

## Conference Paper

# A Study of Balinese Traditional Houses through Lontar as a Guideline to Sustainable Design

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**Abstract**

Traditional houses usually reflect their surroundings. As they lived among natures, people of the past used resources they found around to build their houses, such as bamboo, reeds, and wood, which is now, remain as traditional housing. The material selections and construction techniques are based on the local environment, social structure, and economic circumstances. This living ways has been going on for a long time and proven to bring positive impacts on the surrounding environment. In Balinese architecture, the proper usage of these resources has been written in lontar manuscripts which are considered as guidelines in Balinese architectural and construction. This study used Lontar Asta Kosala-Kosali from the Geria Jlantik Baler which has been translated into Indonesian. The guidelines related to the basic concept, cosmology, material selections, and construction technique were studied using the interpretative criticism to find the deeper understanding in theory behind this guideline and explore the relation of the built environment and its inhabitant. Guidelines regarding basic concept and cosmology were proven to shows their strong relationship to human and nature which similar to the concept 'ecological' and 'environment.' The use of woods as the main material which was detailed in the guidelines shows an attempt to make the preservation of the rare and high-quality woods as well as building a durable house. This study may help to see which part of the Asta Kosala Kosali lontar still can be used as a guide by today's architects to create a sustainable design concept.

**Keywords:** sustainable design, local material, traditional house

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## 1. Introduction

Architecture is one of many that give a significant impact on the natural environment. As discussed by Williamson [1] the word sustainable (and sustainability) entered into the consciousness of architects and became an essential concern in the discourse of architecture not less than the end of the twentieth century. Sustainable architecture is a revised conceptualization of architecture in response to a myriad of contemporary concerns about the effects of human activity. The label 'sustainable' is used to differentiate

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this conceptualization from others that do not respond so clearly to these concerns. Many topics discussed to find the solution to reduce these effects. Increase awareness in protecting and maintaining their environment has become one of the topics.

Balinese architecture has this awareness long before the word sustainable arise. It is one of vernacular architecture built by the community and developed in the community. In the primary stage, people think and feel in a cosmic and mystical sense of life, or religion. It creates a different architecture because it is inspired by the depths of the soul [2]. It is resulting an architecture in harmony with its inhabitants. According to Siwalatri [3], this architecture mostly applied sustainability concept, even they did not have the intention of sustainable development. Its practice has been passed down from generations to generations. Nevertheless, that does not mean that scientific study cannot be carried out from its traditional houses.

Balinese architecture not only leaving its traditional houses as legacy but also its written guidelines. Guidelines in building Balinese housing have been written in various lontars. According to Gelebet [4], the existence of lontar could be stated as a knowledge system within Balinese architecture. Among them are lontar Asta Kosala-Kosali (later abbreviated into AKK in this paper), Asta Bhumi, Aji Janantaka, and others which have recorded the forms of architectural thought. The contents of this lontars include physical and non-physical aspects of the development where the physical elements include the size order (dimensions) and counting (option numbers) while the non-physical aspects include philosophy, ceremonies, incantations, wariga, and working procedures [5].

Language and writing used in lontar AKK is Kawi language in general. Although has been found some lontar that use the Balinese language, but for lontar associated with Balinese architecture are still using Kawi language. In the 1970s began efforts to collect and translate lontar into the Latin letters and then translated into Indonesian. One of which is Lontar AKK from the Geria Jlantik Baler which is used in this study.

*“Manakah pengetahuan itu? Itulah sastra, penyuci segala makhluk dan terhadap apa yang diperbuat, terhadap pengetahuan yang suci benar mengantarkan pada penguasaan segala jenis kayu.” (Article 1, paragraf 5 [6])*

This article stated that literature is a source of knowledge. Therefore all the guidelines contained in the lontar are aimed to give fine results which are represented with the term “penyuci” (one that brings holiness). The statement “penguasaan segala jenis kayu” (mastery of all types of wood) led to an understanding that Balinese architecture is a technique of processing wood, as its main ingredient.

This lontar is like tales. The guidelines are written in narrative form with various rewards for every instruction being followed. Therefore this study aims to explore its deeper understanding of building environmentally friendly Balinese houses. It includes the understanding of a basic concept, cosmology, material selections, and constructions which produce ecologically friendly houses.

## 2. Materials and Methods

This study used interpretative criticism to find a deeper understanding of the theory behind this guideline and explore the relation of the built environment and its inhabitant. Study of architectural text using interpretative criticism has been done before in Javanese text by Prijotomo [7]. By using interpretative, Prijotomo tried to read, understand, analyze, and reconstruct Javanese architecture from its text, Kawruh Kalang and Kawruh Grya [8].

The main characteristic of interpretative criticism is naturally personal where the critics act as interpreters for the readers, not claim to serve doctrines, system, or type, also not to create any objective and measurable evaluation. Otherwise, the interpretative critics are trying to create other people vision, lead them to see what the critics see. There are three technics in interpretative criticism; advocatory, evocative, and impressionistic criticism. This study used advocatory criticism as the technic where the critic stands as an advocate, not a judge [9-10]. Advocatory used to seek the benefits that have been ignored by the readers, also to find the charms which most readers find it's boring.

Selected articles in the discussion are representing the main guidelines used to build Balinese housing consisting of the basic concept, cosmology, material selections, and construction technique. In this study, articles are collected based on the similarity to the discussion. Then every sentence in the articles was interpreted by analyzing various possibilities on its meaning as well as its correlation to Balinese housing. Information collected from analyzes were used as the basis interpretation to put it close to modern architectural literature.

## 3. Results and Discussion

### 3.1. Basic concept of Balinese architecture

*“Ka artinya wit, asal, yu artinya Buddha yaitu budi, pikiran. Sesungguhnya pikiranmu lah yang unggul. Wi artinya yang membakar yaitu api. Bayangkan*

*Sang Hyang Agni berada pada pusaranmu, membakar segala jenis penyakitmu. Semua terbakar.” (Article 1, paragraph 6 [6])*

This article describes the basic concept of Balinese architecture which lies in the term “kayu” (wood). The term “kayu” (wood) consists of ‘ka’ which means ‘wit’ (origin) and ‘yu’ which means budha or mind. This shows that in Balinese architecture, wood plays an important role as both tangible and intangible element. While the term “wi”, as in “wisesa” means the one which duty is to neutralize negative things inside a human. It can be understood that fine architecture plays an important role in human life.

The two articles above are initial proof that lontar of Balinese architecture can be used as a source of knowledge in architecture. Moreover, this shows that Balinese architecture is not only about buildings but also its strong relationship with human and nature. This is similar to concept ‘ecological’ and ‘environment’ in which according to Williamson [1] is one of the labels that embody the notion that the design of buildings should fundamentally take account of their relationship with an impact on the natural environment.

### 3.2. The cosmology of Balinese architecture

*“Jantung adalah kayu, empedu adalah bumi, hati adalah api, buah zakar adalah air. Demikianlah caramu berpikir. Bila engkau tidak memilih petunjuk yang baik, itu serampangan namanya.” (Article 6, paragraph 1 [6])*

This article discusses the basic guidelines in architecture. Its encourage architect to use the suitability between the macrocosmic and the microcosm elements as a basis for thinking. There are four main elements work as the balance of macrocosm and microcosm. Referring to Cakra Dewata Nawa Sanga, as shown in Figure 1, these elements occupy the four corner of the wind directions.

The metaphor of macrocosm elements into microcosm organs seems likely to have similarities in both functions, as shown in table 1. By pairing them both and relate them to architecture, a conclusion can be drawn that building Balinese houses should have attention to several points: circulation system, protection, beauty, and renewable.

### 3.3. Wood selection

Following guidelines in lontar AKK, type of woods used in the building is divided into three categories based on the type of the buildings; parahyangan (shrine), bale

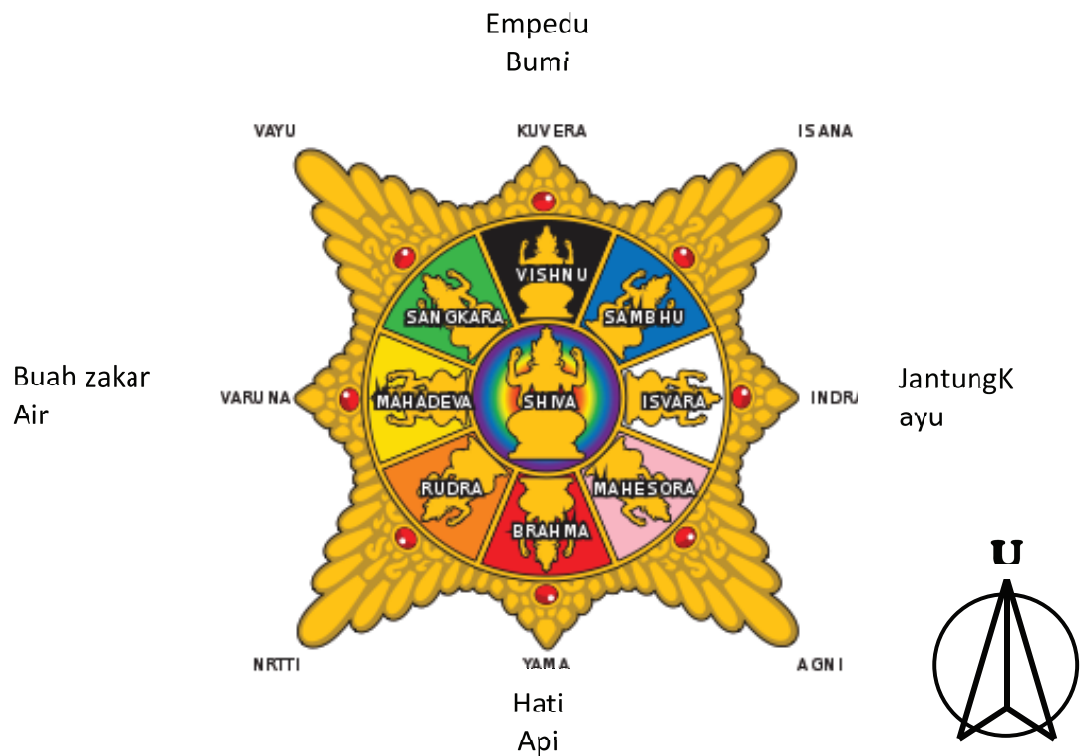


Figure 1: Cakra Dewata Nawa Sanga.

(residence), and both paon (kitchen) and jineng (paddy stock). This shows an effort to distinguish the quality of woods based on the building functions. Woods used for shrine have better quality than ones used for bale and kitchen. Later, from each category, the type of woods is sort listed from its quality by giving the specific names. The following is an article which contains guidance of wood selection for shrine:

*“Inilah perhitungan jenis kayu yang dapat dipakai parahyangan dan sanggah: Cendana adalah prabhu, Manengen adalah patih, Cempaka adalah arya, Kwanitan adalah demung, Majegau adalah tumenggung, Suren adalah rangga.”* (Article 28, paragraph 1 [6])

Prabhu, patih, arya, demung, tumenggung, and rangga are all titles in Balinese traditional government. This naming shows a clear instruction that wood stand with name prabhu has the highest quality, while rangga has the lowest quality.

This article shows what Balinese believe that only chosen and purified woods can be used for a shrine. One of the wood’s characteristics is the good scent comes out from the woods, such as sandalwoods and cemps. The use of cemps as roof construction is shown in Figure 2. However, those woods have been chosen for other reasons; it’s

TABLE 1: Metaphors in lontar of Balinese architecture [11].

		Function	Conclusion
Jantung adalah kayu (heart is wood)	Heart	As a sign of life; controlling blood circulation in the body	Both have similarities in function, it is working in the circulation system.
	Wood	Or trees, wood is a channel for food essence; In buildings, wood distributes mass circulation	This can be understood that building should have a structure with the fine circulation system.
Empedu adalah bumi (gallbladder is earth)	Gallbladder	As a container of bile	Both have similarities in function, as a container or as a protector. This can mean that a building should be a place and protector for its owner.
	Earth	As a container of natural minerals	
Hati adalah api (liver is fire)	Liver	maintains body balance, neutralize toxins	Both have similarities in their function as a neutralizer of negativities. It can be said that architecture can neutralize bad things to look good. Also, both are symbolized by a reddish color that symbolizes grandeur and beauty.
	Fire	lighters and smelters	
Buah zakar adalah air (male reproductive organ is water)	The male reproductive organ	The origin of human life	Both have similarities in function. It is as the beginning of life and regeneration. This can be interpreted that a building should be renewable.
	Water	The source of life for all beings on earth	

decorative surface and long lasting strength. Considering the time, money, and energy are highly needed to renovate one shrine.

The following is an article which contains guidance of wood selection for residence:

*“Dan yang dapat dipakai untuk bale yaitu: Nangka adalah prabhu, jati adalah patih, Benda adalah arya, Sentul adalah rangga, Sukun adalah demung, Timbul adalah tumenggung dan prabu Kwanitan. Dan yang dapat dipakai untuk jineng dan dapur yaitu: Wangkal adalah prabhu, kutat adalah patih, blayu adalah arya, endep adalah demung, buu adalah tumenggung.”*  
 (Article 28, paragraph 2-3 [6])

On the contrary to the shrine, the types of woods which are chosen for bale and kitchen are not pleasant scent and purified wood. However, they all still have a strong

TABLE 2: Woods used in Shrine [8].

Woods	Usage	Construction	Decorative	Conclusion
Sandalwood is prabhu; Manengen is patih	Petaka (tip of the roof), ceiling	Strong, light	Dark brown, smooth, straight fiber, with sleek and shiny surface	High quality in decorative and construction. Strength and long-lasting for the roof
Cemp is arya; Kwanitan is demung	Lambang and iga-iga	Hard	Dark, straight fiber, smooth, flex	Long lasting and strong to be crafted, bring trough ornaments to lambang
Majegau is tumenggung; Suren is rangga	Sesaka (pole)	Hard, heavy	Yellow-brown, smooth fiber, shiny surface, reddish, coarse	Seldom used

structure, durable and termite resistant. For ceiling of bale, jackfruit wood is used, which is although strong but not as heavy as teak. While teak is selected as wood for poles of bale. Differences in the usage of wood appear to be more than just based on the sanctity of the tree, but from the properties of woods. Its usage seems like an efforts to add value in terms of its structural strength and aesthetics. Moreover, when observed, timber which is used for poles, i.e. teak (for bale) and majegau (for shrine), are the type of woods with small fibers that can give smooth result when they are carved. So as to add aesthetic value to the decorative elements, as shown in Figure 3.

A further study from this article shows that woods selected are the type of woods that cannot be cultivated. Woods that are in the prabhu category, like sandalwood for shrine or nangka for bale, proved to be more difficult to be seen in the forest than woods that are in patih category (in this case is manengen for shrine or teak for bale) and thus to other categories more underneath.

This categorization of wood seems to indicate an attempt to make the preservation of these quite rare woods. By stated sandalwood as the material of petaka, then to construct a shrine would not require large amounts of sandalwood. Whereas for poles, which require more woods, selected wood are more often found, they are kwanitan and majegau. Thus the high-quality and rare wood would not simply cut down for building materials. As well as to encourage the next generations to contribute to preserving this rare wood for the wood is needed for shrine as a building that is purified. It is convenient to the meaning of sustainability stated by Sassi [11] that is a way of life affecting everything an individual does. Knowing what kind of a relationship we want to have with the global and local environment is the first consideration.



**Figure 2:** Roof construction of shrine – Pura Taman Sari, Klungkung.

### 3.4. Construction technique

*“Dan caranya memasukkan sunduk, mulai dengan sunduk panjang, hati-hatilah olehmu berpikir, menghadap ke timur, lihat bayangan matahari. Sunduk itu berpribadi Sang Hyang Smara, tiang berpribadi Sang Hyang Ratih. Rapatkan pertemuannya.” (Article 7 [6])*

This article provides instructions on how and when the architect should attach the beam to the pole. Sang Hyang Samara, or God Smara, in Balinese Hindu mythology, holds the role of a god of love. While Sang Hyang Ratih, or Dewi Ratih is the goddess of the moon. Both are often used as a depiction of two harmonious and long-lasting elements. By using God Smara and Dewi Ratih as a metaphor, there seems to be an





**Figure 3:** Roof construction of bale – Jro Kuta, Denpasar.

effort to explain that the pair between beam and pole must be suitable and able to withstand the structural load properly so that the building can last for a long time. Also, this pairing system of beam and pole allows for movement in the structure. It can handle vibrations quite well such as earthquakes and wind, without leaving any fracture to the building.

It was also stated that in putting up a beam, an architect must pay attention to the sun's shadow. By paying attention to the orientation of the sun and shadow when attaching the beam to the pole will result in a bale which has a good and proper orientation. Bale with the right orientation is possible to get better sunlight at the daytime. Here is seen an attempt to produce buildings which are able to maximize natural lighting.

Moreover, the usage of this *sunduk-tiang* (beam and pole) joint system in Balinese houses allows the building to be assembled easily so that the high-quality wood would not simply ruin. This preservation effort shows the other concept of sustainability lies in Balinese houses, where the work should not only be able to support the sustainability of human life as a resident, but also the sustainability of nature and the surrounding environment. Balance, as one of Balinese aesthetics, not only refers to the physical

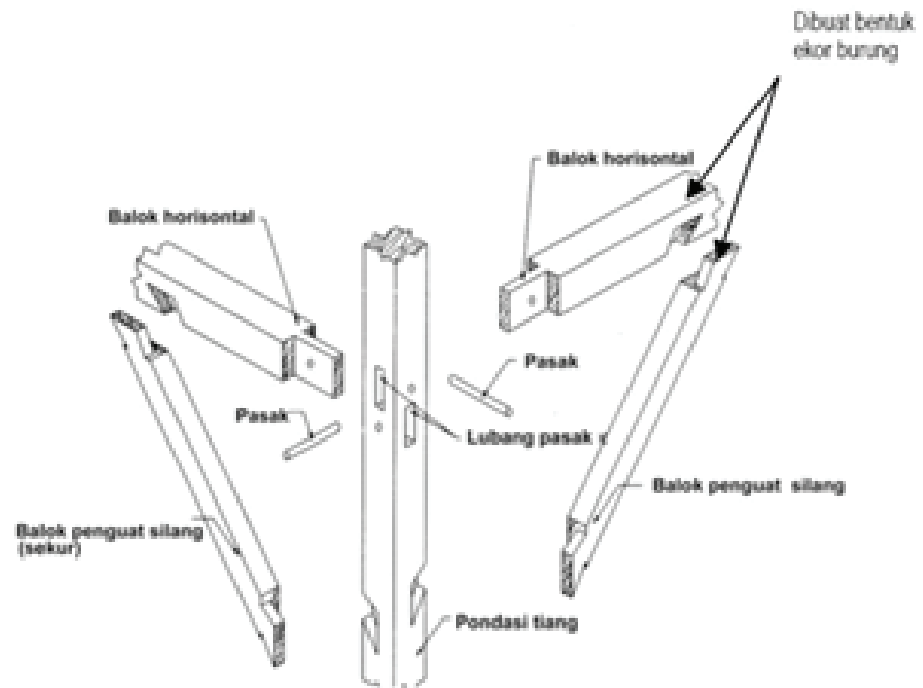


Figure 4: Illustration of poles and beams joint [5].



Figure 5: Poles and beams joint applied in bale - Jro Kuta, Denpasar.

form of the building but also the stability of Tri Hita Karana concept, one of which is the harmonious relationship between man and nature [13].

#### 4. Conclusion

The understanding of sustainability in building Balinese houses can be found through the reading of its lontar manuscript, especially Asta Kosala-Kosali of Geria Jlantik Baler. The article of the basic concept in lontar AKK shows that Balinese architecture is not only about buildings but also its strong relationship to human and nature is a significant part of Balinese architecture. This is similar to the concept 'ecological' and 'environment'. The

articles of cosmology are based on the balance of macrocosm and microcosm; resulting Balinese architecture has attention to several points: circulation system, protection, beauty, and renewable. These points apply in how Balinese build their houses, one of which is the wood selection and construction technique. Not only that Balinese preference in using local material, but also their specific way to choose the type of wood shows an attempt to preserve the rare and high-quality wood. Moreover, the usage of *sunduk-tiang* joint system in Balinese houses is flexible so that it able to handle the earthquakes and wind without leaving any fracture to the building. It shows how Balinese applied sustainability concept by building environmentally friendly houses. Moreover, by understand and apply Balinese architecture concept and guidelines written in lontar AKK, can lead an architect into creating sustainable design.

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