Development of Cost Estimation Model for Residential Building

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Abstract: **Estimated cost plays an important role to predict the cost of projects need to be provided by the owner. Estimator are often faced with the question of how much is the cost to build homes. To answer that question we need a model that can be used practically by the estimator or even owner in predicting the costs required to finance the construction of residential houses.**

The method will be used in this research is to collect data from the developer who lives in Jakarta, the data calculation of estimated costs of quantity surveying consultancy firm, the data interviews and questionnaires. The data collected was processed using Microsoft Excel to get the model estimation.

Development cost estimation model that can be used by the estimator to calculate the estimated price for residential buildings is Y = -622.48 + 16,19X2 + 6,76X3 where Y = cost of construction of houses, X2 = Total land area, X3 = Building Area, after applying the model in residential buildings, the accuracy of the model obtained is in the range of + 5.40% s / d -16.08% of the development cost for the maximum / minimum land area is 140/36 m2 and maximum / minimum for building area is 150/36 m2

Keywords: **Estimates, Costs, Model, Building, Residential.**

I. INTRODUCTION

Estimated cost of the project can be used for several purposes, one of which is the provision of initial project costs of the project. The accuracy of the cost estimate depends on the skill and accuracy estimator in following the whole process of work and according to the latest information.

Estimator learns the plans and specifications prior cost estimates. Based on the plans can be seen material needs. Quantity calculation done if the planning process is mature so that the image or clear job description, but in the early planning may not be based on the calculation of the quantity.

Selection of detailed price estimation methods require more detailed guidelines and a relatively long time in order to obtain an accurate estimation.

Estimator are often faced with the question of how much is the cost to build homes. To answer that question we need a model that can be used practically by the parties concerned as estimator or even the owner in predicting the costs required to finance the construction of residential houses and the results of the cost estimate is expected to approach the actual cost.

Referring to the above conditions, then done research on the development of the project cost estimation model residential buildings. From this assessment will be made a model that can be used to calculate the estimated cost at the initial stage of the project.

II. REVIEW OF LITERATURE AND RESEARCH METHODOLOGY

Estimated cost is the art of estimating the amount of fees required for an activity that is based on the information available at that moment, by definition, are the cost estimates have an understanding as follows: a) The cost estimate is to see, calculate and conduct estimates on things will happen next. b) Analysis of charge, which means the assessment and discussion of the cost of ever being used as an important information. (Soeharto, 2001).

Predicting the amount of costs that will be needed to realize the project is one of the important elements that must be done in the early stages of a project plan. Estimated cost of construction is adequate is a key factor in construction projects. There are three models compared estimate that Neural Networks (NNS), Multiple Regression Analysis (MRA) and Case-Based Reasoning (CBR). (Kim, An, & Kang, 2004)

The cost estimate is a prediction process used to measure, costs, and prices of resources required by the scope of investment options, activities, or projects (AACEI, 2004). In addition to the necessary technical knowledge and Engineering, estimation quality is largely determined by the availability of data and information, techniques and methods used, the skill and experience of the estimator, the purpose of using cost estimates.

A. *Type Project Construction Cost Estimation:*

There are several types of construction cost estimates that can be selected to determine the price. The following methods and types of construction cost estimates are:

1. Estimated Price Definitely:

There are two methods that you can use to make sure the price estimates:

a. Methods Lump sum:

This is done when the type of work and the amount is known and recognized properly. In this case the risk is relatively high for the contractor. Owners benefit from a price that is certain so they can make a budget.

b. Methods Unit Price:

Methods unit price is determined based on the price per item of work. In the estimation of the number of deals included every kind of work to then totaled by drawing architectural plans.

2. Estimated Price:

This estimate is based on the fact details of the cost of previous projects. Several methods can be used:

a. Price per function. Calculations based on estimated usage of each function.

b. Wide price. This method bases the calculation of square area.

c. Price Volume. Volume pricing based on volume cubication of building.

d. Modular Takeoff. This method refers to the concept of the module is then multiplied by the entire project.

e. Partial Takeoff. Method by combining all types of jobs previously estimated based on the unit price.

Unit Price Panel. This method is done by assuming a price per unit of floor area, circumference, wall, roof and all other work items.

B. *Sources of Data:*

The data used in this study there are two sources of primary data and secondary data. Sources of primary data are in the form of projects of common data and technical data of the project. Sources of secondary data are cost estimation, Bill of Quantity calculation data; Work Plan and Conditions; and working drawings and literature. Data is the dominant secondary data, while primary data obtained it is only used as a supplement and complement with the aim to help writers in drawing conclusions. Secondary data is the supporting data used in the manufacturing process and formulation research from a field that can be directly used as a source of calculation so that a data ready for use.

C. *Method of collecting data:*

In this study, data collection carried out by the method of direct observation by referring to the following:

1. Collecting data cost calculation similar projects in residential building project in Jakarta.

2. The data collected in the form of cost estimates submitted by the owner for each work package.

3. The price component of the cost of work and the total cost of the work is collected without Value Added Tax (VAT)

D. *Data analysis:*

Data analysis techniques used in this research is using descriptive statistical analysis and inferential analysis.

The multiple regression analysis uses the assumption that the cost of construction as the dependent variable and the cost of those items work as independent variables. Both of these variables have the multiple linear regression can be formulated as follows:

$Y = a_0 + a_1 X_1 + a_2 X_2 + a_3 X_3 + \ldots + a_n X_n$

Where:

Y = Dependent Variable

X = Independent Variables

a = Coefficient equation

Analysis of data using inferential analysis is multiple regression analysis with the help of a computer program Microsoft Excel and SPSS (Statistical Product and Service Solution)

E. Results and Discussion:

The amount of data on the calculation of project cost estimation residential building acquired a number of 50 projects scattered residential buildings in Jakarta.

Analysis of the input data used Microsoft Excel. The cost of construction of houses (Y) as the dependent variable and independent variables, namely the status of ownership, land area, building area, number of bedrooms, number of bathrooms, number of floors and watts of electricity.

From the results of statistical tests performed using Ms. Excel elected independent variables: Land area (X2) and building (X3) that has an influence on the dependent variable cost of construction (Y) which can be seen in Table 1 below:

Table 1. Correlation between the cost of construction with a building area and land area

	Luas Tanah	Luas Bangunan	Biaya Pembangunan
Luas Tanah	1.00		
Luas Bangunan	0.37	1.00	
Biaya Pembangunan	0.90	0.66	1.00

Table 2. Regression

Regression Statistics	
Multiple R	0.96
R Square	0.93
Adjusted R Square	0.92
Standard Error	167.94
Observations	22

 Summary Output in Table 2 shows that the residential building project obtains the figure adjusted R Square = 0.92, these results indicate that 92% of the cost (Y) is influenced by: a land area (X2) and building (X3) only. While the rest (100% - 92% = 8%) be influenced by other causes. From the ANOVA test or F-test, level of significance = 1,27062E-11 value <0.05, the regression model can be used to predict the cost of development or it could be explained that the independent variables affect the dependent variable and the value of t-Stat for the remaining variable indicates the value > 2, shown in table 3 below:

Table 3 Anova

	df	SS	MS	F	Significance F
Regression	2	6,980,705.63	3,490,352.81	123.75	1.27062E-11
Residual	19	535,889.83	28,204.73		
Total	21	7,516,595.45			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	(622.48)	133.49	(4.66)	0.00	(901.87)	(343.09)	(901.87)	(343.09)
Luas Tanah	16.19	1.41	11.44	0.00	13.23	19.15	13.23	19.15
Luas Bangunan	6.76	1.18	5.72	0.00	4.28	9.23	4.28	9.23

Obtained by linear regression models the relationship between the estimation of the cost of construction of residential building with an area of certain buildings and certain land area are:

$Y = -622{,}48 + 16{,}19\ X_2 + 6{,}76\ X_3$

Where:

Y = Estimated Construction Cost (Rp/m^2)

a_0 = Intercept

a_2 = Land Area

a_3 = Building Area

From the test results show that the model of the model's accuracy rate is in a range between + 5.40% and - 16.08%. For the needs of the initial estimate of a residential development, this model can be used to predict the cost of construction of residential houses with a certain area.

III.   CONCLUSION

Cost estimation model for housing development obtained from the processed form multiple regression is $Y = -622.48 + 16.19\ X_2 + 6.76\ X_3$ with figures adjusted R Square = 0.92 indicates that 92% of the cost (Y) affected by: a land area ($X2$), and the building area ($X3$). While the remaining 8% is influenced by other causes.

From the test results obtained by the accuracy of the model estimation methods cost structure of residential buildings ranging between + 5.40% and - 16.08%

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