

# Revealing The Vernacular Concept Through Proportions In Architecture

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**Abstract**— Recently, vernacular architecture has become a source of inspiration to create innovative building designs by utilizing the latest technology. Proportion systems of the vernacular house are one of the basic principles that can be elaborated for module innovation in the industrialization era. The universal standardization and generational change are part of the reasons why vernacular architectural concepts are rarely considered again. Such conditions are indicators that weaken the understanding of vernacular philosophical concepts and spirit. Therefore, the enlightenment of the concept becomes important especially concerning its nature to revive the thinking of the current generation that physical appearance has a unique spirit and cultural content. This paper aims to formulate a conceptual model of proportion systems in vernacular architecture through precedent studies. It was formulated inductive-qualitatively by referring to the theoretical building of Ihalauw [1] and the research design of Creswell [2]. Information units obtained from the precedent vernacular architecture research results in Indonesia combined with the cases from other countries that were selected randomly. Each selected information unit is linked inductively to produce theme categorization and each theme is integrated through logical relationships to produce a conceptual formulation diagram. At the end of writing, the formulated conceptual model is compared with others as the form of theoretical dialogue. The result of the study affirms that the proportion system in vernacular architecture is related to the expression of human efforts in aligning themselves (microcosm) with God/ancestor (macrocosm). The manifestation of these expressions is used to mark sacred-profane values and social ethics in addition to being physically used to modify the local climate and to produce forms of beauty.

**Index Terms**— Conceptual model, proportions, vernacular, architecture

## 1 INTRODUCTION

THE EXISTENCE of vernacular architecture provides an indicator that each ethnic has a different culture that is rich in philosophical and aesthetic values. Over time, the existence of vernacular (*Verna*-latin=home born slave; *Vernaculus*-latin=native architecture), which has eventually become a tradition, began to be scarcely found, especially in the areas adjacent to urban vicinities. The scarcity is not only due to the growth of civilization but it is also due to natural disasters which entail the reduced availability of natural materials. To maintain the knowledge of vernacular architecture, among others, is to study the characteristics of traditional vernacular architecture for the needs of advancement. Technological innovation is unavoidable in the field of industrialization. In terms of architecture, it proves that building components can be produced in a relatively short and mass, as well as modular shape. Vernacular architecture is a source of inspiration for the industrialization module system in anticipation of the extinction of the existence of such architecture in the present and the future. Present studies related to this cover: 1) understanding the module system as a subdivision/differentiation complexity of the building components of a form that has various sizes and shapes by considering functions, movements, the psychological perception of space, connectivity, [3]; 2) parsing archetypes of building components to find modular ontology, [4]; 3) revealing modular spaces and modular components [3],[5], [6],[7]. Numerical digitization is used as the basis for creating standardization in all fields including building components.

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Innovation based on vernacular architectural knowledge requires an effort to recognize a system of repeated comparison of the size and distance (proportions) used in determining the dimensions and placement of building components. The basis of the concept of proportion is ratio. The proportioning system is built by comparing the permanent quality of one composition to another so that it produces a consistent set of the visual relationship among certain parts of the building as a whole. The observer can understand the relationship through repeated experiences and can interpret it after receiving, feeling, and recognizing visual stimuli. [8] Highlights that "the proportions of the formal elements and their intermediate spaces are almost always related to certain numerical progressions logically followed out". The logic of the geometry of an object is mathematically related to numerical calculations. The creativity of shapes adapts to the logic of numerical progressions [9]. determining the building components of the vernacular cultural perspective is not only for the aesthetic needs and strength of the structure, but it is also for the language and symbolic expression of the philosophical values held by its inhabitants or community. The basis of anthropometric measurements is not merely related to the unidentified numerical and universal devices, but more to the assumption that dwellings represent the living things just like human beings [6], [10], [11], [12], [13]. Based on this assumption, everything associated with the embodiment of the house is synchronized with the harmonious relationship among humans, nature, and God the Almighty. The principle of anthropometric measurement based on the organs of occupants represents an effort to achieve harmony in accomplishing these three relationships. If it is rationalized into a universal measure, it is necessary to study the proportional system. Previous research on proportion and its relation to vernacular architecture is merely segmental and not integrated as a whole conceptual formula. The transformation and rationalization of traditional proportions into the modern

modular systems tend to release the system of proportions from the philosophical content that enlivens it. This paper is the result of contemplation to generate a conceptual formula underlies the birth of a proportion system in the vernacular architecture field. The conceptual formulation comes from the accumulation of the results of previous studies by inductively analyzed those components to obtain the concept integration.

## 2 METHOD

The objective of this writing is to develop a conceptual model of proportions systems as part of basic principles in vernacular architecture. The steps (fig.1) used to formulate the conceptual model in this paper referred to the Ihalaw's theoretical building [1] and Creswel's qualitative research design [2].

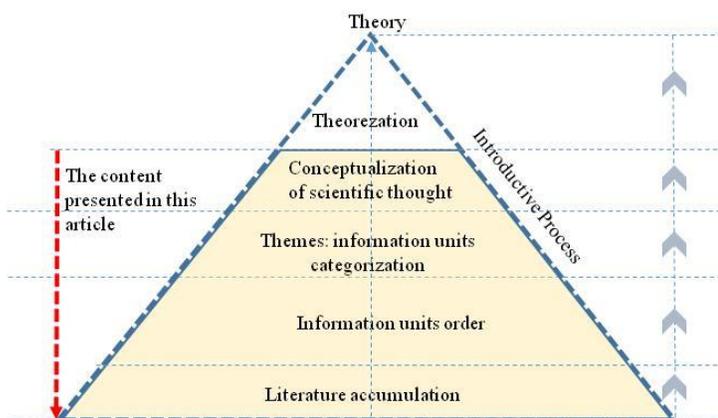


Fig.1 Inductive – qualitative method of the study, derived from the theoretical building of Ihalaw [1] and Creswell's method [2]

The mentioned steps are as follow:

**Step-1: Studying precedent research results.** This article is a concept of scientific thought formulated through studies of previous research findings that have been published in various journals and discussed the proportion of vernacular architecture in Indonesia. The articles are chosen randomly based on the completeness information units regarding physical and non-physical aspects that logically formed the occurrence of the concepts of proportions.

**Step-2: Determining information units and themes.** The empirical information unit used from various sources refers to the accumulation of thoughts and ideas whose contents discuss philosophical proportions and the value of vernacular architecture. Information units can be in the form of phrases or sentences that are considered to have significant value to formulate a particular theme. Every unit of information that has a similar meaning was inductively classified into a certain theme. The title of the theme was the proper term to represent the content of the constellation among information units. Units of information that were considered not closely related to the focus of the study are reduced by removing them from the collection of significant information units. The information was then validated by cross-checking among sources.

**Step-3: Formulating a conceptual model.** The conceptual model was formulated based on the constellation of themes. It was possible to have themes that were or have a closeness of

meaning. If this was found, then what was done was to choose one of the representative theme titles otherwise determines another title that represents the similar theme category. Themes were integrated through the construction of logical relationships into a diagrammatic concept model. Themes were considered as aspects of the basic nature of the formulated conceptual model. The qualitative nature of writing requires comprehensive information; therefore, the built conceptual formulation relies heavily on the completeness of information needed. Therefore, the conceptual model formulated at the end of this paper can be updated simultaneously with the increase and diversity of information units. **Step-4: Conducting theoretical dialogue.** The discussion of proportions in vernacular architecture is universal. It is found in any part of the world. In order to increase the variety of content and to complement the research findings, the formulated conceptual model was compared with theoretical concepts from various countries that were chosen randomly

## 3 RESULT AND DISCUSSION

The result of the study indicates that proportions in vernacular architecture refer to 1) the ratio of body size and occupant beliefs; 2) technical experience, microclimate modifier, the symbol of respect and ethics; 3) the concept of balance and the process of human life. The findings will be thoroughly discussed in turn.

### 3.1 The ratio of body size: macrocosm-microcosm and aesthetic harmony

Ketut [10] reveals that the architecture of traditional Balinese housing and settlements is based on the consideration of harmonious relations between humans (*Bhuana Alit/microcosms*) and between humans and God the Almighty (*Bhuana Agung/macrocosms*). Physically, the regulation of relationship balance is based on Hinduism beliefs: Cosmological balance (*Tri Hita Karana*), hierarchy of value (*Tri Angga*), cosmological orientation (*Sangga Mandala*), open space concept (*Natah*), proportion and scale, chronological development, honesty of structure, honest used of material. For Balinese people, the house (*pelemahan*) in which they carry out their daily activities denotes good and bad of the occupants' ways of life. To harmonize human life, nature, and God the Almighty, the unit of measurement used for a house (building components, building dimensions, building lay-out, building yard) refers to the body size of the occupants (fig.2)

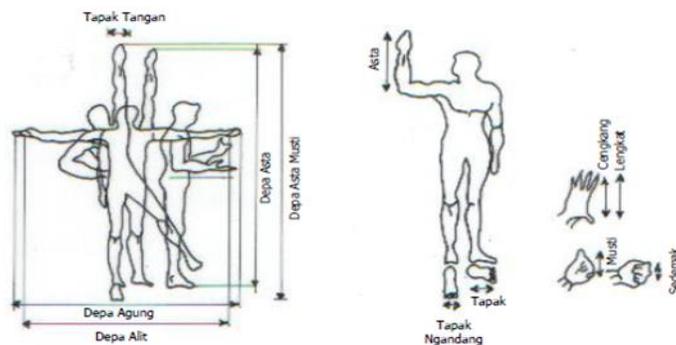


Fig. 2: The body size measurement unit in Balinese Vernacular Architecture [14]

as the user of the building [13]. Thus, the unit of measurement of houses does not represent the similarity among buildings since the body size of the occupants may vary from one to another. The unit of measurement derived from the organs of the inhabitants of the body above is called *Gegulak*. The unit of measurement of the building uses *Rai* (the size of the cross-section of the pillar), in which the dimensions of the cross-section are determined by using multiple finger joints plus the excess for the *pengurip* (additional space). Yard measurements are measured in *Depa* units (the length of the outstretched hand, measured from the tip of the right finger to the tip of the left finger) and the *pengurip* (multiple fathoms for the length of the sides of the yard). The building layout is determined by footprint size (footprint length from heel to toe) and multiples. Local terms about building distances include *sri*, *senses*, *yama*, *rudra*, *brahma*, *kala*, *uma*. Each building is placed in a certain number of sites according to its function and is associated with certain gods/goddesses/ancestors. The spacing of barns: multiples of *sri* (rice is a symbol of Goddess Sri); Distance *paon*/kitchen: multiple of Brahmas (fire is a representation of the powers of Brahma); the distance of ancestor worship buildings: multiples of teachers. The parts of the body referred to as units of measurement are as follows:

*Reppa* (the same meaning as *Depa*) is used by the husband and wife of Buginese families to determine the height, width, and length of the house. The house is considered as a representation of its inhabitants who have heads, bodies, and legs. The use of human organs as a unit of measurement is an attempt to unify the harmony of the microcosm (the human world) with the macrocosm (the universe). The quadrilateral module in the spatial arrangement of the house has a symbolic meaning of perfection (the Genne's Ball) of human beings composed of four elements of the motherland, fire, and wind [14]. In contrast with the above concept, numerical theory and Vitruvian's ratio of the Golden section, which also refers to the comparative measurement of the organs of the human body, are oriented to the aesthetic needs in creating regularity of ratios between building-forming components. "Golden" section refers to the ratio of smaller parts compared to larger parts which are equal to the ratio of larger parts to the whole. The Golden section concept determines that the magnitude of 1.618 (as a result of comparison) is considered to meet aesthetic beauty. Measurements on Indonesian people, by referring to the principle of comparison of the Golden section, it was found that the values of golden section proportion contained in the bodies of Indonesian men and women are of 0.618 [15][16]. Irwan [17] through his research produced a method of the proportion of Central Javanese architecture using Josef Muller-Brockmann's perspective for graphic design needs. Irwan diverts the formula  $5n + P$  which was formulated by Prijotomo to the proportions of the dimensions of the body organs of wayang *purwa* (puppet figures of Mahabaratha and Ramayana).

### 3.2 Technical experience, microclimate modifier, the symbol of respect and ethics

Meutia [5] found three types of Acehnese houses: 24-columned large house (*rumoh limong ruweueng*), 20 medium-sized house (*rumoh peut ruweueng*) and 16-story small house (*rumoh lhee ruweueng*), with type 4 *rueng*, 5 *rueng* and 7

*rueng*. In cross-section, the house is divided into three rooms where the space in the middle (L2) is higher than the other two rooms (L1 and L3). While the width of *Rumoh Aceh*'s building span, refers to the technical experience of the builder, it is determined by the building materials that are generally available and in accordance with tradition. The consistency of comparison between the wide and length of building components in each building type is not always logically consequent to the consistency of the height variance of parts of the house. If the construction is merely based on the empirical experience of the craftsman, then an inconsistent proportion of the height aspect is possible because of the inaccuracy based on sensory experience. Setting the height of buildings is related to Islamic religious ethics adopted by its inhabitants [12]. The height of the building is considered an appropriate solution to avoid being unclean, in addition to the placement of service areas that are not integrated with the residence and the placement of stairs that do not obstruct the direction of prayer. Another consideration for determining the height of a building is the geographical conditions in which the location is in the coastal area. The linear module that extends and has a gender concept from *Rumoh Aceh* is oriented towards the Qibla. Soflaei et al., [5] conducted research on the traditional Iranian Courtyard, found that the courtyard functions as a microclimate modifier. The ratio of the courtyard to the enclosed space supports energy efficiency and flexibility to the needs of thermal comfort in all seasons. The difference in the ratio of closed room widths in the north, west, east, and south is arranged so as to achieve the desired comfort. Besides, the courtyard has a philosophical meaning related to Islamic ideology, social, culture in Iran. The courtyards surrounded by closed rooms express the principle of unity, "symbol of the divine in all things", in the context of social; the courtyard serves as a space for self-introspection as a symbol of respect for the ideology of Islam. The comparative system in Malay traditional houses is related to social considerations and appropriateness [19]. Zain in his research on the traditional architecture of the Sambas Malay house, West Kalimantan found that the proportion system on the object under study was related to the consideration of thermal comfort and social interaction. In accordance with its function as a shelter, setting the height of the ceiling (the second-floor space with voids that arise due to the use of high roof space) refers to the logic of free airflow due to the free space between the roof with shingles and the sloping floorboards (roof height is 4m from parquet floor). The height of the free space roof gives the building owner the freedom to adjust the height of the bulkhead walls between spaces. Based on the social considerations, the ratio area between spaces is calculated in line with the function of space. Public space that is calculated to accommodate many people is made wider than the private space (ratio 3.627:1). The openness of Malays is indicated by the wide public space for the needs of social interaction. Private space in the form of a parent's bedroom is created wider than other bedrooms (ratio 3,558:1). In general, Malay people have put higher the social status of parents or elders as an expression of respect in terms of parents' room is bigger out of the other.

### 3.3 The concept of balance and the process of human life

The principle of balance through axial, bilateral, symmetrical designs in Chinese houses is reflected through proportions in the appearance of buildings. Puspitasari [18] through precedent study and architectural visual research in Kampung Cina, Pekalongan, Central Java (sample: fig.3) formulated a theoretical concept about Shop House Façade Style Characteristic and concluded that the concept of balance is manifested in the building façade through the equal division of left and right sides of the axis. The same division is used repeatedly to determine the division in a sequence of geometry for the size of the ratio of length:  $1/2L$ ,  $1/4L$ ,  $1/8L$ , etc., and the ratio of height measurement  $1/2T$ ,  $1/4T$ , etc.

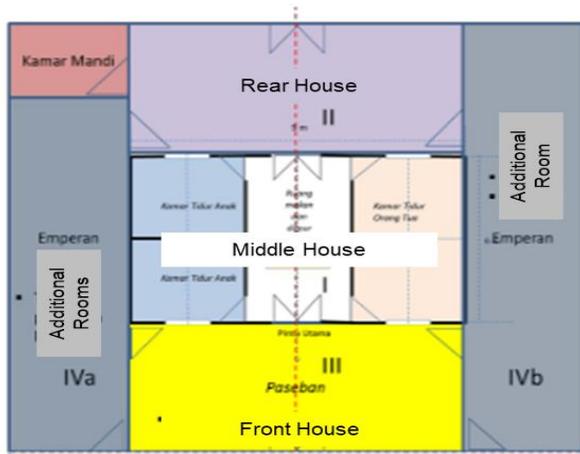


Fig. 3: The geometric sequence of Chinese houses in Curug, Tangerang, Indonesia [18]

The same comparison is found in the case of Sub-urban Chinese Houses in Curug, Tangerang (West Java) [8]. In Urban and Sub-urban Chinese houses, the axis of the line passes through the sacred space, the offering table room. Space is a place where residents communicate and maintain kinship social relations with ancestors who have died and families who are still alive. The core of the house is the 'gen' of the Sub-urban Chinese houses. The table of offerings is the starting point, the process and the endpoint of the lives of the inhabitants as well as being a reference point to create a sequence of geometry to determine the proportions to the left and right of the axis. The symmetrical axis and façade lines reflect a philosophical concept of Chinese ethnic life that considers two dialectics content in life, 'Yin-Yang'. The concept of "Yin-Yang" is interpreted into two things that are contradictory to good and bad. To achieve a harmonious, healthy and prosperous life, bad values need to be avoided or anticipated so that it becomes a good thing. Zang [6] through his research investigated the classical courtyard housing of Beijing. Part of the explanation discusses that Beijing Siheuan in its design depicts axial, bilateral, symmetrical and hierarchical planning. In setting up the house, it is important to consider the match between the size of the house and the size of the household. In consideration of the physical and spiritual health of its inhabitants, the layout of the dwellings is arranged in such a way that the closed rooms are oriented towards the courtyard. Such an arrangement refers to the concept of *Feng Shui* where the inside of the house needs to get a balance. The completeness of the courtyard inside the house and the symmetrical and psychologically complete distribution of houses represent perfection and balance.

### 3.4 The formulation of the conceptual model (fig.5)

Based on the above findings, a conceptual model can be formulated as follows: the proportion system derived from vernacular culture acts as a medium to express the concept of its creator/its inhabitants. The system of proportion is

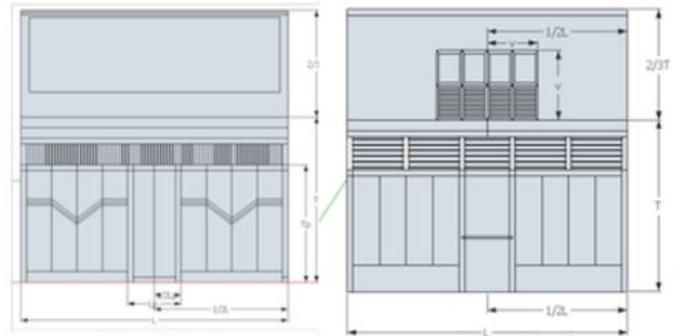


Fig. 4: The symmetrical axis plan of Sub-Urban Chinese house in Curug, Tangerang, Indonesia [11]

Associated to balance and harmonize the relationship between microcosm and macrocosm. Efforts to achieve harmony are carried out by using human organs as a unit of measurement when building a house. The horizontally and vertically proportion of space is associated with the assumption of sacred and profane values and space hierarchies, the comparison of open and closed spaces for the need for climate modification, aesthetic expression and the realization of social ethics. The system of proportion as a microclimate modifier aims to achieve thermal comfort by relying on the ability of the master builder's technical experience. The system of proportion is modified by the master-builder in the way of considering material size and types. The system of proportion is an important part of aesthetic principles assuming the regularity of the ratio between building components is one that determines the creation of beauty, preferences, and appropriateness. Determination of the proportion is also related to social ethics to distinguish between the public and private domains for intergenerational appreciation needs.

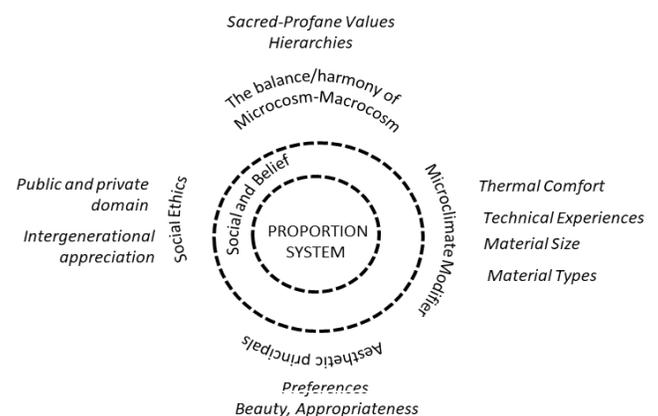


Fig 5. Vernacular Conceptual Model of Proportions based on precedent study in Indonesia

### 3.5 Theoretical Dialogue

#### 1) Vernacular design as a model system [19]

Asquith & Vellinga (2006: 192, referring to the concept of Rapoport, 1969, 1989, 1992, 1993a, 2004) formulated a vernacular design as a system model as abstracted in figure 6.

The conceptual model of Asquith & Vellinga (2006) refers to the vernacular architecture where its social situation is homogeneous, its rule system is still strictly implemented, and its cultural changes are relatively run slower. The conceptual model emphasizes that the built environment is a holistic manifestation of the culture of processes and products. They are expressed informally and specific in physical structure and social arrangements. In the context of proportions, both of these are expressed through the proportion of horizontal and vertical space. The conceptual model of proportions, that is formulated based on the cases in Indonesia, is in line and is a more detailed derivative of Asquith & Vellinga's concept (2006) on social aspects and belief, as well as their physical aspects.

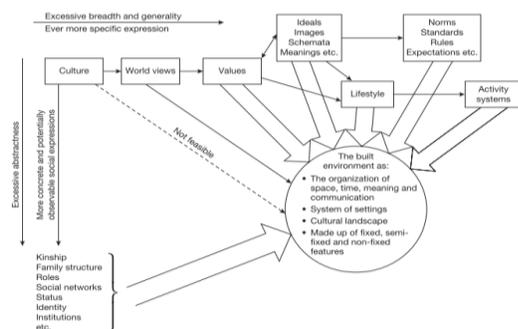


Fig. 6. Vernacular design as a model system (Asquith & Vellinga, 2006)

#### 1) Correspondence Analogic Proportion as Classical Cosmological Justification [20], [21], [22],[23]

Referring to classical European history, a system of architectural proportions is justification through analogy and correspondence to human organs. The body was seen as a living rulebook. The ancient architecture composition of the classical Roman century that was conceived by Marcus Vitruvius Pollio (Roman architect, first century BC, designer of many of the most beautiful temples in Rome.), in his book *de Architectura*, compiled the architectural guidelines of Roman's ancient temple in terms of proportions based on analogy to the size of human organs and symmetrical principal. *Analogia's* concept of Vitruvius revived the concept of the Ancient Greeks where the human body was seen as a symbol of all Nature and the microcosm (human world) reflected the macrocosm (universe). The parts of the human body are naturally considered to be in harmony with the cosmic arrangement of the Godness. Sensory Perception of the temple is a transcendent knowledge of the basic principles of the universe. The same thought is also shared by Indian ancestors [23]. Vitruvius's conception stated that a building design needs to consider 3 things: *firmness* (strength), *utility* (functionality), and *venustas* (beauty). Related to the aesthetic element, *venosity* (beauty), proportion (Greek = *analogia*) is used to

establish a fixed module in arranging building components. A comparison of the size of human organs is considered as an ideal natural proportion. For the needs of architectural design, the comparison can be transformed into both circle and square geometric forms. Other roman scholars stated that the proportion of the building was more related to the material in accordance with certain construction requirements. In this case the conception of proportions is formulated based on the architect's experience and practical expertise. Figure 3 shows that the Vernacular Conceptual Model of Proportions based on the cases in Indonesia is still cover the correspondence analogic proportion of classical cosmological justification theories and also its relation to the master experience and practical expertise.

### 4 CONCLUSIONS

Vernacular architecture is an embodiment of intangible philosophical elements, one of which is expressed into the physical building through a numerical and proportion system. For certain ethnicities, the system of proportion is a representation of belief related to social values and ethics between human-nature and God. Following its function as a shelter that must be safe and comfortable, local climate factors affect the comparison system on the component space and horizontal and vertical elements. The visual impact due to the system of proportion used is an element of beauty that arises due to the overall structure of the building. Thus, the system of proportion needs to be seen holistically from both tangible and intangible aspects.

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