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Sustainable Modern Environment Responses on Bawean Architecture

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Abstract

The continuous search for sustainable architectural practices in the vernacular model paves the way for alternative approaches to modern diversity. In particular, the growing demand for habitation leads to loss of local identity architecture. This phenomenon or dilemma of "cultural aridity" occurred in many areas of Indonesia with settlements linked to history. The purpose of this article is to explore Bawean architectural identity located in the north-java island. With a focus on an examination of the original design of Bawean architecture into modern development design. Through, mapping and inventory of identity, assess the perspectives of the occupants of houses and those who are involved in the construction to get a better understanding of public knowledge, experience, and responses. The results show that the concept of Bawean architecture, mainly granaries is applied to modern architectural design with the advantage of wind flow to maintain storage humidity. However, a better understanding of this adaptation needs more investigation with the future study of an energy simulation analysis to develop a strategy for energy-efficient buildings. This article contributes to the emerging literature on developing granary design toward sustainably minimizing the environmental impacts of household electricity utilization.

Keywords: Bawean, Environment, Sustainable, Modren, Architecture.

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1. Introduction

Traditional Indonesian houses have numerous types of designs depending on the ethnic culture of cities. It is a reflection of people's traditions, overall landscape, urban forms, and the activities it concentrates on in some parts of the design. The colonial era also indirectly contributed to the reflection due to its profound impact on aspects of everyday life (Yapp, 2020). In the past Indonesia, the design and building process is represented by integral beliefs and creative abilities of the local community. Moreover, defines cultural identity as the foundation of architects following each geography to understand climate and environment.

Nowadays, in Indonesia, most cities' house design and building are based on imported trends, and do not express the values of the local community or urban spaces lost their identity. In order to find sustainable design solutions in the future, it is important to preserve traditional design houses as a valuable point of reference. Due to indigenous design houses are considered climatically responsive that provide comfort for the dwellers and eco-friendly materials (Ajabli et al, 2023).

However, the design seems to be faded with time and replaced by massive construction of modern houses such as semi-detached houses and terrace houses. Therefore, reinventing the study of traditional Indonesian houses design could be the provide solution as a reference for new design generation.

2. Problem Study Context

In order to explore, archive, and conserve Nusantara architecture, a journey to the origin of the Nusantara architecture building is necessary. In traditional Indonesian buildings, tribes who have implemented a natural farming system will create a place to store the farming results, which are called granaries. In addition to functioning as a place to store food, several granaries in Indonesia are also built as resting places for the surrounding community and are usually placed adjacent to the houses or residences of the community houses.

Geographically, by mixing different such as Javanese, Madurese, Malay, Buginese, and many other cultures (Setiawan and Amar, 2021), the Bawean built environment is met through temporary meaning to translate the traditional--formal meaning into a newer form (Hidayah et al, 2022).

As the modern era influenced reach bawean, it affects how society lives. Pantry and larder were introduced to people around and also part of the trend on modern style. For society that has granaries of their own, people accept and apply the newer form of building on their house (Byrne et al, 2023). The granaries in the Bawean area or also referred to as dhurung by the local community, are one of the architectural heritage of the area, which is unique and also when viewed from its history Bawean is one of the locations for the distribution as well as a shift from artisans/artists from Mojopahit who also spread to the Bromo area, Bali, and its surroundings.

3. Method

This research uses an inductive and deductive methodology through data collection to achieve a deeper understanding about identity, assess the perspectives of the occupants of houses and those who involve in the construction to get a better understanding of public knowledge, experience and responses. This could be done by analyzing the local adaptations and additions done to already existing spaces through field visits and interviews with people to understand their points of view and needs.

4. Result and Discussion

4.1 Dhurung Granary Bawean

4.1.1 Basic Forms of Dhurung

Dhurung in Paromaan Village has a body/living room size of about 4m x 2m and a roof size of about 5mx3m, including a roof overstek/cantilever (Figure 1).

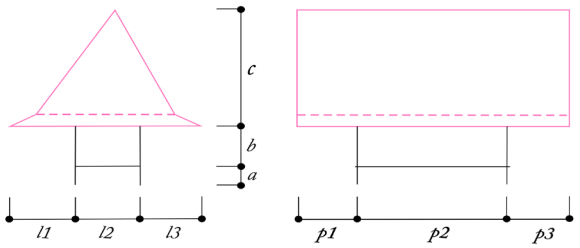


Figure 1. Base form

Thatch/dheun roof is commonly used on Dhurung in Bawean, and this happens because the material is easy to find and is widely available in the surrounding area. Along with the times, some of the-

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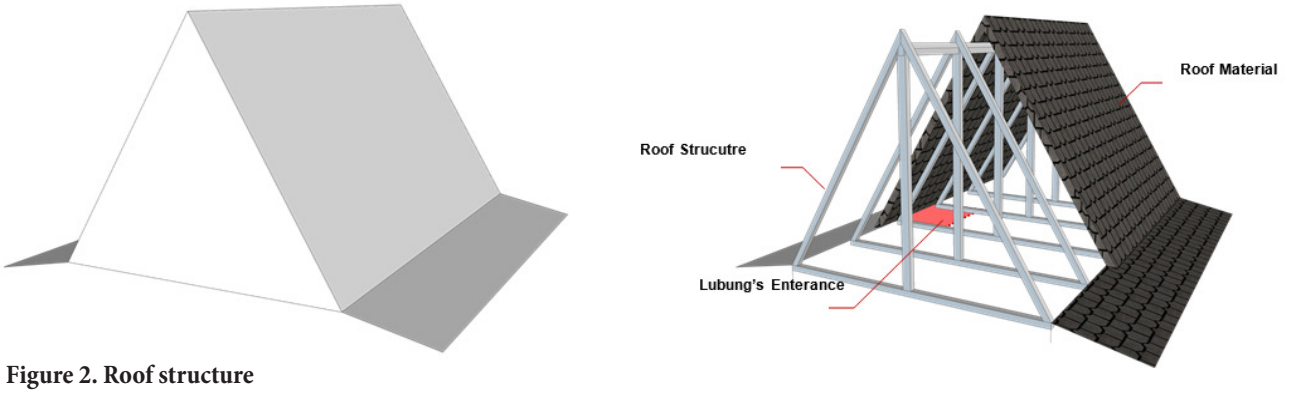


Figure 2. Roof structure

-Dhurung buildings have replaced roofing materials with tile, zinc, or asbestos roofs. If we look at figure 2, the roof structure is made of a wooden block and generally has a door for entrance at the bottom of the structure.

In the living room, four pillars function as roof supports, and on the shorter side between the two poles, there is a central wooden beam that connects the two poles (figure 3). On each support / Pang-Pang, there is a jelapang, also a holder for the connecting wood (figure 3). At the bottom, a pen hole structure is used as a fastener (figure 4). This structure is strong enough to withstand the heavy load of the storage space on the roof, along with the weight of the roof.

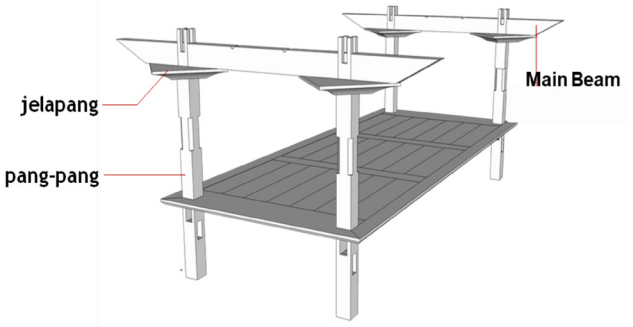


Figure 3. Middle structure

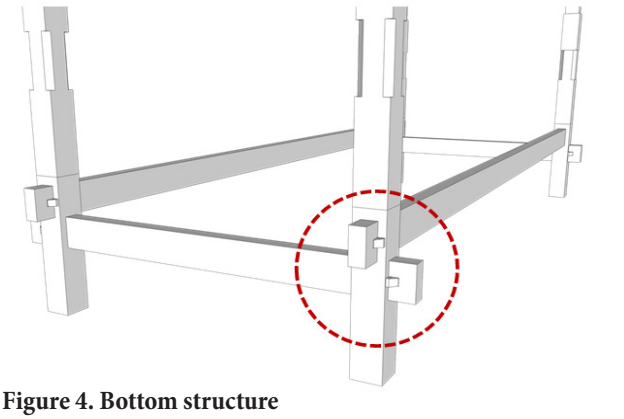


Figure 4. Bottom structure

The type of wood used as a building material is generally teak1, but in Daun Village, it was found that Dhurung used jackfruit wood as a substitute for teak (figure 9). The replacement of wood materials used for buildings is not only applied to Dhurung but also to house buildings that have particular wood as a replacement material. Jackfruit wood is also easy to find and is widely available in the area. This condition is similar to conditions in several other areas, for example, in the Tengger area where the pure wood building materials have substitute wood, namely Nagasari wood and Reuge wood which are deliberately planted and prepared.

The materials used on the roof of the dhurung found in Paromaan Village, Daun Village, and Candi Hamlet are quite diverse; it is found that Dhurung still uses leaf midrib and also found dhurung that uses tile or zinc roof.

The development process from Dhurung up to now can be said to be done separately for each part of the building and is carried out by one expert who is specifically working on that part where one person is every time the Dhurung is made, that person will always work on that part.

4.2 Dhurung Type

4.2.1 Paromaan Village

Dhurung Paromaan village has a linear base pattern with its triangle roof shape and is covered with a linear pattern (figure 5). And at its pang-pang, the jelapang has a special round shape (figure 6).

4.2.2 Candi Village

The Dhurung in the temple hamlet has a square-shaped Jelapang (figure 8) and a cross-roof pattern on the front side of it and is covered with a linear pattern (figure 7).

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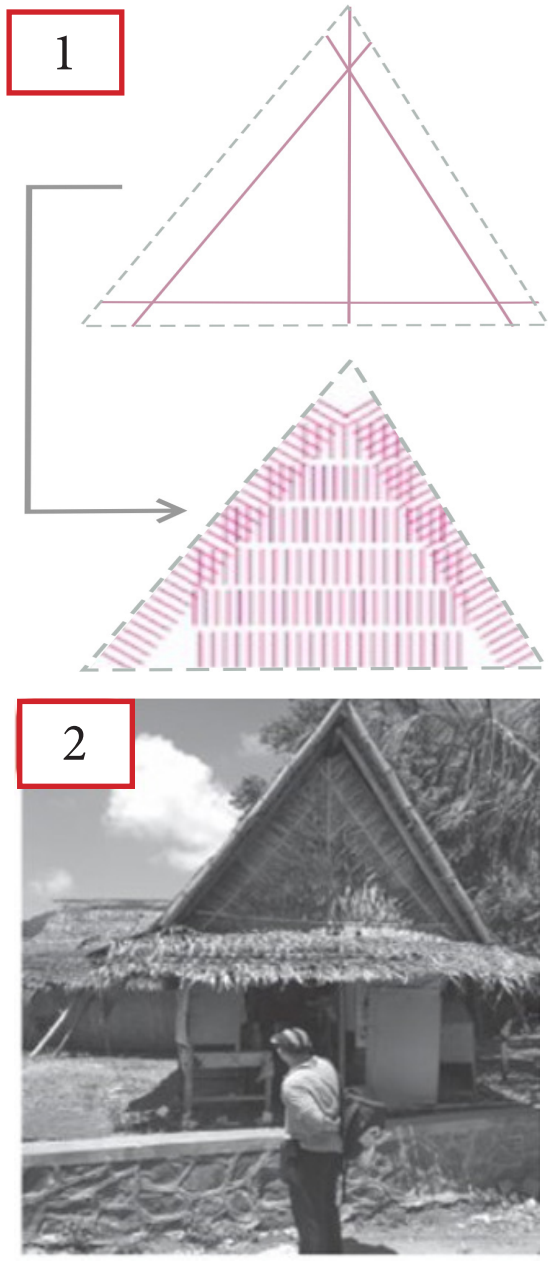


Figure 5. Paromaan dhurung's configuration, (1) Roof motive and (2) Paromaan dhurung

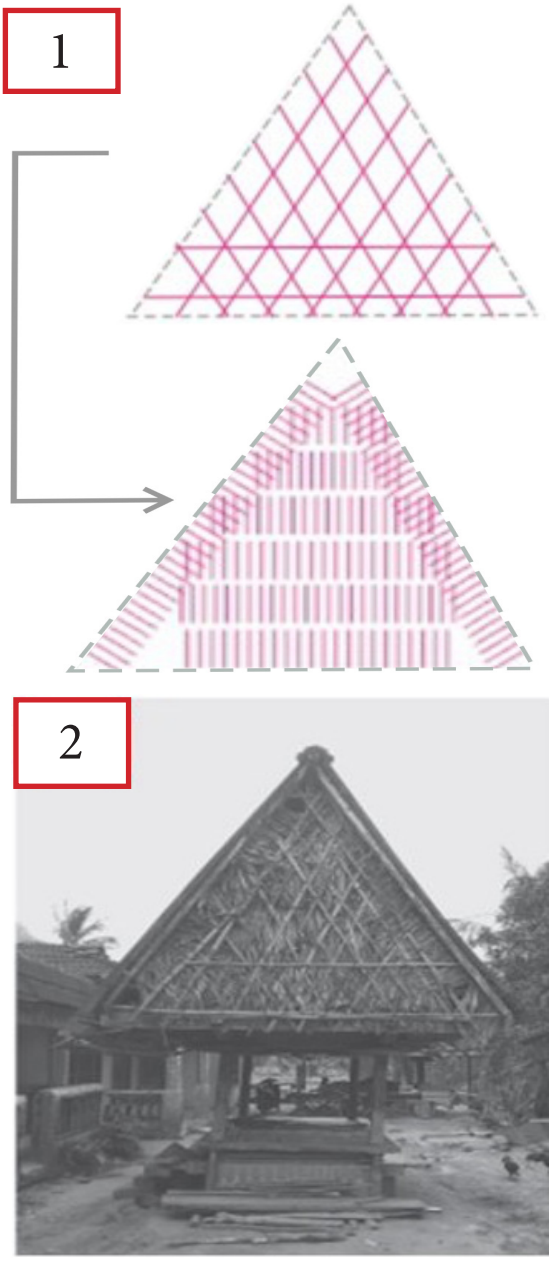


Figure 7. Candi dhurung's configuration, (1) Roof cross motive and (2) Candi dhurung

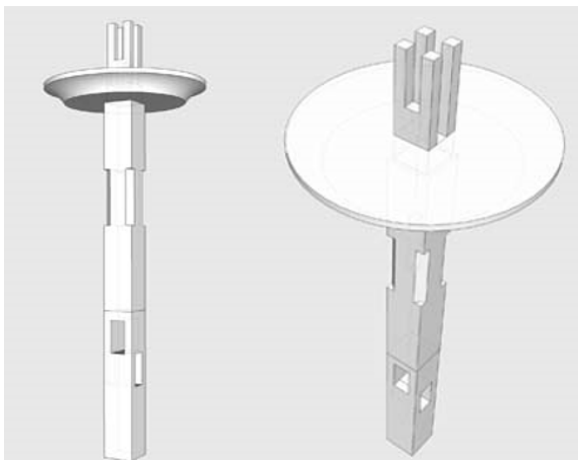


Figure 6. Round jelapang

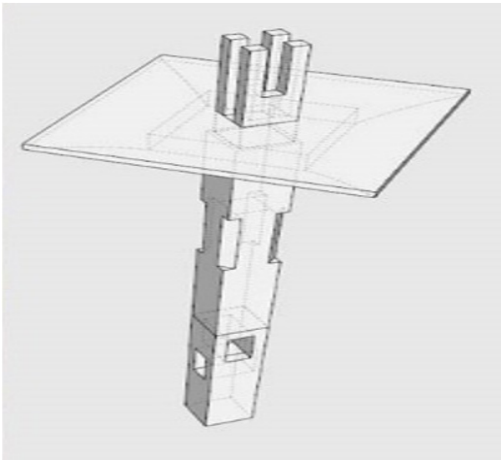


Figure 8. Rectangle jelapang

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4.2.3 Daun Village 1

The first type of dhurung in the Daun village has a storage location on the roof of the building. However, the wood for building material was taken from jackfruit tree. This wood is one of the substitute trees for the primary material for the Dhurung building (figure 9).

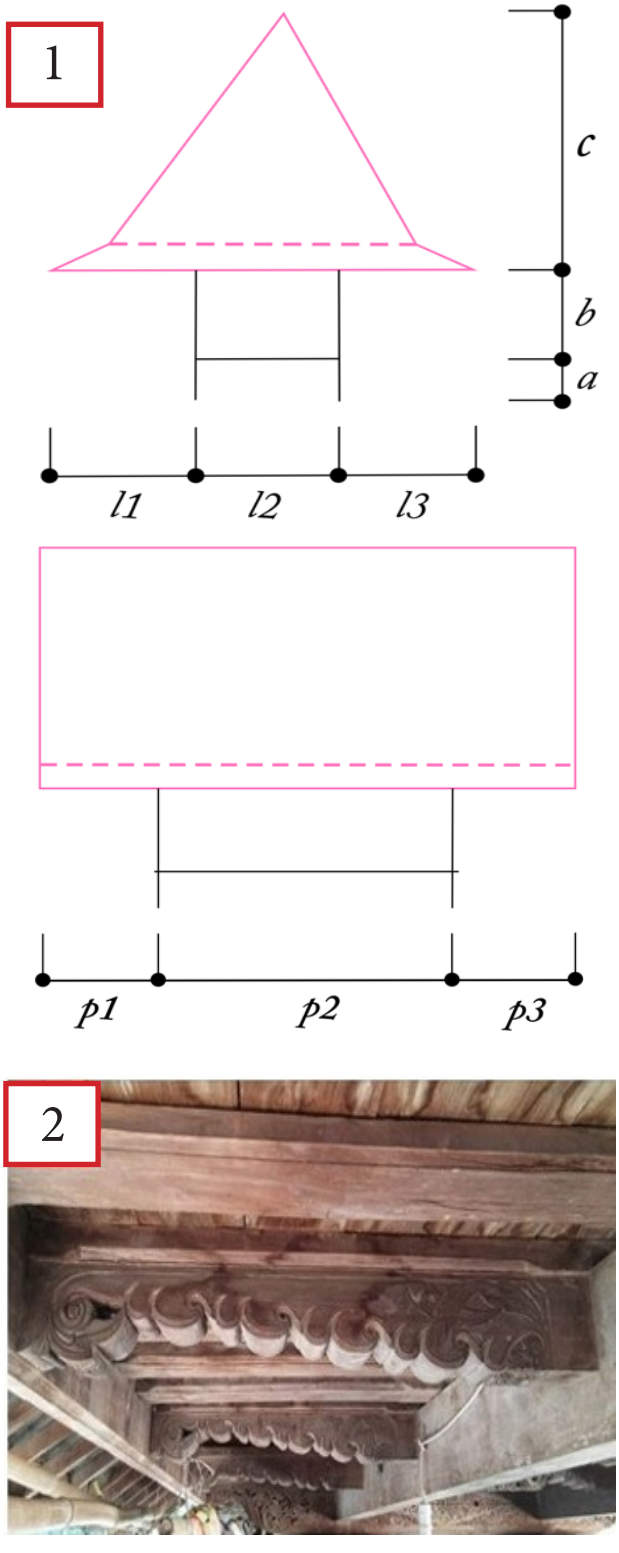


Figure 9. Daun dhurung's configuration, (1) Dhurung form and (2) Jackfruit wood as material



Figure 10. Dhurung's type at Bawaean, 1. Type A (Paromaan); 2. Type B (Candi); 3. Type C (Daun 1); 4. Type D (Daun 2)

4.2.4 Daun Village 2

The second type of dhurung in the Daun village is different because the granary space is already minimally used. The area was lowered and made to be on the side of the house and no longer on the roof (figure 10). In addition, its function is not only to store food but also to store other items such as vehicles and can be referred to as a warehouse.

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Table 1. Uses of Various Types of Construction Stiffeners and Decorations

Dhurung	Construction			Decoration		
	Rope	Pen Hole	Hob	Certain Motive	2 Dimension	3 Dimension
Paromaan Village (Type A)	v	v	v	-	-	-
Candi Village (Type B)	v	v	v	-	-	-
Daun 1 Village (Type C)	-	v	v	Plant stylization, Sun pattern	-	-
Daun 2 Village (Type D)	-	-	v	-	-	-

4.2.5 Age Analysis

If each type of Dhurung in Bawean is seen, the four types can be sorted by the age of manufacture (table 2). Type A is the Dhurung type from Paromaan village, type B Dhurung is from the temple village, and types C and D are the Dhurung type from the Daun village ordered by the age of production (figure 10).

The Dhurung species in Paromaan and Candi villages are older than the Dhurung species in Daun Village. Looking back at the differences and changes that exist in terms of construction and decoration between the types of Dhurung in Paromaan Village, Candi Village, and Daun Village, it appears that evolution has occurred from time to time marked by the disappearance of the use of ikat constructions, materials which were changed from teak wood to jackfruit wood, and applied beauty to the Dhurung in the form of decorative carving motifs, 2-dimensional shapes, and 3-dimensional shapes.

Table 2. Dhurung Type's Ages

Early	Paromaan Village's Dhurung & Candi Village's Dhurung
Middle	Daun 1 Village's Dhurung
Late	Daun 2 Village's Dhurung

4.3 Diachronic Analysis

This analysis shows how changes in terms of form and space occur in Dhurung from time to time (figure 10). In the Bawean area, Dhurung itself is usually placed in front of people's houses, besides that, in this area, there are also architectural buildings from other areas that have existed since the colonial era, but right in front of them, there is also a Dhurung. Data analysis was taken from four villages in the Bawean area: Paromaan Village,-Daun Village, Candi Hamlet, and East Pudakit Village.

4.3.1 Form and Space Transformation

There has been a transformation and development in Dhurung in several places, for example, the change into a "market"/buying place where every morning merchandise is placed in the central area or social area, and people buy in that place.

In several villages in the Bawean area, there has been a transformation in Dhurung in the area. An example is the change in Dhurung's social area into a buying and selling area/market, where every morning on Dhurung, merchandise will be spread over the social area, and buying and selling activities are also carried out directly in that area. This form of transformation is found in Paromaan Village and Daun Village.

There is also a Dhurung whose storage space has been reduced due to the reduced intensity of use. Previously as a place to put rice, the rice did not have to be placed in that place anymore because there were already other warehouses, in this case, shops, markets, and similar places that also store food ingredients. There, where previously, the granaries were used to store food needs for a period of several months. The result of the decrease in the storage area, which is next to the house and is no longer on the roof, is a warehouse, the warehouse is still filled with food ingredients, but in some cases, the warehouse is also used as a storage place for motorbikes or other goods with a different capacity and size big. This form of transformation is found in the village of Daun.

4.4 Synchronous Analysis Synthesis

To check the similarity between Bawean and other look-alike granaries, several variables are-

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-needed as benchmarks. These variables include form, which is assessed in terms of geometry, proportion, form, and space, which is assessed in terms of space function.

4.4.1 Synthesis Dhurung (Bawean) – Jineng (Bali)

Based on table 3, the synthesis results show that the two granaries indirectly have a close relationship when viewed from the overall aspect of form and space. The difference between the two granaries is in the proportion of heads affected by access to the rice storage area (figure 11).

4.4.2 Synthesis Dhurung (Bawean) – Sambi (Sasak)

The synthesis in table 4 that shows the two granaries have a distant relationship when viewed from the aspect of form. However, if you look at the-aspect of space in terms of function/utilization, the two granaries still have a fairly close relationship because they both function as storage places (figure 11).

4.4.3 Synthesis Dhurung (Bawean)–Uma Lengge (Bima)

The synthesis in table 5 shows result that from the aspect of form, there is a slight difference in the proportions of the head, body, legs, and also access to the entrance to the granary where the entrance to the Uma Lengge is horizontally up using the stairs to the door while the Dhurung is vertically using a sliding door located at the bottom of the storage area. In addition, there are also slight differences in terms of the function of using the roof space, but it remains the same for the hall area (figure 11).



Figure 11. Dhurung from different places, (1) Bawean; (2) Bima; (3) Bali; (4) Sasak; (5) Bada

Table 3. Variable between Bawean & Jineng

Variable		Similarities/Differences	
		Dhurung	**Jineng**
Form	Geometric	Beams on the bottom and triangular prisms on the roof	Beams on the bottom and triangular prisms on the roof
	Proportion	Have a lot of vertical space	Has wide storage space
	Shape	Communal spaces are open, and storage spaces are very closed	Communal spaces are open, and storage spaces are very closed
Space	Function	The bottom part is for open space, and the top part is for storage	The bottom part is for open space, and the top part is for storage

Table 4. Variable between Bawean & Sasak

Variable		Similarities/Differences	
		Dhurung	Sasak
Form	Geometric	Beams on the bottom and triangular prisms on the roof	Cube block shaped
	Proportion	Have a lot of vertical space	More symmetrical and level space
	Shape	Communal spaces are open, and storage spaces are very closed	Level and looks towering
Space	Function	The bottom part is for the storage and resting area	The roof as a storage space

Table 5. Variable between Bawean & Bima

Variable		Similarities/Differences	
		Dhurung	Bima
Form	Geometric	Beams on the bottom and triangular prisms on the roof	Triangular pyramid
	Proportion	The balance between body and head	Dominated by the triangular pyramid shaped supported by the legs
	Shape	Communal spaces are open, and storage spaces are very closed	The triangular pyramid becomes the center and the main storage space
Space	Function	For storage and rest	For storage and rest

Table 6. Variable between Bawean & Bada

Variable		Similarities/Differences	
		Dhurung	Bada
Form	Geometric	Beams on the bottom and triangular pyramids on the roof	Beams on the bottom and triangular pyramids on the roof
	Proportion	The balance between body and head	The balance between body and head
	Shape	Communal space is open, and storage space is very closed	Communal space is open, and storage space is very closed
Space	Function	The bottom is for open space, and the top is for storage	The bottom is for open space, and the top is for storage

4.4.4 Synthesis Dhurung (Bawean) – Bada

From the synthesis of table 6 results, it was found that from the space aspect, the function of the granary itself is actually the same, but there is an additional function in the hall area or social place contained in the Bada, which is also used as a place for preparing ceremonies or activities related to religion (figure 11).

5. Conclusion

Granaries building in Bawean or known as Dhurung is a granary building that has changed from time to time. These granaries have changed along with the spread, and increasing types of-granaries in the Bawean area changes occur in terms of structural form, function placement, and visual aesthetics. The basic shape of the granaries when compared to several other granaries forms in other areas looks familiar, has the same basic shape and function placement, and has a relatively similar shape but differs in terms of size, shape, and volume.

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