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PERFORMANCE EVALUATION OF HOUSING CONTRACTOR BY APPLYING THE PRINCIPLES OF ENVIRONMENTALLY FRIENDLY INFRASTRUCTURE

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ABSTRACT

Contractor performance is very influential in determining the quality of construction project. Many factors cause the problem of construction projects in Indonesia. One of the most influential issues is the contractor's management system and services to the customers or users. Contractor management and service systems have a significant effect on the contractor's performance. This study aims to evaluate the quality of contractor performance in the procurement of housing construction projects. The performance evaluation of contractors refers to the Green Building principles, which has become an essential issue at the moment regarding the application of environmentally friendly buildings. The object of research is housing project in Jember East Java Indonesia. The method used is multiple linear regression analysis by analyzing the level of user satisfaction on contractor performance. The level of comfort is referred to as the voice of user which is the consumer who bought the house in the project. Most of the physical implementation of the plan considers a lot of technical aspects without including a perception that contains the needs and user satisfaction of the physical work. The research results obtained seven contractor performance variables that need to be evaluated include Assurance, Responsibility and Reliability, Functional Performance, Aesthetics, Easiness, Durability, and Environmentally and Eco-friendly. The result of analysis gets the influence of seven performance factor which represented by the value of R Square = 0.964, meaning the variation of house procurement performance by the contractor can be explained by regression equation equal to 96.4% while the remaining equal to 3.6% explained by other factors outside model equation. The value R = 0.982 means that the influence of the seven performance factors is powerful. These results can be recommended in the

evaluation and improvement of contractor performance in housing procurement projects.

Keywords: performance, contractor, green building

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1. INTRODUCTION

The development of Indonesia's construction project is undergoing considerable changes in several respects. These developments affect the quality of work performed by contractors, so the contractor's performance is required to meet the demands and needs of Indonesian society. One such change occurred in the construction management carried out by the contractors. The increase in contractor quantity requires making many innovations in its project management so as not to compete with other contractors and to become the public trust in the physical implementation of the construction project. This study aims to evaluate the quality of contractor performance in the procurement of housing construction projects. The performance evaluation of contractors refers to the Green Building principles which have become an essential issue at the moment regarding the application of environmentally friendly buildings. To anticipate any disruption to the building, it can be applied the concept of green building is the concept of a structure that seeks to minimize the adverse effects on the natural environment and humans (Sedayu, 2015). Environmentally friendly buildings have the impact of reducing and avoiding environmental damage from physical implementation to the functions operational of the building. Green Building can provide solutions in the procurement of sustainable construction projects from the stage of implementation, maintenance until the building is used functionally (Samudro *et al.*, 2011). The Green Building Principles that can be referred to (Sedayu, 2016) include conserving energy, Working with climate, Minimizing new resources, Respect for users, Respect for the site, and Applicable in Holism. The object and location of the research is the procurement of housing projects in Jember District East Java Province. Consideration of housing projects to be the object and area of study because this object is a primary public facility and become the needs of Indonesian society today that many old problems of occupancy. Jember as the third largest city in East Java Province after Surabaya and Malang has many issues in residential. The research data is derived from the perception of residential users which consumers who buy housing and use the contractor services in housing procurement. User perceptions of satisfaction levels are used to evaluate contractor performance.

2. METHODS

The stages of research include the preparation of research instruments and research analysis. The results of the study are discussed to conclude the research problem. This research seeks to assess the performance results of contractors which consider many technical aspects without including aspects of user needs. The performance evaluation is based on user perceptions called the voice of the user. The methods and analysis step contain as follows.

2.1. Preparation of Research Instruments

The development of research instruments is based on the view of the user through survey and preliminary interviews on the object and location of the research that is housing in Jember.

The research instrument is also compiled with previous studies, but in this research, there is a development of research novelties compared to the previous analyses. Table 1 shows the prior research that became the reference in this study.

Table 1 The Previous Researches

Number	Researcher	Year	Research Variables	Method
1	Priyo	2013	Cost and technically aspect	Lost system and Merit Point System
2	Huda	2013	Appropriate Site Development, Energy Efficiency and Refrigerant, Water Conservation, Material Resources and Cycle, and Indoor Air Health and Comfort	Field measurement, Qualitative and quantitative, and Greenship standard ranking
3	Syahrozi	2013	Land use, form and facade of the building, and air conditioning	Documentation, Optimation, and modeling
4	Ervianto	2013	Environment and Water, Access and Equity, Construction Activities, Materials and Resources, and Pavement Technologies	Rating Green road and Invest
5	Komalasari	2014	Energy Efficiency Measure, Natural and artificial Lighting, Ventilation, Climate Change Impact, dan Air condition system	Comparison study, Modeling by using software, and Field measurement
6	Muzammil	2014	Flood intensity, soil water quality, flood area, and soil type	Survey and field application
7	Sedayu	2015	Security, Safety and Health, Responsiveness of management institution, Utility building performance, Architectural aesthetics, convenience and affordability, Reliability, Building durability, Frequency and density, Comfort and regularity, availability and public facilities, and environmental-friendly concept	Survey and Statistic Descriptive
8	Ervianto	2015	Healthy and Safety in work, quality of air, building environment management, resources and material cycle, appropriate land use, water conservation, and energy conservation	Model of Assessment Green Construction
9	Furqan	2016	behavior, minimum waste, and maximum value	Analysis of descriptive, reliability, and multiple linear regression
10	Sedayu	2016	Assurance, Responsiveness and reliability, Performance, Aesthetics, Easiness, Durability, and Eco-friendly	Importance Performace Analysis and Quality Function Deployment
11	Prakasa	2017	Water conservation, energy conservation, healthy and Safety in work, project comfort, quality of air, building environment management, resources and material cycle, and appropriate land use	Model of Assesment Green Construction
12	Nugrahardani	2017	Waste and Carbon Footprint	Survey and Statistic Descriptive

2.2. Validity and Reliability Test

This step to determinate instrument test for the survey. The research instrument to be distributed to 30 respondents for this test. Beside that, to know the instrument validity should use validity test. Validity test is used to know the validity from respondents that answer the

questions. The number of respondents is 30 persons is the minimum respondents for this test (Sugiyono, 2009). This test as correlation test by use product moment from Pearson equation:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\left\{N\sum X^2 - (\sum X)^2\right\}\left\{\left(N\sum Y^2\right) - (\sum Y)^2\right\}}}$$

Where :

r_{xy} = Correlation coefficient for all items

X = Respondents score for each item

Y = Score total for each respondent in all items

ΣX = Number of the score in distribution X

ΣY = Number of the score in distribution Y

ΣX^2 = Number of the square of each score X

ΣY^2 = Number of the square of each score Y

N = Number of subjects

In this research, an instrument is defined strong correlation if the correlation value bigger than 0,6 (Sugiyono, 2009). Reliability test aims to know that data collector can show the level of accuracy, stability, and consistency in define phenomena in different time. To examine the internal consistency by using consistency coefficient (Alpha Cronbach). Alpha Cronbach equation that used in this reliability test as follows: $r_1 = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum \sigma b^2}{\sigma.t^2}\right]$

Where :r_1 = Instrument consistency; k = Number of question item; $\Sigma\sigma b^2$ = Number of variance; σb^2 = Total variance

The instrument will be reliable if the consistency coefficient has value above 0,60 (Sugiyono, 2009). The validity and reliability test by using SPSS 20. A measurement scale in the preliminary survey include:

1 = Not satisfactory

2 = Less satisfactory

3 = Quite satisfactory

4 = Satisfactory

5 = Very satisfactory

The Bernoulli equation seeks the determination of respondents as the research samples: $N \geq \frac{\left(Z_{a/2}\right)^2 p.q}{e^2}$, so that become $N \geq \frac{(1{,}96)^2.0{,}95.0{,}05}{(0{,}05)^2} \rightarrow N \geq 72{,}99 \approx 73$

Where N = amount of minimum sample; Z = value of normal distribution; e = level of error; p = proportion of questionnaires that are assumed true; q = proportion of survey that is considered false. Value is expected true equal to 95%, and then polls that are supposed wrong equal to 5%.To avoid lacking data because of mistake of filling or the questionnaires are not return, the number of respondents to be used by 100 persons.

2.3. Multiple Linear Regression Analysis

The Multiple Linear Regression Analysis to be used to know the influences between research variables to service quality of housing procurement. Multiple Linear Regression needs requirement test that called Classical Assumption Test contain normality test, linearity test, multicollinearity test, autocorrelation test, heteroscedasticity, and Partial Influence Test. The normality test is used to know the standard distribution of population data. The termination of normal distribution level of a population data is done by using the Asymp value. Sig. (2-tailed) Compared with an alpha level of 5% (Sudarmanto, 2005). Linearity Test of Regression to prove the linear line model according to the conditions. One method of linearity testing of regression line equation is done by comparing the significant coefficient to the error rate of 5% (Sudarmanto, 2005). The multicollinearity test is done to prove or to know the relationship between independent variables. This test compares the significance coefficient of the SPSS 20 output with a 5% error rate or a 95% confidence level (Sudarmanto, 2005). The autocorrelation test is carried out to know the correlation between observation data. The parameter used to indicate whether there is an autocorrelation which uses Durbin-Watson statistic value is close to value 2, it can be stated that the observational data has no autocorrelation. The heteroscedasticity test is used to determine the similarity level of residual absolute variance for all observations. Comparison coefficient significance uses the determination of this test with alpha level 0.05 (error level 5% or 95% confidence level). Partial influence test is intended to determine the influence level of one independent variable to the dependent variable, while one or more other independent variables are fixed or controlled (Sudarmanto, 2005). This research includes seven independent variables and one dependent variable as hown in Figure 1.

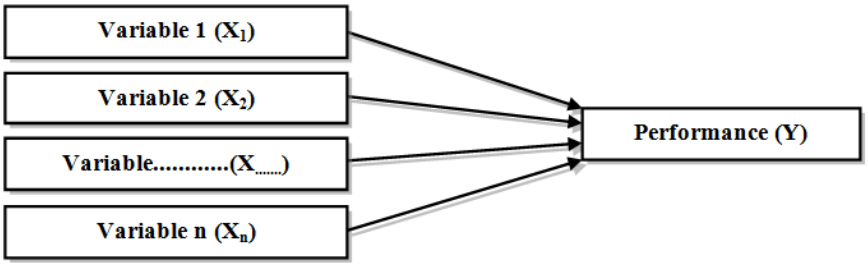

Figure 1 The Relationship between contractor performance

2.4. Data Analyzing Technic

Multiple Regression Models with this equation: $\mathbf{Y = a_1X_1 + a_2X_2 + ...+ a_nX_n + e}$. Where: Y =Dependent variable**;** a_0 = Intercept; a_1, a_2, a_3=Independent coefficient**;** X_1= Independent variable 1**;** X_2= Independent variable 2**;** X_n= Independent variable n

3. RESULTS AND DISCUSSION

3.1. The Result of Research Instrument Preparation

The research instrument is compiled through the data collection of the voice of the user and previous studies. The results of the compilation of research instruments as a means of collecting data analysis are shown in Tables 2 and three consisting of seven independent variables and one dependent variable. The seven separate variables include Assurance, Responsibility and Reliability, Functional Performance, Aesthetics, Easiness, Durability, and Environmentally and Eco-friendly. Contractor performance in the housing projects procurement becomes one dependent variable.

3.2. The Results of Validity and Reliability

The test of research instrument on 30 respondents obtained the results of validity test (correlation value) for all variables greater than 0.6 which means the device is called valid. The reliability test obtains the alpha value of 0.984 which higher than 0.6. The results of this reliability test indicate that the instrument is called reliable. The effect of validity and reliability test which valid and reliable explains that the device can be used as a data collection tool.

3.3. The Results of User Satisfaction Survey

The result of collecting the mean value of the user satisfaction level on the seven independent variables of the contractor's performance using the research instrument is shown in Table 2, while Table 3 is the result of calculating the mean value for the level of user satisfaction as the dependent variable. The calculation result of this mean value can be used in the next analysis that is multiple linear regression.

Table 2 The Level of User Satisfaction to Seven Independent Variables (X)

Number	Sub Performance Factors	Mean
X_1	Assurance	
1	Clarity of contracts and project agreements are honest and clearly	3.724
2	The payment system in ethical financial order and banking	3.812
3	Determine the design and specifications of house building	3.874
4	Completeness and clarity of house procurement document	3.874
5	Clarity of protection under force majure conditions	3.676
6	Protection services for post-construction building damage	3.661
7	Free from intimidation, harassment, and threats	3.899
X_2	Responsibility and Reliability	
8	Contractor give attention to all client complaints	3.703
9	The contractor is quick to respond to client problems	3.741
10	The contractor is polite and friendly in serving	3.815
11	Contractor provide transparent and honest information	3.766
12	The contractor has complete information	3.842
13	Services by the client's needs	3.828
14	The construction process based on the project schedule	3.375
15	Reliability in the service of all housing procurement activities	3.504
X_3	Functional Performance	
16	Functioning of facilities and utilities of the house	3.887
17	Operation of facilities and services in the housing area	3.927
18	Construction and nonconstruction performance is good	3.721
X_4	Aesthetics	
19	Building aesthetics is according to the design items requested	3.887
20	Building aesthetics by the payment	3.822
21	Building aesthetics by the materials specifications	3.874
X_5	Easiness	
22	Ease of getting all housing procurement information	3.755
23	Ease of inspection and evaluation in construction project	3.918
24	Ease of getting service during and after construction	3.872
25	Easy to coordinate with the contractor	3.778
26	Easy to coordinate with the construction executor	3.874
27	Easy to organize with the banking	3.827
X_6	Durability	
28	The durability of construction and nonconstruction materials	3.732
29	Material specification used is according to technical requirements	3.706
X_7	Environmentally and Eco-friendly	
30	Designs and materials support safety and security	3.689
31	Design and elements of ergonomics and comfort	3.761
32	Materials and construction used environmentally and eco-friendly	3.685

33	Alternative energy is solar panel resources	3.328
34	Alternative energy is wind resources	3.478
35	There is no negative area either inside or outside space	3.849
36	Design and material to respond the disabled person	3.715
37	Functioning of natural lighting (solar panel)	3.924
38	The operation of natural air condition (wind circulation)	3.892
39	View and direction of building oriented to the wind and sun orientation	3.795
40	Space organization and direction by standards	3.803

Table 3 The Level of User Satisfaction to Dependent Variable (Y)

Number	Performance Factors	Mean
1	Assurance in agreement, payment, design, contract, document, force majure condition, building destruction, interruption, and intimidation	3.807
2	Responsiveness and reliability of contractor in providing attention, to solve many problems, good in service and communication, know all information, polite and friendly, and construction process finish on time	3.915
3	Performance of facility and utility at housing and region, and production of construction and nonconstruction materials	3.769
4	Aesthetics suitable for design, cost, and material specification that is determined and agreed	3.861
5	Easiness in information, inspection and evaluation, service, coordination with the construction company, and banking	3.774
6	Durability in construction and non-construction material and material specification suitable for criteria	3.815
7	Environmentally and Eco-friendly in design, material, alternative energy from wind and solar cell, no negative area or space, natural lighting and air circulation, orientation, and spatial organization	3.709

3.4. The Result of Multiple Linear Regression Analysis

The results of multiple linear regression analysis to determine influence level between variables and create a mathematical model for contractor performance evaluation is shown in Table 4.

Table 4 Multiple Linear Regression Analysis Result

Variable	Unstand.	t-account	t-table	
(constant)	22.718			
Assurance (X_1)	3.782	3.892		t count > t table (significant)
Responsibility and Reliability (X_2)	9.275	4.114	1.623	t count > t table (significant)
Functional Performance (X_3)	7.305	3.927	(dk = 50	t count > t table (significant)
Aesthetics (X_4)	3.661	2.971	and alpha =	t count > t table (significant)
Easiness (X_5)	2.854	3.520	5%)	t count > t table (significant)
Durability (X_6)	6.528	6.451		t count > t table (significant)
Environmentally and Eco-friendly (X_7)	3.796	5.045		t count > t table (significant)
R	= 0.982			
R Square	= 0.964			
α	= 0.05			

Notes:

- Number of data (respondent) = 100

- Dependent variable (Y)

The result of analysis gets the influence of seven performance factor which represented by the value of R Square = 0.964, meaning the variation of house procurement performance by the contractor can be explained by regression equation equal to 96.4% while the rest 3.6%

explained by another factor outside model equation. The value R = 0.982 means that the influence of the seven performance factors is powerful. From the analysis process can be made regression model as follows,

$$Y = 22{,}718 + 3{,}782X_1 + 9{,}275X_2 + 7{,}305X_3 + 3{,}661X_4 + 2{,}854X_5 + 6{,}528X_6 + 3{,}796X_7$$

3.5. Classic Assumption Test Results

The calculation results to test the normality obtained Kolmogorov-Smirnov Test Z has shown for each variable has Asymp value. Sig. 2 tailed> of the alpha level of 0.05, meaning the data is from a normally distributed population. The linearity test results show that the significance value> 0.05 for the seven performance factors so that the regression line model is linear. The effect of Multicollinearity test indicates that the amount of significance is more significant than alpha level of 0.05. Thus it can be concluded that among independent variables does not occur multicollinearity. The analysis results for the Autocorrelation test obtained Durbin-Watson value of 1.998. This value is said to be close to value 2, so it can be concluded there is no autocorrelation between observation data. The calculation results for seven variables obtained significance value higher than the alpha level of 0.05. Hence there is no heteroscedasticity.

3.6. Partial Influence Test Results

The result of partial influence test shows that seven variables have a powerful effect where the result of t-count> t-table. These results can be seen in Table 4, where the value of t-table = 1.623 while the amount of t-count for the seven variables above the t-table value = 1.623.

Contractor's management system and services have a significant effect on its performance in the housing procurement of construction projects including. The satisfaction level referred to as the voice of the user is very important to consider in assessing and evaluating the contractor performance. The most of physical implementation project think a lot of technical aspects without including user perceptions that contain the user needs to physical work, affected the result not maximal. The level of user satisfaction can measure the contractor performance in the implementation of housing project work. Users can be defined by consumers who buy a housing unit in the project. The results obtained seven contractor performance variables that need to be evaluated include Assurance, Responsibility and Reliability, Functional Performance, Aesthetics, Easiness, Durability, and Environmentally and Eco-friendly. The analysis results obtained the influence of seven performance factors represented by R Square = 0.964, meaning the variation of house procurement performance by the contractor can be explained by the regression equation of 96.4% while other factors outside the model equation explain the remaining of 3.6%. The value R = 0.982 means that the influence of the seven performance factors is powerful. The classic assumption tests include normality test, linearity test, multicollinearity test, autocorrelation test, and heteroscedasticity test to ensure that the model obtained can be evaluated for contractor performance. The calculation results of the normality test obtained Kolmogorov-Smirnov Test Z shows that the data derived from a healthy distributed population. The effect of linearity test shows that the significance value for seven factors makes the regression line model linear. The result of the Multicollinearity test showed that the significance value obtained explained that among the independent variables did not occur multicollinearity. The analysis result for Autocorrelation test obtained Durbin-Watson value which illustrates no autocorrelation between observation data.

4. CONCLUSIONS

The calculations results for seven variables acquired value significance that explains no heteroscedasticity that occurs. Partial influence test results show that seven variables have a powerful effect. All the results of this test can be recommended in the evaluation and improvement of contractor performance in housing procurement projects.

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