Exploring Architectural Style of Gianyar and Creating Building Material Innovations

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Abstract. Traditional architectural styles are essential for presenting local identity, so that it is necessary to recognize and explore local architectural identities in an attempt to maintain traditional architectural styles as one of the richness of local culture. Generally, the traditional Balinese architecture, particularly the Gianyar architectural style, is still used by Balinese. The design's application is also attributable to the Balinese local government legislation about using traditional Balinese architectural style in a building. However, the style's design process is an architectural challenge for building actors and people willing to realize that the construction processes usually need more time and costly. Because of this situation, it is considered essential to producing a building material that gives a traditional impression through the efficient use of resources and funds. By introducing a phased approach, this research starts with an analysis of the Gianyar architecture, which is used as a guide in designing traditional-style materials used by the broader communities.

1. Introduction

Globalization has evolved quickly, pushing cities and towns to grow more rapidly. This phenomenon is a global standardization, by sharing and incorporating global information and values between regions, in cultural, social, financial, political and technical aspects [1]. This phenomenon offers regions the difficulty of evolving without neglecting their identity. In the competitive period, losing these identities, including architectural identity, implies losing the identities and values. The difficulty to maintain architectural identity, including the traditional Balinese architecture style, is an architectural challenge for the Balinese in which the construction of traditional Balinese architecture is complicated and costly. Therefore, it is essential to create a new construction model, including the materials, to easily apply the traditional Balinese architectural style in their new buildings.

Learning history is a means to scrutinize identity when it makes a relationship between what has allegedly been in the past and what is currently happening. The construction of history is a meaningful universe of events and stories for a person or a collection of subjects [2]. Moreover, as the object of this creation process stems from a topic living in a particular social environment, we might say that history is an example of the present in the past that is used as a region’s identity.

Architectural practice is one of the significant components that express the distinctive identity of a society in a particular region. Four elements distinguish one place or area from others, including spatial qualities (including architecture) and culture or history [3]. As a significant kingdom in Bali in the 15-19th century, Gianyar was not only the centre of government but also the centre of cultural and ritual activities. The vital role of Gianyar in the past produced various cultural practices, including
architecture [4]. Cultural and ritual practices, including architecture, were ways to express the strength of a kingdom's influence and to express its distinctive identity [5], [6].

The localization and diversity of Balinese architectural dialects have been influenced by Bali’s political agenda, primarily since the 18th century when the Majapahit Kingdom from Java conquered Bali, in which the palace that is the central government of the kingdom is called puri. Bali was then ruled from the single primary puri (palace) of Klungkung, and the other puris such as Badung, Bangli, Tabanan, Karangasem and Gianyar were described as secondary independent palaces [5]. To express their superiority, the primary and secondary kingdoms performed state cultural practices in their territories to reveal their status differences [5], [6]. Every palace, including Gianyar, developed independently the Balinese culture that led to the differences in the implementations of cultural practices, including the architecture. They expressed themselves and created boundaries with others. In this context, tradition and culture can be seen as a resource to develop boundaries and identity [7]–[10].

The application for the architecture is also attributed to the laws of the local authority in Bali. The design phase of the style, however, is an architectural obstacle for construction actors and individuals who have a desire to consider how it is restricted by time and expense. This condition makes it necessary to produce a building material through the efficient use of resources and funds but still expresses the traditional style. This study begins by examining Gianyar architecture as a reference for the conception of traditional models that have been used by communities and followed by the production of material designs for the traditional style of buildings.

2. The Architectural Style of Gianyar

The Kingdom of Gianyar was seeking to put its territories into a new image as a binding and creative identification, with the different problems and influences of other kingdoms in Bali. The Gianyar Authority sought to forget the boundaries of previous forces, driven by complex cultural and political motivations [11]. Around the same time, a contemporary architectural production has demonstrated how this new area has created something massive and monumental. In that case, technology has been used to portray general concepts about race and the great society.

Three sections are the shape of the kori agung in Bali, including the kori agung of the royal house in Gianyar. The head is on the top of the structure, while the middle part is the body, and the lower part is the legs. There are three layers of the head and a small bentala or mudra on the top; one main structure and one or two lelengens on their legs. The body is equipped carved wood doors, which is the way for the offerings to go in and out during ceremonies [12]. The legs on which kori agung are fitted with brick steps (Figure 1). This kori agung was an architectural production to establish a local identity for the royal family [7]–[9]. This identity shows a generational disparity between members and non-members [10]. In this tradition, the royal houses are seen as the crossroads of the history of goods and customs. This intersection is an occurrence between many vernacular buildings [13].
As a royal family house, the gates are made of a combination of red brick and sandstone. In general, bricks are the main structure, while the ornament is generally made from sandstone [14]. The sandstones are attached to brick and carved in detail with plant and animal motifs as ornaments. Ornament is a Latin word, *ornare*, meaning decoration. The concept initially encompasses elements and decorations adapted from natural leaves and created from them [15]–[18].

3. The Model of a contemporary building material adopting traditional architectural style.

The existing bricks have a similar form, so that if the people want to make the traditional style, they should call traditional builder experts. The limitation of the brick’s forms has created difficulty for Balinese communities, including in Gianyar, to applied traditional style in the contemporary buildings. Therefore, it is necessary to make various forms to fulfil the use of decoration as required by traditional buildings. In previous research about brick materials, silicium is used to manufacture the *calcium silicate hydrate* that acts as an adhesive [19]. A further analysis was made on the topic of researches [20], [21], containing bagasse-ash or equivalent additive content. To avoid combustion, sand and water were used in the moulding process on the hydraulic machinery to produce interlocking bricks [22], [23]. Many researches have been carried out on the invention of interlocking brick with a bagasse ash mixture using clay as the base of a material mixed with cement [21].

The interlocking brick is produced using a moulding machine that requires unskilled labourers. This brick is so dense that the walls look very sturdy and not too thick to build the traditional Balinese walls. By showing the positive and negative elements of the upper, lower and sides of brick surfaces, the bricks can be dried and can automatically be levelled when the joints are finished. This interlock system has been designed to make easier construction process for unskilled labourers [24]. A pyramid locking mechanism with a hole in the centre has the benefit of the interlocking brick style. This method was deemed better because the transition of the excitement of force can be uniformly spread horizontally [25].

This application needs to be done to simplify and accelerate the construction that still impresses these traditional buildings. To get the desired form, three basic forms must be made. The first form is the body form. This form has the same shape as a brick in general, and it is just that the size of the module is bigger so that it can speed up the installation process but can still be lifted by a builder. The second form is the legs. This form will later function as the legs of the wall, which has width greater than the body and has little ornamentation. This leg form can be made the same as the wall head form. The third form is the pole form. This form functions as a corner meeting of the walls with a certain
thickness (Figure 2). Here there are negative and positive forms (opposites). Besides that, the legs of the pillar and the head are also needed.

![Figure 2. The alternative form of the bricks](image)

The existence of different forms will undoubtedly affect the mould that is made. In this case, three moulds should be required, which have different sizes from each other. This condition will certainly make it quite expensive to make these different prints. Besides that, the mould also requires a place to work on it. In this case, a wider area is needed for the work areas. In this situation, purchasing material would minimize the expense, which, for the construction of the projects, would guarantee compliance with the standard of the already developed material and material of the sort on the market. Several experiments used waste materials to mitigate the cracks in the project system [26], [27]. The bricks industry is the most highly-informed industry for technical waste absorption by the large volume of raw material used in manufacturing and the large volume of finished goods [28].

To reduce costs and use the land for making the mould, it is necessary to modify the mould to be flexible and make printing for various forms. The most likely thing to do is to use a mould where some of the components can be removed. It is necessary to think more deeply in deciding the form of this print, which on the one hand should facilitate the work, especially in production, but also reduce costs and saving time. To get the three things above together is certainly not possible. Therefore what needs to be done is to create the most optimal form so that the production results are maximized.

Seeing the shape requirements of the bricks, two moulds are needed, both of which must be flexible. These shapes correspond to their functions. The first is the shape of walls, and the second is the shape of the pillars. These two forms of moulds must produce a brick that will fit perfectly into each other. Furthermore, each will produce two types of forms, namely the shape of the legs, including the head and the other the body shape.
4. Conclusions

In general, brick technology can be modified to produce bricks that have a traditional feel through amalgamation in ways commonly practiced by construction practitioners in Bali so far. This traditional nuance can be developed by investigating the traditional architecture of the kori agung of the royal houses in Gianyar. The development of bricks with traditional nuances is made to facilitate the work of traditional buildings and does not require special skills for the installers. This traditional Balinese architectural style brick can produce a traditional Balinese impression without producing much waste when working.

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