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Implementation Of Construction Management System Based On Information Technology (IT) And Integrated Towards Digital Construction in Industry 4.0

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Abstract. The world of construction from time to time does not stand still, but continues to develop in various ways. Developments in the construction world aim to make it easier for the parties involved in completing their respective responsibilities. As time goes by and demands to speed up the process of completing work, nowadays we find more and more software and applications that are used to support construction work. The use of this software will make the work products of construction actors more efficient, effective and productive where this is the goal of all construction actors. Several construction companies that develop information technology infrastructure in the form of software are PT Tunas Jaya Sanur, PT Mardika Griya Prasta and PT Sanur Jaya Utama with their Integrated Project Management System (IPMS) software. This study aims to compare the company's performance after and before using information technology (IT) infrastructure and to find out the advantages and disadvantages of using information technology infrastructure, especially at PT Tunas Jaya Sanur, PT Mardika Griya Prasta and PT Sanur Jaya Utama. Comparison of the performance of PT Tunas Jaya Sanur, PT Mardika Griya Prasta and PT Sanur Jaya Utama after using information technology infrastructure, the whole process can be faster in terms of time, and in terms of costs, this system can reduce operational costs and staff costs so that the company can become more efficient, efficient, effective and productive. The advantage of using this information technology infrastructure is that it is faster in terms of time, more efficient in terms of operational costs, more environmentally friendly because it uses less paper and can be done anywhere. While the drawback is that it requires investment costs at the beginning and must be connected to the internet.

INTRODUCTION

Construction is an activity to build facilities and infrastructure. In a field of architecture or civil engineering, a construction is also known as a building or infrastructure unit in an area or in several areas. In carrying out a construction activity usually involves several parties such as planning consultants, supervisory consultants and contractors where each party has a different function. Contractors or construction companies in this case as project executors do not only work on one project, the bigger and more projects, the more complex the scheduling management because the funds managed are very large, the need and supply of resources are also large. This raises the need for digitizing the company's work methods to be very necessary. With the technological innovation BIM, it has proven that the construction work sector has entered the digitalization era in the process of planning, designing, implementing development, and maintaining the building and its infrastructure for all parties involved in a project. By using digital methods supported by a qualified information technology infrastructure, construction companies are required to work productively, efficiently and effectively. The challenge in project implementation is how to plan an

effective time schedule and efficient cost planning without compromising quality. In addition, by using digital-based information technology facilities, it is hoped that the construction process will be more environmentally friendly in accordance with the green construction concept. Green construction or green construction is a sustainable movement that aspires to create construction from the planning, implementation and use stages of environmentally friendly construction products. With the many advantages described above against the advantages of using information technology infrastructure in construction companies, it is hoped that to welcome this industrial 4.0 era, all construction companies have begun to digitize their company management.

METHOD

Data Collection Stages

Based on secondary data, what problems might be discussed in this study will then be developed with primary data. Primary data is primary data obtained by interviewing experienced parties (experts) and involved in the use of information technology infrastructure in PT Tunas Jaya Sanur. Next, conduct a questionnaire filled out by respondents who are actors or users of the IPMS program. This is done with the aim of obtaining data to compare the advantages and disadvantages that arise after the use of information technology infrastructure in PT Tunas Jaya Sanur, PT Mardika Griya Prasta and PT Sanur Jaya Utama in the form of IPMS software. previous studies that are similar to this research, while to obtain primary data obtained using research instruments. The research instrument is a tool that can be used to obtain, process and interpret the information obtained from the respondents using the same measuring pattern. In the preparation of interview questions the questions used must be able to obtain information gathering that allows the analyst to study the attitudes, beliefs of several people in the organization. To make the level of data collection effective, a questionnaire or interview form is needed that is in accordance with the research instrument and is easily understood by the respondent.

Analysis Using Smart PLS

Partial Least Squares (PLS) was first developed by Wold as a general method for estimating the path model using latent constructs with multiple indicators. The approach using Partial Least Square (PLS) uses the assumption of a free approach or distribution free. The data analysis technique to evaluate the causality relationship in this study uses PLS-Path Analysis. The model compiled is regression analysis which aims to determine the pattern of relationships between variables, namely between exogenous variables of service in the design process, exogenous variables of individual, organization and management, exogenous variables of design process implementation, exogenous variables of design technical evaluation, exogenous variables of design management, variables exogenous total quality service, and exogenous variables of continuous design with endogenous variables of design document quality. Because the relationship between exogenous variables and endogenous variables is considered to be an estimate and proof of the level of causality, respectively, the use of PLS regression analysis in this study is the most appropriate.

Validity Test

The validity test aims to determine how valid the instrument used in the study is. For research instruments that meet validity/validity will have an impact on research results that meet validity as well. Meeting the validity means that the instrument can be used to measure what it is supposed to measure. Thus, validity is related to measuring what is to be measured. Testing the validity of the convergent using a factor analysis model, [1,2]. Meets the validity test if it is less than 0.50 (<0.50).

Reliability Test

Reliability test is an index that shows the extent to which a measuring instrument has consistent results when repeated / if the measuring instrument is repeated it will give a consistent value [3,4]. Reliability testing is based on Cronbach's Alpha value (α), if the Cronbach's Alpha value (α) is greater than and equal to 0.6 the research data is considered good and reliable enough to be used as input in the data analysis process to test research

hypotheses [5,6] Cronbach alpha statistical calculations in determining the magnitude of the instrument reliability coefficient, the following is the Cronbach alpha reliability formula:

$$\alpha = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum S_i^2}{S_T^2} \right) \quad (1)$$

With : Cronbach's alpha value

k : number of items
 S_i : score variance for each item
 S_T : total score variance

Measurement of reliability analysis is carried out to determine the level of consistency of a variable or set of variables in estimating parameters [7], by conducting a reliability construct analysis, namely by calculating the reliability index of the instrument used.

Inner Model (t test)

Formally the form and model of the PLS regression equation is as shown in the initial model as follows:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon \quad (2)$$

Where:

$\beta_1, \beta_2, \dots, \beta_n$ = koefisien variabel
 X_1, X_2, \dots, X_n = kelompok variabel eksogen Y = variabel endogen
 ε = $\sqrt{1 - R^2}$

In this study, correlation analysis was conducted to prove the level of significance between exogenous and endogenous variables.

RESULTS AND DISCUSSION

In this study using variables from 2 sides, namely from the company side and from the project owner / owner, the following are the variables used in the study:

TABLE 1. Variables from the company side

VARIABLE	INDICATOR
A) Real data transfer	Accurate data Good data grouping system Fast information sharing
B) Fast Process	On time Quick bill Fast payment Quick troubleshooting
C) Integrated data	Conect with various divisions Can be checked anytime Can be quoted anytime
D) Company performance	Human resources Software and Hardware Company performance appraisal (ISO) As tender supporting data

TABLE 2. Variables from the Owner side

VARIABLE	INDICATOR
X) Cost	1) Contract 2) Thermyn 3) Addendum
Y) Quality	1) Quality control 2) Corective actions
Z) Time	1) Enviroment/weather 2) Community stabilty 3) Rule

After determining the variables, data searches were carried out using questionnaires to 45 respondents who were directly involved in the use of information technology-based information systems to obtain links between one variable and another and to find out which variables had the strongest influence on company performance. The following are the results of data collection using a questionnaire that has been summarized according to the weights.

TABLE 3. The results of data collection using a questionnaire

N	A	A	A	B	B	B	B	C	C	C	D	D	D	D	X	X	X	Y	Y	Z	Z	Z	
O	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	1	2	3	
1	3	3	3	3	4	2	4	3	3	3	2	2	2	2	4	4	4	4	4	4	4	4	4
2	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	4	5	4	4	4	4	4	4	4	4	4	4	5	4	4	5	4	4	4	4	4	4	4
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5	4	2	3	4	3	4	2	3	4	3	4	2	3	4	4	2	3	4	3	4	2	3	3
6	2	2	2	2	3	2	2	2	2	2	2	4	2	2	4	4	4	4	4	4	4	4	4
7	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	4
8	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9	4	4	3	4	4	4	4	4	4	5	4	4	3	4	4	4	4	4	4	4	4	4	4
10	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	4
11	4	5	4	4	5	4	5	4	4	5	5	4	5	4	4	5	4	4	5	5	5	5	4
12	2	2	4	4	4	4	4	4	4	4	4	2	2	4	2	2	4	4	4	4	4	4	2
13	4	4	4	4	4	2	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4
14	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
15	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	3	4	4	4	4	4	4
16	2	5	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	3
17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
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24	2	3	3	3	4	2	4	2	4	4	3	2	2	3	4	3	4	4	3	4	4	4	4
25	2	3	3	3	4	2	4	2	4	4	3	2	2	4	4	4	3	4	4	4	4	4	4
26	2	2	2	2	3	2	4	3	3	3	2	2	2	3	4	4	3	4	4	4	4	4	4

TABLE 3. The results of data collection using a questionnaire, continued

N O	A 1	A 2	A 3	B 1	B 2	B 3	B 4	C 1	C 2	C 3	D 1	D 2	D 3	D 4	X 1	X 2	X 3	Y 1	Y 2	Z 1	Z 2	Z 3
27	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	5	5	4
28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
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31	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	3	4	4	4	4	4
32	2	5	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	3	3
33	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
34	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2
35	2	5	3	3	4	2	4	4	4	4	3	2	2	3	4	4	3	4	4	3	4	4
36	2	3	3	3	4	3	4	4	4	4	3	2	2	3	4	4	3	4	4	3	4	4
37	2	3	3	3	4	2	4	2	4	4	3	2	2	3	4	4	3	4	4	3	4	4
38	2	3	3	3	4	2	4	2	4	4	3	2	2	3	4	4	3	4	4	3	4	4
39	4	4	3	4	4	3	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	3
40	2	3	3	3	4	2	4	2	4	4	3	2	2	3	4	3	4	4	3	4	4	4
41	2	3	3	3	4	2	4	2	4	4	3	2	2	4	4	4	3	4	4	4	4	4
42	2	2	2	2	3	2	4	3	3	3	2	2	2	3	4	4	3	4	4	4	4	4
43	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	5	5	5
44	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
45	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

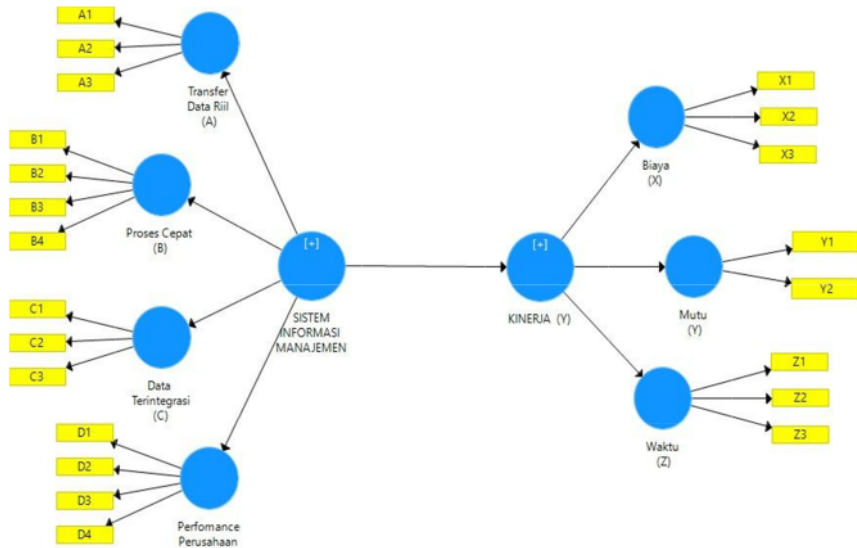


FIGURE 1. Modeling using Smart PLS

From the data above, modeling and analysis was carried out using Smart PLS in order to obtain the following research model:

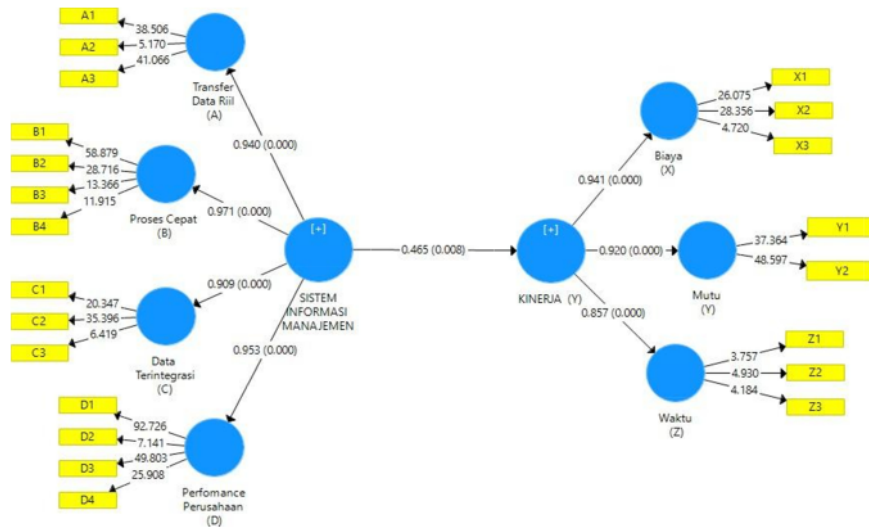


FIGURE 2. Modeling using Smart PLS

From the results of the bootstrapping output using PLS, it is found that the fast process variable (b) has the most significant influence on the management information system of construction companies. The management information system will be directly related to the performance of a company in the eyes of the owner in terms of the performance of the cost variable that has the greatest effect on the performance of the construction company.

CONCLUSION

From the results of the analysis above, it is found that the complexity of the interrelationship of the fast process variable (variable b) has the highest influence with a value of 0.971 on the construction company management information system which directly affects the company's performance. Meanwhile, the cost variable (variable x) has the greatest influence in terms of company performance. And a comparison of the performance of construction companies in this research location, namely PT Tunas Jaya Sanur, PT Mardika Griya Prasta and PT Sanur Jaya Utama after using information technology infrastructure is that the whole process can be faster in terms of time, and in terms of costs with this system can reduce operational costs and staff costs so that companies can become more efficient, effective and productive. The advantage of using this information technology infrastructure is that it is faster in terms of time, more efficient in terms of operational costs, more environmentally friendly because it uses less paper and can be done anywhere.

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