



Value engineering analysis of the green semesta housing project in Semarang

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ABSTRACT

The demand for housing continues to rise along with the growing population. Housing development is one of the efforts to meet society's need for residential homes. The Green Semesta housing project in Semarang offers Type 36 and Type 45 houses. However, given the vast area of Semarang and the intense competition among housing developers offering higher-segment housing at similar price ranges, it can be concluded that there is cost inefficiency in the construction of this project. Therefore, a solution is needed to address this issue by applying Value Engineering. This study aims to analyze the optimization of the cost budget plan without compromising the quality and functionality of the buildings using the Value Engineering method. This method compares the cost advantages of the landscape design before and after redesign by modifying the house layout, appearance, and the number and composition of houses/site plans to achieve maximum benefits. This analysis follows the stages of Value Engineering Planning, which include the information stage, creative stage, analysis stage, recommendation stage, and presentation stage. Based on the results of the Value Engineering analysis of the Green Semesta Housing Project in Semarang, the most profitable design alternative is Design B, which involves modifying the number of Type 45 units from 21 to 9 and increasing the Type 36 units from 16 to 31. After the redesign, the production cost for Type 45 units decreased from IDR 135,254,167.70 to IDR 124,656,875.91, while the original cost for Type 36 units decreased from IDR 96,224,877.00 to IDR 93,086,166.00.

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1. INTRODUCTION

In recent years, the housing business in Semarang has seen a significant increase, marked by the development of residential housing ranging from very simple homes (Rumah Sangat Sederhana/RSS) to luxury-type houses (Bowar, 2022). This growth presents a business opportunity for developers who compete to offer a variety of house types and designs. The choice of house type and design significantly impacts the construction of the building itself (Halik Syahnaz Rabiatul M et al., 2018). The most noticeable effect is the use of different building materials and the quantity of materials used, which can lead to wastage that affects the price of the houses (Zhang et al., 2009). The Value Engineering (VE) method is effective because it can reduce project costs without sacrificing quality, function and aesthetics. VE can also increase innovation and creativity and can prevent and reduce potential unnecessary and unnecessary costs prevent cost overruns at the end of project implementation.

Financing in a project is a critical area of focus to maximize profits and minimize costs (Widi Hartono et al., 2016). Several alternatives have been developed as a basis for conducting a study. This does not involve correcting calculations or identifying errors made by planners but rather aims to reduce costs without compromising the quality of the buildings (Khalef & El-Adaway, 2024). Thus, Value Engineering can be used as an option to address these issues (Atabay & Galipogullari, n.d.). Value Engineering is an effort to enhance the value of a project with more efficient/lower costs, without reducing quality and safety aspects (Talar et al., n.d.-a).

The Green Semesta residential area, developed by Pancanaka Group Green Semesta Semarang, offers a comfortable living space with an area of 4,200 m² located close to downtown Semarang (Nandito & Huda, 2020a). This housing, featuring a modern and minimalist concept, is strategically located with numerous public facilities nearby. Targeting the middle market segment, the housing prices range from IDR 203,000,000 to IDR 284,000,000, offering various house types including types 36 and 45, and different land sizes such as 84 m² and 120 m². The area is densely populated and faces stiff competition from other developers who provide higher housing segments at similar price ranges (Talar et al., n.d.-b). Setting the right selling price is crucial for developers to market their products and achieve optimal profits (Irfanto et al., 2023).

2. RESEARCH METHOD

This data analysis was conducted to determine the extent of profit gains following the redesign of house plans and modification of house compositions using the comparative method applied to the Green Semesta Housing Development Project (Agung et al., 2023). To facilitate this comparison of potential profit gains from altering house designs and compositions, several preliminary steps were undertaken before using the comparative method (Yohanes D Adiando, 2022). In this analysis, alternatives are calculated based on predetermined parameters, namely in terms of cost, aesthetics, implementation time, implementation technique, level of maintenance, and level of durability. VE is a method used to analyze the function of an item or work system. The goal is to achieve the required functionality at low cost.

The steps taken before the comparative method included: a. Acquiring original budget estimate data and the site plan of the housing development, b. Identifying vacant land that could be utilized for building expansion to potentially increase the property's market value (Nandito & Huda, 2020). Comparing the profit gains after changing the site plan layouts and house compositions from Plan A to Plan B.

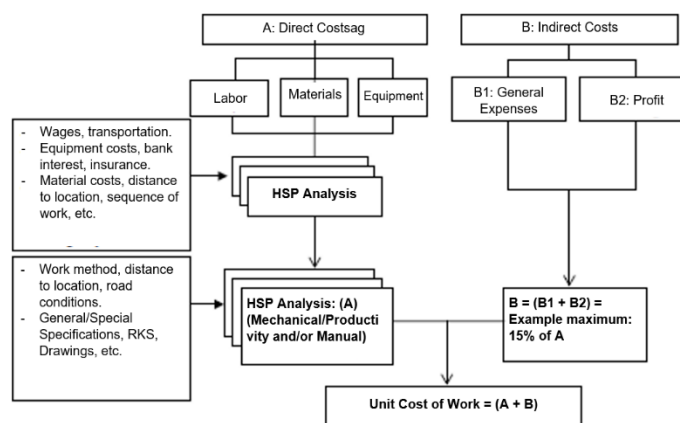


Figure 1. Unit price analysis of work (Ramadhan & Kurniasari, 2024)

This research uses value engineering which aims to reduce costs as much as possible but does not reduce quality, quality and function. The following are the stages of this Value Engineering research, namely a. Information Stage, b. Creative Stage, c. Analysis Stage, d. Development Stage, e. Recommendation Stage.

3. RESULTS AND DISCUSSION

Survey Data Results

This Value Engineering study required original data from the Green Semesta Housing Development project planning (Ivania Devita, 2022). Both primary and secondary data were used as references to ensure that the function and utility of the buildings did not deviate from the initial plans. (a) Total land area = 4,500 m², Buildable land area = 65% of 4,500 m² = 2,925 m², Area for public facilities and open spaces = 35% of 4,500 m² = 1,575 m², House types according to the Green Semesta housing plan a. Type 36, b. Type 45.

Site Plan Layout

The site plan shown in Figure 2 features two house types: Type 36 and Type 45. There are two land sizes available, 84 m² and 120 m², thus resulting in two different building areas tailored to the availability of land (Rozanova & Syarifudin, 2022). The layout for the Type 36/84 house is depicted in Figure 2, and the layout for the Type 45/120 house as shown in Figure 2.



Figure 2. Original site plan of green semesta housing

Figure 2 presents the original site plan of the Green Semesta housing development, which covers a total land area of 4,500 m² and includes a total of 36 houses, comprising two house types and two different land sizes: 15 units of Type 36/84 and 21 units of Type 45/120.

Budget Estimate

In this study, the Budget Estimate was derived from calculations based on unit price multiplied by volum (Wijayanti et al., 2023). The unit price data were obtained from the AHSP 2022 (Riyanto, 2023). The budget estimate results for the Type 36 house are shown in Table 1 and for the Type 45 house in Table 2.

Table 1. Budget estimate for type 36

No.	Task	Total Price
I	Preparation Work	IDR 5,784,705
II	Foundation Work	IDR 13,915,719
III	Structural Work	IDR 7,522,125
IV	Wall Construction	IDR 35,036,328
V	Roofing Work	IDR 23,630,000
VI	Finishing Work	IDR 10,336,000
	TOTAL	IDR 96,224,877

From the data in Table 1, the budget estimate for the Type 36 house totals IDR 96,224,877.

Table 2. Budget Estimate for Type 45

No.	Task	Total Price
I	Preparation Work	IDR 1,801,950
II	Foundation Work	IDR 4,679,298
III	Structural Work	IDR 63,295,338
IV	Wall Construction	IDR 13,033,300
V	Roofing Work	IDR 20,188,414
VI	Finishing Work	IDR 32,255,864
	TOTAL	IDR 135,254,167

From the data in Table 2, the budget estimate for the Type 45 house totals IDR 135,254,167.

Data Analysis

This initial stage of the Value Engineering work plan is focused on data collection (Noviyanti et al., 2022a), which includes: (a) Primary Data, obtained directly from original sources. (b) Secondary Data, supporting data acquired from other references. (c) The next step involves identifying and performing a cost breakdown model, which ranks work items from the highest to the lowest cost (Sawaluddin et al., 2024). Below are the results of the Pareto analysis for the Type 45 house.

Table 3. Pareto analysis results for type 45 house

No	Task	Total Price (IDR)	Percentage (%)	Cumulative Percentage (%)
1	Preparation Work	35,546,167	28.51%	28.51%
2	Foundation Work	27,677,592	22.20%	50.71%
3	Structural Work	21,654,151	17.37%	68.08%
4	Wall Construction	20,804,196	16.69%	84.77%
5	Roofing Work	15,077,984	12.09%	96.86%
6	Finishing Work	3,896,784	3.14%	100%
	Total Cost	124,656,875		

Creative Stage

At this stage, creative thinking is paramount to generate alternative design ideas and other innovations to achieve the desired results without compromising the project's quality and standards (Emelia & Purba, 2021).

Analysis Stage

Here, the ideas generated are analyzed and evaluated. For instance, changing the site plan layout and then determining the most efficient design alternative (Sigmon, 2023).

Development Stage

In the development stage, alternatives from the previous phase are further analyzed, leading to the consideration of various aspects, including material costs and others (Noviyanti et al., 2022).

Recommendation Stage

This stage involves selecting alternative recommendations that were considered in the previous phase to propose the best cost-saving measures (Sakao & Shimomura, 2007b). The results from the Budget Estimate calculation are as follows:



Figure 3. Redesigned site plan of green semesta housing

Figure 3 shows the redesigned site plan of Green Semesta housing on a land area of 4,500 m², where the initial plan of 36 housing units has been redesigned to accommodate 40 units.

Budget Estimate After Redesign

In this study, the Budget Estimate was derived from calculations based on the unit price multiplied by the volume of work (Nugroho et al., n.d.). The Budget Estimate results for the redesigned Type 36 house are shown (Salong et al., 2024). In this study, the Budget Estimate was derived from calculations based on the unit price multiplied by the volume of work (Alam & Suroso, 2024). The Budget Estimate results for the redesigned Type 36 house are shown in Table 4, and the Budget Estimate results for the redesigned Type 45 house are shown in Table 5.

Table 4. Budget estimate comparison for type 36 house

No	Task	Original Design Cost	Cost After Redesign
1	Preparation Work	IDR 5,784,705	IDR 5,784,705
2	Foundation Work	IDR 13,915,719	IDR 13,607,750
3	Structural Work	IDR 7,522,125	IDR 9,288,375
4	Wall Construction	IDR 35,036,328	IDR 33,498,336
5	Roofing Work	IDR 23,630,000	IDR 21,465,000
6	Finishing Work	IDR 10,336,000	IDR 9,442,000
	Total Cost	IDR 96,224,877	IDR 93,086,166

From the data in Table 4, the original Budget Estimate for the Type 36 house was IDR 96,224,877, and the cost after redesign was IDR 93,086,166, showing a cost difference of IDR 3,138,711.

Table 5. Budget estimate comparison for type 45 house

No	Task	Original Design Cost	Cost After Redesign
1	Preparation Work	IDR 1,801,950	IDR 3,896,784
2	Foundation Work	IDR 4,679,298	IDR 35,546,167
3	Structural Work	IDR 63,295,338	IDR 21,654,151
4	Wall Construction	IDR 13,033,300	IDR 15,077,984
5	Roofing Work	IDR 20,188,414	IDR 20,804,196
6	Finishing Work	IDR 32,255,864	IDR 27,677,592
	Total Cost	IDR 135,254,167	IDR 124,656,875

From the data in Table 5, the original Budget Estimate for the Type 45 house was IDR 135,254,167, and the cost after redesign was IDR 124,656,875, showing a cost difference of IDR 10,597,292.

Production Cost per House Type After Redesign

The following table presents the profit calculated from the difference between the original and redesigned costs of the building and land.

Table 6. Budget estimate comparison for house type 45

No	House Type	Building Cost Before Redesign (IDR)	Building Cost After Redesign (IDR)	Land Price (IDR)	Total Cost of Building + Land Before Redesign (IDR)	Total Cost of Building + Land After Redesign (IDR)	Profit (IDR)
1	45/120	135,254,167	124,656,875	1,196,943	278,887,327	268,290,035	10,597,292
2	36/84	96,224,877	93,086,166	1,196,943	196,768,087	193,629,377	3,138,711

Landscape Design/House Composition After Redesign

Adjustments in landscape design/house composition shifted from units with lower profit margins to those with higher profit margins (Gede et al., 2018). The table below shows the house composition before and after the redesign.

Table 7. Landscape design

No.	Type	House Composition	
		Original Design	Design A
1	36/84	15	31
2	45/120	21	9
	Total	33	40

Selling Price Before Redesign

Calculations were made to determine the selling price of each house unit before the redesign and to compare it with the cost of building and land before redesign, to ascertain the profit obtained (Pembangunan Gedung Poliklinik Dan & Teknik Sipil Dan Perencanaan, 2014). This initial total profit is used as a baseline for comparing the profitability of the redesign, thus determining a more optimal profit percentage.

Table 8. Selling prices before redesign

No	Type	Unit	Total Cost of Building + Land Before Redesign (IDR)	Selling Price of Building + Land (IDR)	Total Profit (IDR)
1	36/84	15	196,768,087	203,000,000	93,478,695
2	45/120	21	278,887,327	284,000,000	107,366,133
				Total	200,844,828

Selling Price After Redesign

Calculations were made to determine the selling price of each unit by changing the type and number of each house (Kuliah et al., n.d.). Comparisons were then made to identify higher profits than those achieved with the previous designs, resulting in optimized profits. The total profit is derived from the difference between the total selling price and the total production cost. Production cost is the sum of types 36/84 and 45/120. The total profit is presented in the table below.

Table 9. Selling prices after redesign

No	Type	Unit	Building + Land Cost Before Redesign (IDR)	Harga Jual Bangunan + Tanah (IDR)	Total Profit (IDR)
1	36/84	31	193,629,377	203,000,000	290,489,313
2	45/120	9	268,290,035	284,000,000	141,389,685
				Total	431,878,998

Profit Chart

The total profit is calculated as the difference between the total selling price and the total production cost. The production cost is the sum of types 36/84 and 45/120. The total profit is presented in the table below.

Table 10. Total profit

No	Design	Production Cost (IDR)	Selling Price (IDR)	Profit (IDR)	Profit Percentage (%)
1	Original Design	8,808,155,172	9,009,000,000	200,844,828	0.00%
2	Design A	8,417,121,002	8,849,000,000	431,878,998	115.07%

The increase in profit after the redesign from the original design of IDR 200,844,828 to IDR 431,878,998. The increase in profit after the redesign is IDR 231,034,170 or 115.07% from the initial profit.

4. CONCLUSION

The alternative design change for the Green Semesta housing complex is to change the original design to a cheaper design by changing the composition of the house on the site plan. The design alternative is to redesign the original floor plan and visible pieces without reducing the quality, function and quality of the building. as well as changing the number of house compositions on the site plan with 2 house types 36 and type 45 but with different numbers. Cost reduction obtained after the redesign from the original price of type 36 Rp. 96,224,887.00 to Rp. 93,086,166.00 and the price of type 45 which was originally Rp. 135,254,167.00 to Rp. 123,656,875.00. The cost reductions achieved through the redesign from the original prices of Type 36, from IDR 96,224,887 to IDR 93,086,166, and of Type 45, from IDR 135,254,167 to IDR 123,656,875, were significant. The profit from the redesign of the Type 36 houses was IDR 3,138,711, while the profit from the

Type 45 houses was IDR 10,597,292. The overall profit increased from the original IDR 200,844,828 to IDR 431,878,998 after the redesign.

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