    | H16        | Negative and indirect significant | Not Accepted |

Base Testing the Hypothesis can be seen from Table 2 that the Accepted Hypotheses H2, H5, H11, H17, H21, H22, H25, H26. while the rejected hypotheses H1, H3, H4, H7, H8, H9, H10, H12, H13, H14, H15, H16, H18, H19, H20 and H24.
The Measurement test is a decision to decide whether a system can be developed, resumed or terminated. The following calculation formula can be used to determine the Measurement test of a system (equation 1):

\[
\text{Measurement Percentage} = \frac{\text{Actual Score (f)}}{\text{Ideal Score (n)}} \times 100\% \quad \ldots \quad (1)
\]

**Description:**
- Actual score (f) = Number of respondents answer score
- Ideal score (n) = Highest score If the respondent chooses the answer with the highest score

After getting the calculation result, then compared with the conversion scale to be expressed very good, good, enough, less, and very less.

**Table 3. Interpretation of Likert Scale**

| Percentage achievement (%) | Interpretation |
|----------------------------|----------------|
| 0%-20%                     | Very not good |
| 21%-40%                    | Not good      |
| 41%-60%                    | Good enough   |
| 61%-80%                    | Good          |
| 81%-100%                   | Excellent     |
Based on the Measurement testing Result, variables Analyzability has a percentage of 80.4%, Changeability 81.6%, Stability 74.3%, Testability 81.1%, Adaptability 81.3%, Instability 84.8%, Conformance 82.7%, Maintainability 83.9%, Satisfaction (Quality of Use) 84%, Quality System 85.2%.

4.4. Recommendations

Respondents response in Measurement testing to Stability in the SAP system is represented. Average percentage score obtained is 74.3% of the total items is 639 which means that the tolerance for errors in system has been categorized as the smallest among the Measurement results and changeability has an influence on maintainability variables, because stability and changeability are subvariable in maintainability variable and directly variable stability and changeability have an impact on positif effect when viewed from the results of the hypothesis and if we see the results of the Measurement testing then for variable portability experiencing problems, researchers only recommend improvements to the maintainability variables found on the sub variable stability. So, i as a writer suggest a more stable system recommendation from SAP ECC 6.0 that is used today, namely SAP S / 4 HANA, because SAP S / 4 HANA has several reasons that make system performance in processing data more stable.

SAP S / 4 HANA directly uses the SAP HANA database and it is better to connect it than SP ECC which uses databases from other database providers. In addition, the SAP S / 4 HANA stores are different orders than the previous versions. In addition, the data is not stored on the hard disk before, but in the working memory (RAM). This change also increases the query speed of the software, since the data does not have to be loaded into the working memory from a hard disk with relatively low read speeds. If the cloud is purchased from SAP, these hardware costs are avoided. Improved performance and more efficient data storage only processing speed but also reaction speed. For example, SAP S / 4 now enables real-time analysis, which prevents data resources and machine failures. In this case it will also influence the relationship between the results of the hypothesis between stability and changeability which has a positive and significant effect, broadly if the level of stability of SAP HANA will better affect the results of changeability where changeability has easy questions placed on the existing system type on Telkom OGP and will produce good output on variable changeability.

SAP HANA is always imagined as a cloud platform, although initially as a database analysis.
SAP HANA Cloud Platform brings the capabilities of a full-scale cloud application platform for developers. SAP HANA Enterprise Cloud brings managed-cloud-as-a-services capabilities to businesses that will previously buy local databases and include partnerships with IBM SoftLayer. SAP R/4 HANA provides an award winning UX (SAP Fiori) along with a host of application and use case- specific benefits. On the technical end, SAP R/4 HANA also resolves common issues with traditional ERP systems, such as batch latency, manually driven processes and data sprawl. That means lower IT costs, better stability and less disruption from future upgrades.

5. Conclusions
This Research aims to analyse the internal Maintainability and Portability variable ISO 9126. For the result of internal Maintainability and Portability analysis result with ISO 9126 standard is:

a. Effect of Maintainability on Satisfaction for the Quality System
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between maintainability and satisfaction variables obtained shows the value of Original Sample is 0.263 means have Positive impact T-statistic of 3.572, which is greater than the T-statistic with a determination of alpha standard 5%, significance level of 1.96. So, it can be concluded that maintainability variables have a positive significant effect on satisfaction systems on Telkom OGP.

b. Effect of Portability on Satisfaction for the Quality System
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between portability and satisfaction variables obtained shows the value of Original Sample is 0.704 means have Positive impact and T-statistic of 11.707, which is greater than the T-statistic with a determination of alpha standard 5%, significance level of 1.96. So, it can be concluded that portability variables have a positive significant effect on satisfaction systems on Telkom OGP.

c. Effect of Portability on Satisfaction for the Quality System
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between portability and satisfaction variables obtained shows the value of Original Sample is 0.704 means have Positive impact and T-statistic of 11.707, which is greater than the T-statistic with a determination of alpha standard 5%, significance level of 1.96. So, it can be concluded that portability variables have a positive significant effect on satisfaction systems on Telkom OGP.

d. Effect of Maintainability for the Quality system
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between maintainability and Quality system variables obtained shows the value of Original Sample is 0.453 means have Positive impact and T-statistic of 3.823, which is greater than the T-statistic with a determination of with alpha standard 5% significance level of 1.96. So, it can be concluded that maintainability variables have a positive significant effect on quality system on Telkom OGP.

e. Effect of Portability for the Quality system
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between portability and Quality system variables obtained shows the value of Original Sample is 0.562 means have Positive impact and T-statistic of 3.823, which is greater than the T-statistic with a determination of alpha standard 5%, significance level of 1.96. So, it can be concluded that portability variables have a positive significant effect on Quality system on Telkom OGP.

f. Effect of Maintainability for the Portability
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between maintainability and portability variables obtained shows the value of Original Sample is 0.382 means have Positive impact and T-statistic of 4.408, which is greater than the T-statistic with a determination of alpha standard 5%, significance level of 1.96. So, it can be concluded that maintainability variables have a positive significant effect on portability systems on Telkom OGP.

g. Effect of Satisfaction for the Quality system
   Based on the results of testing carried out using the ISO 9126 model states that the correlation between satisfaction and quality system variables obtained shows the value of Original Sample is -0.100 means have Negative impact and T-statistic of 0.620, which is lower than the T-statistic
with a determination of alpha standard 5% significance level of 1.96. So, it can be concluded that satisfaction variables do not have a negative and indirect significant effect on satisfaction systems on Telkom OGP.

5.1. Based on Measurement testing
variables Analyzability has a percentage of 80.4%, Changeability 81.6%, Stability 74.3%, Testability 81.1%, Adaptability 81.3%, Instability 84.8%, Conformance 82.7%, Maintainability 83.9%, Satisfaction (Quality of Use) 84%, Quality System 85.2%, then the formulation of recommendations based on the lowest Measurement test result Stability. The recommendation is to upgrade the use of SAP to SAP S/4 HANA look at the level of stability and for databases directly to SAP HANA as a database already supported by the cloud and more hybrid for the system.

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