

Optimization House Type and Feasibility Study in Kitanara Regency Jombang

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Abstract— With the high growth of population in Jombang, it will lead to increased demand for residential houses. Kitanara regency offers a total of 61 residential housing units, where the house consists of 19 houses type A, type C 31 houses and 11 houses of type C. Sensitivity analysis of Kitanara Regency housing result is NPV Rp 6,155,903,283, BCR 1.94, and IRR 17%. In this feasibility evaluation used parameters such sensitivity analysis as the Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR). This study resulted in optimization composition of houses for type A, type B and type C, each of which was 16; 33 and 12 units with Quantitative Analysis for Management (QM) program. From the financial analysis based on the composition of the house, it produces a Net Present Value (NPV) of IDR 7,613,270,783 > existing NPV, Benefit Cost Ratio 1.94 (BCR) > 1.65 BCR existing and Internal Rate of Return (IRR) value of 17 = existing IRR.

Keywords— Feasibility, Housing, Optimization.

I. INTRODUCTION

Housing is a basic necessity in Indonesia, therefore housing is highly prioritized. For the Indonesian government, housing is a priority to be realized. Therefore houses must be managed by the state. In Indonesia housing is regulated by the Ministry of Public Housing. So that the procurement of houses is orderly and well ordered, especially in urban areas. Do not let a city have its residential arrangements in chaos and chaotic so that it is difficult to manage its urban planning.

Properties should be able to plan properly manage the project in order so that they can run according to the desired expectations.

Jombang, East Java, Indonesia is a strategically located city because it is in the middle of other cities and a city through which transportation passed between other cities in East Java. In the north Jombang is bordered with Lamongan, in the west is bordered with Nganjuk, in the south is bordered with Kediri, in the east is bordered with Mojokerto, this situation makes Jombang city very strategic because all the activities of these cities pass. Jombang also not far from the city of Surabaya which is the provincial where the city of Surabaya has been used as a business in all fields. Moreover, Jombang has now built toll roads that connect with other cities which are usually easily and quickly reached. Here we will research property business opportunities in Jombang.

In this research, we will analyze starting from residence development planning, which optimizing the comparison of house types and their feasibility studies. This research will provide input for development who will carry out their business. It will be a record that can be calculated for development.

II. LITERATURE REVIEW

An investment is an activity of investing in the long term which apart from the investment, it is necessary to realize from the beginning that the investment and will be followed by a number of other periodic expenses.

Feasibility Study

The purpose of feasibility study is to improve investment options because available limited resources, so most profitable project alternatives are selected and determine investment priorities. In analyzing an effective project should consider interrelated aspects and collectively determine how the benefits of a particular investment and consider all these aspects at every stage in the project planning and the planning cycle.

Cash Flow

Cash flow is an increase or decrease in the amount of money raised. In finance, this term is used to describe the amount of cash that is generated or consumed in a certain period of time. Cash flow can be divided: (Hernawan, 2011).

1. Initial Cash Flow
Pattern of cash flow related to capital expenditures.
2. Operational Cash Flow
Determining operational cash flow will be a year is the starting point for assessing the profitability of the investment proposal.
3. Terminal Cash Flow.
Terminal cash flow cash flow is generally comprised of the residual value of the investment and return on working capital.

Investment Assessment Criteria

Assessments can be used in assessing a proposed investment or project: (Halim, 2005).

1. Concept of Time Value of Money
a Compound interest Compound interest, also referred as interest, shows the interest on principal of the loan.
b Present value shows how the value of money at moment to a certain value in the future.
2. Net Present Value (NPV)
Net Present Value (NPV) is a method of calculating the net present value. Present assumption that explains the

initial time of calculation coincides with the time of evaluation performed or during the period tahunke-zero (0) in the calculation of cash flow investment.

$$NPV = \sum_{i=1}^n \frac{NB_i}{(1+i)^i} - n$$

If calculated NPV is greater than 0 (zero), this means project is feasible to be implemented and if NPV less than 0 (zero) this means not feasible to be implemented. The result of the calculation of the NPV is equal to 0 (zero), this means the project is in a Break Event Point (BEP).

3. Internal Rate of Return (IRR)

In the method of Internal Rate of Return (IRR) that will look for the interest rate when NPV equal to 0 (zero). So, in this IRR method, the information generated relates to the ability of cash flow to return investment, which is described in terms of % each time periods. The simple logic explains how the cash flow's ability to return capital and how much obligations that must be met. This capability is Internal Rate of Return (IRR).

$$IRR = i_1 + NPV_1 (NPV_1 - NPV_2) \times (i_2 - i_1)$$

4. Benefit Cost Ratio (B/C Ratio)

The benefit cost ratio (BCR) method is one of the methods often used in the initial evaluation stages of investment planning or as an additional analysis in order to validate the evaluation results that have been carried out by other methods. This BCR method emphasizes the comparison value between the benefit aspects to be obtained with the aspects of costs and losses to be borne (cost) with the investment.

$$B/C = \frac{PV(\text{Benefit})}{PV(\text{Cost})}$$

* If $B/C > 1$ the project was feasible; if the $B/C < 1$ the project was not feasible.

Linear Programing

Linear programming is an analytical planning technique that uses mathematical models and aims to find the best alternative. The emphasis is on the optimum combination, meaning that one step has been considered from various sides or efficient and effective. The combination is maximizing or minimizing the objective function that satisfies the requirements determined by the constraint in the form of linear inequality.

Standard form of the linear program models consist of several functions: (a) objective function, and (b) constraints function.

Objective function is a function that describes objective of optimally allocating resources to obtain maximum benefit or minimum cost. Meanwhile, the function of constraint is the available capacity which will be allocated optimally to various company operation activities.

There are two methods of linear programming:

1. Graph Method

Graphing method can be used when two variables are used but if more than two variables can use the graph we will have difficulty. For more than two variables easier we use the simplex method

2. Simplex Method

Simplex method is a systematic method starting from a basic feasible to manager others feasible (with the number of repetition is limited) so it can set the base of optimal and at each step produces the value of the objective function is always greater or less or equal to the previous steps. If a linear program problem contains only 2 activities or decision variables, it can be solved using the graphical method. However, if it involves more than two activities, the graphical method is no longer effective, so the simplex method is needed. The simplex method is a method commonly used to determine optimal combination of three or more variables.

Before doing iterative calculations to determine the optimal solution, first general form of linear programming is changed to standard.

Quantitative Analysis for Management (QM)

Quantitative Method (QM) is software and accompanies steps regarding operations management. QM for windows is a combination of the previous DOS and POM for windows programs, so when compared to the POM for windows program there are more modules available in QM for windows.

One of the analytical techniques that is often used as an alternative in solving maximum or minimum problems, so that with the help of this module, various problems in research operations can be resolved quickly.

III. METHOD

This study uses qualitative research methods using sensitivity analysis to variables that affect investment of KITANARA Residential, in Jombang Regency and using Quantitative Analysis for Management (QM) program to optimization composition of houses type with simplex metod. In this research, we also calculate the feasibility study of the Kitanara development project by applying optimization of house types.

Kitanara Residency was developed from Surabaya, East Java. In implementation, the construction involves local contractors from Jombang. Some of other works were several by subcontractors. The management and facilities are still managed by PT Trianda Karya, which will later by separate management. Management includes security costs, maintenance, waste, road cleaning and environment.

IV. RESULTS AND DISCUSSION

Optimization House Type

Advantages of each type of housing is:

- Type of house A as Rp. 100.956.000 \approx 10,09
- Type of house B as Rp. 79.747.000 \approx 7,97
- Type of house C as Rp. 38.686.000 \approx 3,86

Objective function can be written is as follows:

$$Z = 10.09 X_1 + 7.97 X_2 + 3.86 X_3$$

Constraint function is an equation of various variables that can reduce the maximum profit that can be obtained by the developer. The constrains functions that have been determined

are as follows:

1. Through land
 - a. Where it has been determined area of land designated for the building to be sold is 4.314,3 M².
 - b. The land area that is devoted entirely for buildings and will be sold consists of three types, A; B; and C with an area of 72 M²; 72 M² and 60 M². So that we get the constrains function, are as follows:
 $72 X_1 + 72 X_2 + 60 X_3 \leq 4.314,5$

2. Through a comparison of consumer interest in each type of house.

Based on the results of the types that have been sold, then that the comparison of consumer interest in each type of house are as follows:

- a. Type of house A as 6 units
- b. Type of house B as 23 units
- c. Type of house C as 6 units

So it can comparison of the demand for house into three types:

$$\text{Type A : Type B : Type C} = X_1 : X_2 : X_3 = 6 : 23 : 6$$

Simplifying comparison above by dividing equally, the comparison, it will obtain a comparison:

$$X_1 : X_2 : X_3 = 1 : 3,8 : 1$$

Thus obtained constrains functions second and third constrains functions, is as follow:

$$3,8 X_1 \leq X_2 \text{ and } X_2 \leq 3,8 X_3$$

So it can be formulated as follows:

$$Z = 10,09 X_1 + 7,97 X_2 + 3,86 X_3$$

$$3,8 X_1 - X_2 \leq 0$$

$$X_2 - 3,8 X_3 \leq 0$$

TABLE 1. Optimal Results in QM Program

	TYPE A	TYPE B	TYPE C	RHS	Equation form	
Maximize	10,9	7,97	3,86		Max 10,9TYPE A + 7,97TYPE B	
KENDALA 1	72	72	60	<=	4314,5	72TYPE A + 72TYPE B +
KENDALA 2	2,8	-1,4	0	<=	0	2,8TYPE A - 1,4TYPE B <= 0
KENDALA 3	0	1	-2,8	<=	0	TYPE B - 2,8TYPE C <= 0

Source: Calculation Result, 2020

From the results of calculations using QM program is obtained:

$$X_1 = 16,6675.$$

$$X_2 = 33,335.$$

$$X_3 = 11,9054.$$

$$\text{Optimization Value} = 493,3102.$$

The result is a decimal value, it can be rounded to:

$$X_1 = 16.$$

$$X_2 = 33.$$

$$X_3 = 12.$$

TABLE 2. Linear Programing Results in QM Program

	TYPE A	TYPE B	TYPE C	RHS	Dual
Maximize	10,9	7,97	3,86		
KENDALA 1	72	72	60	<=	4314,5
KENDALA 2	2,8	-1,4	0	<=	0
KENDALA 3	0	1	-2,8	<=	0
Solution->	16,6675	33,335	11,9054		493,3102

Source: Calculation Result, 2020

Optimization Value is 479,1384 then multiplied by 10

million to Rp. 4,791,384,000.00.

From the optimization value with the QM program, it is obtained a savings value is Rp. 1.457.367.500,00.

Net Present Value (NPV)

Calculation of NPV analysis by using interest rate, its level of interest rates on loans.

Based on the results of the calculation, it can be seen NPV = Rp. 7.613.270.783, its means NPV > 0 (zero), then the decision can be accepted and the project is feasible to run.

Can also be calculated with the benefit cost ratio (B/C Ratio).

$$\text{B/C ratio} = \frac{\sum \text{NPV Positif}}{\sum \text{NPV Negatif}} = 1,94$$

As long as the B/C ratio is ≥ 1 , the project development can be accepted.

Internal Rate of Return (IRR)

IRR calculation is to calculate interest rate on the condition NPV = 0. The project is feasible if the IRR > level results. Calculation using interpolation method, until the NPV approaches 0.

Based on the calculation, can be seen a positive NPV closest to 0 (zero) and the level of interest rates and negative NPV closest to 0 (zero). This means IRR is between interest rates. Thus it can be seen that the amount of IRR is between the interest rates.

$$\text{IRR} = I_1 \left(\frac{\text{NPV Positif}}{\text{NPV Positif} - \text{NPV Negatif}} \right) (I_2 - I_1)$$

$$\text{IRR} = 17 \%$$

V. CONCLUSIONS AND RECOMMENDATION

Conclusions

To get maximum profit, optimal composition of the house type being built is 16 units type (A); 33 units type (B) and 12 units type (C). Which composition before optimization is type (A) as 19 units; house type (B) as 31 units and type house (C) as 11 units.

Based on the optimal composition of the implementation of the QM program, the financial analysis of the Kitanara Regency housing project is as follows:

1. Net Present Value (NPV) is Rp. 7,613,270,783 which is greater than the NPV of the existing condition is Rp. 6,155,903,283.
2. The Internal Rate of Return (IRR) value obtained 17%, which is greater than the IRR of the existing conditions of 17%.
3. Value of Benefit Cost Ratio (BCR) is 1.94, which is greater than BCR for the existing condition, which is 1.66.
4. By following the composition of the number of housing units in accordance with this research, the developer can gain more profit as Rp1.457.367.500,00.

Recommendation

1. For the next research, it is hoped expected to more components and more types of houses, so it will be obtained better studied and research.

2. To use QM program (Quantitative Analysis for Management) is expected later be used to add an item on the module, so it will be obtained complex research.

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