

DISCUSSING JAVANESE HOUSE USING VITRUVIUS THEORY

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ABSTRACT

Javanese House is well-known as one of the significant vernacular architecture Indonesia which is built by indigenous people. The local builder holds on the philosophical and cosmological concept for the spatial plan arrangement of the Javanese house. Each space has its proper function and meaning which is reflected from the society and culture of Java. Javanese architecture has been used on the human scale as its proportion design that gives both aesthetic and symbolic dimension. In addition to the aesthetic and functional value of Javanese house, the indigenous builder builds their house by using their traditional construction method, which is known as *teknologi tepat guna*. This construction method is not only appropriate to their local availability of material and environment but also have high strength and durability. The vernacular architecture of Java is the product of indigenous people from many times of trials and errors. The aim of this study is to discuss how do indigenous people of Java interpret the Vitruvius theory into their Javanese house. This final design might show that the local builder has followed the application of Vitruvius theory: *Firmitas* (strength), *Utilitas* (functionality), and *Venustas* (beauty).

KEYWORDS: Vitruvius, Vernacular Architecture in *Rumah Jawa*

INTRODUCTION

Indonesia is known as the largest archipelago in the world with a complex culture that has diverse ethnic cultural systems. Indonesian life is full of religious activities and rituals. Metaphysical symbolism is important to vernacular architecture and therein lies the wisdom of its designs (Satwiko, 1999). The various kinds of Indonesian culture have contributed greatly to variations in Indonesian vernacular architecture. Each region in Indonesia has its own traditional architectural style, which remains a strong part of local identity. Javanese houses are the most preferred vernacular dwellings in Java. These houses found in Central Java and Yogyakarta Province of Indonesia. Javanese house is the original architecture of indigenous Javanese people that reflects their ethnic culture system. For indigenous people, vernacular architecture is considered *dharma*, a social obligation engendering complete harmony between man, nature, the built environment, and God.

Javanese architecture has been used on the human scale as its proportion design that gives both aesthetic and symbolic dimension. According to historian who is also an expert of house building art, Javanese house construction is an imitation of the temple. The roof and the frame represent the head, while the walls, doors and windows at the center

represent the body, and the floor represents the feet (Subiyantoro, 2011).

In Indonesia, traditionally developed rules of vernacular architecture are not scientifically documented. The blueprint is ordinarily instructed verbally through the generations and supports a few superstitious arrangements. In addition to the aesthetic and functional value of Javanese house, indigenous builders build the house by using their traditional construction method which is known as *teknologi tepat guna*. In Javanese society, the knowledge of building houses is carried out by indigenous people and they share the knowledge from generation to generation by combining one material with another in the form of construction based on rational calculations. The construction of the house is done easily by using local technology and local materials from nature. The local builder makes the buildings by trial and error even with certain calculations. This trial-and-error method are for the anticipation and evaluation of Javanese homes for changes, both changes from the outside (natural, climate, social and cultural) and from the inside (economics, education and religion). The application of trial-and-error method in Javanese homes for the anticipation and evaluation of nature, especially earthquakes, has the structural completion and construction technique peculiarities. This is because

the area of Java is included in the area of earthquake III or moderate earthquake. This construction method is not only appropriate to their local availability of material and environment but also have high strength and durability.

The local builder holds on the philosophical and cosmological concept for the spatial plan arrangement of Javanese house. Each space has its proper function and meaning which is reflected from the society and culture of Java. Traditional Javanese house has multi functions, not only privately owned, but also a social function as part of Javanese culture (Ardiyanto Antonius, Djunaedi Achmad, Ikaputra Suryabrata, and Djadmika Adi, 2014). In the mindset of Javanese people, a Javanese house is a form of arrangement that tends to have physical and spiritual characteristic. This physical characteristic is reflected in the forms and structures such as *pendhapa* that has mountain shape in front, and a *dalem*, which has a *senhong* inside, a room at the back, which is arranged in three rooms (see Figure 1). The spiritual characteristic can be viewed on the arrangement of space that connected from one to each other. This represents the connector of the symbols and forms a meaning for the residents as part of the mystique that cannot be separated (Subiyantoro, 2011).

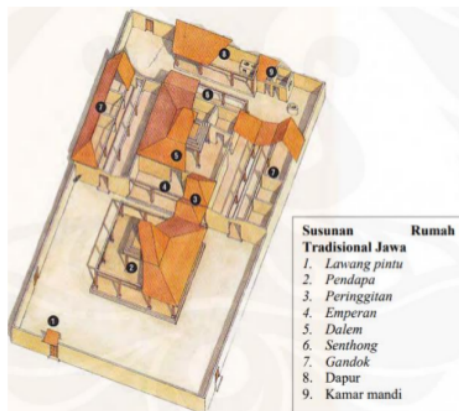


Figure 1 : Layout plan of Traditional Javanese House
(Source: <https://www.arsitag.com/o/arsitektur-tradisional-omah-adat-jawa>, accessed on December 2019)

The arrangement of main spaces in a Javanese house are broken down into four sections as following (Widayat, 2004):

1. *Pendhapa*: located at the front part of Javanese house that is open with four pillars (*saka guru*) where functioned as the meeting hall.
2. *Pringgitan*: located between *Pendhapa* and *Dalem* which functioned as a performance place for *ruwatan* ceremonies.

3. *Dalem*: located at the back part of the house and divided into 3 rooms (*senhong*). *Senthong tengah* is located at the middle and functioned as a store room. *Senthong kiwa* and *senhong tengen* is located at the side of *senhong tengah* and functioned as a bed room.
4. *Gandhok and pawon*: *Gandhok* is a long room located at the left and the right-hand side of *pringgitan* and *dalem*. *Pawon* is function as kitchen, which is located at the back of *senhong*.

There are 5 typologies of Javanese houses existed in Indonesia (Ardiyanto Antonius, Djunaedi Achmad, Ikaputra Suryabrata, and Djadmika Adi, 2014):

1. *Joglo* House
2. *Limasan* House
3. *Kampung / Village* House
4. Houses with mosque shape and *Tajug or Tarub*
5. *Panggung Pe* House

From 5 types of Javanese houses, *Joglo* is the most often discussed as a representation of Javanese architecture. The shape of *Joglo* house is typically square and has four central columns/pillars, which is called as *Saka Guru*. *Saka Guru* is not only the main structure of *joglo* roof, but also has ability for earthquake resistant.

The Javanese house is enriched with symbolic meaning, socio-cultural values as well as architectural value, together with a unique structure that is adapted to the environmental conditions, culture, and climate. The vernacular architecture of Java is the product of indigenous people from many times of trials and errors. It seems that the final design by the local builder is inline with the application of Vitruvius theory: *Firmitas* (strength), *Utilitas* (functionality), and *Venustas* (beauty). Therefore, the aim of this study is to discuss how do indigenous people of Java interpret the Vitruvius theory into their Javanese house.

FORMULATION OF THE PROBLEM

Based on the background of the Javanese House, which has been described in the introduction, the indigenous Javanese people might have integrated the Vitruvius theory into their design. Then the formulation of the problem is:

1. How do indigenous people of Java interpret the theory of Vitruvius into the architecture?
2. How Vitruvius theory fits with the way Javanese house is built?

RESEARCH OBJECTIVE

The purpose of this study is to explore the application of Vitruvius theory in vernacular architecture of *Rumah Jawa* which is built by indigenous people .

RESEARCH METHOD

The method carried out in this study is based on a literature review and case studies.

LITERATURE REVIEW

Vernacular Architecture

1. Definition of vernacular architecture

The word "vernacular", which refers to the local dialect, comes from the Latin root *vernaculus*. Vernacular therefore means locality which originates from a certain location (Tarigan, 2016). Vernacular architecture is an architecture that grows and develops from the architecture of people born from ethnic communities and based on ethnic traditions, and is built by craftsmen based on experience, using local techniques and materials as a response to the environmental conditions in which the building is located and is always open to transformation (Turan, 1998), for example material, technology, knowledge, and so on. Due to the fact that vernacular architecture greatly optimizes local potential or culture, a building with a vernacular concept takes environmental sustainability into account so that it is also architecturally sustainable. Vernacular architecture is discovered by trial and error by the people themselves (Tarigan, 2016).

According to Parinaz, Maryam, and Mojtaba (2016: 3), vernacular architecture is an architectural product that appears in response to societal requirements before the industrial revolution and insurmountable barriers created by regions and environment, and due to the unusual experiences between the human mind and the knowledge gathered by observation of natural phenomena. The vernacular architecture provides inherent and unwritten knowledge on how to maximize low-cost energy efficiency of buildings using local materials (Altman, Martin, Chemers, 1980).

Vernacular architecture is influenced by environmental factors (such as geographical, geological, climate, temperature), technological factors (such as management of building technical skills resources), and cultural factors (such as philosophy, perception, religion, social and family structure, and economics). Vernacular architecture is usually associated with cosmology, the ethical community's way of life and lifestyles and become an alternative response to modernization (Wiranto, 1999). Vernacular architecture is always related or even identified with traditional architecture. Although often associated, there are still differences between the two styles (Tarigan, 2016: 24).

2. The concept of Vernacular Architecture (local knowledge)

Broadly speaking, vernacular theory is explained by Rudofsky (1964), Rapoport (1966) and Papaneki (1995) in one sentence: "Vernacular architecture underline architecture with character of anonymity, self-built, sustainable sources and pragmatic of encountering environmental hindrances". In various practical translating self-build theories are often translated also as indigenous or native, which means original; sustainable sources translates into local material and encountering environmental hindrance to local environment. Anonymity itself, if you look at the background of the era development and practical translation above, is a result of the melting of indigenous, local material and local environment into a local knowledge. Thus Anonymity arises because of ownership of vernacular "design" not by individuals, but by the community where the design is located (Bhaswara, 2010: 11).

a. Anonymity

In practice the development of the architectural world, began to disappear since the Renaissance era. This is a logical result of the development of this era where the basis is intellectual humanism (rationalism) (in architecture from pyramids to postmodernism). In general this era emerged as part of an effort to oppose



Figure 2 : Framework of local concepts of knowledge in vernacular architecture
(Source : Bhaswara, 2010)

the absolute doctrines of medieval European churches. This movement allegedly originated from universities in Italy, especially in Florence and Rome, which offered new ideas about independent individual humanism. In addition, many challenges also arise from the arts, which in the middle era can only develop limited in certain places for certain purposes as well (Bhaswara, R., 2010: 12).

b. Self-built

Pual Oliver (1987) said about the concerning vernacular architecture, namely "the architecture of the people, and by the people, but not for the people". Thus vernacular architecture is a form of folk architecture (Folk Architecture), which was built by the people using local knowledge that is known to the people, but that does not mean for the people because

it is not mass. The vernacular architectural product is owned by a society in the form of "mechanistic" or traditional and affectual forms.

c. Sustainable resource

Interpreted as the availability of material resources that always exist in the context of the environment in which the vernacular products are located. The choice of construction material of the first choice involves its availability in nature, and the second involves the use of minimal energy in society. Pragmatic of encountering environmental hindrances, which translates to the local environment. It needs serious attention because the question is the environment.

3. Vitruvius Theory of Architecture

As a complete theory, architecture is always concerned with the three interrelated terms, which, in Vitruvius's Latin text, are given as *firmitas*, *utilitas* and *venustas*. *Firmitas* refers to solidity and strength, *utilitas* refers to function, and the *venustas* refers to beauty. These three main components are the building blocks of architecture.

Likewise, in the book of ABC of Architecture, Gorman (1998: 10) revealed that a building or architecture must have 3 main factors namely robustness (*firmitas*), function/usability (*utility*) and beauty (*venustas*). In the world of architecture, *firmitas* factors can be interpreted as structural aspects, available materials, construction techniques used in building buildings. Utility factors can be intended as aspects relating to the function/usability of the building (the building program) and the needs of the architectural users. While the *venustas* factor is intended as an aspect of the design system and material that can be a beauty in buildings. Materials can be seen as texture, color, material, proportion, rhythm, and shape. The basic principle of Vitruvius is known as the Vitruvius Trilogy as quoted in his book, The Ten Books on Architecture (Book I, Chap. III, point 2).

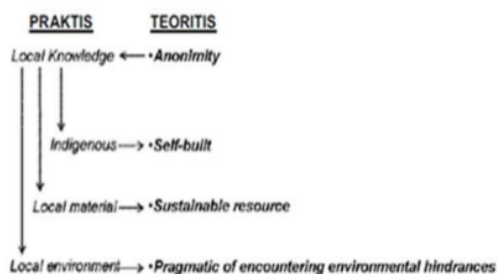


Figure 3: Diagram of the relationship of practical and theoretical vernacular definitions
(Source: Bhaswara, 2010)

a. *Firmitas* (solidity/strength)

1 "Durability will be assured when foundations are carried down to the solid ground and materials wisely and liberally selected;..." (Vitruvius : Ten Books on Architecture. Book I. Chapter III.)

Firmitas that is meant by Vitruvius includes good load distribution from buildings to the ground and also the selection of appropriate materials. Vitruvius explained every material he used in his building, such as bricks, sand, lime, pozzolana, stone, and wood. Each material is explained starting from the characteristics of each type to how to get it or make it.

Firmitas can be interpreted as an aspect that has a direct relationship with the structural and material of a building. *Firmitas* (solidity/strength) is a building's ability to remain durable after extended use and exposure to the natural elements. Over time, architects have been able to calculate with greater levels of exactitude the expected life spans of their buildings.

b. *Utilitas* (function)

1 "...convenience, when the arrangement of the 1 artments is faultless and presents no hindrance to use, and when each class of building is assigned to its suitable and appropriate exposure;..." (Vitruvius : Ten Books on Architecture. Book I. Chapter III.)

The utilities that are emphasized are good spatial arrangements, based on functions, relationships between spaces, and building technology (lighting, ventilation, etc.). This arrangement also applies to city planning. For example, where we have to place temples, fortifications, and so on, in the city space. *Utilitas* relates to the convenience of using, managing spaces, building locations, "private" and "public" spaces, building orientation to sunlight, demands related to the social level of building users in the community. Utility is related to how a building can provide good and proper access, width of space between poles with the right position.

Utilitas can also translated as a usefulness in which a building's ability to appropriately predict and respond to the needs of its intended inhabitants.

c. *Venusta* (beauty)

1 "...and beauty, when the appearance of the 1 work is pleasing and in good taste, and when its members are in due proportion according to correct principles of symmetry." (Vitruvius: Ten Books on Architecture. Book I. Chapter III.)

Venustas emphasizes more on beauty, limited to the quality of beauty/decoration in a building. Proportion and symmetry are factoring that Vitruvius considers to affect beauty. With this, he offers the concept of beauty in architecture to the human body that each member has a good proportion of the

whole body and a symmetrical relationship of several different limbs with the center of the body.

Venustas (beauty) is a building's relationship to its context's standard of aesthetics. This element can be made apparent in the use of an attractive building or flooring materials. The aspects of *venustas* also consider the level of craftsmanship and the attention to detail (how a wall meets a floor, for example, has been a serious concern for architects concerned with beauty).

In short, the Vitruvius Trilogy said that an architecture must have 3 basic components, namely robustness, usefulness and beauty. If it does not have one of these 3 components, then the building cannot be called architecture.

RESULT AND DISCUSSION

The application of the Vitruvian Traid in Javanese Architecture

1. *Firmitas* (solidity / strength)

The discussion defined the use of Vitruvius ideas on the construction or structural and material aspects in a building that appear in a traditional Javanese house. *Firmitas* means the need for structural integrity. A building has to be resilient and able to withstand the cumulative effects of environmental and time-related wear and tear. Referred to the architecture feature of the vernacular architecture of Javanese house, the structure of *Joglo* house shows a special case to discuss with the Vitruvius theory of *Firmitas*.

Construction system & structure

Traditional Javanese structures are built as a simple raised post and beam system (*rangkaian*) where the upright posts are connected with horizontal beams (Mugica, 2019). More specifically, they are constructed using a "knock-down" method using *purus-pasak* (tenon and mortise) joints without nails in order for the building elements to be easily dismantled and re-assembled whenever desired (Mugica, 2019).

Rumah Joglo is a traditional heritage house with high quality artworks that has a high architectural value as a form and culture of the region which is also a form of building art or traditional building art style. *Rumah Joglo* has a main building framework consisting of four main pillars supporting the building structure as well as the cone in the form of pillar supporting blocks. In addition to supporting the main structure of the house as well as the roof of the house, the roof of the house can be shaped *pencu*. The *Joglo* house was constructed with a wooden structure supported by four main pillars in the center called "*soko guru*" and 12 smaller peripheral pillars. The *soko guru* and other pillars stood up at upper ground types foundation

called *umpak*. At the upper parts, the four *soko guru* were rigidly connected by *tumpang sari* - multi-frame beams built one on top of the other by interlocking and overlapping system. The upper part of *Joglo* roof is supported by this very rigid *tumpang sari*. The *umpak-soko-guru-tumpang sari* integration developed a core framework known as "*rong-rongan*". Believed to be the best component, *Joglo* is stabilizing the effect of ground shaking due to its rigid and weighty construction (Ikaputra, 2011).

Since the entire construction is made of lightweight materials and joined using timber joints, then the building is naturally earthquake resistant. There are three types of construction systems that make this structure has stability and resistant with earthquake: the *Purus* system functions as a lock; the *Ceblokan* system where the column is inserted directly in the floor without the *Purus* system; and the *Cathokan* system where the beams located at the center of the building, while using a locking system (*emprit gantil*), protrude upwards in order to prevent the beams from moving (Mugica, 2019).

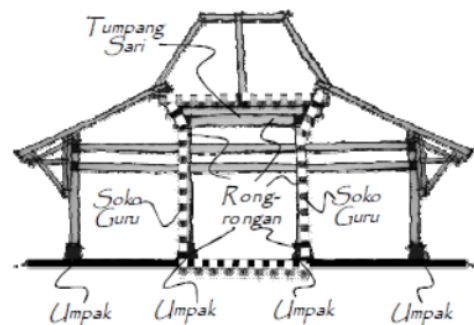
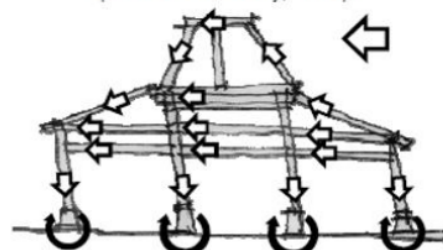


Figure 4: The *Joglo* Structural Parts
(source: Ikaputra, 2011)

CASE 1: Resist to earthquake (modified from Priatmaji, 2007:3)



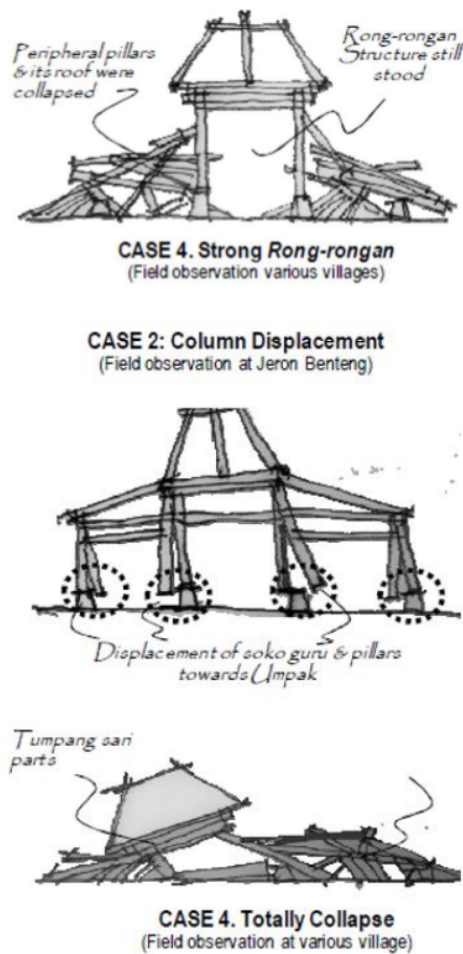


Figure 5: The Joglo Structural Parts and Joglo Damage Typology
(source: Ikaputra, 2011)

The *Joglo* has a solid device structure to anticipate the earthquake, the critical parts are the connection between the *umpak* and *soko guru* or peripheral pillars, the *soko guru* and the *tumpang sari*, and the peripheral pillars to the beams above them (Ikaputra, 2011).

2. Functionality (Utilitas)

Utilities include materials and textures that give rise to comfort and are in accordance with the needs of the user, and the aspects related to the function/usability of the building.

Layout Plan

The Javanese mythology and cosmology strongly influence the layout of the spaces in *Joglo* building. It means that traditional Javanese house is not only

interpreted as a shelter (practical function), but also as an embodiment of life's ideals and philosophy (symbolic function).

The traditional Javanese house consists of a combination of gendered spaces where one belongs to women, one belongs to man, and the other is seen as either a neutral or common space. In general, the back-east part is the realm of women whereas the front-west portion is dedicated to men (Mugica, 2019). The traditional Javanese house has several symmetrical rooms and there is a hierarchy of space inside. From the outside, there is a common public space, and the space become private when going deeper to go inside the house. The outside, so-called terrace, is a roofless open space. The terrace is also a public space used as an external entry area into the building. The next place, the *pendapa*, remains a public space. The host utilizes this room to accommodate the guest. *Pendapa* has a square shaped space and has four main columns (pillars) called "*saka guru*" located in the middle of the hall. This room does not have borders on all four sides. This symbolizes openness of the owner to welcome anyone who comes. *Pendapa* describe the harmony of the Java community lifestyle (Widayat, 2004).

Orientation

The orientation or laying of traditional buildings is one thing that is very calculated by the Javanese community. This building is usually placed in a line/axis north-south. The north-south orientation of traditional Javanese houses is related to people's belief.

Material

In traditional societies, the material used is material that is mostly found in the nature, the environment around them. Materials that eventually become the characteristics of traditional Javanese buildings are wood in traditional house buildings, and stones in temple buildings, places of worship or kingdoms or kratons.

Natural lighting and ventilation

Javanese traditional houses have air and natural lighting, especially during the day. The lighting and natural airing of traditional Javanese house spaces are obtained through window openings, doors, vents, and so on. Some of the factors that influence the lighting and natural air in this traditional home include:

- a. The use of natural building materials on structures and roof truss and cover. These natural elements become thermal insulators which absorb heat in the daytime and gives off heat at night.

- b. The existence of vegetation and open spaces between buildings.
- c. *Tritisian* (the edge part of the roof), in addition to providing protection against rainwater also protection against sunlight (see Figure 6).

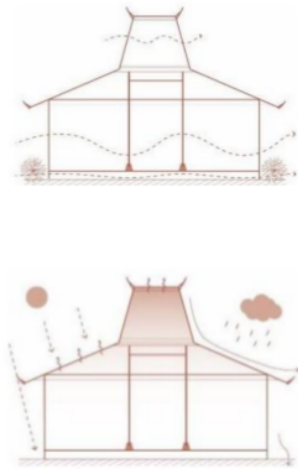


Figure 6. Cross air ventilation and sun diagram of Joglo House
Source: (Mugica, 2019)

3. Beauty (*Venustas*)

Venustas has more to do with shapes, ornaments and parts that can produce beauty for its architecture. The beauty aspect in vernacular architecture does not lie only in the style, motifs and ornaments of the exterior but also including the interior design including the ceiling, the ornament carved on windows, walls, doors and poles.

Roof

From the beauty of the exterior, the architecture of the Javanese house was first seen by the appearance of roof shape as an interesting point. According to Heinz Frick in *Building Construction* volume II, the meaning and function of roof construction act as a human protector against the weather, both protective against heat and rain. Rainfall in Indonesia is quite high, so rain water that falls on the roof surface must be quickly channeled into the ground. That requires a fairly large roof slope, which is 30°. With this, rainwater can be directly discharged from the roof surface through horizontal gutters. This chamfer is installed along the surface of the roof lip. This is one of the reasons why the shape of traditional building roofs in Indonesia has a fairly steep slope. This can be proven by various forms of thatched or shingle-coated roofs that originate from west to east Indonesia. The roof

shape of the traditional building has an average slope of around 30°.

Ceiling

Empty raguman is one of the architectural elements of a Javanese building, in the form of a ceiling-functioning interior roof coating. The sweetness made of bamboo blades arranged in a given pattern is a sign of the homeowner's level of socio-economic ability.

The Javanese house has two main structural components of the building, namely the *balungan* component (building framework) and the oversized component (roof frame) (Priyotomo, 2006). *Empak* is a roof system that was assembled before the house was built in full with the main ingredients of bamboo and wood (Ismunandar, 1990).

Architectural elements

The Javanese traditional building decoration includes the flora, fauna, nature, and religious decoration. The variety of ornamental flora cannot be separated from the influence of pre-Islamic times. Flora which is used as decoration in traditional Javanese buildings has a sacred meaning. In general, *Joglo* uses more variety of ornamental flora types. The meaning of this decoration is the beauty and goodness of red, green and yellow (gold). The decoration was more can be looked at joglo roof (see Figure 7).



Figure 7: Joglo Roof
Source: Tjahjono, 1999

CONCLUSION

The study found that the indigenous Javanese people design and build the house with local wisdom and knowledge that is in line with Vitruvius Theory: *Firmitas*, *Utilitas*, and *Venustas*.

The aspect of *firmitas* in Javanese architecture can be seen in the extraordinary structure of Javanese house and roof structure. In addition to the structure that presents the beauty of the façade and roof forms representing typical Javanese architecture, it also contributes to survive from earthquakes. The building

material used is also taken from naturally present in the surrounding environment.

The *utilitas* aspects of Javanese architecture can be found in the use or function of space. Javanese architectural space patterns are flexible and can change into other functions. Therefore, Javanese architecture is very popular to be used with the desires of various building use; it can function as a house, restaurant, coffee shop, hotel, and other use.

The *venustas* aspects in Javanese architecture, the beauty of the house structure lies in the pattern of the pillars and ornamentations carved on the pillars, windows, doors, and the color of the walls. In addition to that, *joglo* house ceiling roof is also very interesting that is also adds beauty to the house. It appears that the elements of *venustas* found on the roof shape also present the beauty of the house.

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