Subak as Biocultural Diversity-Heritage Framework

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Abstract. Bioculture can be explained as a deep relationship between biodiversity and local culture, resulting in harmonization between the two. biological and cultural aspects that are interrelated with human behavior. Biological and cultural aspects interact with each other so that they affect various types of aspects of human life. Bioculture is an approach that can be applied in various fields, especially environment, agriculture, biology, health and education. As one of the world's cultural heritages, subak is a biocultural system that is fixed in society. Subak's consistency in a long period of times has been well tested. The existence of co-adaptation and co-evolution mechanisms causes subak to be rich in various biocultural diversity, namely all the diversity of life that includes biodiversity, culture and language in the social system of society. Subak bioculture also contains existing conservation values which are strengthened by local village awig awig or pararem. Thus, it is interesting to study a basic framework of subak with its rich bioculture that can support sustainable development. Results The basic framework of Bioculture within the scope of the subak includes a framework that is completely covered by the concepts of Ecosystem that consist of, Social, Physical, and Culture aspect which can support subak Sustainability.

1 Introduction

Bioculture is an aspect of biology that is closely related to the culture of a particular ethnicity. The biocultural approach views humans as biological, social and cultural creatures in relation to the environment. Until now, in academic circles, biodiversity and culture are still considered two different entities. This can hinder understanding of diversity and the ongoing interactions between biological and cultural components in response to social changes, trends and economic and ecological conditions (Maffi & Woodley, 2010). Biocultural studies are closely related to biodiversity, cultural diversity and language diversity. Biodiversity and cultural diversity in fact have an interrelated, interdependent and mutually reinforcing relationship between the two diversity.

According to Maffi & Woodley (2007), the diversity of life is not in a separate state, but rather in interactions and influencing one another in various complex ways. The interrelationships between the various components of biocultural diversity take place

through complex systems of social ecological adaptation. This relationship continues to develop through mutually beneficial adaptations between humans and their natural environment, possibly through a process of coevolution. Biocultural diversity includes biodiversity (at all levels: genes, species, ecosystems), cultural diversity in all its manifestations (including linguistic diversity), from individual ideas to whole cultures; and most importantly, the interactions between all this diversity. The aspect of biodiversity that can be studied is biodiversity which includes species, populations, ecosystems, components in ecosystems and interactions. Meanwhile, the cultural aspects include social interactions, customs and various rituals. Basically, subak is an ordinary irrigation system in the form of an irrigation system managed by farmers. However, subak is not just an irrigation system, but in the subak system there are very dense ritual activities. This ritual activity is what distinguishes the existing irrigation system elsewhere with the subak irrigation system (Sedana, 2020).

The subak system has become one of the attractions of Bali Province. The irrigation system that developed under the influence of strong Hindu values has become local wisdom which enables Balinese farmers to be in harmony with nature to obtain optimal yields. Subak is a unique cultural landscape that has survived from the Mpu Markendya era to the present. This proves that subak is a solid system that is rich in philosophical values. Resources from subak are managed by applying the salunglung sabayantaka principle or what is better known as senasib sepenanggungan. The subak cultural landscape is a landscape with links between irrigation systems, social systems and Balinese culture. Every activity carried out by farmers in Bali is always based on ritual and culture so that the Balinese people realize that the synergy between culture and religion is one of the bases for sustainable development. Basically, subak adheres to the Tri Hita Karana concept. With 'Tri' which means three, 'Hita' which means happiness and / or welfare, and 'Karana' which means cause, the meaning of Tri Hita Karana can be concluded as 'the three causes of happiness and prosperity'. These three things are applied in the Subak system as Parahyangan (a harmonious relationship between humans and God); Pawongan (harmonious relationship between humans and others); and Palemahan (harmonious relationship between humans and nature and the environment).

From the social system, the subak organization is widely known because it has excellent local wisdom, namely starting in its irrigation or irrigation system (one inlet and one outlet), the harvest period system or mass paper, and the awig awig system which is based on the spirit of togetherness. Subak farmers, hereinafter referred to as krama subak, have proportional rights and obligations, neither is superior nor inferior. nggota Subak or in Balinese known as Krama Subak, are farmers who have cultivated rice fields and get part of the water in their fields. Subak members are grouped into three groups. First, Krama Active. Referred to as active members such as Krama Pekaseh, Sekaa Yeh or Sekaa Subak. Second, passive Krama, namely members who replace their obligations with money or other agreed upon things. Nowadays, the existence of subak faces challenges, especially from an economic and biological perspective, with the increasing number of land use change events causing a decrease in biodiversity and damage to the function of the ecosystem.

The subak framework as a biocultural heritage has been implicitly discussed by experts. Windia (2012) states that subak as one of the ecological systems has three types of subsystems in it, namely cultural subsystems, subsystems, social subsystems and physical subsystems that interact with each other to form a harmony. In everyday life, these subak principles are known as the pawongan aspect (as a social institution), the palemahan aspect (as an institution in the agricultural sector), and the parhyangan aspect (as an institution with religious characteristics). These principles are crystallized in the Tri Hita Karana philosophy. On the other hand, in the context of bioculture in local communities, Lain

(2012) designed a conceptual framework that integrated the components of the research, action, and advocacy approaches into the bioculture of local communities. Looking at the two biocultural frameworks that have slices or similarities in these concepts, a subak framework can be designed as a biocultural heritage with various types of biological diversity in it.

Thus, it can be concluded that subak is one of the potential biocultural heritage which is rich in philosophical meaning in it. To make it easier to understand how the system takes place in the subak, the basic framework or framework of subak based on the Tri Hita Karana as one of the biocultural heritage in Bali will facilitate the understanding of the community, practitioners, and government policies related to empowerment and preservation of subak, especially those in Bali.

2 Method

This study uses the systematic review (SLR) method, which identifies, evaluates, and interprets relevant research data related to specific research questions, certain topics, or phenomena of concern (Kitchenham, 2004, in Siswanto, 2010). To design a subak as biocultural diversity-heritage framework, this study examines scientific journals related to using protocol 1) formulating background, 2) research questions, 3) search terms, 4) selection criteria, 5) quality checklist and procedures, 6) Data extraction strategy, and 7) Data synthesis strategy.

3 Discussion

3.1 The Manifestation Of Tri Hita Karana's Concept As The Foundation Of Subak Bioculture

The existence of subak as one of the values of local wisdom in Bali has a strong legal basis, namely the Bali Provincial Regulation No. 9 of 2012. The regulation states that subak is a traditional organization in the field of water use and / or crop management at the farm level in Balinese indigenous peoples who are socio-agrarian, religious and economic in nature which have historically continued to grow and develop. The Tri Hita Karana value contained in subak is one of the factors that causes subak to remain "steady" to this day.

Tri Hita Karana can be defined as three causes of happiness that can be achieved by maintaining harmony between the three elements in Tri Hita Karana, namely the elements of parahyangan (God), pawongan (humans) and palemahan (environment). These Tri Hita Karana values underlie subak as a cultural heritage of community social organizations based on the principle of mutual cooperation. Harmonization of the three components is an important factor that maintains the sustainability of the subak itself. So that farmers as a system driving unit within the subak must have a good understanding of the subak itself. Andika's research (2017) states that the knowledge of farmers about Tri Hita Karana to support sustainable food crop agriculture in Subak Mungkagan is in the very good category with a score of 4.28. A good understanding or knowledge of subak is the basic asset for implementing the Tri Hita Karana concept or values. From the bioculture aspect, the subak has succeeded in maintaining biological biodiversity, language, ancestral agricultural technology, and the value of togetherness for the people in it.

Topographically, the contours or the shape of the mountains in Bali make irrigation difficult. However, subak management that prioritizes the principles of justice, openness, harmony and togetherness, is distributed according to the interests of the community,

resulting in very high efficiency of subak in the irrigation process. The units in the subak represent a very complex biocultural system. Starting from the organizational structure, Subak has a stratified organizational structure with very clear responsibilities. Subak members or also commonly referred to as krama subak are farmers who have cultivated rice fields and get part of the water in their fields. Within the subak members there are also several groups called Sekaa, the Krama subak are classified into 3, namely:

1) *Krama aktif*, is an active member such as Krama Pekaseh, Sekaa Yeh or Sekaa Subak.
2) *Krama pasif*, namely members who replace their obligations with money or in kind due to several causes which are commonly referred to as Pengampel or Pengohot.
3) *Krama Luput*, namely a member (krama) who is not active in all kinds of subak activities because of his duties such as the village head or Bendesa Adat.

Meanwhile, in terms of management (prajuru), Subak can be distinguished as follows:

1) *Pekaseh / Kelian* has a duty as head of subak.
2) *Pangliman / Petajuh* have duties as deputy head of subak.
3) *Penyarikan / juru tulis* has a duty as a secretary.
4) *Petengen / Juru raksa* has a duty as treasurer.
5) Saye/ the interpreter / juru uduh / juru tubak / kasinoman have related duties in matters of notification or announcement.
6) Stakeholders have special duties in ritual / religious matters.

Besides that, the subak also has a kolempok (sekaa) which is a subak operational work unit group, the members of the group will work hand in hand according to their respective duties. The tasks of each group are generally specific and reflect the tasks they are assigned to.Sekaa Numbeg, merupakan kelompok petani yang mengatur hal pengolahan tanah.

1) *Sekaa Jelinjingan*, is a group of farmers in charge of regulating water treatment.
2) *Sekaa Sambang*, is a group of farmers who have the task of controlling water from theft, catching or deterring plant-destroying animals such as birds or mice.
3) *Sekaa Nandur*, is a group of farmers in charge of planting rice seeds.
4) *Sekaa Mejukut*, is a group of farmers in charge of weeding rice.
5) *Sekaa Manyi*, is a group of farmers who harvest / cut / cultivate rice.
6) *Sekaa Bleseng*, is a group of farmers who have the task of transporting the rice bundles that have been hatched from the fields to the barn.

The potential of subak bioculture is not only limited to the structure and management of the organization, but also the physical and technological aspects of the irrigation system which has a complete complexity and function, from water sources to the land of each farmer. The order is:

1) *Dam* / dam as a source of water flow / dam.
2) *Bungas* / Buka is as an entry (in take).
3) *Aungan* is a closed water channel or tunnel.
4) *Telabah aya* (large), is the main channel.
5) *Tembuku aya* (large), is a building for the main water distribution.
6) *Telabah tempek* (munduk / dahanan / friend), is as a branch water channel.
7) *Telabah cerik,* as a twig water channel.
8) *Telabah panyacah* (rope), in some places known as Penasan (for 10 parts), Panca (for 5 people), and Pamijian (for yourself / 1 person).

The sizes of the irrigation channel have been arranged and agreed in such a way in the awig-awig of the customary village so that it will be adhered to and implemented by all subak krama. That way, every subak krama gets fair and even water. Another physical building that reflects the harmonization of the Tri Hita Karana subak concept is the

existence of Pura Ulun Carik or Pura Bedugul, which was specially built by farmers to worship Dewi Sri. Besides that, in Subak there are often small temples called 'Bedugul', often found in rice fields and usually located near water dams. This small temple without a roof, Bedugul was built by individuals for their own rice fields. The most important pacara that Subak performs at Ulun Carik Temple is during the 'Ngusaba Nini' celebration, which is usually held before or immediately after harvesting.

3.2 Subak As Biocultural Diversity-Heritage Framework

The UN Educational, Scientific and Cultural Organization (UNESCO - The United Nations Educational, Scientific and Cultural Organization) has recognized Subak in Bali as a world cultural heritage. In accordance with the submission, Subak in Bali which has an area of approximately 20,000 ha consisting of several subaks in 5 districts, namely Badung, Bangli, Buleleng, Gianyar, and Tabanan districts. The following are sites in Bali designated by UNESCO as world cultural heritage:

1) Pura Ulun Danu Batur at the end of Lake Batur which is the main water temple (water temple) as the source of every spring and river.
2) Subak landscape of the Pakerisan Watershed (DAS), which is known as the oldest irrigation system in Bali.
3) Subak landscape from Catur Angga Batukaru, Jatiluwih rice terraces tourism object is one of its parts.
4) Pura Taman Ayun, which is the largest water temple with its most famous architecture, exemplifies the full expansion of the subak system under Balinese royal rule in the 19th century.

The concept of subak as a biocultural diversity-heritage framework is actually not a new concept, because it has been implicitly published in national and international journals. However, to clarify this framework, this study examines and analyzes previous studies, which refers to Windia's research (2012) which explains that subak has three subsystems that are interrelated with each other, namely the Cultural Subsystem, Social Subsystem and Physical Subsystem. On the other hand, the description of Iain et. al. (2012) stated that bioculture in local communities actually has three basic frameworks to maintain its sustainability, namely aspects of research and development, aspects of action and preservation, and aspects of advocacy. Analyzing the research in the context of subak bioculture which has local wisdom values in the form of Tri Hita Karana, a basic framework can be designed that reflects the concepts in the bioculture that are related to one another. The concept of subak as a biocultural diversity-heritage framework can be seen in Figure 1.

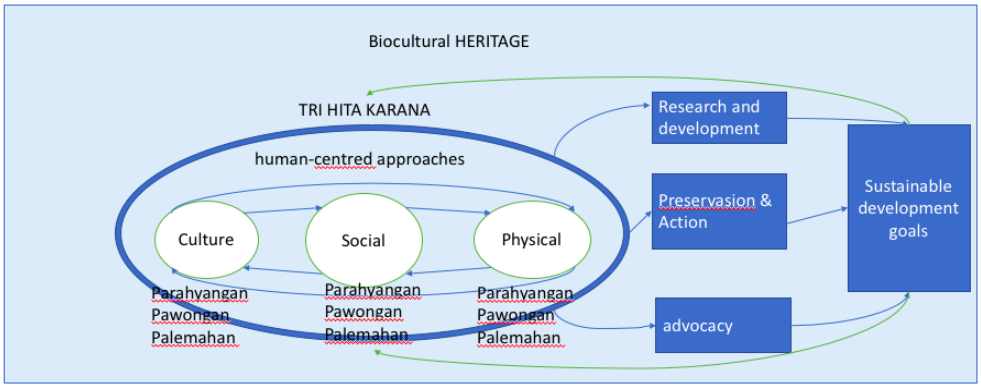

Figure 1. Subak as Biocultural Diversity-Heritage Framework

In this structure, it can be seen that the framework places the Tri Hita Karana concept at the core which is the basis for each subsystem, namely the cultural subsystem, social subsystem and physical subsystem. Each of these subsystems influence each other. The cultural subsystem which is the result of creativity, taste, initiative, and works of krama Subak is closely related to the social interactions within the subak. This social interaction will develop a culture or ritual that is carried out within the scope of the subak, such as the mebiyukukung ceremony, mendak toya, and so on. All of these interactions are inseparable from the physical subsystem, namely, subak topography, environmental temperature, soil, air, and other abiotic components in the subak including the width of the irrigation canals, and subak supporting equipment. In detail, the connection between the Tri Hita Karana concept in the Subak as Biocultural Diversity-Heritage Framework can be explained as follows.

Cultural Subsystem

The concept of parahyangan in the cultural subsystem in this framework is closely related to the existence of water as something that is considered sacred and is a creation of God Almighty. Water is a core component that provides life for the subak ecosystem so that its existence is vital for the subak ecosystem so that it has a place of worship, namely the temple. The existence of the temple is a control function of water management in the subak irrigation channel. The water management mechanism is based on the principle of harmony and togetherness among the subak krama, because every krama has the belief that if someone violates this principle, they will get the law of karma phala.

The concept of pawongan in the cultural subsystem emphasizes that social interaction between each community based on the principle of saguluk saguluk salunglung sabayantaka greatly supports the harmony of subak krama in work. Uniting together in work, respecting every opinion of members or subak krama, reminding each other, loving each other, and helping each other are the driving factors that cause subak to still exist today.

The concept of palemahan in the physical subsystem is closely related to the provision of special land for sacred buildings in the subak area at certain strategic locations that are considered important. In addition, if there is any remaining land from the sacred building, it will be reused or allocated for ritual purposes.

Social Subsystem

In the social subsystem the concept of parahyangan in Tri Hita Karana is strengthened by the existence of awig awig which is agreed upon by krama subak. This awig awig is a

social provision in Bali, whether written or not, which is formed or outlined in a mutually agreed upon regulation. In addition, the subak organization has accountable management of irrigation water, this will foster a sense of trust among the subak krama. In social interactions related to the belief of subak krama, krama subak also has a pelampias system, namely a policy to provide additional water for krama subak which has rice fields downstream.

The concept of pawongan in the subak organization places flexibility in its structure, that is, the subak organizational structure can adjust its function and management structure according to the interests of the community or local subak krama. The coordination process between krama subak and village officials is also an important focus in the social subsystem. This coordination system is overlapping because subak land is usually owned by customary villages and official villages. This coordination system has been running harmoniously even though the customary and official villages have been given autonomy in managing their overlapping regions. Interaction between one subak krama and another also occurs in mutual cooperation activities and meetings which are held regularly by krama subak.

Whereas in the case of the palemahan concept, each member of the subak does not mind if the land or area of the subak is used as a place for rituals or as a place to build sacred buildings.

Physical Subsystem

Physical subsystem or material subsystem is a subsystem that accommodates the other two subsystems because it is used as a place, facilities and infrastructure for rituals or activities that take place in the subak. In the subak, the concept of tektek is known in every subak building. This technique is an irrigation system that is fair and proportional so that it can provide a sense of tranquility among the subak krana. Pura Uluncarik or Pura Bedugul which was specially built by farmers to worship God. The existence of this pretense is an expression of gratitude and gratitude for farmers who are devoted to worshiping Dewi Sri as a manifestation of God Almighty as the goddess of prosperity and fertility. The concept of pawongan in the physical subsystem is manifested in a water borrowing system between members of a subak and between subak and other subaks. In addition, cooperation between one subak administrator and other subak administrators in carrying out the subak program can also foster a sense of togetherness among the subak krama.

Furthermore, for the concept of palemahan in the physical subsystem, each subak has a tapping building and drainage channels (one inlet and one outlet system). Besides that, krama subak always uses the surrounding materials or local materials to build each subak. The integration of the Tri Hita Karana concept for each subsystem will strengthen the existence of the subak internally. On the other hand, not only internal support is needed by subak but also external support to maintain and develop subak as a world cultural heritage. These external factors include Research and Development, Preservation and Action, and Advocacy. The three external factors that have been mentioned will support sustainable development goals (SDGs).

The implementation of Research and Development provides an overview of the potential or superiority of subak, the problems along with its alternative solutions, future development strategies for subak and other aspects that can support the sustainability of subak. Sriartha's research results (2017) show that from her research carried out in 69 Villages of Badung Regency, Tri Hita Karana Subak resilience can be categorized into 3, namely, high resistance categories as many as 29 subaks, medium resistance categories 28 subak, and low resistance categories 12 subak. The results of this study have indicated that the Tri Hita Karana concept that underlies subak has been slowly being abandoned by krama subak, because the proportion has moved from the medium category to the low

category. This is in line with the research of Wijayanti et.al. (2020) which states that the mindset of farmers or krama subak greatly affects the rate of land conversion. This mindset must be strengthened through awig awig subak, because awig awig subak has an important function in controlling land use change. Seeing this phenomenon requires a strategy to strengthen the existence of the Tri Hita Karana value in the mindset of every krama subak.

Apart from Research and Development, preservation and action also have an important part in realizing the Sustainable Development Goals. Subak conservation efforts often clash with the large problem of changing job functions from farmers and their families. (Budiastuti, 2015). The solution to this problem must be holistic, that is, internally by carrying out the concept of *parasparos selunglung sebayantaka sarpanaya*, which means that everything is good, bad, light weight is shared, and externally, both assistance from the government for empowering subak krama and setting the market price for the horticultural commodity krama subak. So that Krama Subak can have a decent and sufficient income for their daily needs.

Advocacy referred to in this framework is legal protection of all resources and activities in the subak, even though subak itself already has awig awig as a source of law, the existence of awig awig must be strengthened by state regulations to protect all resources in subak. . The Provincial Government of Bali through its authority in the field of autonomy forms a Regional Regulation which specifically regulates Subak, which is contained in Regional Regulation Number 9 of 2012. This regional regulation was formed with the consideration that to preserve the Subak Institution based on the Tri Hita Karana philosophy as a social organization in the agricultural sector based on the teachings of Hinduism in Bali, the position, function and role need to be regulated by a Regional Regulation. This regional regulation has been based on the dresta chess that has developed in society, namely:

1) *purwa dresta*: habits that have grown and been passed down from generation to generation and are believed to be today;
2) *loka dresta*: habits that grow at the local or regional level;
3) *dresta literature*: teachings or life provisions which are expressed in religious literary sources as written in literature; and
4) *dresta village*: customs that apply to certain villages.

4 Results And Disscussion

The conclusions obtained are based on the description of the discussion, namely the Subak As Biocultural Diversity-Heritage Framework carries the *Tri Hita Karana* values which include 3 subsystems, namely: cultural subsystem, social subsystem, and physical subsystem. Not only internal support is needed by subak but also external support to maintain and develop Subak as a world cultural heritage. These external factors include Research and Development, Preservation and Action, and Advocacy. The three external factors that have been mentioned will support sustainable development goals (SDGs).

The research related implementation of *Tri Hita Karana* value in subak mostly focus on its implementation, only a few research construct a proper framework for Tri Hita Karana Conception Framework in subak and how its impact for subak sustainability. Other research only focusing on the role of farmer and crop rotation in subak. By build a proper framework subak, it will increase the level of subak adaptation in globalization era.

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