

## Strategy of Adaptation of Traditional House Architecture Bali Aga

\*Dwinik Winawangsari<sup>1</sup>, Himasari Hanan<sup>2</sup>, Widjaja Martokusumo<sup>3</sup>

<sup>1</sup>Doctoral Student in Architecture; School of Architecture Planning and Policy Development,  
Institut Teknologi Bandung (ITB)

<sup>2,3</sup>Lecturer, School of Architecture Planning and Policy Development, Institut Teknologi Bandung (ITB)

\*Corresponding author\* Dwinik Winawangsari

**ABSTRACT :** Adaptation is defined as a change to adapt to the environment or change the environment to fit the need to achieve balance. The Bali Aga community in Pengotan village has a tradition of building a house that refers to the concept of Tri Angga based on the Tri Hita Karana philosophy which is an expression of harmony with God, with human beings, and with the natural surroundings. Each element and layout of the building represents the alignment. In line with the development of the era, the pattern of community life changed resulting in traditional buildings are very regular and uniforms individually undergo a process of change without leaving the concept of Tri Angga and the philosophy of Tri Hita Karana. This paper is the result of field research that examines building changes by taking the example of traditional homes that undergo many changes to be able to conclude how traditional value changes occur in the original house. The results indicate that the change occurred partly due to the personal tastes of its inhabitants without the loss of fundamental changes in their philosophical value. Changes are found in non-structural building components and are strongly influenced by the ease of implementation of construction aspects. The building facade is striking with the appearance of ornaments on traditional buildings previously unknown in Pengotan

**Keywords:** Adaptation, Bali Aga, Pengotan, Residential architecture

### I. INTRODUCTION

Settlements are the result of human adaptation to the environment and are based on the beliefs of the people that are manifested in the form of traditional environment (customary environment). Pengotan Village is a traditional Bali Aga settlement that still exist until now. The village of Bali Aga is a native Balinese settlement that is less influenced by the Hindu kingdom of Java (pre Majapahit). In this village, there is a traditional yard whose spatial pattern refers to the *Tri Hita Karana* philosophy which emphasizes the balance of relationships in the context of harmony between humans, the environment, and God that manifested in the settlement spaces [1]. *Tri Hita Karana* (three elements of life) that regulate the balance or harmony of humans with the environment, arranged in the composition of the human body / *angga*, giving derivation of the concept of space called *Tri Angga* [2]. *Tri* literally means three and *Aga* means body, which emphasizes three physical values, namely: *Utama Angga* (head), *Madya Angga* (body), and *Nista Angga* (foot) which arranges the elements of human life in nature / physical environment. Vertically, the application of the concept consists of *utama* is in the top / sacred position, middle position *madya* and *nista* in the lowest position / dirty. In everyday life, this concept is reflected in the hierarchy of spatial that shows the balance of human relationships with nature, people with others. The traditional building of Pengotan village uses the foundation material of dried soil (*pol-polan*), walls and roof coverings using bamboo, and without any openings other than the door to go in and out. Views of buildings without ornaments with natural color of dry bamboo. At the roof of the building, at the end of the ridge is installed ornaments of bamboo and fibers (*ijuk*) as a binder.

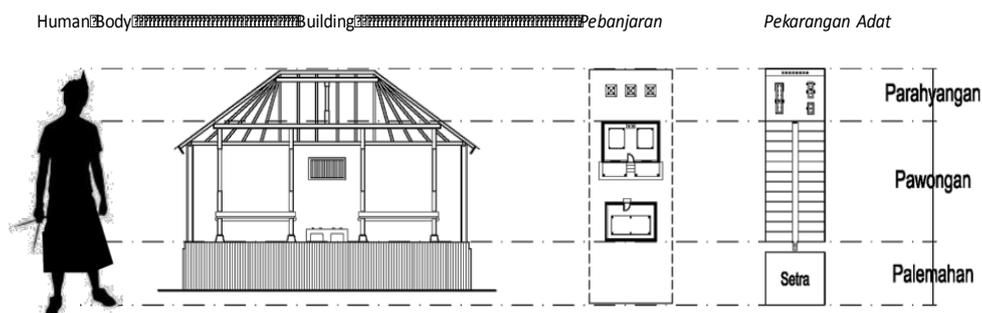


Figure 1. Tri Angga concept applied to every physical aspect of Pengotan traditional yard

Most buildings leave their traditionalism by using modern building materials that are more practical, easier and relatively faster to get them compared to using traditional building materials that are around which are still through further process in order to be used as building materials.

The uniqueness of the uniform shape and appearance of the building in this village is disturbed by the appearance of old buildings with new look and the addition of new facilities such as *warungs*, warehouses and the development of private homes of less-planned office *bale*. But in this study the discussion focused on the changes that occur in customary buildings *meten*. Economic demands and the influence of information and tourism in Bali, as well as a consumptive life culture are the factors of influence that threaten the uniqueness and sustainability of this village.

## **II. ADAPTATION OF THE TRADITIONAL HOUSE ARCHITECTURE**

Traditional homes change shape over time in an effort to adjust to changing occupant needs over time. Rapoport [3] explains that a cultural system is volatile and some tend to survive. The core part of culture that is belief or habits of life will last longer than the physical elements are volatile. Changing the physical elements in order to adapt to the usual environment is defined as adaptation.

The environmental adaptation expressed by Arkkelin and Veitch [4] states that "adaptation behavior is part of the human response to its phenomenal environment". The phenomenon that occurs due to non-conformity or outside the habit that causes the adaptation by humans to achieve balance.

According to Berry in Altman et al [5], adaptation mechanisms by humans to achieve balance with the environment through several ways or strategies, namely: 1) adaptation by reaction, behavioral changes are in the direction against the environment, this can cause changes Environments that, in essence, improve the appropriateness of both, but not with behavioral adjustments, 2) adaptation by adjustment, behavioral changes are in a direction that reduces conflict between environment and behavior by changing behavior to be in harmony with the environment. In general, this diversity is most often meant by the terms "adaptation," and 3) adaptation by withdrawal, behavior is in a direction that reduces the pressure of the environment, this means the elimination of the adaptive environment. James Douglas [6] explains that building adaptation is the work on the building for maintenance in altering capacity, functionality or performance in other words interventions to adjust, reuse and improve the ability of buildings. Adaptation is interpreted in the broadest sense as it covers all the works to buildings that are not maintained.

The scope of adaptation is change, expansion, improvement as well as conversion and renovation. The range of adaptation options is huge - from partial to full change of usage, small or large improvement, or small to large extension [6]. Further explained, there are many other different terms used to describe the intervention into buildings that are not just maintenance. Words such as 'refurbishment' or 'rehabilitation' and 'renovation' or 'restoration' are sometimes considered identical to each other by adaptation. 'Refurbishment' comes from the word 're', to be done again, and 'furbish', to polish or rub. Thus to fix something done facelift or reparation with the aim of improving the appearance and function. In the context of the building it involves extensive maintenance and repairs as well as improvements to bring it to a better standard. At the ground level, improvements imply that work is superficial or cosmetic, including the improvement of aesthetic and functional performance of the building. However, on the other hand, the refurbishment includes major repairs, sometimes called a building overhaul or a makeover or refurbishment of the building '.

The different terms of adaptation relate to the extent and nature of the changes and the interventions they describe. The following table highlights the scale of adaptation options.

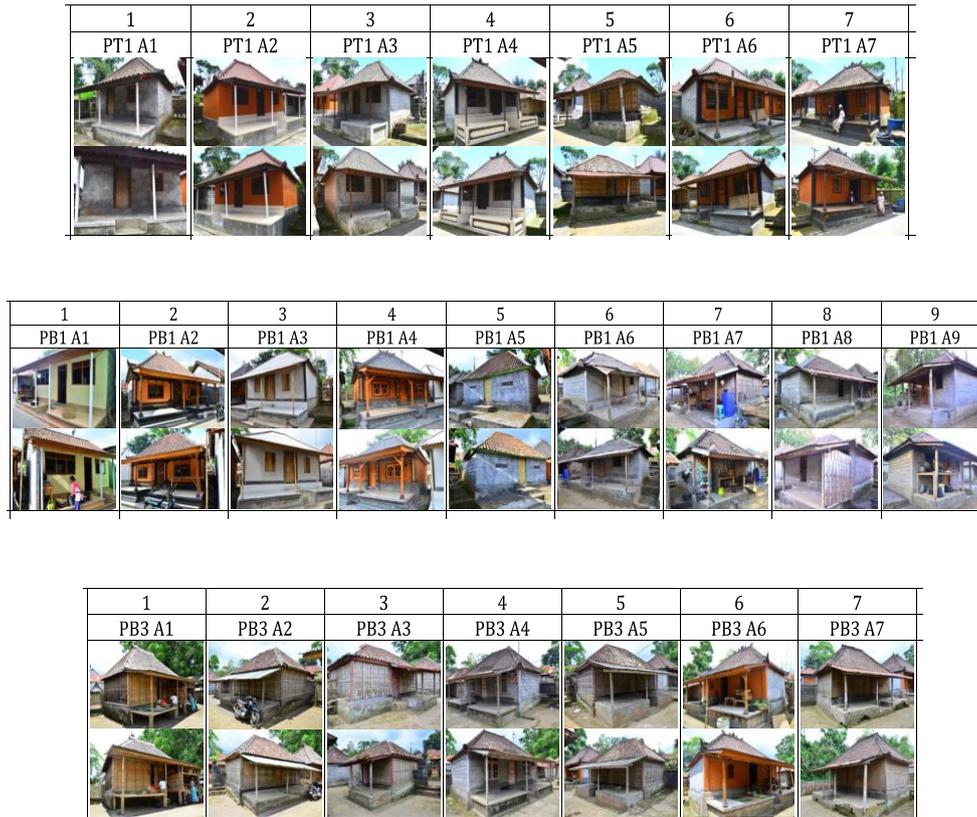
**Table 1.** Scale of adaptation options and degree of change [6]

<i>Scale</i>	<i>Degree of change</i>	<i>Type</i>	<i>Example</i>
Small	Low-key	Minor improvement of surfaces. Upgrading of fittings. Minor extension.	New floor coverings, re-roofing, painting/re-painting or rendering/re-rendering external walls. Replacement of doors, windows, and kitchen/toilet fittings. Porch, conservatory or small rear/side extension, and loft conversion. These may involve some minor structural work, such as forming new openings.
Medium	Substantial	Conversion scheme. Major upgrading of surfaces and elements. Major retrofitting of services. Enlargement of capacity. Structural alterations. Major change of use of an old building.	Change of use from office to flats or vice versa. Overcladding of walls and recovering of roofs with improved thermal qualities, and over-roofing flat roof, recladding of walls. New air-conditioning system, addition of lift/s and service cores. Major lateral or vertical extension. Removal/insertion of walls and floors. Conversion and renovation works to a derelict or wrecked property.
Large	Drastic	Extensive remodelling works. Reconstruction of new building behind existing main external walls. Extensive spatial and structural alterations to enlarge/reduce the building's capacity or change its use.	Restoration of a ruinous multi-storey building. Facade retention scheme. Major extension to as well as internal and external modification of existing building.

### III. METHODOLOGY

The research was conducted in Pengotan Village, Kintamani, Bali by tracing the physical traces of traditional houses in traditional courtyards by observing the addition or subtraction of the building form. Physical tracking according to John Zeisel [7] means systematically looking at the physical environment to find reflections from previous activities that were not produced for measurements by researchers. He further said that 'From a trace investigators ask questions about what caused it, what the person who created the trace intended, and what sequence of events led up to the trace. The imageable quality of physical traces makes it easy to generate hypotheses about causes ....'

The research begins by conducting an inventory of all traditional house buildings in Pengotan village's traditional yard. Subsequently, samples were selected that could illustrate the change of custom house in more detail. The final stage, an analysis of the changes in the shape of the building, then concluded which form the most changed and the factors causing the change. The picture below is the result of recording 21 traditional house building '*meten*'.



**Figure 2.** Twenty-one samples of traditional house 'Meten' as the object of research

Then the research was done by direct observation in the field and recording the object of study in the form of photos and video, sorted and then selected. From the photographs obtained then analyzed changes in the shape of the building through the use of building materials

For a systematic discussion, house building is recognized as 'head-body-foot' as well as the concept of *tri angga* adopted by Pengotan society. Referred to the head is a roof covering, body parts are walls, beams and columns, and the feet are the floor and the foundation / *bebaturan*. The head section distinguished the roof cover of the main building and the terrace on the custom house, while the change in roof covering material is distinguished over roof tiles, asbestos and zinc. Wall building materials used are brick and brick which commonly exist in Pengotan.

The building materials of columns and beams include wood, concrete or a mixture of both. The foundation material is limited only to concrete, and wood is used as material for doors and windows. Processing of observation result using building component matrix to building materials and using ornament. Any change in the form of custom house is assessed based on changes in building components, and the number of changes is marked by the number of components that change. From the summation of existing changes can be concluded how the traditional house changes occur. For more detailed analysis, unstructured interviews are conducted to the occupants or owners of each building being sampled on the background of the shape changes made to the building. In addition, the interview is also addressed to the customary chief to find out how far the village regulates the traditional buildings in *pekarangan adat*.

#### IV. ADAPTATION OF TRADITIONAL HOUSES *METEN*

The original building *meten* constructed of bamboo and clay as the main building material. Bamboo traditional materials used for roof covering (bamboo shingle), wall (woven bamboo), columns, beams, frames and doors and long benches in front of the building (terrace). Clay is used for building materials *bebaturan* (foundation of elevated soil). Both of these materials are easy to get and there are many in Pengotan village.



**Figure 3.** Traditional house Pengotan (source: Dwinik, 2013 and Adiputra, 1999)

From the visual analysis, found several categories of changes made by building owners, namely: 1) category 1, the buildings are changed due to the use of new materials, fixed form, 2) category 2, buildings that change due to the use of new materials, the shape changed with window as a new element, and 3) category 3, the buildings that change due to the use of new materials, have window as new elements, ornaments with wood and stone carvings, and painted with striking colors.

#### 4.1 Building Materials and New Elements

Based on field conditions, there are many form changes occurring due to the use of new materials on building elements (roofs, walls, columns, beams, floors and foundations). Old building materials such as bamboo or soil are replaced with new materials that fit their function. New building materials that are easy and fast to work, available on the market, affordable and durable prices encourage people Pengotan renovate their homes. Bamboo is a roofing material of the main building and the terrace is replaced by tile from soil, asbestos or zinc. Bamboo is also used as building material elements of the wall which is then replaced with *batako* or brick material. Along with the replacement of wall materials are usually replaced also window and door frames, from bamboo replaced wood. Columns and beams of bamboo are replaced with wood, concrete, iron pipes or a mixture of *paralon* pipes filled with cement and sand. *Bebaturan* old material is a pile of stones covered with dry soil and serves as a floor replaced by concrete and floor using plaster or ceramic.

Replacement of roofing material from bamboo to zinc or asbestos directly changes the slope angle of the roof becomes more sloping, as well as the replacement of wall materials from bamboo to *batako* or brick, *bebaturan* on terraces with tiled floors, changing the image of the tropical building, which is light and flexible in terms of structure, shifted into a massive building. But in terms of structure and building patterns did not change. The uniformity of the basic shape and layout is preserved in accordance with strict village rules.



**Figure 4.** Changes in the use of building materials. New building materials used are tile, zinc, asbestos, bricks, and ceramics

BUILDING ELEMENTS		
	OLD	NEW
Rooftop cover	Bamboo	Clay tile, asbestos or zinc
Wall	Bamboo	Brick
Window and door frames	Bamboo	Wood
Columns and beams	Bamboo	Wood, concrete, steel pipe or mixture of paralon pipes filled with cement and sand
Foundation/ <i>Bebaturan</i>	Dry Clay	Concrete
Floor	Dry Clay	Plastering or ceramics

Figure 5. Components of traditional buildings are changing

The Changes in the shape of the building are also caused by the use of ornaments, the appearance of buildings that look simple to be very different from the original building. The addition of ornaments along with the change of old material is replaced with new material that is different from the original. The addition of ornaments occurs in many settings where the plain *bebatu* surface is affixed to the relief. The addition of this type of relief ornament also occurs on the wall. The roof element is the next element of the head of the building given ornament on the ridge, *jurai* and listplank. In the concrete column, the bottom of the column is made thick (enlarged dimension) is the use of other ornaments. While the wooden columns on the top is carved with flower motifs, as well as the beam that connects the pole.

Traditional house buildings that previously had no ornaments gained an external influence from the popular image of Balinese buildings so that the modernization of building materials was followed by the addition of ornaments on the part of the building. The division of the head-leg-body building in this case provides the widest possible space for applying ornaments to the building. New ornaments often found on the roof of buildings, columns, walls, and *bebatu*, with shades and expressions that follow its position in the building. Since the ornament is not a functional part of the building, its existence is more aimed at self-actualization of the inhabitants for their success in improving their economic status or social status.

Striking colored paint is also a trend and takes part in the process of changing the shape of the building. Paint is used on the exterior of the building whose function is not to protect the wall from the weather because this concept is not in the original building. Paint is used to provide the color of brick as a wall building material that combined stone ornaments with different colors. The use of striking colors not only change the image of the building also change the image of the region.

4.2 Building Adaptation Process The process of changing the shape of the building takes place over a long period of time, slowly, following the community's need to improve their buildings. Judging from the process of change - can be seen from the condition of each building in the field - found some homes that changed the use of materials only on roof covering elements and foundations / *bebatu*. This means that replacement of new materials begins with roof cover (roof) or roof cover (main building) or *bebatu*. The next change is on the wall and / or door. The gradual process of change occurs for several reasons, including the use of bamboo roofing material not resistant to extreme climate change. The frequency of replacement of roof covering material is more frequent compared to other walls or elements because the roof is directly exposed to solar radiation and rain water. Likewise, in the case of *bebatu*, rainwater splashes cause *bebatu* - which is only a soil and a stone arranged without glue and wrapping - frequent erosion.





Figure 6. The process of changing traditional buildings

Wall replacement material is usually accompanied by the addition of window elements, to include daylight (light of sky) into the building (see **figure 6**). The original building is not familiar with the concept of openings on the walls, so the space in the building gets light from the bamboo wall holes. The air exchange in the building is quite good because the pores of the bamboo chamber are wider than the windows. Another change with the window on the building is a relationship between the inner and outdoor in each house. Window openings that use transparent materials (glass) to make space in front of the building as space that can be watched more intensively. Another function of the openings is that it can bring the outer space into the building. Previously, the concept of such space is not known because the inner space is firmly separate from outdoor.

#### 4.3 The Factors that affect the physical changes of buildings

Natural materials such as bamboo have limited life, weathered and susceptible to pests. This limitation can be caused by many factors such as climate where rain and alternating heat and high air humidity also accelerate the weathering process in bamboo. The preservation process is quite complicated and takes a long time to become a weakness of bamboo as a building material. Buildings that use uncured bamboo only 3-5 years, depending on the type of bamboo used, the increasing age of the building, the strength and durability of the building construction of bamboo function is reduced rapidly.

The availability of bamboo as a building construction material must be balanced with the availability of land for the preservation of bamboo plants. The decreasing of bamboo forest around Pengotan traditional village due to the changing of cultivation pattern of plant become the influence factor of the decreasing of the use of bamboo material as building material. The availability of new building materials is also a factor affecting the shifting of buildings. New materials using simple, precise technology show different performance with old building materials. Ease of implementation is also a factor that influences people to replace bamboo as building material. The new buildings around *pekarangan adat* contribute to influencing the shifting of buildings. A new, modern-looking building that represents the luxury and social status of the owner. The appearance of buildings made of bamboo for ordinary people gives negative connotations that are poor and not modern, so people tend not to maintain bamboo as a building material today. The economic ability of owners determines traditional house changes because the replacement of old building materials requires a large cost. The choice of new materials no longer takes into account the alignment between building and inter-building elements because the purpose of replacement materials is to highlight the economic status of the owner. Changed homes usually give the image that homeowners are successful in improving their economic level.

## V. CONCLUSION

Pengotan traditional house consists of only one room, the average size is 4 m x 6 m and 1.5 m x 6 m for terraces, where all household activities are carried out in the building. Like other Indonesian vernacular buildings that use bamboo as the main construction material, built with local expertise, as well as strict rules that limit it, making this residence look simple. Over time, the simple look of a *meten* building transforms into a modern-looking building. The change occurred partly due to the personal tastes of its inhabitants without the loss of fundamental changes in their philosophical value. Changes are found in non-structural building components and are strongly influenced by the ease of implementation of construction aspects. The building facade is striking with the appearance of ornaments on traditional buildings previously unknown in Pengotan.

According to **table 1**. Scale of adaptation options and degree of change, the changes made by the owner are very drastic, although the layout has not changed. The change of facade caused by the use of new and modern building materials directly also changed the area. Image as a Bali Aga environment that comes with

simplicity and uniformity to be lost is replaced by buildings that appear individual put forward personal identity.

However, the Bali Aga community based on the *Tri Hita Karana* philosophy and *Tri Angga* concept are still maintained that govern the orientation of the building, the division of the building with the concept of head-body-feet, horizontal and vertical, residential buildings remain neatly lined, with altitude and dimensions are relatively uniform. A precise adaptation strategy, the gap of strict rules in which the facade and the replacement of building materials is not regulated, serve as an opportunity to preserve traditional buildings or in other words applying sustainable concepts to traditional buildings.

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