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The Effect of Building Volume on the Cost and Time of Construction of Honai Traditional Houses in Mountainous Papua Province

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Abstract: Subsidized housing in the Papua Highlands is generally not fully adapted to the region's geographical conditions, climate, and local cultural characteristics. This study aims to analyze the structural components, construction cost, construction time, and the influence of building volume on the cost and construction time of Honai houses among the Dani, Lani, and Yali tribes. A mixed-methods approach was employed, involving 75 informants through interviews, field observations, documentation, and building measurements. Quantitative data were analyzed using SPSS, while qualitative data were examined descriptively. The findings indicate that all major components of the Honai house are constructed from locally sourced forest materials, and the construction process is carried out through community mutual cooperation, making food provision the largest construction expense. Regression analysis revealed that building volume has No. significant effect on either construction cost (Sig. = 0.154) or construction time (Sig. = 0.347). These findings suggest that Honai construction is influenced more by the local social system and the availability of natural resources than by building size.

Keywords: *Construction of traditional house: differences in social and cultural values of each tribe*

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I. INTRODUCTION

Housing development is one of the government's strategic programs in improving community welfare through the provision of decent housing[1]. One of the programs that is being implemented in Mountainous Papua Province is the construction of subsidized houses as an effort to meet the housing needs of the community. However, the implementation of subsidized housing with the concept of modern housing still faces various obstacles. Based on the results of field observations, modern subsidized houses are less in demand by some people in Mountainous Papua because the design of the building is considered less in accordance with geographical conditions, cold mountain climate, and culture and lifestyle of the local community. This condition shows that the uniform approach to housing development has not been fully able to answer the needs of the local community.

A form of vernacular architecture, the Honai traditional house has developed through a long process of adaptation to the environmental conditions of the Mountainous Papua. Honai houses have characteristics in the form of a circular building, low walls, a roof made of weeds, and an inner space that is able to maintain a warm temperature so as to provide comfort for its residents. In addition to functioning as a place to live, Honai also has high cultural value because it reflects the identity, social structure, and local wisdom of the Mountainous Papuan people. These characteristics make Honai houses a form of housing that is more adaptive than modern houses in mountainous environments.

From a construction perspective, the volume of Honai buildings affects the need for materials, labor, and the duration of the construction implementation. The larger the building volume, the more materials are needed, such as wood, weeds, and other structural elements, so construction costs also increase. On the other hand, the increase in the size of the building causes the construction process to become more complex and requires a longer work time[2]. Therefore, the volume of the building is one of the important factors that need to be considered in the planning of the construction of a Honai traditional house.

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The results of observations on the Honai houses of the Dani, Lanny, and Yali tribes show that there are variations in shape, size, number of building components, and construction methods that affect material needs, costs, and construction time. These differences are influenced by the function of the building, the number of occupants, location conditions, and the availability of local materials. However, until now there has been no study that comprehensively analyzes the relationship between Honai building volume and construction costs and time in the three tribes. This information is very much needed as the basis for the preparation of Honai house construction standards that are more effective, efficient, and in accordance with the characteristics of the Mountainous Papuan community.

Based on these conditions, this study was conducted to analyze the components that make up the Honai traditional house, determine the cost and time of construction needs, and examine the influence of building volume on the cost and time of construction of Honai traditional houses in the Dani Tribe, Lanny Tribe, and Yali Tribe in Mountainous Papua Province. The results of the research are expected to be a reference for the government, academics, and practitioners in formulating a more adaptive, efficient, and sustainable concept of housing development based on local wisdom.

II. LITERATURE REVIEW

Research on the relationship between building volume and construction costs and time has been widely conducted on various types of buildings. Rachman et al.'s (2024) research analyzed the volume and cost of residential construction using the 5D Building Information Modeling (BIM) approach and found that differences in the calculation of the volume of structural work have a direct influence on the estimated construction cost[3]. Respati et al. (2024) through the approach *Value Engineering* shows that cost and time efficiency can be achieved through design optimization and material selection[4]. Meanwhile, Tochaiwat et al. (2015) prove that the increase in building complexity, especially the number of floors, leads to an increase in construction duration and cost in conventional construction methods[5]. Another study by Saghi and Ghaffari (2020) shows that the application of modern construction technology is able to speed up implementation time while reducing the cost of housing projects[6]. In addition, Muthike et al. (2025) stated that construction costs, material prices, and late payments affect productivity and project completion time[7]. The results of these studies show that the physical characteristics of buildings are one of the main factors that affect the cost and time of construction implementation. However, research on the influence of building volume on Honai traditional houses in Highland Papua is still very limited, so it is a research gap (*Research gap*) that needs to be studied further.

The Honai traditional house is a vernacular architecture of the Mountainous Papuan people that is built using local materials and designed according to the geographical and cultural conditions of the local community. From the perspective of construction management, the volume of the building is one of the parameters that determines the amount of material needs, labor, costs, and duration of work implementation. The larger the volume of the building, the greater the amount of materials used and the longer the time required in the construction process. Therefore, the volume of the building is seen as having a direct relationship with the cost and time of construction of the Honai traditional house.

This study also uses the concept of *Labor Utilization Rate* (LUR) to evaluate labor productivity during the construction process of Honai houses. (*Labor Utilization Rate*) LUR shows a comparison between productive working time and total working time so that it can describe the level of labor utilization efficiency. The combination of building volume analysis, RAB, S Curve and *Labor Utilization Rate* (LUR) is expected to provide a comprehensive picture of the effect of building volume on the cost and time of construction of Honai traditional houses in the Dani Tribe, Lanny Tribe, and Yali Tribe in Mountainous Papua Province.

III. RESEARCH METHODS

A. Research Location and Time

This research was carried out in the Mountainous Papua Province on the Dani Tribe, Lanny Tribe, and Yali tribes who still maintain the construction of Honai traditional houses as residences. The selection of the location was carried out purposively because the three tribes represent the characteristics of Honai houses that are still in use and have variations in building volumes that can be analyzed. The research will be carried out in 2026 through field observation activities, interviews, and the collection of technical data on the construction of the Honai house.

B. Population and Sample

The research population is all people in the Mountainous Papua Province who build and use Honai traditional houses. The research sample was determined purposively, namely people from the Dani Tribe, Lanny Tribe, and Yali Tribe who have knowledge and experience in the construction of Honai houses. Informants are selected based on their involvement in the construction process so that they are able to provide information about building components, material needs, costs, and construction time.

C. Research Variables and Indicators

The research variable consists of building volume as an independent variable, while construction cost and construction time are dependent variables. The indicators observed include the components that make up the Honai house, the dimensions and volume of the building, material needs, construction costs, the amount of labor, and the duration of construction.

D. Data Collection and Analysis Methods

The research uses a mixed methods method with a sequential exploratory design, which combines qualitative and quantitative approaches in stages. Data collection was carried out through field observations, structured interviews with resource persons, documentation, and data collection of Work Unit Price Analysis (AHSP). The cost analysis was carried out using the Cost Budget Plan (RAB) method, while the time analysis used *the time schedule* and the S Curve.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jul1750

E. Research Stages

The research stages include problem identification, determination of research location, collection of primary data through observation and interviews as well as secondary data through documentation, identification of building components of Honai houses, calculation of building volume, preparation of Cost Budget Plan (RAB), preparation *of time schedule*, analysis of the influence of building volume on construction costs and time, then drawing conclusions based on the results of the analysis obtained.

IV. RESULTS

A. Informant Data

Table 1 Informant Data

Yes	Number of Informants	Experience (Years)	Tribe	Role
1	10	14–30	Dani (Hubula)	Traditional Figures, Builders, Owners (Honai Hunila)
2	10	8–25	Dani (Hubula)	Traditional Figures, Craftsmen, Owners (Honai Pilamo)
3	10	12–35	Dani (Hubula)	Traditional Figures, Builders, Owners (Honai Uma)
4	15	6–28	Lani (Lanny)	Traditional Figures, Builders, Owners (Honai Kunume)
5	15	12–32	Lani (Lanny)	Traditional Figures, Artisans, Owners (Honai Ome & Oliya)
6	15	8–30	Lost	Traditional Figures, Craftsmen, Owners (Honai Yowi)
7	16	5–30	Lost	Traditional Figures, Builders, Owners (Honai Homiya)

Based on Table 1, this study involved 91 informants from three tribes in Mountainous Papua Province, namely the Dani (Hubula), the Lani (Lanny), and the Yali Tribe. Informants were selected purposively taking into account their experience and direct involvement in the construction of the Honai traditional house. All informants consist of traditional leaders, traditional craftsmen, and Honai owners, so that they are able to provide comprehensive information about technical aspects of construction, building functions, material use, cost, construction time, and cultural values related to Honai traditional houses.

Based on the number of informants, the Dani Tribe is represented by 30 informants from three types of Honai, namely Hunila, Pilamo, and Uma. The Lani tribe was also represented by 30 informants from the Honai Kunume and the Honai Perempuan and Dapur (Ome and Oliya). Meanwhile, the Yali tribe has the highest number of informants, namely 31 informants, who come from the Honai Yowi and Honai Women and Kitchens (Homiya). The relatively balanced distribution of the number of informants in the three tribes provides a representative picture of the characteristics of Honai house construction in each community group.

In terms of experience, the informant has experience in building and utilizing Honai houses which ranges from 5 to 35 years. The range of experience shows that most of the informants have been involved in the construction of traditional houses for a long time so that they have a deep understanding of the construction process, the use of local materials, the gotong royong system, and the factors that affect the cost and time of construction. Such long experience increases the credibility of the data obtained because the information comes from individuals who have practical knowledge and hands-on experience in the field.

Based on the role of informants, this research involves three main groups, namely traditional leaders, traditional craftsmen, and Honai owners. Traditional leaders play a role in providing information about the social, cultural, and philosophical functions of the Honai house, while traditional craftsmen explain the technical aspects of construction, the use of materials, and the construction methods applied. Honai owners provide information about building utilization, space needs, construction costs, and the length of construction time based on their experience. The combination of the three groups of informants allowed the research to obtain more complete and in-depth data on the construction of Honai traditional houses in the Dani, Lani, and Yali tribes.

The research involved informants from three tribes in the Mountainous Papua Province, namely the Dani Tribe, the Lanny Tribe, and the Yali Tribe, which consisted of traditional leaders, traditional craftsmen, and Honai house owners. All informants were selected purposively because they had experience in the construction of Honai traditional houses. The data obtained includes building components, dimensions and volume of buildings, material needs, construction costs, construction time, and functions of each type of Honai. The results of the interviews showed that all types of Honai use local materials in the form of wood, reeds, and rattan obtained from the forests around the village. The main differences between the tribes lie in the function of the building, size, and number of floors, while the principle of construction is relatively the same.

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The recapitulation of the interview results shows that local materials, mutual cooperation systems, and the use of forest resources are the main characteristics of the construction of Honai houses. In addition, all informants stated that the volume of the building affects material needs, consumption costs, and construction time.

B. Components of the Honai house (Dani, Lanny, and Yani Tribes

Table 2 Percentage of informant answers on the Honai component of each tribe

No.	Answer Theme	Dani (n=30)	Lani (n=30)	Loss (n=31)
1	Walls using wooden planks	30 (100%)	30 (100%)	31 (100%)
2	Roof using reeds	30 (100%)	30 (100%)	31 (100%)
3	Flooring uses wood, rattan, and shears	30 (100%)	30 (100%)	31 (100%)
4	Fasteners using wicker rope	30 (100%)	30 (100%)	31 (100%)
5	Materials come from the forest around the village	30 (100%)	30 (100%)	31 (100%)
6	The male honai has two floors	20 (100%)	15 (100%)	15 (100%)
7	Female honai/kitchen has one floor	10 (100%)	15 (100%)	16 (100%)

Based on Table 2, the results of interviews with informants from the Dani, Lani, and Yali tribes show that all respondents have the same perception of the main components that make up the Honai traditional house. All informants (100%) stated that the walls of the building used wooden boards, the roof used reeds, the floor used a combination of wood, rattan, and solating grass, while the construction connection system used rattan rope. In addition, all respondents also explained that building materials are obtained from the forests around the village so that the development of Honai still fully utilizes local natural resources. This condition shows that the traditional construction system is still maintained by the people of the three tribes in Mountainous Papua.

The Dani tribe, all respondents (100%) stated that the male Honai, namely Hunila and Pilamo, have two floors that are used as activity rooms and storage of traditional equipment. Instead, Honai Uma was used as a residence for women and family domestic activities. Although they have different functions, all types of Honai in the Dani Tribe use the same materials and construction systems, namely using wood, reeds, rattan, and other local materials.

The Lani tribe, all respondents (100%) also stated that the construction of Honai uses local materials obtained from the forests around the village. Honai Kunume as a men's house has two floors that function as an activity room and storage of traditional supplies, while Honai Women's and Kitchen (Ome and Oliya) only has one floor which is used as a center for domestic family activities. The difference in the number of floors shows that there is an adjustment in the shape of the building based on the function of the space being run.

Similar findings were also obtained in the Yali Tribe. All respondents (100%) explained that Honai Yowi as a men's house has two floors, while Honai Homiya as a women's house and kitchen only has one floor. Both types of buildings are built using local materials in the form of wooden boards, reeds, rattan, and weeds obtained from the forests around the village. This shows that the Yali people still maintain the traditional construction system that has been passed down from generation to generation.

Overall, Table 2 shows that there are similarities in the construction characteristics of the Honai traditional houses in the Dani, Lani, and Yali tribes, which are characterized by the use of local materials and traditional construction techniques. The differences found are mainly related to the function of the building and the number of floors according to the social and cultural needs of each tribe. These findings indicate that the Honai traditional house is a vernacular architecture that has uniform construction principles, but still undergoes adjustments to the spatial function and activities of the local community.

C. Time and Cost Requirements for Making Honai Honai (Dani, Lanny, and Yani Tribe

Table 3 Summary of honai time and cost

No.	Honai Name (Tribe)	Number of Days	Cost (Rp)
1	Hunila – Honai Dapur (Dani)	36	15.000.000
2	Pilamo – Male Horn (Dani)	11	24.500.000
3	Uma – Honai Perempuan (Dani)	8	20.000.000
4	Kunume – Honai Laki-lucky (Heaven)	6	24.000.000
5	Ome and Oliya – Honai Perempuan & Dapur (Lani)	6	25.500.000
6	Yowi – Honai Laki-laki (Lost)	40	16.500.000
7	Homiya – Honai Perempuan & Dapur (Yali)	35	16.500.000

Based on Table 3, there are variations in the construction time and cost of each type of Honai traditional house in the Dani, Lani, and Yali tribes. These differences are influenced by the function of the building, the size or volume of the building, and the length of the process of collecting materials from the forest. However, the development costs

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presented in this study are consumption costs during mutual cooperation activities, because all building materials are obtained from the surrounding environment and workers do not receive wages.

In the Dani tribe, the construction of Honai Dapur (Hunila) takes the longest, which is 36 days, with a consumption cost of around IDR 15,000,000. The length of construction time is due to the process of collecting materials which takes about 30 days, while physical construction only lasts about six days. In contrast, Honai Pilamo as a men's house can be completed in an average of 11 days, but it requires a higher cost, which is around IDR 24,500,000, because the size of the building is larger and involves more workers during the gotong royong process. Meanwhile, Honai Uma as a women's house has a construction time of about 8 days at a cost of around IDR 20,000,000, so it is one of the types of Honai that is relatively faster to build than Hunila and Pilamo.

In the Lani Tribe, both Honai Kunume and Honai Perempuan and Dapur (Ome and Oliya) have a relatively short construction time, which is about 6 days. Even though they have the same duration, the construction cost of Ome and Oliya is higher, which is around IDR 25,500,000, compared to Kunume which reaches around IDR 24,000,000. This difference is influenced by the larger size of the Ome and Oliya buildings so that it requires more mutual cooperation consumption during the construction process.

Unlike the other two tribes, the construction of traditional houses in the Yali Tribe takes a relatively longer time. Honai Yowi takes an average of 40 days, while Honai Homiya takes about 35 days, with the same consumption cost, which is around IDR 16,500,000. The length of construction time is mainly due to the process of collecting materials from the forest which takes longer due to topographic conditions and the distance of the material collection location. However, the physical construction process of the building can still be completed in a relatively short time through the community mutual cooperation system.

Overall, Table 3 shows that the construction time of the Honai traditional house is not always directly proportional to the amount of costs incurred. The highest cost types of Honai are Ome and Oliya in the Lani Tribe, while the longest construction time is found in Yowi and Homiya in the Yali Tribe. These findings show that in the construction of Honai traditional houses, costs are more influenced by consumption needs during gotong royong activities, while construction time is greatly influenced by the length of the process of collecting materials from the forest, not by the physical construction process alone. Thus, the construction characteristics of Honai traditional houses are different from modern constructions which are generally influenced by material prices and labor costs.

D. The Effect of Honai Building Volume on Construction Time

Table 4 Variable Coefficients

Coefficients[a]

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t
(Constant)	30.397	11.417		2.662
Volume Bangunan (m³)	-.493	.475	-.421	-1.037

a. Dependent Variable: Waktu Pembangun (Hari)

Source: Data Analytics, 2026

Based on the results of the regression analysis in the Coefficients table, a value of 30.397 with a significance level of 0.045 was obtained. This value shows that if the Building Volume (m³) is considered to be zero, then the predicted construction time is 30,397 days. A significant constant value indicates the base time required in the construction process, regardless of the size of the building volume built.

The Building Volume variable (m³) has a regression coefficient (B) of -0.493, which means that any increase in building volume by 1 m³ is expected to decrease the construction time by 0.493 days, assuming other factors are considered constant. A negative coefficient indicates an inverse relationship between building volume and construction time. In other words, the larger the volume of the building, the shorter the construction time tends to be. However, logically this relationship can be influenced by the characteristics of the research data, for example the presence of buildings with a larger volume but worked on by more workers so that they can be completed faster.

The Standardized Coefficient (Beta) value of -0.421 indicates that Building Volume has a negative influence with the strength of the relationship that is classified as weak to moderate to the Construction Time. However, the results of the t-test showed a calculated t-value of -1.037 with a significance value of 0.347. Because the significance value is greater than 0.05 (0.347 > 0.05), the effect of Building Volume on Construction Time is not statistically significant.

Based on these results, the regression equations that can be formed are:

$$\text{Construction Time} = 30.397 - 0.493\ (\text{Building Volume})$$

This equation shows that there is a tendency to decrease construction time as the building volume increases. However, because these influences are not statistically significant, Building Volume cannot be used as a strong predictor to explain the variation in the Construction Time of a Honai

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house. Thus, the length of construction time is likely to be more influenced by other factors, such as the number of workers, construction methods, worker experience, material availability, weather conditions, and the level of difficulty of construction in each type of Honai.

Based on all the results of the correlation and regression analysis that has been carried out, it can be concluded that the volume of the building does not have a significant effect on the cost of consumption and the construction time of the Honai house.

Consumption costs, indeed, have a positive relationship with building volume (R = 0.600), which shows that the larger the building volume, the higher the consumption cost, the more likely it is to increase. However, the results of the regression test showed a significance value of 0.154 (greater than 0.05), so the effect was not statistically significant. This means that the increase in building volume has not been proven to cause an increase in consumption costs.

At the time of construction, the building volume had a negative relationship with a correlation coefficient of -0.421 and a regression coefficient of -0.493. However, a significance value of 0.347 (greater than 0.05) suggests that the relationship is also not statistically significant. Thus, the large size of the building volume has not been proven to affect the length of time it takes to build the Honai house. This study shows that the volume of the building is not the main factor that determines the cost of consumption and the construction time of the Honai house. Variations in construction costs and times are more likely to be influenced by other factors, such as the number of workers, the community mutual cooperation system, the availability of building materials, terrain conditions and construction sites, worker experience, and the construction characteristics of each type of Honai

V. DISCUSSION

A. *Components of the Honai house (Dani, Lanny, and Yani Tribes*

The results of the study show that all informants from the Dani, Lani, and Yali tribes have the same perception regarding the main components that make up the Honai traditional house. All respondents (100%) stated that the walls used wooden boards, the roof used reeds, the floor used wood, rattan, and solating grass, while the construction joints used rattan rope. In addition, all materials are obtained from the forests around the village so that the development of Honai does not depend on factory materials. These similarities show that the three tribes still maintain the principles of vernacular architecture that utilize local natural resources as the main material for development. The difference found lies only in the function of the building and the number of floors, where male Honai generally have two floors, while female Honai and kitchen are dominated by one floor.

The findings are in line with the concept of vernacular architecture which states that the form and construction system of buildings evolve through the process of adaptation to environmental conditions, culture, and the availability of local resources. The use of wooden boards, reeds, and rattan shows that the Dani, Lani, and Yali peoples still retain traditional construction technology that has been passed down from generation to generation. Thus, the sustainability of Honai development is not only influenced by technical aspects, but also by the cultural values inherent in the people of Mountainous Papua.

In terms of construction cost and time, the results of the study show that the difference in building volume is followed by the difference in the consumption needs of mutual cooperation and the duration of construction. Honai Ome and Oliya in the Lani Tribe have the largest building volume so they require the highest consumption costs, while Honai Hunila in the Dani Tribe takes the longest construction time because the material collection process lasts up to about 30 days before the physical construction begins. In the Yali Tribe, the construction time is also relatively longer because the location of the material collection is quite far from the settlement. On the other hand, the physical development of Honai in all tribes generally only takes about six to twelve days because it is carried out in mutual cooperation.

These results support the theory that building volume has a relationship with construction costs and time. Conceptually, the larger the volume of the building, the more materials that must be collected, the greater the labor requirement, and the longer it will take to complete construction. However, this study shows different characteristics compared to modern construction. In the construction of Honai, the increase in costs is not caused by the purchase of materials or the payment of labor wages, but by the increase in consumption needs during mutual cooperation activities. Thus, building volumes affect costs through increasing the logistics needs of workers, not through material prices as happens in modern construction projects.

The findings of this study are consistent with the research Rachman, Hendriyani, and Pratiwi (2024) which states that changes in the volume of work affect the amount of construction costs[3]. In the study, the difference in the volume of concrete and reinforcement resulted in a difference in estimated costs of around 13% through the 5D Building Information Modeling (BIM) approach. Although the research objects are different, they show that volume is an important variable in determining the need for construction costs. The difference is that the research is carried out on modern buildings with costs dominated by materials and labor, while in the construction of Honai the cost is dominated by the consumption of mutual cooperation because materials are obtained directly from the forest.

The results of the study are also in line with the research Respati et al. (2024) which explains that cost and time efficiency can be achieved through the management of structural work and implementation *Value Engineering*[4]. In the development of Honai, efficiency is not obtained through changes in design or materials, but through a system of community cooperation that is able to speed up the physical construction process even though all materials still use

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traditional materials. Thus, the social system of the community plays a role as an efficiency factor that replaces the application of modern technology.

Findings on the influence of building size on construction time also support research Tochaiwat et al. (2015) which states that the increase in the number of floors and the complexity of buildings causes the construction duration to be longer in conventional construction systems[5]. In this study, male Honai which has two floors requires more material needs and work stages than female Honai which generally consists of only one floor. This condition shows that the complexity of the building still affects the duration of construction, even though the construction process is carried out traditionally.

Instead, research Saghi and Ghaffari (2020) shows that the use of modern construction technology is able to accelerate construction time by about 50% and reduce construction costs by about 30%[6]. These results are different from this study because Honai construction does not use modern technology, but relies on traditional technology and mutual cooperation systems. However, the culture of mutual cooperation has been proven to be able to maintain the efficiency of physical development time so that most types of Honai can be completed in just about a week after all materials are available.

In addition, the results of this study also support the research Muthike et al. (2025)**)** which states that construction costs affect productivity and project completion time[7]. In the construction of Honai, the increase in consumption costs shows that more and more workers are involved in gotong royong activities so that work productivity increases and physical development can be completed in a relatively short time. Thus, the relationship between cost and time in Honai construction is more influenced by the social aspects of the community than by the construction market mechanism.

Based on the overall results of the study, it can be understood that the volume of buildings is a factor that affects the cost and time of construction of the Honai traditional house. However, the mechanism of influence is different from modern construction. In Honai houses, the building volume increases the need for materials collected from the forest as well as consumption needs during mutual cooperation, while material prices and labor wages are not the main components of development costs. Therefore, the construction of the Honai traditional house reflects a combination of traditional construction engineering principles, the use of local resources, and the socio-cultural values of the Mountainous Papuan people. These findings are the basis for drawing conclusions about the relationship between building volume and the cost and time of construction of Honai traditional houses in the Dani, Lani, and Yali tribes.

B. Analysis of the Time and Cost Requirements of Making Honai (Dani, Lanny, and Yani Tribe)

The results of the study show that the time and cost of building Honai traditional houses in the Dani, Lani, and Yali tribes have different characteristics according to the function of the building, the volume of the building, and the geographical conditions of the material collection location. Based on Table 3, Honai Hunila in the Dani Tribe requires a construction time of 36 days with a consumption cost of Rp15,000,000, Honai Pilamo requires an average of 11 days at a cost of Rp24,500,000, while Honai Uma takes about 8 days at a cost of Rp20,000,000. In the Lani Tribe, Honai Kunume and Honai Ome and Oliya can both be completed in about 6 days. However, the construction cost of Honai Ome and Oliya is larger, which is around IDR 25,500,000 compared to Honai Kunume of IDR 24,000,000. Meanwhile, in the Yali Tribe, Honai Yowi takes about 40 days to build and Honai Homiya about 35 days, with a relatively similar consumption cost, which is IDR 16,500,000.

The difference in construction time shows that the duration of the construction of the Honai traditional house is not only determined by the size of the building, but also influenced by the stages of collecting materials from the forest. In the Dani community and especially Yali, the process of collecting wood, reeds, and rattan takes a relatively long time because the location of the source of the material is quite far from the settlement and must be adjusted to the topography conditions of the mountains. On the other hand, after all materials are available, the physical development process can be completed in a relatively short time through the community mutual cooperation system. These findings show that the pre-construction stage has a greater contribution to the total construction time than the physical construction stage.

These results are in accordance with the construction time theory put forward by Abd El-Karim et al. (2017) and Nkado (1995), which explains that the duration of construction implementation is influenced by the volume of work, method of implementation, number of labor, location accessibility, and material availability[8], [9]. In the construction of Honai traditional houses, accessibility and availability of local materials are the most dominant aspects. The farther away the material collection location and the larger the volume of the building to be built, the longer it will take to complete the entire series of works. Thus, the construction time of Honai is not only influenced by the construction process, but also by environmental conditions and natural resource utilization systems that are still carried out traditionally.

From the cost aspect, this study shows that the construction of Honai traditional houses has different characteristics from modern construction projects. Development costs are not dominated by the purchase of materials or the payment of labor wages because all building materials are obtained directly from the forest and the development process is carried out through a mutual cooperation system. The main expenditure of the community is in the form of consumption costs provided for workers during the development process. Therefore, the increase in costs is more influenced by the number of workers involved and the length of gotong royong activities compared to the price of construction materials.

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The findings support the development cost theory put forward by Pappa et al. (2025) and Oktaviani et al. (2023), which states that construction costs are the accumulation of all expenses required during the construction process[8], [9]. In the construction of the Honai traditional house, the cost component undergoes adjustment to local characteristics, where material costs almost do not arise because all materials come from the surrounding nature. Thus, the construction cost structure of Honai is more dominated by consumption costs, local transportation, and logistics needs during the construction process. This condition shows that the concept of the Cost Budget Plan (RAB) in traditional houses is not entirely the same as modern buildings because it must consider the value of mutual cooperation and the use of local materials.

The results of this study also show that the relationship between building volume and construction costs and time is positive. The larger the volume of the building, the more materials that must be collected, the greater the number of workers needed, and the higher the consumption costs during mutual cooperation activities. However, these increases do not necessarily result in longer development times because they are influenced by the number of people involved in the development process. For example, Honai Ome and Oliya have the highest cost, but the physical construction time is relatively short because they are done jointly by the community.

The findings are in line with research Rachman, Hendriyani, and Pratiwi (2024) which states that changes in the volume of work affect the amount of construction costs[3]. The difference is that in the study, the increase in costs occurred due to changes in the volume of concrete and reinforcement in modern buildings which were calculated using 5D Building Information Modeling (BIM), while in this study the increase in costs was more due to the increase in consumption needs during mutual cooperation activities. Thus, although the mechanisms of cost-forming are different, both studies show that building volume remains the main factor influencing the need for development costs.

The results of this study also have similarities with the research Respati et al. (2024) which states that cost and time efficiency are important indicators in the implementation of construction projects[4]. In the research of Respati et al., efficiency was obtained through the application of *Value Engineering* by optimizing the design and material selection. On the other hand, in the construction of Honai traditional houses, efficiency is achieved through a mutual cooperation system that is able to accelerate the physical development process without changing the shape or material of the building. Thus, the culture of mutual cooperation is a form of local efficiency that has a similar function to the application of value engineering in modern construction.

The results of this study also support the research Tochaiwat, Pimma, and Mantala (2015) which explains that the increase in building complexity leads to an increase in the duration and cost of construction in conventional construction systems[5]. Male Honai which generally have two floors show greater material requirements and costs than female Honai which mostly consist of only one floor. However, the effect of the number of floors on the duration of construction in Honai is not as large as in modern buildings because the mutual cooperation system is able to speed up the completion of physical work.

In contrast to research Saghi and Ghaffari (2020) which shows that modern construction technology is able to speed up construction time by up to 50% and reduce costs by about 30%, this study shows that the acceleration of the construction of Honai traditional houses is obtained through community participation, not through the use of modern technology[6]. Therefore, the efficiency of Honai's development is more influenced by the social capital of the community compared to construction technology innovations.

The findings of this study also support the results of the research Muthike et al. (2025) which states that construction costs affect project productivity[7]. In the construction of Honai, the increase in consumption costs shows that more and more workers are involved in gotong royong activities so that work productivity increases and physical development can be completed in a relatively short time. This condition shows that the relationship between the cost and time of construction of the Honai traditional house is not only influenced by economic factors, but also by the social strength of the community which is reflected through the culture of mutual cooperation.

This discussion shows that the time and cost of building the Honai traditional house is influenced by a combination of building volume, building function, geographical conditions, availability of local materials, and the community mutual cooperation system. In contrast to modern construction which is greatly influenced by material prices and labor wages, the development of Honai is more influenced by the length of material collection and the amount of consumption needs during the mutual cooperation process. These findings reinforce that the Honai traditional house is a traditional construction system that integrates technical, environmental, and socio-cultural aspects simultaneously and is the basis for drawing conclusions about the time and cost needs of Honai traditional houses in the Dani, Lani, and Yali tribes.

C. Analysis of the Influence of Honai Building Volume on Construction Time

The results of the regression analysis showed that the building volume had a regression coefficient of −0.493 with significance value 0,347 ($p > 0.05$). These results show that the volume of the building does not have a significant effect on the construction time of the Honai traditional house. Despite the tendency of negative relationships, statistically building volumes cannot explain the variation in construction times. Theoretically, construction time is influenced by the volume of work, method of implementation, number of labor, and availability of materials[8]. However, in the construction of Honai, the conditions are different because the construction process is carried out through a mutual

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cooperation system and all materials are obtained from the forests around the village. As a result, the construction time is more influenced by the length of material collection, terrain conditions, and the number of workers than by the volume of the building.

The results of this study are different from the Tochaiwat et al. (2015) which states that the greater the complexity of the building, the longer the construction time will take[5]. In Honai houses, larger buildings generally involve more labor so that the physical construction process can still be completed in a relatively short time. Rather, these findings are in line with the concept of *Labour Utilization Rate* (LUR) which states that labor productivity affects the efficiency of project implementation time. The high participation of the community through the mutual cooperation system increases productivity so that it can keep pace with the increase in the volume of work[10].

Thus, this study shows that the volume of buildings is not the main factor that determines the construction time of the Honai traditional house**.** The duration of construction is more influenced by the number of workers, the mutual cooperation system, the availability of materials, geographical conditions, and the experience of workers. Therefore, the hypothesis that the volume of buildings affects the construction time is unacceptable based on the results of statistical analysis.

VI. CONCLUSION

A. Conclusion

Based on the results of the study on the influence of building volume on the cost and time of construction of Honai traditional houses in the Dani, Lani, and Yali tribes in the Mountainous Papua Province, it can be concluded that:

- The building components of Honai houses in the three tribes have relatively similar construction characteristics, namely using local materials in the form of wood, reeds, rattan, and grading grass. The main differences are in the function of the building, the division of space, and the number of floors that are adjusted to the needs and culture of each tribe.
- The time and cost of building Honai houses are more influenced by the mutual cooperation system and the availability of local materials. The cost of construction is dominated by the consumption of workers during mutual cooperation, while the construction time is more used for the process of collecting materials from the forest than for the physical construction process.
- The volume of the building has no significant effect on the time or cost of building the Honai house. The variation in time and cost is more influenced by the number of workers, the mutual cooperation system, geographical conditions, access to materials, and the socio-cultural characteristics of the community.

B. Suggestions

- The local government and related agencies are expected to use the results of this research as a reference in the preparation of a program for the construction and preservation of Honai traditional houses that maintain the local wisdom of the Mountainous Papuan people.
- The next study suggested adding other variables, such as labor productivity, location accessibility, geographical conditions, and material availability, so that the factors that affect the cost and time of construction of Honai houses can be analyzed more comprehensively.

C. Implications

The results of this study show that the construction of Honai traditional houses has different characteristics from modern construction. Therefore, planning the cost and time of traditional house construction should not only consider the volume of the building, but also pay attention to the mutual cooperation system, the availability of local materials, and geographical conditions. These findings can be the basis for the formulation of traditional house preservation policies and the development of development planning models based on local wisdom in Highland Papua

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