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The Impact of Infrastructure, Facilities, Utilities, and Overhead Costs on Affordable Housing in Magelang

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Abstract

This study aims to find the impact of infrastructure, facilities, utilities, and overhead costs on affordable housing construction in Magelang. While housing requires adequate infrastructure for livability, these components significantly influence lifecycle and project costs. The objective is to determine the specific percentage impact of these combined costs on the total construction costs of housing units. Secondary data was collected via field observations and interviews at the Asri Permai and Sun Garden 3 complexes. Data were analyzed using a descriptive quantitative cost analysis approach and historical costs were subsequently adjusted for 2025 inflation. Results indicate that these combined costs account for 20.84% and 39.4% of total costs for the respective complexes, averaging 30.12%. The study concludes that infrastructure, facilities, utilities, and overhead constitute 22%-39% of total production costs, with utilities representing the smallest component (2%-4%) and the basic unit cost being the largest (61%-78%).

Keywords: *Affordable Housing, Infrastructure Cost, Facility Cost, Utility Cost, Project Overhead, Housing Production Cost*

Abstrak

Penelitian ini bertujuan untuk mengetahui dampak biaya infrastruktur, fasilitas, utilitas, dan overhead terhadap pembangunan perumahan terjangkau di Magelang. Meskipun perumahan memerlukan infrastruktur yang memadai untuk menjamin kelayakan hunian, komponen-komponen tersebut secara signifikan memengaruhi biaya siklus hidup dan biaya proyek. Tujuan penelitian ini adalah menentukan besaran persentase dampak gabungan biaya-biaya tersebut terhadap total biaya konstruksi unit perumahan. Data sekunder dikumpulkan melalui observasi lapangan dan wawancara di kompleks perumahan Asri Permai dan Sun Garden 3. Data dianalisis menggunakan pendekatan analisis biaya kuantitatif deskriptif, dan data biaya historis kemudian disesuaikan dengan tingkat inflasi tahun 2025. Hasil penelitian menunjukkan bahwa gabungan biaya-biaya tersebut mencakup 20,84% dan 39,4% dari total biaya di masing-masing kompleks, dengan rata-rata sebesar 30,12%. Penelitian ini menyimpulkan bahwa infrastruktur, fasilitas, utilitas, dan overhead mencakup 22%–39% dari total biaya produksi, di mana utilitas merupakan komponen terkecil (2%–4%) dan biaya unit dasar merupakan komponen terbesar (61%–78%).

Kata kunci: *Perumahan Terjangkau, Biaya Infrastruktur, Biaya Fasilitas, Biaya Utilitas, Proyek Overhead, Biaya Produksi Perumahan*

Introduction

Housing is a collection of houses as part of a settlement, whether urban or rural, equipped with infrastructure, facilities, and public utilities as a result of efforts to provide livable housing in accordance with Government Regulation of the Republic of Indonesia Number 12 of 2021 concerning Amendments to Government Regulation Number 14 of 2016 concerning the Management of Housing and Settlement Areas. Housing constitutes an important element of human settlements because its function extends beyond the provision of physical shelter. A residential

environment provides a setting in which individuals and families carry out their daily activities while seeking safety, comfort, and an adequate quality of life. Within the Indonesian context, the characteristics of residential environments are also associated with the capacity of residents to maintain their daily activities and respond to social and environmental changes(Dian Rahmawati, Ema Umilia, Hertiari Idajati, 2021). At the same time, the physical and environmental conditions of housing can influence residents' health, particularly when inadequate residential conditions expose occupants to environmental hazards(Regia et al., 2021)

The performance of a residential area is therefore determined not only by the quality of individual housing units but also by the availability of supporting infrastructure and services. Infrastructure, facilities, and public utilities constitute essential components that enable a residential area to function as an integrated settlement. From a spatial and environmental perspective, the expansion of residential areas needs to be accompanied by consideration of land suitability and environmental carrying capacity. Demonstrated that residential growth that is not aligned with the capacity and spatial characteristics of an area may generate environmental pressures and affect the sustainability of the surrounding settlement(Hermawan & Rudiarto, 2023). Consequently, residential planning requires an integrated consideration of land resources, spatial structure, infrastructure provision, and environmental sustainability.

The arrangement of residential space also has implications for the social dimension of housing. Residential neighbourhoods provide opportunities for residents to establish relationships and develop a sense of community through interactions occurring within shared spaces. (Dewi et al., 2024) found that the size of neighbourhoods is significantly associated with social cohesion among residents of gated housing developments. This finding suggests that the physical organization of a residential area can influence not only its functional performance but also the social relationships that develop within it. Accordingly, housing development should accommodate both the physical requirements of residents and the spatial conditions necessary to support interaction and community formation.

In addition to physical and social considerations, the development and long-term management of residential areas are influenced by institutional and regulatory arrangements. This is particularly evident in the provision and handover of infrastructure, facilities, and public utilities (PSU), which require coordination between housing developers and local governments. The implementation of PSU handover, however, remains subject to various institutional and administrative challenges.

Studies on infrastructure, facilities, and utilities (PSU) from a cost perspective are generally associated with initial investment aspects, management efficiency, impact on property value, and financial implications resulting from non-compliance with technical standards. In construction management, PSU is viewed as a significant cost component that influences the life cycle cost structure of a residential area or public infrastructure (Maskur, 2022). The cost of constructing PSU is not limited to initial construction costs but also includes operational costs, maintenance, and potential corrective costs throughout the infrastructure's life cycle.(Djaelani et al., 2021)

Research by Cristabella et al., 2026 published in Jejak Digital: Jurnal Ilmiah Multidisiplin, analyzes the utilization of PSU in apartment complexes in East Jakarta. Although the study focuses on facility usage rates, the results indicate that the low utilization of certain PSU components has the potential to result in wasted initial investment costs (underutilized capital costs). From a cost management perspective, this situation reflects inaccuracies in infrastructure demand forecasting, which leads to inefficient allocation of construction budgets and suboptimal asset utilization. From a construction cost management perspective, inadequate planning and non-compliance with technical requirements may lead to additional expenditures during construction and subsequent operation. Design modifications, rework, corrective measures, and additional maintenance requirements can increase the overall cost of a development project. Therefore, appropriate planning and compliance with applicable technical requirements are important elements of cost control in the development of residential infrastructure and supporting facilities.

Overall, these studies indicate that PSUs have multidimensional cost implications, encompassing potential investment wastage due to planning inaccuracies, cost increases resulting from non-compliance with technical standards, and enhanced economic value as a consequence. The provision of adequate infrastructure. However, previous studies still tend to treat cost aspects as secondary implications rather than as primary variables in analytical models. Therefore, further research is needed that explicitly integrates cost analysis, life cycle cost, and cost risk management approaches

into the planning and control of PSU development.(Ramandha, 2025)

Previous studies have primarily focused on housing livability, accessibility, and residential development, with these issues generally examined from spatial, social, and policy perspectives. Meanwhile, research examining the contribution of infrastructure, facilities, utilities, and overhead costs to the production cost of individual housing units, which may ultimately be reflected in the price paid by consumers, remains limited. In particular, there is still limited empirical evidence regarding the proportion of these costs within the total production cost of affordable housing and the extent to which variations in these cost components contribute to differences in housing prices. Understanding the magnitude and composition of these costs is important not only for improving the accuracy of construction cost estimation but also for anticipating potential financial risks and maintaining housing affordability. Therefore, a research gap remains in the quantitative assessment of infrastructure, facilities, utilities, and overhead costs as components of affordable housing production costs, particularly within the Indonesian housing context.

The novelty of this study lies in its comparative analysis of two affordable housing developments and the adjustment of cost data to 2025 values. The analysis identifies the contribution of infrastructure, facilities, utilities, and overhead costs to the total production cost of individual housing units and determines the components that make the most significant contribution to the overall cost. By examining the composition and magnitude of these costs, this study provides updated empirical evidence regarding the cost structure of affordable housing development. The findings are expected to support more accurate housing cost estimation and provide a basis for controlling supporting development costs while maintaining the provision of adequate infrastructure, facilities, and public utilities.

Based on the identified research gap, this study aims to quantify and analyze the contribution of infrastructure, facilities, utilities, and overhead costs to the production cost of affordable housing units. The study also compares the cost composition between two housing developments to identify the dominant cost components and assess their implications for the base price of housing units. The results are expected to provide practical information for developers and other stakeholders in preparing more accurate cost estimates and managing housing development costs while maintaining housing affordability.

METHODS

This study was conducted in two simple housing developments located in Magelang, Central Java, Indonesia. The first development, Asri Permai Housing, consists of two housing types: Type 36/72, comprising 13 housing units, and Type 45/84, comprising 8 housing units. The second development, Sun Garden 3 Housing, consists of one housing type, namely Type 36/80, with a total of 43 housing units.

The main data used in this study were secondary data obtained from the housing developer's project documents, including site plans, technical drawings, and other documents containing information on the dimensions and quantities of housing infrastructure and facilities. Field observations and interviews with field supervisors and the company's head of the technical department were conducted to obtain, clarify, and validate the information contained in these documents. Therefore, observations and interviews were not treated as the primary sources of the cost data but were used to verify the completeness and accuracy of the secondary data.

The required data consisted of infrastructure, facilities, utilities, and overhead cost components. Infrastructure data included road construction costs, drainage/channel construction costs, water discharge systems, infiltration wells, and infrastructure-related land acquisition costs. Facility data included community hall construction costs, park and park lighting construction costs, and related land acquisition costs. Utility data included electricity installation and street lighting costs. The dimensions and quantities required for the cost analysis were obtained from the project drawings and supporting documents, while the numerical cost data were calculated by the researchers based on these dimensions, quantities, and applicable unit costs. Thus, the data analyzed in this study consisted primarily of validated secondary project data and the cost calculations derived from those data.

The collected cost data were classified into infrastructure, facilities, utilities, and overhead based on the function and characteristics of each cost component. Infrastructure costs were defined as costs associated with the provision of basic physical infrastructure that supports the operation and accessibility of the housing development. These included road construction, drainage/channel construction, water discharge systems, infiltration wells, and infrastructure-related land acquisition. Facility costs referred to physical facilities that support residents' social and communal activities, including community hall construction, parks, park lighting, and related land acquisition. Utility costs

referred to service systems that provide basic utilities to the housing area, including electricity installation and streetlights.

Overhead costs were classified as supporting development costs that were not directly attributable to the construction of infrastructure, facilities, or utilities but were required for the development, operation, administration, or marketing of the housing project. These included gate construction, housing complex signage, security post construction, complex fencing, maintenance costs, building permits, site plan preparation, IMB, and marketing costs.

Land and building prices per square meter were analyzed separately as supporting cost and price variables and were not included as components of PSU costs. The classification of infrastructure, facilities, and utilities was guided by the provisions of Ministry of Home Affairs Regulation No. 9 of 2009 concerning Guidelines for the Handover of Infrastructure, Facilities, and Public Utilities for Housing and Settlements in Regions, while overhead costs were classified based on their functional role as supporting development costs.

The research was conducted through six main stages: research background and objective formulation, determination of the research location and objects, data collection, cost classification, cost calculation and analysis, and comparison of findings. The study was conducted in two simple housing developments in Magelang, Central Java. Project documents, including site plans, technical drawings, quantity data, and cost-related information, were used as the main data sources, while field observations and interviews were conducted to validate and clarify the collected information.

The costs were classified into infrastructure, facilities, utilities, and overhead. Each cost component was calculated based on the required quantities and applicable unit prices and subsequently adjusted to 2025 values. The contribution of each component to the total housing production cost was then calculated and compared between the two housing developments to identify the dominant cost components and their implications for housing unit prices.The flowchart in this research method is shown in Figure 1.

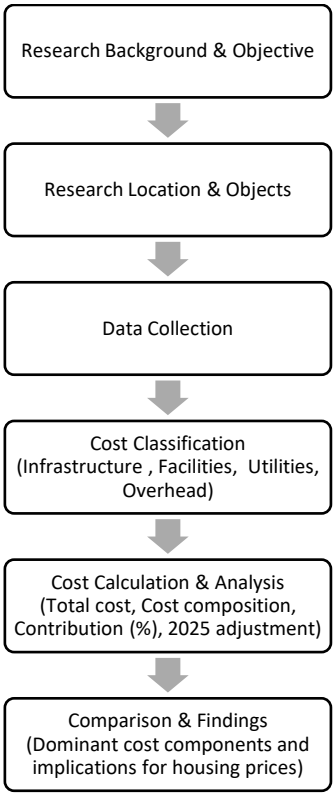

Figure 1. Flowchart Methode

RESULTS AND DISCUSSION

Known costs must first be converted to the year 2025 to achieve value adjustment. The inflation rate for 2025 is 2.92%.(Bank Indonesia, 2025)

The calculation for the inflation conversion formula BS is as follows:

$$BS = Bn\ (1+in+1) \quad (1)$$

BS is the cost in 2024, Bn is the cost in the year of acquisition, and in is the inflation rate in the year n. From the calculation results, the costs for infrastructure, facilities, utilities, and overhead for 2025 are obtained as shown in Table 1.

The construction cost calculation for the housing unit was analyzed using the following calculation:

$$Biaya\ Unit = ((LB \times HB) + (LT \times HT)) \quad (2)$$

Where LB is the building area, HB is the construction cost, LT is the land area, and HT is the land price.

It is known that the land price per square meter for the Asri Permai housing complex and the Sun Garden 3 housing complex is Rp390,000 and Rp380,000, respectively. The construction cost per square meter for the Asri Permai housing complex and the Sun Garden 3 housing complex is Rp3,000,000.

From the analysis of the formula above, the base cost per unit for a house in the Asri Permai housing complex, type 36/72, is Rp168,480,000, and for the 45/84 house type, it is Rp208,260,000. The base cost per unit for the Sun Garden 3 housing complex with the 36/80 house type is Rp112,359,136.

The results of the cost conversion analysis to the year 2025 are presented in Table 2. The total infrastructure, facilities, utilities, and overhead costs for the Asri Permai housing complex are Rp1,082,822,813, while the total infrastructure, facilities, utilities, and overhead costs for the Sun Garden 3 housing complex are Rp3,140,962,941.

The infrastructure, facilities, utilities, and overhead costs for the Sun Garden 3 housing complex are higher than those for the Asri Permai housing complex. This difference is associated with the larger residential area and the greater allocation of land for public and social facilities in Sun Garden 3. The total area of Sun Garden 3 is 6,445 m², compared with 2,590 m² in Asri Permai, while the total parcel area is 3,440 m² and 1,708 m², respectively. In addition, Sun Garden 3 allocates 3,005 m² of land for public facilities, substantially larger than the 882 m² allocated in Asri Permai. Thus, the larger total residential area, parcel area, and public facility area in Sun Garden 3 contribute to the higher infrastructure, facilities, utilities, and overhead costs compared with Asri Permai. Quantitatively, the total area of Sun Garden 3 is 148.84% larger than that of Asri Permai, while the area allocated for public facilities is 240.70% larger. This difference is accompanied by a 190.07% increase in total PSU and overhead costs.

Table 1. Base Costs for the Asri Permai Housing Unit

Asri Permai		
LB	LT	Cost
36	72	Rp257,000,000
45	84	Rp314,000,000
Sun Garden 3		
36	80	Rp265,000,000

The Effect of Infrastructure, Facilities, Utilities, and Overhead (PO) Costs on Housing Unit Construction Costs

The impact of infrastructure, facilities, utilities, and overhead costs is derived from the analysis below

$$K = \frac{Bo}{Bp} x100\% \quad (3)$$

K refers to the impact of infrastructure, facilities, utilities, and overhead costs. BP is the total cost of producing a housing unit, including infrastructure, facilities, utilities, and overhead costs, and BO is the cost of infrastructure, facilities, utilities, and overhead. The value of BP is obtained from the following calculation

TR=UR + BO/unit (4)

Where UR is the base cost per housing unit and BO/unitis obtained from the following calculation:

BO/unit =BO/m^2 ×LT (5)

Cost $BO/m^2$is obtained from the analysis:

$$\frac{(\text{HT x LT Public Facilities}) + \text{TPO}}{plot\ area} \quad (6)$$

Where HT is the land price per m², LT Public Facilitiesis the land area for public facility construction, and TPO is the total cost of infrastructure, facilities, utilities, and overhead.

The analysis revealed the impact of infrastructure, facilities, utilities, and overhead costs on the unit price of housing, as shown in Table 2. It shows that the impact of infrastructure development on the Asri Permai housing complex is smaller than on the Sun Garden 3 housing complex, namely 37.02% in the Asri Permai housing complex and 42.82% in the Sun Garden 3 housing complex. The impact of facility and utility development is also smaller in the Asri Permai housing complex. The overhead item for the Asri Permai housing complex has a larger impact, namely 42.04% and 29.38% in the Sun Garden 3 housing complex. The average impact of infrastructure, facilities, utilities, and overhead costs on the Asri Permai housing complex is 20.84%, and 39.4% for the Sun Garden 3 housing complex. From these values, it is known that the average impact of infrastructure, facilities, utilities, and overhead costs for simple housing in Magelang is 30.12%.

Table 2. Results of cost conversion analysis and PSU impact

No	Items	Conversion to 2025		Impact on PSU+O	Conversion to 2025		Impact on PSU+O
		Asri Permai			Sun Garden 3		
Infrastructure							
1	Construction of street	Rp	138,218,438	12.76%	Rp	364,597,803	**11,61%**
2	Construction of drain	Rp	15,600,000	2.77%	Rp	184,101,962	**5.86%**
3	Infiltrat ion wells	Rp	15,600,000	1.44%	Rp	30,367,334	**0.97%**
4	Land purchase	Rp	217,035,000	20.04%	Rp	766,015,999	**24.39%**
		Rp	**400,834,688**	**37.02%**	**Rp**	**1,345,083,098**	**42.82%**
Facilities							
1	Landscaping and garden lighting	Rp	9,750,000	0.90%	Rp	12,653,056	**0.40%**
2	Purchase of land for facilities	Rp	142,935,000	13.20%	Rp	569,387,511	**18.13%**
		Rp	**152,685,000**	**14.10%**	**Rp**	**582,040,567**	**18.53%**
Utilities							
1	Electrical installation	Rp	19,500,000	1.80%	Rp	151,836,670	**4.83%**
2	Street lights	Rp	5,850,000	0.54%	Rp	37,959,167	**1.21%**
3	Network water clean	Rp	48,750,000	4.50%	Rp	101,224,446	**3.22%**
		Rp	**74,100,000**	**6.84%**	**Rp**	**291,020,284**	**9.27%**
Overhead							
1	Construction gate	Rp	15,600,000	1.44%	Rp	12,653,056	**0.40%**
2	Board name housing	Rp	5,850,000	0.54%	Rp	3,795,917	**0.12%**
3	Construction fence	Rp	86,653,125	8.00%	Rp	375,447,798	**11.95%**
4	Overhead maintenance	Rp	2,925,000	0.27%	Rp	126,024,436	**4.01%**
5	Permit construction	Rp	61,425,000	5.67%	Rp	37,959,167	**1.21%**
6	Site site plan	Rp	19,500,000	1.80%	Rp	25,306,112	**0.81%**
7	IMB	Rp	9,750,000	0.90%	Rp	12,653,056	**0.40%**
8	Marketing	Rp	253,500,000	23.41%	Rp	328,979,451	**10.47%**
		Rp	**455,203,125**	**42.04%**	**Rp**	**922,818,993**	**29.38%**
TOTAL PSU+O		**Rp**	**1,082,822,813**	**100%**	**Rp**	**3,140,962,941**	**100%**

From the investment analysis, it was found that the investment value for Asri Permai is Rp4,939,142,813 and Rp7,972,405,770 for the Sun Garden 3 housing complex, as shown in **Table 3**. These findings are consistent with previous studies that emphasize the importance of cost considerations in housing development. Maskur (2022) examined the estimated construction costs of economical and environmentally friendly housing for low-income communities, while Djaelani and Sinambela (2021) analyzed cost planning for simple housing projects. Similar to these studies, the present study demonstrates that supporting development costs are an important component of housing investment. However, unlike previous studies that primarily focused on overall construction cost estimation and cost planning, this study specifically separates infrastructure, facilities, utilities, and overhead costs and quantifies their respective contributions to housing production costs. The contribution of this study lies in

providing comparative empirical evidence from two simple housing developments, showing that the proportion and dominant cost components vary according to the characteristics and scale of the development.

Table 3 presents the components of housing unit production costs, consisting of infrastructure, facilities, utilities, overhead, and the total basic cost of housing unit construction, where the sum of these components constitutes the investment costs incurred by the developer. It can be seen from **Table 3** that the basic cost of building a housing unit is the largest expense incurred for each housing project. To calculate the total basic cost of building a housing unit (T), the following formula is used

$$T = \sum(\text{number of units} \times \text{basic unit cost})$$

Table 3 shows that the infrastructure, facilities, utilities, overhead, total unit cost, and investment items in the Sun Garden 3 housing complex are greater than those in the Asri Permai housing complex. This is because the number of housing units, plot area, and public facilities in the Sun Garden 3 housing complex are larger than those in the Asri Permai housing complex.

Figure 2 illustrates the percentage breakdown of infrastructure, facilities, utilities, overhead, and total unit base costs relative to the total investment costs incurred by the Asri Permai housing developer and **Figure 3** by the Sun Garden housing developer. As shown in the diagram, unit base costs are the most significant component of the investment costs incurred by the developer, accounting for 61% of the total for Sun Garden 3 and 78% for Asri Permai. The smallest allocation of costs in the developer's investment is for utility service construction, amounting to 4% for the Sun Garden 3 housing complex and 2% for the Asri Permai housing complex.

Table 3. Infrastructure, Facilities, Utilities, Overhead, Unit Base Cost, and Investment

Item	Asri Permai (Rp)	Sun Garden 3 (Rp)
Infrastructure	400,834,687	1,345,083,098
Facilities	152,685,000	582,040,567
Utilities	74,100,000	291,020,284
Overhead	455,203,125	922,818,993
Total Unit Cost (T)	3,856,320,000	4,831,442,829
Investment	4,939,142,813	7,972,405,770

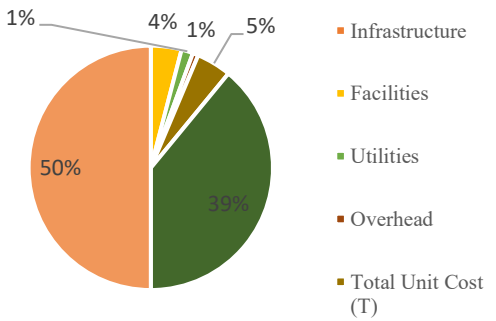

Figure 2. Percentage breakdown of infrastructure, facilities, utilities, overhead, and total unit base costs Asri Permai

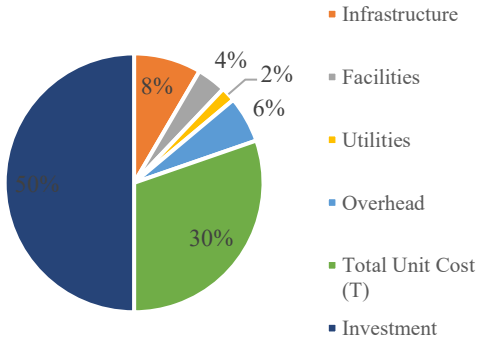

Figure 3. Percentage breakdown of infrastructure, facilities, utilities, overhead, and total unit base costs Asri Permai

CONCLUSION

Based on the analysis and discussion conducted, it is concluded that infrastructure, facilities, utilities, and overhead costs account for 22%–39% of the total production cost of simple housing units in Magelang. Utility provision represents the smallest cost component in housing development, amounting to 2%– 4%. The cost with the greatest impact on housing provision is the base cost of the housing unit itself, which accounts for 61%–78%.

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