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BUILDING AFFORDABILITY: AN EXPLORATION OF INCREMENTAL HOUSING DESIGN

Bayu Teguh Ujianto[1], Muhammad Nelza Mulki Iqbal[1,2*]
[1]Program Studi Arsitektur, Institut Teknologi Nasional Malang, Jln. Bendungan Sigura-gura No.2 Malang, Indonesia
[2]School of Architecture and Landscape, The University of Sheffield, Western Bank, Sheffield, United Kingdom

*Email Correspondence: nelzamiqbal@lecturer.itn.ac.id

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ABSTRACT

In Indonesia, the availability and quality of housing is a significant challenge. One potential solution that needs to be explored is the incremental housing strategy, which can provide options for users as their needs and income grow. This research aims to explore and develop affordable housing design ideas that specifically target the criteria of subsidized housing in Indonesia, based on the exploration of the national regulation related to the subsidized housing, and developed from the principles of affordable housing design such as the separation of functions and mass, the exploration of structure and materials, and the use of a cohesive form. Using design-based research as the design method, the research resulted in two alternative ideas for affordable housing. The design development as well as construction cost estimates use standard commercial building materials to get an idea of the possibility of building affordable housing with standard materials. This research is a valuable step in the exploration of ideas for affordable housing in Indonesia and will provide a valuable reference for future research and development of affordable housing in Indonesia.

Keywords: Affordable Housing, Growing House, Incremental House, Subsidized Housing

INTRODUCTION

Housing is a fundamental human right and is recognized by national law (Susanto et al., 2020) and international standards set by the United Nations through the Sustainable Development Goals (Moghayedi et al., 2021). However, in Indonesia, housing availability and quality are major challenges. According to the Central Bureau of Statistics, there is a significant backlog of housing ownership, with 11.4 million unclaimed homes in 2015. This problem is further compounded by issues of low-quality housing, particularly in the subsidized housing segment (Bramantyo et al., 2019; Dwijendra, 2013). This low quality of housing makes it difficult for citizens to access their right to decent housing. The data shows that only five percent of housing in Indonesia is considered to be in good quality (Bramantyo et al., 2019). Given this situation, it is not surprising that some people have turned to informal housing and self-help as their only options for obtaining a place to live (Tunas and Dormoyono, 2014).

The government of Indonesia has been implementing various programs in recent years to address the challenges related to housing availability and quality, such as the Kampung Improvement Program, National Housing Program, Liquidity Financing and Housing Facilities, and One Million Homes Program (Tunas and Dormoyono, 2014). These programs aim to improve living conditions in informal settlements, provide affordable housing for low-income households, increase financing options for housing development, and construct 1 million houses for low-income families. However, despite these efforts, the problem of low-quality housing remains prevalent, particularly in the subsidized housing segment. According to recent data (Kemenpan, 2022), the housing backlog has even increased. This highlights the need for the government to shift its focus from meeting housing needs in terms of quantity to ensuring the quality of the constructed housing.

It is important to note that more than the government's efforts alone may be required to address the challenges related to housing availability and quality. The private sector, civil society organizations, and citizens themselves must also play a role in addressing this issue. For example, the private sector can contribute to the development of innovative housing designs that can improve the quality of housing, civil society organizations can advocate for the rights of citizens to access decent housing, and citizens themselves can actively participate in housing development programs and contribute to the improvement of the living conditions in their communities.

Furthermore, when we examine the provision of housing in more depth, it is also related to the limited contribution of private developers, who should be able to work with the government to solve the housing problem. Unfortunately, the subsidized housing segment is often seen as unappealing to private developers (Dwijendra, 2013). One of the primary reasons for the limited involvement of private developers in the subsidized housing segment is the low profitability of these projects. Private developers are generally more interested in developing high-end housing projects that offer higher returns on investment. On the other hand, the subsidized housing segment is characterized by low prices and, therefore, low-profit margins.

Another factor contributing to the limited involvement of private developers in the subsidized housing segment is residents' need for more engagement and knowledge in the development process. This can lead to the construction of low-quality housing that aligns

differently with the needs and preferences of residents. As a result, private developers may not view these projects as viable investments. To address this issue, incremental or growing housing should be re-emphasized as a potential solution to address both the quantity and quality of housing. This approach which focuses on empowering communities and residents to improve and expand their housing gradually, can increase the participation and engagement of residents in the development process and ensure that the constructed housing meets their needs and preferences.

Discussions on subsidized housing often focus on identifying problems related to the physical quality of housing produced by developers (Bramantyo et al., 2019; Dwijendra, 2013; Moghayedi et al., 2021). However, there is also literature that links the problem of subsidized housing to other factors beyond the physical aspect, such as community closeness (Riazi and Emami, 2018; Vale et al., 2014) and social-political aspects (Tunas and Dormoyono, 2014). In terms of design, there are few studies that have experimented with design solutions that align with the guidelines for subsidized housing, such as the regulations set by the Ministry of Public Works and Public Housing (Kepmen PUPR) No.242/KPTS/M/2020 on the Income Limits of Target Groups for Credit/Financing of Subsidized Home Ownership, Interest Rates/Margins for Subsidized Financing, Subsidy Periods and Credit/Financing Terms for Home Ownership, Selling Price Limits for General Landed Houses and General Apartment Units, Land and Floor Area Limits for General Landed Houses and General Apartment Units, as well as the Amount of Down Payment Subsidy for Housing (Kepmen PUPR, 2020). These regulations contain critical aspects related to the amount, price, and size of subsidized housing and land.

It is essential to consider the design aspect when discussing the subsidized housing problem, as it includes the physical quality of the housing and the regulations the government has set. The design should comply with the regulations and guidelines set by the government to ensure that the housing produced is of good quality and meets the needs and preferences of the residents. Moreover, it should suit low-income families and align with the community's closeness and social-political aspects. This can be achieved through more experimentation with design solutions that align with the guidelines for subsidized housing and engaging with the community to ensure that the housing being constructed meets their needs and preferences.

Recent research on incremental housing, also known as "growing housing", mainly focuses on the unique features of this concept, such as the option to develop it vertically or horizontally depending on the type of land (Agusniansyah and Widiastuti, 2016), also its design principle based on the separation of functions and mass, exploration of structure and materials, and the use of a cohesive form (Iqbal and Ujianto, 2021).

Incremental housing has the potential to be prioritized again in the development of housing and settlements in Indonesia, both through initiatives involving the private sector and primarily through government efforts. A well-known case study of incremental housing is the Quinta Monroy in Chile, which involved various elements from the government, architectural firms, universities, and the community. The design proposed was a half-built home consisting of structural elements (roof, walls, and stairs) and infrastructure (kitchen, bathroom, and utilities). The residents then developed the unit over time, according to the number of residents, changes in function, condition, and economic

access (Vale et al., 2014). However, despite the conceptual exploration of incremental housing, it is not always maximally implemented in the field. This is unfortunate because incremental housing is quite attractive if followed up. After all, it can provide options for users as their needs and income grow.

From the perspective of incremental housing design, this research aims to offer an alternative design solution based on a literature review of both incremental and subsidized housing. The goal is to develop a design that primarily meets the housing needs of low-income families and aligns with the guidelines for incremental housing. To ensure that the housing meets the needs and preferences of the community, it is essential to conduct further research and experimentation with design solutions and engage with the community throughout the process. The ultimate objective of this research is to provide an alternative design idea of incremental housing that can be developed to overcome the housing problem in terms of quality and quantity, particularly for low-income families.

METHODS

This study aimed to explore relevant design possibilities for low-income housing that could contribute to the discourse of incremental affordable housing in Indonesia. The study adopted a "design-based research" approach, which involved integrating design and research to improve the design process and the quality of architectural interventions within real-world settings. The method of the study comprises three parts:

1. Development of design criteria: A literature study was conducted to explore the critical measures that could bridge the concept of incremental housing and affordability. Three criteria emerged from the previous research (Iqbal and Ujianto, 2021) as the basis for further design development: separating functions and mass, exploring structure and materials, and using a cohesive form.
2. Meeting the boundary of the subsidized regulation: The design criteria were then applied to the boundary of the subsidized regulation, which is limited by the budget and size of the site. The boundary conforms to the regulation Keputusan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 242/KPTS/M/2020 (Kepmen PUPR, 2020), which classifies affordable landed housing prices into four regional segments, ranging from Rp. 150.500.000 to Rp. 219.000.000, and mandates a minimum site size of 60 m2 and a building area within the range of 21-36 m2.
3. Exploration and development: The exploration phase is conducted using digital modeling tools to propose two possibilities of incremental housing offerings for low-income families.

The focus of the study is to bridge the concept of incremental housing with affordability by implementing the design criteria and exploring the possibilities within the boundaries of the subsidized regulation.

RESULT AND DISCUSSION

Defining Affordability Housing in Indonesia

Subsidized housing is one of the government's efforts to address population density issues. Houses in the subsidized category will have differences in price and allocation.

These differences are based on the intended buyer and the house payment method. The government's provision of subsidies in the housing sector is aimed at providing affordable housing for low-income communities. The goal of providing subsidies for low-income communities is to ensure that they have access to decent and affordable housing.

According to the national regulation Keputusan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 242/KPTS/M/2020 (Kepmen PUPR, 2020), the affordable landed housing prices are categorized into four different regional segments. The lowest price segment is at Rp. 150.500.000, and the highest price segment is Rp. 219.000.000, with an average suggested price for affordable housing being around Rp. 170.000.000. This regulation also mentions that the minimum size of the site will be 60 m^2, with the building area between 21-36 m^2. However, as per Susanto et al. (2020), the minimum space standard for housing tends to be influenced by sociocultural and political implications. Therefore, it is crucial to conduct more studies and research on the appropriateness of this standard to ensure that it is in line with the needs of society and the context.

In a study of the average suggested price for affordable housing, we examined the direct and indirect costs involved in housing project development. According to research (Firdasari et al., 2021; Musyafa, 2013), an ideal proportion for subsidized housing projects is 80% direct cost and 20% indirect cost. Direct costs encompass land and construction costs, while indirect costs include overhead costs, facilities and infrastructure, additional costs, and net profit for the developer. In determining the proportion of land and construction costs, we found that land costs typically make up 35% of direct costs, and construction costs make up 65%. However, in this study, we assumed that construction costs would make up 75% of direct costs, including the developer's net profit. As a result, the total direct cost of building an affordable house is approximately Rp. 100.000.000.

Furthermore, it is important to note that the direct cost of land acquisition and construction is a major factor in determining the overall cost of affordable housing. In order to keep the cost of housing affordable, it is crucial to keep the direct costs as low as possible. However, it is also important to consider indirect costs, such as infrastructure and facilities, which can also have a significant impact on the overall cost of the housing project. By allocating a proportion of 20% for indirect costs, we ensure that the necessary amenities and infrastructure are in place to support the residents of the housing project. Additionally,

Table 1. Building Cost Estimation

Proposing Housing Price	170.000.000
Direct Cost + Net Profit 80 %	136.000.000
Construction Cost (75%)	102.000.000
Land Cost (25%)	34.000.000
Indirect Cost 20% (Overhead costs, facilities and infrastructure, additional costs, and net profit for the developer)	34.000.000

Source: Author, (2022).

by including a net profit for the developer in the construction costs, we acknowledge the importance of ensuring that the housing project is financially viable for the developer as well.

Land Dynamic in Affordable Housing Development

The concept of incremental houses in Indonesia, also known as "Rumah Inti Tumbuh" (RIT), has been in existence since the 1980s as a solution to address housing affordability and availability issues. The initial concept established a standard size of 15 square meters for a house, which includes one bedroom, one toilet and bathroom, and a multi-functional room, and the minimum land area is 72m^2 (Kepmen PU, 1980). However, in practice, the standard size often encountered is 21 square meters, consisting of two modular rooms measuring 9 square meters and one service room. This raises the question of whether Indonesia's current minimum standard size of houses and growing houses are still appropriate and suitable for the current socio-cultural and political conditions (Susanto et al., 2020). Furthermore, the current national regulation Keputusan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 242/KPTS/M/2020 has reduced the minimum land area to 60 m^2, while the largest land area remains at 200m2.

Land is one of the essential factors in the development of subsidized housing, especially when it is related to location and accessibility (Abidoye et al., 2020; Ling et al., 2017). Thus, using the minimum area of 60m^2 for the plot of land will impact the lesser budget for the land allocation and allow for building inside the site area. Although, it is essential to note that the use of a smaller land area can also negatively impact the house's functionality and liveability.

Furthermore, advancements in construction technology have yet to be fully incorporated into the regulations for growing houses in Indonesia. Specifically, the use of mezzanine structures and floors has yet to be adopted, which can provide additional living space while maintaining a small footprint. Mezzanine structures can add an extra level to a house without increasing the overall footprint, providing extra space for bedrooms, living areas, or storage. This can be especially useful in densely populated areas with limited and expensive land. Similarly, using mezzanine floors can help optimize the use of space within a smaller house, providing extra living space without the need for expansion.

The adoption of mezzanine structures and floors in growing houses can increase the house's functionality and be an effective way to address housing affordability issues. It can provide additional living space while maintaining a small footprint, which can be especially useful in densely populated areas where land is limited and expensive. Additionally, it can optimize space within a smaller house, providing extra living space without the need for expansion. Therefore, there is a need to reevaluate the minimum standard size of houses and incremental houses in Indonesia, including the minimum land area and the incorporation of advancements in construction technology, such as mezzanine structures and floors, in the regulations for growing houses. The study of the development of affordable incremental housing based on the minimum size of the plot can provide insight into how to balance the budget and functionality of the house.

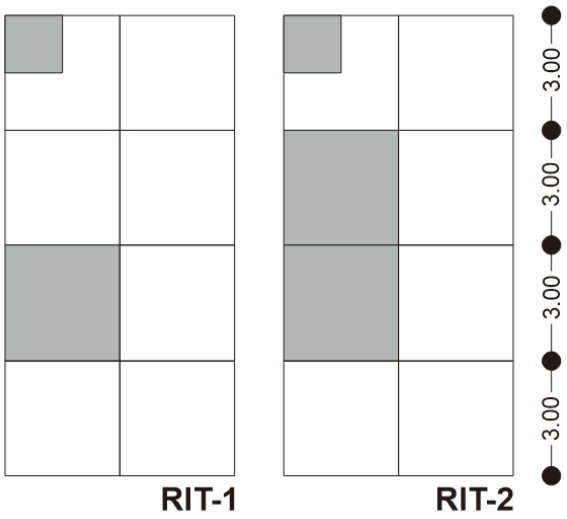

Figure 1. RIT Concept Based on Kepmen PU No. 91/KPTS/1980.
Source: Author, (2022).

Exploration of an Affordable Incremental Housing Design

The current income limitation for subsidized housing in Indonesia is set at Rp. 4.000.000, with a maximum length of housing credit of 20 years. However, the proposed housing price of Rp. 170.000.000 can still be considered a significant amount for many households. According to a study on housing loans in Africa and Asia by Jones and Stead (2020), households should not spend more than 30% of their income on loan payments. However, this does not consider the potential for inflation that may occur throughout the loan. Despite this, the proposed construction cost of Rp.100.000.000 is considered logical and affordable for building a house of decent quality. In the current market, this price range would be equivalent to Rp.3.000.0000 to Rp. 3.500.000, with a built area of up to 30m^2.

Given these considerations, we propose exploring a new alternative for affordable incremental housing in Indonesia. We focus on adding more options to housing arrangements by adopting the mezzanine concept in housing development design. The use of mezzanine structures is a commonly practiced solution in search of incremental housing projects by architects in Indonesia, as seen in projects delivered by Yu Sing (Iqbal and Ujianto, 2021). Although these projects primarily focus on experimenting with micro space areas, the use of mezzanine structures is a commonly found core feature in the houses.

In our previous study (Iqbal and Ujianto, 2021), we proposed three design principles as the basis for further design development: the separation of functions and mass, the exploration of structure and materials, and the use of a cohesive form. The separation of functions and mass leads to the development of the main building function, which will be the main space for the people when they purchase the house for the first time. This includes a multi-functional space (portable bedroom or living/guest room), bedroom, and service (toilet and pantry). In this study, we use the mezzanine idea to provide access to the bedroom. The cohesive form is executed in the arrangement of the space module, where we leave a space beside or behind for further development. This approach allows for the use of minimal land and allows homeowners to expand their living spaces as their needs and financial situations change over time.

Moreover, the Mezzanine concept allows homeowners to grow their living space over time, which is crucial for those with a limited budget. Incremental housing is a cost-effective solution that allows homeowners to invest in their homes over time and eventually achieve their dream homes. As the housing market in Indonesia continues to grow, it is

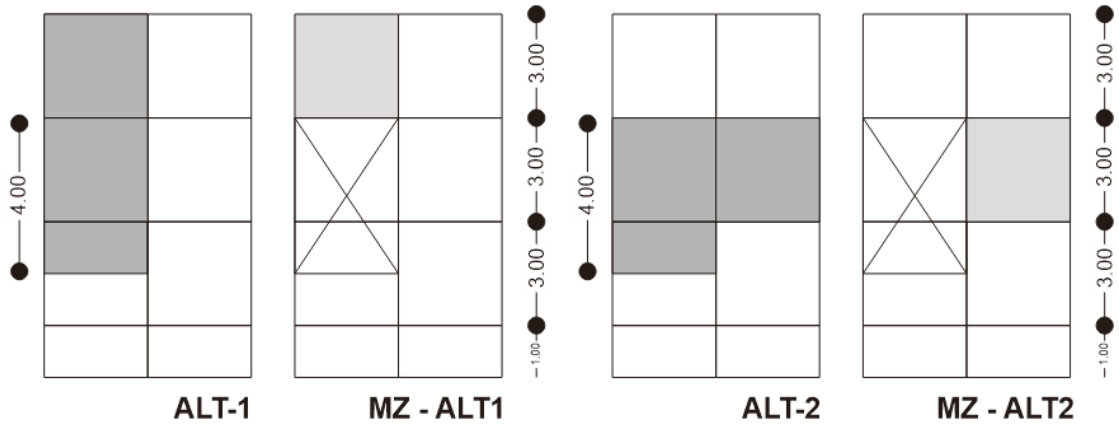

Figure 2. Exploration Concept of an Affordable Incremental Housing Design
Source: Author, (2022).

crucial to provide more affordable options for homeowners. Adopting the mezzanine concept in housing development design is an innovative solution that should be considered a viable option for affordable incremental housing in Indonesia.

The first alternative proposed design for a subsidized housing project in Indonesia features a layout that maximizes the use of space and adaptability. The design incorporates a multifunctional area that can be used as a gathering space, living room, or additional bedroom, along with a separate service area. The main bedroom is situated on a mezzanine floor for added privacy, and the design includes the potential for expansion with the possibility of adding two more bedrooms and an additional spiral staircase for access.

To address the unique challenges of building in a tropical climate like Indonesia, the design incorporates a passive cooling strategy that improves the flow of air throughout the space, reducing the need for artificial cooling. The mezzanine level with higher ceilings and the inclusion of an indoor courtyard also promote a healthy and environmentally-friendly living space. This design proposal balances functionality, comfort, and energy efficiency, with a budget of Rp. 105.200.000 and a total built area of 30m^2, making it a great solution for subsidized housing projects in Indonesia, providing comfortable and healthy living spaces for the residents.

Table 2. Building Cost Estimation Alternative 1

NO.	Wok Item	Price
1	Land Preparation	Rp. 18.500.000,00
2	Earth Excavation Work	Rp. 985.768,35
3	Reinforced Concrete Work	Rp. 17.331.679,60
4	Foundation and Wall Mansonry Work	Rp. 18.743.800,00
5	Wall and Floor Finishing Work	Rp. 15.619.078,07
6	Door and Window Work	Rp. 14.382.875,00
7	Plumbing Work	Rp. 4.060.000,00
8	Ceiling Work	Rp. 4.845.147,73
9	Roofing Work	Rp. 7.939.000,00
10	Mechanical and Electrical Work	Rp. 2.885.000,00
	TOTAL	**Rp. 105.292.348,74**
	Rounded Total	**Rp. 105.200.000,00**

Source: Author, (2022)

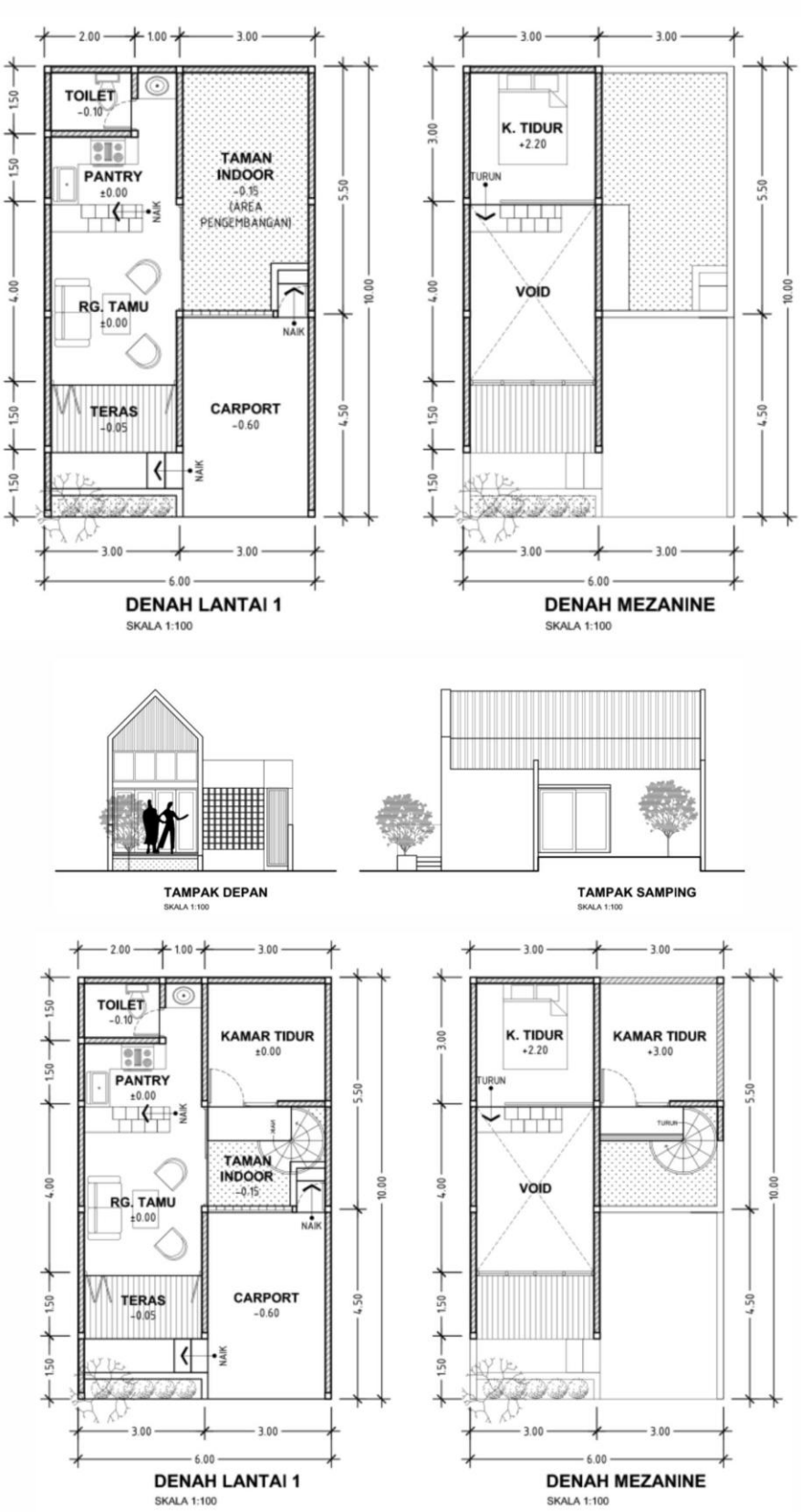

Figure 3. Design Development Alt. 1
Source: Author, (2022).

The second alternative design proposal for a subsidized housing project in Indonesia offers a different space arrangement, with the building design extended in line with the width of the site. This allows for cross ventilation from the front side of the house to the backside, promoting natural ventilation inside the house. The layout of the space is similar to the first alternative, with a multifunctional space and service area located on the first floor, and the main bedroom on the mezzanine level.

Like the first alternative, this design also includes the potential for expansion, with the possibility of adding two more bedrooms and an additional spiral staircase for access. However, this design does not include an indoor courtyard, which could be removed for full space occupation if desired. The decision for the development ultimately depends on the user's preference. Compared to the first alternative, this proposal is slightly cheaper with an expected cost of Rp. 99.000.000, covering the same built-able area as the first alternative. This design proposal offers a cost-effective solution for a subsidized housing project in Indonesia, maximizing the use of space, and promoting the use of natural ventilation.

Table 3. Building Cost Estimation Alternative 2

NO.	Work Item	Price
1	Land Preparation	Rp. 18.500.000,00
2	Earth Excavation Work	Rp. 1.076.458,50
3	Reinforced Concrete Work	Rp. 16.887.096,19
4	Foundation and Wall Mansory Work	Rp. 16.148.250,00
5	Wall and Floor Finishing Work	Rp. 14.906.335,45
6	Door and Window Work	Rp. 14.127.920,00
7	Plumbing Work	Rp. 4.060.000,00
8	Ceiling Work	Rp. 4.095.147,73
9	Roofing Work	Rp. 6.725.000,00
10	Mechanical and Electrical Work	Rp. 2.490.000,00
	TOTAL	**Rp. 99.016.207,86**
	Rounded Total	**Rp. 99.000.000,00**

(Source: Author, 2022)

The building cost estimation for the proposed alternatives for the subsidized housing project in Indonesia were provided by an external party to ensure an independent perspective on the affordability of the designs. The estimated numbers slightly differ from the previous calculations of Rp. 100.000.000, but are still within the expected range for construction costs. It is important to note that this study employs standard building materials that are commonly used in commercial housing projects in Indonesia. The design team aimed to reach the desired construction price by carefully selecting appropriate housing materials.

The concept of incremental design was used as the basis for the development housing plan, and further research could explore the use of alternative materials in order to lower construction costs. However, the team assumed that by using standardized materials, the design would be more widely accepted by the common population in Indonesia. It's also worth mentioning that the function of housing has recently shifted from being a sign of prestige to being more focused on practical and functional matters (Abidoye et al., 2020; Tunas and Dormoyono, 2014). Therefore, the team believes that the use of standard materials will be more beneficial for the target population and the project's overall goals.

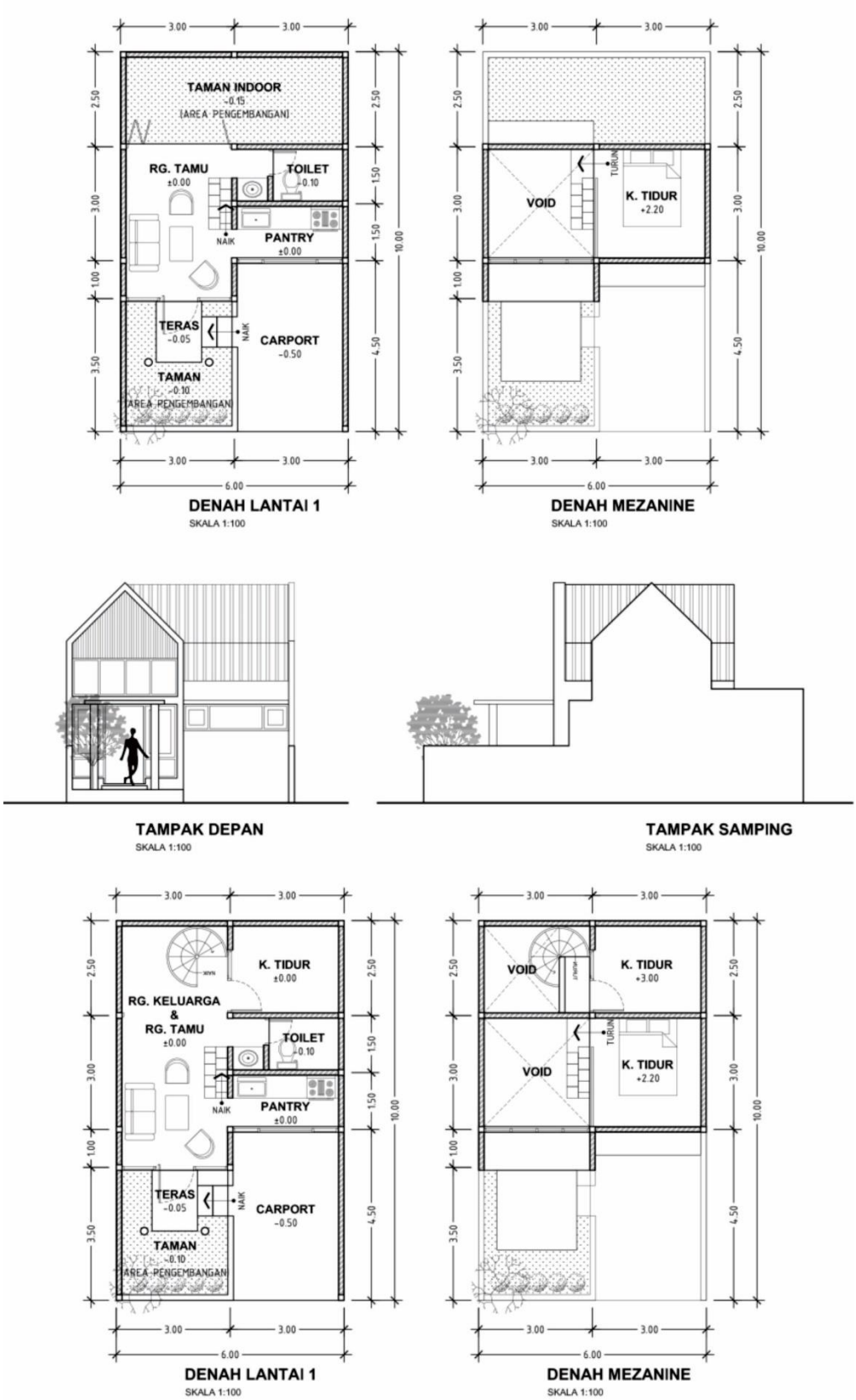

Figure 4. Design Development Alt. 2
Source: Author, (2022).

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CONCLUSION

This research aims to explore and develop affordable housing design ideas that specifically target the criteria of subsidised housing in Indonesia. The proposed selling price benchmark is based on the average price of subsidised houses in four regional areas in Indonesia, resulting in a figure of Rp. 170,000,000. Based on this figure, a reasonable construction cost of around Rp. 100,000,000 was obtained. The research resulted in two alternative ideas for affordable housing developed from the principles of affordable housing design such as the separation of functions and mass, the exploration of structure and materials, and the use of a cohesive form.

Both alternative ideas proposed the intervention of a mezzanine floor that makes the proposed area of the core of the incremental house around 30m^2. This area comprises a multifunctional space and service area located on the first floor, and the main bedroom on the mezzanine level. This design development as well as construction cost estimates use standard commercial building materials to get an idea of the possibility of building affordable housing with standard materials. However, it is worth noting that costs can be reduced if there is an alternative study related to the idea of growing houses that uses other alternatives but still uses a similar mass configuration.

In conclusion, this research is a valuable step in the exploration of ideas for affordable housing in Indonesia. However, it should be noted that research related to affordable housing is still limited and there is a need for further research to be developed in the future. This is especially important considering the increasing demand for affordable housing in the country. The research will provide a valuable reference for future research and development of affordable housing in Indonesia.

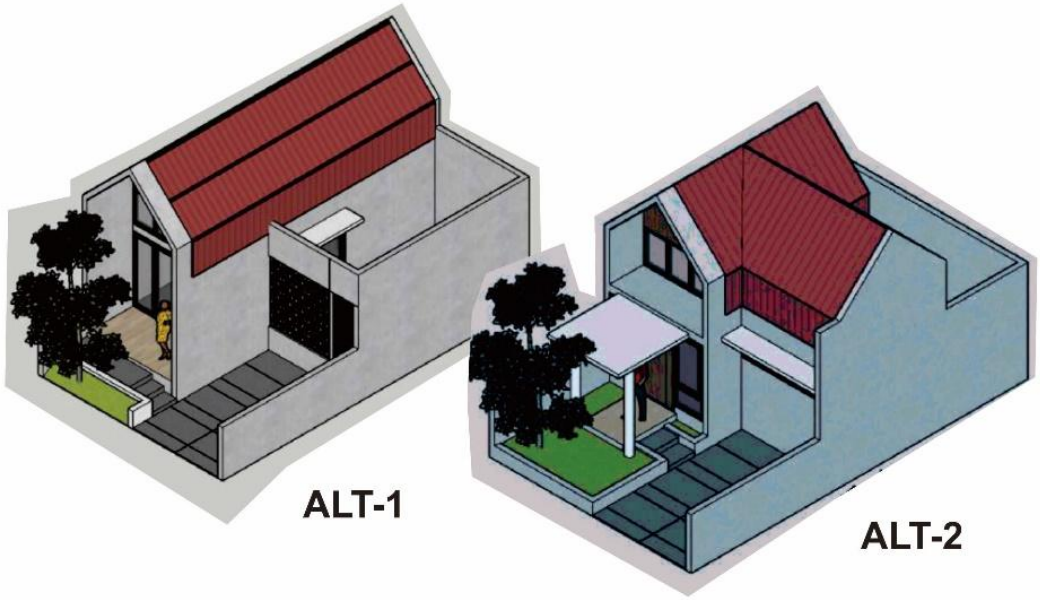

Figure 5. 3D Modelling Incremental Affordable Housing Alternatives
Source: Author, (2022).

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