

Settlement Layout for Disaster Prevention

I Wayan Runa and I Nyoman Warnata

Department of Architecture, Faculty of Engineering, Universitas Warmadewa, Denpasar Bali
Jln. Terompong No. 24 Tanjung Bungkak Denpasar-Bali, Phone: 08174775043,
Corresponding Author: Wayan Runa

ABSTRACT

Lately, the media presents much information about disasters, from natural to man-made disasters. One example of a natural disaster is a volcanic eruption. Indonesia consists of many islands and has many volcanoes. Therefore, volcanic eruptions are considered common events. The question is whether our ancestors had wisdom about settlement planning that is safe from disasters? This seminar material is taken from the research carried out previously, in which the research uses qualitative methods with objects or case studies in villages in Bali. This study uses phenomenology as the paradigm because this research investigates value systems, concepts, perceptions, diversity, uniqueness, local wisdom and people's beliefs about something other than themselves. The research carried out also deals with transcendental matters or multiple realities that local people feel and believe in, but its existence is difficult to explain. If humans do not harm nature, nature will not harm humans in return (Tat Twam Asi). The spatial layout of settlements that are safe from disasters is in the middle or far enough away from sources of natural disasters, specifically mountainous areas and coastal areas or rivers. According to their beliefs, these places are the "house" of spirits, and also very vulnerable to dangers or disasters such as tsunamis, floods, and landslides. Shortage of land and growth of the population strongly affect the selection of architectural aspects in construction activities in the community.

Keywords: phenomenology, in the middle, shortage.

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I. BACKGROUND

Indonesia not only consists of many islands but also has many volcanoes. Therefore, volcanic eruptions seem to be a common occurrence for the Indonesian people. Lately, the media present much information about disasters, both by natural factors and human factors, and their impacts such as loss of life, environmental damage, loss of property, and the psychological effects. Natural disasters are volcanic eruptions, earthquakes, tsunamis, hurricanes or tornadoes, floods, and landslides. On the other hand, disasters due to human factors include collapsed buildings and fires.

Bali as the main tourist destinations in the world experiences rapid development related to land use in order to support tourism. Using the areas around cliff for tourism, such as villa construction, happens very often, especially in tourist destinations such as Badung and Gianyar.

In line with the population growth, settlements in urban areas are built in large numbers. Because land prices in urban areas keep increasing, many developers choose relatively cheaper land located near the cliff to develop settlements. In Denpasar, this matter is quite alarming. Bali Post addressed that issue in an article titled "The City Government Affirms the

Ban on the Use of River Boundaries, Offenders Sentenced to Prison for 15 Years" on Sunday, October 28, 2018 page 3.

Areas around the river and sea boundaries are often used illegally. Now a number of places have boards containing the ban and offenders are fined 5 billion rupiah in addition to being jailed. That ban is in line with the Regional Regulation of Denpasar City Number: 27 of 2011 concerning Regional Spatial Planning 2011-2031 article 83 paragraph 4 letter b. That article clearly states that it is prohibited to erect buildings in river boundaries, except buildings intended for the management of water bodies and/or water use. Areas near the river boundaries are the target of developers especially in urban areas (Denpasar and Gianyar) because those areas are relatively cheap.

Before delving deeper into the discussion about settlements layout that is safe from disasters, it is important to know the layout of the settlements in the villages. Experts claim that there are two types of villages in Bali: Bali Aga villages that are mostly in the mountains, and Balinese lowland villages that are mostly in the plains of South Bali.

Bali Aga village is older than the lowland village. Furthermore, there are only a few of Bali Aga villages. However, the Bali Aga village provides more physical variation. Its main physical

feature is the wide open space that goes from north to south (kaja-kelod) for South Bali, which divides the village into two parts. Open space is generally covered with stones, rising towards the mountains or hills.

On the other hand, lowland village is newer than Bali Aga village. Lowland village is easier to find because most villages in Bali apply this type. Its main characteristic is two main roads that intersect the villages from east-west and north-south, forming the village center at its meeting. This type of village is usually called the Pempatan Agung type; where banjar, village temples, and sometimes noble residences are.

Villages in Bali are believed to have a lot of architectural wisdom related to the layout and pattern of housing/settlements. In addition, there must be other policies related to more detailed matters such as structural and material systems, proportions, building facades, and utilities.

Based on the background, it is important to study the existing villages to enrich knowledge about settlement planning related to disaster security measures. There are various ways to reduce losses due to the impact of earthquakes, such as making buildings that can reduce the shaking of an earthquake or strengthen the structure and construction of buildings. The question is whether the ancestors have wisdom regarding settlement planning that is safe from disasters?

II. LITERATURE REVIEW

2.1. Definition and Types of Natural Disasters

Apriana Sara (2018) states that a disaster is an event or series of events that threatens and disrupts the lives and livelihoods of people caused by natural factors and/or human factors, causing loss of life, damage to the environment, loss of property, and psychological effects. Natural disasters are caused by a natural event or a series of natural events. Natural disasters are the consequence of human involvement in the destruction of nature. In order to protect the environment, people can start by not littering, not burning the forest, and not doing other things that harm the environment.

In general, natural disaster is divided into three types: geological natural disasters, meteorological natural disasters, and extra-terrestrial natural disasters. Geological natural disasters are natural disasters that occur on the surface of the earth such as tsunamis, earthquakes, volcanic eruptions, and landslides.

Examples of the most common geological natural disasters are earthquakes, tsunamis, volcanic eruptions, and landslides. Meteorological/hydrometeorological natural disasters are natural disasters related to climates,

such as floods and droughts. In general, that type of natural disaster can occur anywhere. Among the three, meteorological disaster is the one that occurs the most often. Today, though, the biggest worry of the modernization era is global warming. Extra-terrestrial natural disasters are natural disasters that occur in space. Disasters from outer space come from various celestial objects such as asteroids or solar storms. Since numerous small asteroids exist in outer space, the impact is not very significant. However, they still have the potential to hit the Earth. In addition, there are eleven types of natural disasters: floods, landslides, wild forest fires, earthquakes, tsunamis, droughts, volcanic eruptions, global warming, hurricanes, tropical storms, and disease outbreaks.

2.2. Potential Disaster Threats

Disasters are caused by nature or human. Factors that can cause disasters are:

1. Natural hazards and man-made hazards, which according to the United Nations International Strategy for Disaster Reduction (UN-ISDR) can be grouped into geological hazards, hydrometeorological hazards, biological hazards, technological hazards (the danger of technology), and environmental hazards (a decrease in environmental quality).
2. High vulnerability to the people, infrastructure, and elements in cities/regions at risk of disaster.
3. Low capacity of various components in the society.

2.3. Disaster Management System

Since the earthquake and the following tsunami that hit Aceh and its surroundings in 2004, Indonesia realizes that disaster issues must be dealt with serious commitment. Disaster is a very comprehensive and multi-dimensional discussion. Responding to disasters whose frequency keeps increasing every year, thoughts on disaster management must be understood and implemented by all parties. Indonesia periodically builds a national system for disaster management, which includes several aspects:

1. Legislation. In terms of legislation, the Indonesian government has ratified Law Number 24 of 2007 concerning Disaster Management. The legal products under this Law include Government Regulations, Presidential Regulations, Agency Head Regulations, and Regional Regulations.
2. Institutional. Institutions can be viewed from the formal and non-formal sides. From the formal side, the National Agency for Disaster Management (Indonesian: Badan Nasional Penanggulangan Bencana, abbreviated as

BNPB) is the focal point for government institutions at the central level. Meanwhile, the disaster management focal point at the provincial and district/city levels is the Regional Agency for Disaster Management (Indonesian: Badan Penanggulangan Bencana Daerah, abbreviated as BPBD). On the non-formal side, forums at national and local levels were formed to strengthen disaster management in Indonesia. At the national level, there is National Platform for Disaster Risk Reduction (Indonesian: Platform Nasional Pengurangan Risiko Bencana, abbreviated as Planas PRB), which consists of civilians, businessmen, members of universities, media, and international institutions. At the local level, there are the Yogyakarta PRB Forum and the East Nusa Tenggara PRB Forum.

3. Funding. Currently, disaster is not only a local or national issue but also involves the international community. The international community supports the Indonesian government in developing better disaster management. The government also shows a strong commitment to disaster issues as evidenced by giving disaster management a significant budget.

2.4. Rural Area

There are several different opinions from experts about the origin of the rural community in Indonesia. According to Ter Haar (2001), experts on adat law (customary law) argue that there are two basic classifications regarding the origin of Indonesia rural community: the principle of kinship or genealogical relations and the principle of living in a close distance or territorial relations. Anthropologists Koentjaraningrat (1990) added that there are two other principles of relations, namely, the principle of special purpose and the principle superior-subordinate relationships (king, government). Special purpose principle includes needs caused by ecological factors, especially those related to agricultural techniques. According to history, the principle of relations between villages in Indonesia often has dual nature rather than singular nature (Parimartha, 1997).

In Bali, in accordance with Regional Regulation No. 3 of 2001, the term *desa pakraman* is used to replace *desa adat* (customary villages) and *desa dinas* (administrative village structure) (Beratha, 2001). *Desa pakraman* is a community in Bali that abides by *hukum adat*, which possesses a tradition and manners of the Hindu people passed from generation to generation in the form of *Kahyangan Tiga* or *Kahyangan Desa* that comes

with its own territory and assets and has the right to manage its own household.

Each *desa adat* has a social organization or customary institutions such as *desa adat*, *banjar adat*, *subak*, *dadia*, *sekeha*, and *perbekelan* (Geertz, 1959). *Desa adat* is the autonomy of the village government with a shared obligation to maintain the *Kahyangan Tiga* temples (*Pura Puseh*, *Pura Desa/Bale Agung*, *Pura Dalem*). On the other hand, *banjar adat* is a place to live together. *Subak* is the ownership of rice fields in the same water channel. *Dadia* is a family bond based on male lineage. *Sekeha* is a joint membership in a "voluntary" organization. *Perbekelan* is a joint government administration that is officially under the *kelurahan*.

Every member of *desa adat* is bound to the *desa*, physically and spiritually. *Desa adat* members are grouped in *dadia* (one male lineage) and can live outside the area of *desa adat*. The strong attachment to *desa adat* can take the form of attendance at the traditional/religious ceremonies such as *odalan* and *usaba* as well as contributing money and goods for the ceremonies and maintenance of sacred places. The money is usually collected every month during monthly meetings. In certain circumstances, contributions can also be collected every six months or every year during the ceremony (Kawi, 2003).

Each *desa adat* has an area (*wewengkon*) with a certain spatial layout. In general, the area of *desa adat* consists of three components, namely *parahyangan*, *pawongan*, and *palemahan*. *Parahyangan* includes a territorial temple or *Pura Kahyangan Tiga* (*Puseh*, *Desa/Bale Agung*, *Dalem*) and a family temple (*Pura Dadia* or *Pura Kawitan*). *Pawongan* includes the house yard (*karang desa*), field, *wantilan*, market, *bale banjar*, *bale pemuda*, and the office of the Head of the village. *Palemahan* includes cemetery, rice fields, and garden. The layout of *desa adat* is divided into three parts: *kaja*, middle, and *kelod*. *Pura Puseh* is usually in the *kaja* or directed towards the mountain. *Bale Agung* and the house yard are in the middle. *Pura Dalem* and cemetery are in the *kelod* or directed towards the sea. On the *banjar* scale, space is usually arranged according to the village scale. Sacred places are located in the sacred part/space and other functions in the profane space. A house usually has several pavilion units for specific and general functions. Placement of the pavilion units in the house yard is adjusted to the values of the space such as the spatial layout of village and *banjar*.

Village in another sense is an administrative unit called *kelurahan*. Therefore, villages also exist in the cities. That definition was introduced by the Indonesian government after

independence and applies throughout Indonesia. Outside Java, Madura, and Bali, village as an administrative unit has various names such as gampong (Aceh), kuta, uta or huta (Tapanuli), nagari (West Sumatra), wanua (Minahasa), suku (East Sumatra), mendapo or marga (South Sumatra), tiuh (Lampung), wanus (North Sulawesi), gaukang (Makassar), matowa (Bugis), negory or dati (Maluku), dasan (Lombok) and kampong (Sumbawa). In Bali, a village is an organism with human beings as its parts and open space/road crossing in the middle as its core (Siswono, 1991). Desa adat can also be examined from three aspects: abstraction, typology, and morphology.

a. Village Abstraction

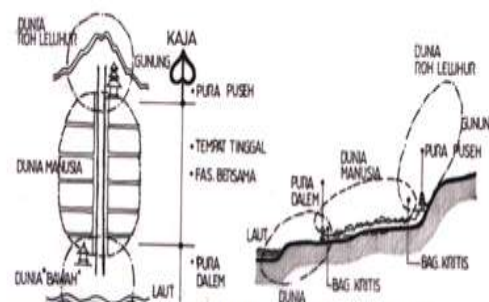
Primitive and modern humans are creatures who love symbols. The purpose of human life according to Hinduism is to achieve inner happiness and natural balance. Three elements that bring happiness are called Tri Hita Karana (Tri: three, Hita: happiness, kindness, Karana: cause). Theological teachings explain that the substance of Hyang Widhi (God) permeated the entire universe (bhuna agung) including the human being (bhuna alit). Both bhuna have a wadag body which consists of five elements (Panca Mahabhuta). The union of God's substance and the wadag body of both bhuna creates new strength (prana) in humans in the form of sabda (words), bayu (energy), idep (thoughts). These three elements are called Tri Hita Karana (Kaler, 1983).

According to Goris (1935), Balinese people believe in two "worlds": the living world and the afterlife. People living their first life in this world, and after death, they live their second life in the world of ancestral spirit. Belief in ancestors is an ancient Balinese belief rooted in prehistoric times. According to that belief, people who have died are divided into two groups. First, people who have died but have not gone through the purification process are called Pirata, and those who are still in the process of purification are called Pitara. Second, the ancestors who have been fully purified are called Dewa, Dewata, Batara, and Sanghyang whom people worship and believe as sacred beings. Pirata is an ancestor whose body has not been cremated. Therefore it is dirty and dangerous, and lives in the "underworld." Pirata is in the same category as night, black, sea, sunset, and tilem (dead moon). Offering for Pirata is usually done in the cemetery or in Pura Dalem to redeem their spirits. Pitara is an ancestor who has been cremated but is still considered to have a worldly soul like humans.

Balinese view space not as a homogeneous, neutral, geometric space, but as a

unique and sacred ontology space. Ontology space is related to the nature of life, in which space has a variety of values and direction of sacredness. There are two pairs of directions; each pair consists of two opposing directions. There are kaja-kelod (mountain-sea) and kangin-kauh (sunrise-sunset). The direction of kaja has positive connotations, such as divinity and prosperity. Kaja is also associated with everything related to the "upper world." The opposite direction is kelod, which is related to "the underworld" (the earth). It has negative connotations, such as evil and worldly power. As for kangin-kauh, kangin is in the same category as kaja, while kauh as kelod.

Consequently, Balinese people have to follow their cosmological views in developing the village. The main axis of the village is the main road that runs in the direction of kaja-kelod. The village space is symbolically divided into three sections. First, there is the kaja section of the village, which is symbolized by the world of ancestral spirits or "the world of God." In this section, there is Pura Puseh ("pusat merajan") which is manifested as the ruler of the village territory and the ancestors of the village's founders. After that, there is the middle section of the village, the location of the yard of a house as well as shared space such as Bale Agung and Bale Banjar. This section is the profane world where human lives. The last is the kelod section of the village, the symbol of the "underworld." Cemetery and Pura Dalem are located in this section (figure 1).



Gambar 1. Religious space in villages in Bali
(Source: Redrawn from Parimin, 1986)

KUMBUH RELIGIUS DESA-DESA DI BALI

b. Village Typology

Korn (1932) suggested that there are two types of village in Bali: Balinese mountain villages (Bali Aga) and Balinese lowland villages. The mountain villages are mostly in the mountains in the middle of Bali Island. These villages are old in terms of age and there is only a few of them. However, they have more physical variation than the lowland villages. The main physical feature of mountain villages (Parimin, 1986) is a fairly large

open space that expands from kaja to kelod that divides the village into two parts. The open space is generally covered with stones and rises towards the mountains or hills. The height contour, however, is not related to the level of sacredness between villages. The spatial characteristics of such village are influenced by the dominant cultural ideology (Hinduism) of their time.

Balinese lowland village is a type that emerges later. Therefore its age is relatively young. Villages of this type are mostly in the plains of South Bali. Most villages in Bali are considered this type. However, villages of this type have fewer physical variations (more "typical"). The main physical feature of Balinese lowland village is two main roads that intersect the village (east-west and north-south) and form the village center at their meeting. This type of village is commonly called the *pempatan agung* type. Around the intersection, there are *bale banjar*, *Pura Desa*, and sometimes noble residences. There is Balinese proverb that says "*desa mawa cara*." This proverb refers to physical and social variations of villages in Bali, which means that each village has its own way and culture that distinguishes it from other villages. This is in line with anthropologist Geertz's opinion (1959) which stated that the social structure of villages in Bali is very complex and varied. There is no simple social structure or general description that can explain the whole thing.

c. Village Morphology

Villages in Bali (Parimin, 1986) have at least four attribute groups: morphological attributes, function attributes, symbol attributes, and social attributes. The first three attributes emphasize physical aspects while social attributes emphasize the non-physical or socio-cultural aspects. Because the three attributes describe the same aspects, it is difficult to distinguish them clearly. When describing the function of space, it cannot be done without seeing the form as a symbol. When analyzing the morphology of the village space, it will be less meaningful without discussing the function of a village space.

Morphological attributes are related to the shape and elements of the village. The area of a village consists of agricultural land (rice fields and garden), rivers, cliff, and the village site. The village site itself consists of built-up areas, a core with open spaces, shared facilities, and residential groups. Shared facilities, house yards, and pavilion units are generally rectangular in shape.

Function attributes consist of *Pura Puseh*, *Pura Desa/Bale Agung*, *Pura Dalem*, *Pura Dadia/Paibon/ Merajan Agung/Panti*, *Pura Subak*, *Pura Abian Semal*, *Pura Melanting*, *Pura Segara*, *Bale Banjar* and *Karang*.

Pura Puseh is a temple to worship God and the village-founding ancestors. *Pura Bale Agung* is a sacred meeting place, a place where villagers meet their ancestors during a village ceremony. *Pura Dalem* is a place to worship the power of the "underworld." *Pura Dadia* is a temple to worship ancestors of male lineage. *Pura Subak*, *Pura Abian Semal*, *Pura Melanting*, and *Pura Segara* are temples to worship the rulers of rice fields, gardens, markets, and oceans. *Bale Banjar* is a meeting place to regulate profane life. *Karang* is a residential plot with *Pamerajan/Sangguh* and units that serve for specific and general functions. The symbol attribute is the orientation of the village, specifically the orientation of the main axis or the main road, the orientation of the residential group, the orientation of the house, and the orientation of the pavilion unit.

Social attributes consist of various social organizations as described by Geertz (1959), such as *desa adat*, *banjar adat*, *subak*, *dadia*, *sekeha* and *perbekelan*. *Desa adat* is the autonomy of village government with a shared obligation to perform worship in the temples of *Kahyangan Tiga*. *Banjar adat* is a place to live together. *Subak* is the ownership of rice fields in the same water channel. *Dadia* is a family bond based on male lineage. *Sekeha* is joint membership in a "voluntary" organization. *Perbekelan* is a joint government administration that is officially under the *kelurahan*.

III. RESEARCH METHODOLOGY

Basically, the seminar material is taken from the results of research that has been carried out previously, where the research uses qualitative methods with objects or case studies in villages in Bali.

This research has a lot to do with value systems, concepts, perceptions, diversity, uniqueness, local wisdom, and people's beliefs about something other than themselves. In addition, the research carried out also has a lot to do with transcendental matters or multiple realities that local people feel and believe in, but its existence is difficult to explain. In accordance with the characteristics of the study object (research problem), this study used phenomenology as the paradigm.

According to Lincoln and Guba (1985), phenomenology (naturalistic) emphasizes the "natural" context, the wholeness that cannot be understood by isolation or elimination that it is separated from the context. A phenomenon can only be captured in its entirety and is a form of reciprocal (interactive) role, not just a linear causal relationship.

The workings of the qualitative method (phenomenology) are as follows. The design is general, flexible, and develops during the research process. The aims are to gain an understanding of meaning, to develop theory, and to describe complex reality. Instruments used in this research include human instruments (the researchers), notebooks, voice recorders, and no research assistant needed. The data in this research is qualitative data collected from participant observation, individual documents, and unstructured in-depth interviews. Small samples are taken purposively and then processed in a continuous and inductive analysis, and after that is looking for patterns, models, or themes. The proposal is short and general, containing relevant problems and no hypotheses, and the research focus is written after the data has been collected from the field.

Qualitative research is closely related to unique contextual factors so that each context is handled in terms of its own context. In this study, the research unit/observation area covers the whole house. The research of houses in Jatiluwih Village is expected to produce identification or information on values/ideas about the local wisdom of traditional houses. These values are to be developed for the preservation model of houses that have been influenced by modernization or become tourist attraction objects.

IV. RESULTS AND ANALYSIS

4.1. Spatial System

In essence, spatial system includes three things: spatial structure, spatial functions, and spatial meaning. A spatial structure has many variations, influenced by people's cosmological understanding and local elements. In general spatial functions are divided into two categories: specific and general (complex) functions. Spatial meaning includes several things such as honor, security/safety, status, economy, education, and order.

As technology becomes more advanced, traditional religious and social values gradually erode, and human life often loses meaning. Human loses the meaning of harmony as indicated by natural forms used in social forms of society. In other words, society has lost sight of the power of boundaries (proportion). This might be due to the reduced economic capacity of society. The proportion of nature, handicrafts, and architecture can help the community in an effort to rediscover the meaning of true proportions. That proportion will generate different boundaries of harmonious relations. Proportion and harmonious patterns of nature imply the limits of the discipline. Furthermore, proportions and patterns of nature

teach humans that boundaries are not only limiting, but also creative.

Humans are not only individual beings but also social beings who live collectively. The distinctive feature of collective life is the division of labor, dependence, cooperation, communication, and discrimination. Human's collective life is not instinctive but is resourceful. With their reason, humans are able to imagine events that might occur so that humans can make choices to achieve effectiveness in their lives. In the collective life of village communities, there are usually more specialized or smaller collective units (social organizations) that have specific goals. For example, villages in Bali have several social organizations such as banjar, dadia, sekeha, subak, and tempek.

Balinese culture is based on the concept of Balinese cosmology, which believes that there are two "worlds": the world when humans are still alive and the world after humans die. Humans live their first life in this world. After they die, they will live their second life in the world of ancestral spirits. That concept then gives birth to the concept of harmony of relations between the elements that bring happiness in life, namely soul, energy, and body, known as Tri Hita Karana. When translated into spatial planning, the philosophy Tri Hita Karana becomes as follows: parahyangan as the soul, pawongan as the energy, and palemahan as the body.

In this study, the term social culture refers to a collective life that has a division of labor, dependence, cooperation, communication, and discrimination according to a system of certain customs that is continuous and bound by a sense of shared identity imbued by Tri Hita Karana. The socio-cultural perspective is only a point of view, one that does not follow the socio-cultural mindset. The use of a socio-cultural perspective essentially aims to enrich architectural engineering disciplines. Additionally, architecture in Bali is a human metaphor with all its social culture.

4.2. Public and Private Spatial Layout

The area of a village has the following characteristics: low population density (ratio of people to land), agrarian employment, and familiar population relations based on tradition. Broadly speaking, the use of land in the village is for settlements in the context of social activities and for agriculture in the context of economic activities. Social activities and economic activities can be broken down into several parts. Social activities include getting a settlement or having a family, attending school, worshiping, recreation, and exercising. On the other hand, economic

activities include farming, gardening, raising livestock, and trade.

There are two types of spatial layouts of village settlements: nucleated settlements and dispersed settlements. Houses in nucleated settlements are grouped together (agglomerated rural settlement). Furthermore, the distance between the houses is close. Around the houses, there is agricultural land where the residents work every day to make a living. In general, houses in traditional villages in Indonesia are the nucleated type, connected by small roads (village roads) or footpaths. On the other hand, houses in dispersed settlements spread throughout the area (disseminated rural settlement). Additionally, the distance between the houses is far apart.

Most of the mountain villages in Bali have nucleated settlements with houses grouped together as seen in the picture below. Houses in the village usually have a garden where the residents grow food. However, houses located in the middle of the village rarely have a garden because they are built tightly or with high density. Some mountain villages also have dispersed settlements called kubu. The dispersed settlements are usually located in gardens quite far from the village center. Residents will return to the main village (village center) if they have finished working on the garden or there is a religious ceremony in the village.

Take Pengotan village as an example. In Pengotan village (Adiputra, 1999), dispersed settlements occur because of the growth of population and the development of a mindset towards the efficiency of mileage between houses in the village center (Karang Satak) and workplaces in the garden. The temporary shack in the garden then becomes permanent residence and formed sub-regions in the desa pakraman called Banjar Pakraman. Although it has formed Banjar Pakraman, members of the banjar, especially Krama Ngarep (members of the core village), are still oriented to Karang Satak in the village center. This happens because there is an obligation to maintain the existence of Sesuhunan Desa and the rights to the traditional house so that Karang Satak remains the center of the village.



Figure 2. Nucleated settlements in Sukawana, a mountain village in Bali
(Source: Field observation, 2002)

Broadly speaking the spatial layout of mountain villages in Bali are divided into two parts: public space and private space. Public space or shared spaces can be roads/open spaces, Kahyangan Tiga (Pura Puseh, Pura Desa/Bale Agung, Pura Dalem), cemetery, schools, bale banjar, fields, wantilan, village barns, baths, guard posts, market, and the village head's office. Public space is usually very wide and takes a strategic place in the middle of the village. Public space is used for joint activities of village communities such as religious ceremonies, social activities, economic activities, and public service. On the other hand, private space or space for personal activities is a house. For Balinese people, a house means a structure of buildings as a place to live and the land where the building was established (Bagus, 1964).

In the area/yard, there are several spaces in the form of pavilion units (bale-bale). Each building has its own functions such as for cooking, sleeping, working, storing crops, storing valuable belongings, receiving guests, performing ceremonies, resting, playing, and raising livestock. There is one building that has several functions (multipurpose). In Sembiran village, each family has a house of a certain size. The border, however, is not very clear. In its development, the family grew due to marriage, so they need a new house. Each new family then separates from the family of orientation. Because the kinship system is patrilineal, the custom of settling after marriage is patrilocal. Each family occupies the land that is determined by the family (clan). Usually, the dimension of private space is smaller than public space. The houses are positioned in rows and determined by the village.

Based on the previous description, there are several general characteristics of public space and private space of mountain villages. The general characteristics of public space are its scattered and strategic location, large dimensions, multi-function (social, cultural, economic, defense, service). On the other hand, the general spatial characteristic of the private space is that the location of the yard is determined by the village, the choice of housing is influenced by the kinship system, there are boundaries, the houses are positioned in rows, the dimensions are small, and has specific and general functions.

In a society that experiences a process of change, there are factors that drive and hinder that process. The driving factors include contact with other cultures; the advanced formal education system; heterogeneous population; dissatisfaction with certain areas of life; future orientation; disorganization in society; and the ability to accept new things easily. Meanwhile, the hindering factors are the lack of relations with other communities; the conservative attitudes of the community; deeply entrenched interests; the fear of shaky integration of culture; closed-minded attitudes, ideology; custom, culture, and values that assume that life is essentially bad and cannot be repaired.

In human history, the difference in those changes lies in quality. The main criteria that indicate the quality of a change is the people livelihoods, ranging from the agricultural sector (primary) to industry (secondary) and services (tertiary). Another factor that needs to be considered is the degree of the change, both horizontally and vertically. Based on these criteria, there are three types of change: small changes, major changes, and fundamental changes. These three types of change are often referred to as structural change, transformation, an industrial revolution, and cultural revolution.

The Balinese people underwent a fundamental change when settled agriculture was applied through the development of a village collective community system and a subak system with various concepts. Another major change the Balinese people experienced occurred during the arrival of Hinduism and Buddhism and following periods due to the Indianization process. Even after Indonesia received Western influence and the idea of nationalism, the Balinese people, in essence, had not changed and were still traditional farmers. After the government of the New Order implemented the Pelita program, Bali experienced a fundamental change or transformation from the agricultural sector (primary) to the non-agricultural sector (secondary and tertiary). As a result, Bali began to loosen traditional life. For people in the villages of Bali Aga, the dominant livelihoods are

still farming, but they are already market-oriented through trading clove, coffee, oranges, vanilla, and livestock.

The yard of the house in Julah village (figure 3) is in the east-west direction. According to village regulations, each yard and sub-yard must be given a boundary such as a wall or living fence. The boundary is made at shoulder level so that people can still communicate or interact with neighbors. The neighbors are very important for the Julah people in order to exchange goods or services to meet their daily needs.



Figure 3. Rows of houses in Julah village
(Source: Field observation, 2002)

At first, each family in the Sembiran village as much as possible lived in the land/dadia area that had been determined by the village. Other families will not dare to inhabit the land that does not belong to the clan because they are afraid of occult dangers. Furthermore, the population continues to increase so that the houses in dadia groups become dense. Then the village creates a new settlement called Banjar Anyar that new families from various dadia can occupy (Bagus, 1968).

According to Goris (1935), Balinese people believe that there are two "worlds": the world when humans are still alive and the world after humans die. After living their first life in this world, people will live their second life after their death, in the world of ancestral spirits. Belief in ancestors and their world is an ancient Balinese belief. According to that belief, dead people are divided into two groups. In the first group, there are Pirata, people who have died but have not undergone a purification process, and Pitara, those whose purification process is not complete. In the second group, there are Gods, Batara, and Sanghyang, the ancestors who have been purified completely, whom people worship.

Pirata refers to an ancestor whose body has not been cremated yet and therefore is still

dirty. Pirata is also dangerous and occupies the "underworld." Furthermore, it has the same association as night, black, sea, sunset, and tilem (dead moon). Offering to Pirata is usually done in the cemetery or in Pura Dalem to redeem their spirits. Pitara is an ancestor who has been cremated but is still considered to have a worldly soul like humans. Pitara is worshipped in the yard of a house but not in Pamerajan. Ancestors who have been completely purified are no longer considered separate individuals but are intangible beings. They have joined and merged with their ancestors. There are ancestors and founders of the village, with whom Balinese people always hold relationships. Ancestors and Gods live in heaven, located "above" the real world, which is symbolized by the high mountains in the middle of Bali Island.

The previous explanation implies that Balinese's view regarding space is always related to their religious experience. They see space not as a "homogeneous," neutral, and geometric space, but as a unique and sacred ontology space. Space has a variety of values and direction of sacredness. There are two pairs of directions, in which each pair consists of opposing directions. The two pairs of directions are kaja-kelod (mountain-sea) and kangin-kauh (sunrise-sunset). The direction of kaja connotes "good, divinity, prosperity," basically everything related to the "upper world." The opposite direction is kelod, which is associated with "evil and the underworld (land) and its power." The direction of kangin (sunrise) has the same association as kaja, while kauh (sunset) has the same association as kelod.

The Balinese ancestral beliefs affect the spatial formation of the village. The main axis of the village is the main road that runs from kaja to kelod (north-south for south Bali and south-north for north Bali). The village space is symbolically divided into three sections. The first section is the kaja section of the village, symbolized by the world of ancestral spirits or "the world of God." In this section, there is the Pura Puseh ("pusat merajan") which manifests as the ruler of the village territory and the ancestors of the village's founders. In the second section, the middle section of the village, there are the yards of residences as well as shared spaces such as Bale Agung and Bale Banjar. This section is the world of human or the profane world. The third section is the kelod section of the village, which is the symbol of the "underworld." In this section, there are a cemetery and Pura Dalem, the temple of the "underworld."

People of mountain villages show a relatively strong collective life. Between the people, there is a sense of unity, which is evident particularly in the use of distinctive language dialects. Each mountain village generally has its

own dialect that differs from other villages, so it takes a long time to understand one's language. For example, there are different ways to greet or address someone's relatives (Ego), depending on age, gender, class, and kinship. The Sembiran dialect has a considerable percentage of words compared to other villages in Bali. As the result, the dialect becomes the village's uniqueness as well as the symbol of the village, especially to people outside the village. In Bali, besides Sembiran there are other villages with prominent dialect such as Cempaga, Tigawasa, and Sidatapa (Bagus, 1968).

Community organizations in mountain villages are generally small communities that show collective and traditional traits. In such a life, the members function for the interests of the village. Being a member of the core village member means having more obligations and fewer rights. Family in the mountain villages is also small in size, just like the organizations. The size of the family is reflected in the size of the house yard.

Most family members in mountain villages are already familiar with the knowledge system through formal, non-formal, and informal education. The quality of education in mountain villages, especially in remote areas, is still lower than education in lowland villages or in cities. The same thing also occurs in the quantity of education. It is evident in the very limited number of family members who can pursue higher education. The causes of that problem are economic, mental, and custom.

Technology actually covers a very broad field such as transportation and new building materials including the construction system. Spatial formation in Bugbug village (Oka, 1981) is also inseparable from the influence of technology, for example, stairs/traps become ramps, more economical materials replace local building material, and paid laborers/experts replace the system of gotong royong.

Based on the socio-cultural studies explained previously, there are several instruments in the form of socio-cultural elements used to detect factors that influence the formation of spatial systems. The social elements are population, kinship system, classification and stratification, and security. Meanwhile, the cultural elements are belief, knowledge, livelihood, social organization, language, arts, and technology.

4.3. Spatial Structure of Houses

Just like their social structure, villages in Bali have distinctive and complex spatial structure, but they still share a number of similar attributes. Houses also have varying spatial structures, from the Nawa Sanga type in a house for a nuclear

family to a linear type in a house for an extended family. Some types of houses almost always have the same attributes such as sanggah, meten, bale, paon, barns, walls, and other buildings.

The spatial structure of houses in Sukawana village is the linear type which consists of many nuclear families. These families consist of two or more extended families. For example, in a residential house that consists of two extended families, there are eleven nuclear family residences which are divided into two rows of houses. In addition, there are five bale adat or bale lanjang, located in the middle and lined up parallel to the direction of the kaja-kelod direction. The joint sanggah is at the top (kaja) and divided into two parts: the left part for newly married couples and the right part for extended family ancestors. The spatial structure of a nuclear family house consists of six main rooms and three terrace sections. The bedroom called lubang gede is located on the front. The space on the back is divided into three, namely selang kaja, selang kelod, and the space in the middle for paon. Because it does not have a barn, the corn is stored in the top of selang kelod or paon. The terrace is divided into three parts: the left and right parts for the family room and the middle part as the entrance.

The yard is equipped with aling-aling in the back, so natah cannot be seen directly from outside/the road. Umah meten is in the north (kaja). Bale adat or bale gede, which has twelve pillars, is in the east of natah. Smaller bale adat which has nine or six pillars is called bale sumanggan. In the west of natah, there is bale sakenem (a bale with six pillars) used by the father and the mother of the head of the family. In the south of natah, there are two modern paon, a pig pen, and a toilet. In the southeast corner (kelod-kangin), there are barns while in the southwest corner (kelod-kauh) there are workshops and a traditional furnace. On the side of the road in the northwest corner (kaja-kauh) of the yard of the house is a shop for daily necessities, and upstairs is used as a display room for gamelan production.

On the spatial structure of a house in the outskirts of Tabanan, the sacred place is in the northwest corner or near the road. The point of sacred orientation in this district is not Mount Agung but Mount Batukaru. On the spatial structure of large houses, there are nine kuren (households) with a total population of more than fifty people. There is still a kinship between the heads of the households. Every household has a meten, bale, paon, and barn. The barns are in the front yard, slightly to the south (figure 4).



Figure 4. Spatial Structure of House in Jatiluwih-Tabanan

(Source: Field measurements, 2002)

4.4. Spatial Functions of Houses

The function of a building is often very complex. Not all functions are related to practical purposes. Many buildings are designed to express emotions or symbol ideas. It is important in order to determine the final shape of the building. Symbols are not only confined to the religious world but also involve the secular world. Often building forms are a combination of practical, expressive, and symbolic functions.

It is important to know Balinese people's socio-cultural background to understand their residences. Thus, a house has a very complex function. The functions of each residential building are as follow. Sanggah or pamerajan is the family's sacred place. Pengijeng karang is to worship spirits that guard the yard. Bale meten is where the head of the family and the daughters sleep and to store valuables. Sometimes bale meten is used for a newly married couple. Bale gede/bale adat is a place for the ceremony of the cycle of life. In everyday life, bale gede serves as a place for many kinds of activity (multipurpose). Bale dauh serves as a workplace, meeting, and a place where the boys sleep. Paon (kitchen) is a place to cook. A barn is a place to store rice/crops.

4.5. Unsafe Layout from Disasters

Lately, In line with the development of tourism in Bali, more and more tourism facilities have been built in areas that are not safe from disasters, such as the construction of hotels on the edge of a cliff. That place is chosen because the scenery in that area is beautiful and relatively calm. In addition, the price of the land in that area is relatively cheap. That is usually the case in rural areas. Because in rural areas the settlements are also getting dense, the villagers start to build

houses in higher areas such near the mountains, or in lower areas.

In addition, in urban areas, there are many developers who build housing facilities in places that are not/less safe from disasters, such as the construction of residential complexes on the banks of rivers or on the edge of a cliff. It is because the price of land in areas farther away from the city center is relatively cheap. The people used to be afraid to live or build something in those areas because according to their belief those areas are the

"living quarters" of spirits and are very vulnerable to tsunamis, floods, and landslides.

There are more details to put into consideration in order to minimize the negative impacts of disasters on settlements such as systems/number of masses, structural systems and materials, and utilities. The shortage of land and the growth of population have a huge influence in selecting architectural aspects in construction activities.



Figure 5. Construction of tourism facilities (hotels) on cliffs in Jimbaran that disrupt the habitat of monkeys and violate regulation concerning border.



Figure 6. Houses built on river banks in urban areas.

Building a house near the river, especially with the foundation of the house in the river, is tantamount to narrowing the river and increasing the potential for danger. Furthermore, from the aesthetic aspect, that kind of house is not beautiful to look at. In addition, the waste coming from the house will be dumped directly to the river as if the river is a giant garbage can for the residents. That will automatically pollute the river.

Houses on the banks of the river have certainly eliminated trees that should have been along the river so that the land cannot accommodate rainwater to the maximum. If the land fails to accommodate rainwater, landslide will occur (Kovoid Abidin, 2018).

V. CONCLUSION

If humans do not damage nature, nature will not damage humans (Tat Twam Asi). The spatial layout of settlements that are safe from disasters is in the middle or far enough away from causes of natural disasters, specifically mountainous areas and coastal areas or rivers. These places, according to the locals' beliefs, are the "living quarters" of spirits, and also very vulnerable to tsunamis, floods, and landslides. The shortage of land and the growth of the population have a huge influence on the selection of architectural aspects in building activities in the community.

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