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Reflection: The Value of Local Wisdom as a Competitive Social Capital in Sustainable Development

(Case Study of Socio-Cultural Life in Pakerisan Watershed)

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ABSTRACT

This paper presents empirical findings from field research and writer observations. Focused on the Pakerisan Watershed (DAS), this study examines the preservation of water resources through the revitalization of local knowledge and a social capital approach. Despite the rarity of research on the role of local knowledge in water preservation, it is crucial for empowering culturally rich communities. The Pakerisan Watershed, integral to Subak irrigation in Bali, challenges the notion that Bali solely prioritizes tourism, especially as it has been nominated by UNESCO as a natural cultural heritage site. This research investigates how social capital contributes to resilience amidst environmental challenges and natural disasters. Despite some initial ignorance, the involvement of local knowledge and social capital is vital for fostering community awareness of environmental issues. To ensure food and biosecurity, further examination of the implementation of social activities and the role of local knowledge in farmers' lives is warranted.

Keywords: Local Knowledge, Social Capital, Cultural Heritage, Sustainable Development.

INTRODUCTION

The sociocultural aspects of life encompass various aspects such as family mobility (Zittoun et al., 2018) the influence of professional culture on individual behavior (Naumović, 2006), lifestyle changes in retirement that affect post-work sociocultural life (Rachmawati et al., 2022), the importance of socialization skills, autonomy, and intelligence in software development (Gluz et al., 2016), and the sociocultural dynamics between masters and slaves in a historical context (Salau, 2011). These diverse cases illustrate how sociocultural factors influence individuals and communities in different settings, ranging from experiences of family mobility to interactions with cultural resources in entrepreneurial efforts, retirement lifestyles, software engineering approaches, and historical slave systems. Understanding the complexity of sociocultural life requires an interdisciplinary approach that considers psychological, economic, technological, and historical perspectives to comprehend the diverse nature of human interactions and societal structures.

Local wisdom plays a crucial role as a competitive social capital in sustainable development by encouraging community participation, preserving cultural heritage, and promoting environmental conservation. Studies on the *Nyadran Kali* tradition in Semarang (Hapsari et al., 2023), the ecotourism sector in Padusan Village, Mojokerto (Suwanan et al., 2023), and the values of local wisdom in Fakfak Regency (Marini & Suharto, 2022) highlight how

local wisdom can enhance accountability, transparency, and community participation, thus contributing to good governance and community development. Furthermore, research on the *sasi* tradition in Raja Ampat, West Papua, and the CSR program of PT Bank Rakyat Indonesia (Suwandi et al., 2022) demonstrates how locally-based practices can protect natural resources and support sustainable development initiatives. Therefore, harnessing local wisdom as a competitive social capital not only preserves traditions but also drives sustainable development efforts through community engagement and environmental management.

RESULTS

The Existing Condition of the Pakerisan Watershed

The community is a collection of individuals bound by unity in various aspects such as cultural background, religion, regional traditions, and others. The diversity within the community is a divine provision to ensure social dynamics in life, fostering interactions among its members. Each community has its own unique identity, differing in principles from one another. The community serves as an environment that can influence the development of individual potentials.

Social life in Bali is generally a communal society with a very high work ethic. The communal character is very visible from the communal life, the habit of *gotong royong* which is always reflected in every activity carried out by the Balinese people. The social life of Balinese people is strongly tied to Balinese Hindu culture, where Balinese Hinduism is a religious belief for most Balinese people, as well as the people in the Tukad Pakerisan Watershed.

Bali Island does not have natural resources derived from mining materials like Sumatra Island with coal mines, Kalimantan Island with oil mines, and Irian Jaya Island with its gold mines. In improving the standard of living and welfare of its people, the economy of Bali Island tends to rely more on the natural resources and culture it possesses. These natural resources and cultural wealth include the beauty of nature, traditions, customs, cultural heritage sites, and other unique features. These resources are utilized to increase income and welfare by developing tourism services. With the increasing number of tourists visiting Bali Island, it encourages the local community to be more creative in creating something with exchange value, even exchange value closely related to commodities. Commodities have double value, on one hand, they have "use value" and on the other hand, they have "exchange value". In relation to tourism, the people of Bali emphasize more on economic value. In line with its development, the people of Bali tend to choose professions more in the tourism industry. These professions include becoming tour guides, establishing travel agencies, car rentals, accommodations, hotels, and selling various types of souvenirs (Soenaryo, 2012).

Among the eight regencies and one city in Bali Province, each regency has its own unique characteristics and potentials. These characteristics and potentials include flatland areas, mountainous regions, and coastal or beach areas. Each regency has its own potentials and distinctive features to be developed as tourist destinations, ultimately leading to an improvement in their standard of living and welfare.

The Cultural Landscape of Bali Province (LBPB) was designated as a UNESCO World Heritage Site on June 29, 2012, during the UNESCO meeting in Pittsburg, Russia. The official proposal submitted by the government for UNESCO recognition was titled Cultural Landscape of Bali Province, Subak as Manifestation of Tri Hita Karana Philosophy. This title was chosen because the proposed area for World Heritage Site status is closely related to the subak irrigation system in Bali. The areas that received recognition to be listed on the UNESCO World Heritage List are: (i) Subak Catur Angga Batukaru Landscape, located in the Penebel District, Tabanan Regency and in the Sukasada District, Buleleng Regency; (ii) Pura Taman Ayun, in Badung Regency; (iii) Pakerisan River Watershed Subak Landscape, in Gianyar Regency; and (iv) Pura Ulun Danu Batur and Lake Batur, in the Kintamani District, Bangli Regency. All the landscapes mentioned above are closely related to the existence of the subak system.

Gianyar Regency, as one of the districts in Bali, is known for its flat terrain. Internationally, Gianyar Regency is recognized as the "art district". With this title, Gianyar Regency has become a major tourist destination for both domestic and international travelers. As a world-renowned tourist destination, Gianyar Regency possesses its own distinct characteristics and uniqueness that sets it apart from other districts in Bali. The natural and cultural richness, including the beauty of its landscapes, traditions, cultural heritage, art, and other unique aspects, are what attract tourists. One of the cultural heritages that is utilized as a tourist attraction is the Pakerisan Watershed.

Preserving the environment is an urgent necessity that cannot be postponed any longer. It is not only the responsibility of the government or national leaders, but the responsibility of every individual on Earth, from infants to the elderly. Everyone should make an effort to save the environment around us according to their own capacity. No matter how small the effort we make, it has a huge benefit in creating a habitable Earth for our future generations.

Water is a renewable natural resource that can be found everywhere, although its quantity and quality are still

limited in terms of geographical presence and availability, both geographically and seasonally. Therefore, increasing its use will result in greater human intervention in water resources. This will allow changes in the hydrological system and cycle of the region, such as uneven distribution and presence of water, both spatially and temporally, as well as a decrease in water quality (Muqaddas et al., 2024). At the same time, the efficiency of water utilization and usage is decreasing, often neglecting the watershed area from which the water originates (Ismail, 2009).

Rivers play a crucial role as a source of water, serving as a versatile natural resource for the survival and sustenance of living beings. Water is indispensable in this life, irreplaceable by any other substance or material. However, if not properly safeguarded, it can pose significant dangers. Rivers must be maintained in their natural state, protected, and preserved to enhance their functions and benefits, while controlling their environmental impact (Subagyo, 1992).

In Indonesia, rivers can be found everywhere with their respective classes. Rivers are utilized for daily needs such as transportation, bathing, washing, and more. In certain areas, rivers can even be used to support food and drink. Rivers, as a water source, play a crucial role in meeting the needs of the community, serving as a primary support system in enhancing national development and as a relatively safe transportation means to connect one region to another.

Water or rivers can be a source of disaster if not properly managed, both in terms of its benefits and its protection. This can be seen in the case of Tukad Pakerisan in Bali. Tukad Pakerisan is one of the major rivers that crosses four districts in Gianyar regency, with a length of 34.5 km, and is a world heritage site. There are 23 dams in the river that irrigate a total of 3650.92 hectares of rice fields, with an average discharge of 1751.5 m³/s, sourced from 15 natural springs (Gianyar Regency Public Works Department, 2012). With such issues and the connection to the community's lifestyle and environmental preservation, it is interesting to explore the social and cultural aspects in the Tukad Pakerisan watershed.

Subak as the Foundation of Social and Cultural Life in the Pakerisan Watershed

The subak system comprehensively reflects the philosophical principle of Bali's *Tri Hita Karana* ("three sources of goodness"), which is the harmonious relationship between *parhyangan* (God), *pawongan* (human beings), and *palemahan* (the environment). The subak temple rituals promote the harmonious relationship between humans and their surroundings through active human involvement in ritual concepts that emphasize dependence on the life-giving forces of the universe. The subak system holds remarkable universal values, with criteria such as the ancient philosophical concept of *Tri Hita Karana*, being a democratic and egalitarian system, and serving as a unique institution (Martiningsih & Eka, 2011).

Geographically, Tampaksiring Village is located in the Tampaksiring District, Gianyar Regency, Bali Province. It is bordered to the north by Manukaya Village, to the south by Sanding Village, to the west by Tegal Alang District, and to the east by Bangli Regency. Tampaksiring Village covers an administrative area of 8.68 square kilometers, consisting of 13 Banjar Dinas and 7 Desa Adat. According to the 2010 census, the population of Tampaksiring Village is 9,925 people, with 5,082 males and 4,843 females living in 2,597 households. There are a total of 201 RTMs with 764 family members. The population growth rate of Tampaksiring is 0.40% with a population density of 1,139 people per square kilometer.

The current social issues that are arising include the decline in agricultural labor in rural areas, especially farm workers, pollution of waste and waste in irrigation channels, damage to agricultural supporting infrastructure such as irrigation channels and farm roads, as well as funding support and capacity development for farmers. Various cases of social conflicts occurring in the research villages include conflicts between parties in the utilization of tourist visit fees, conflicts between core and buffer areas related to Subak tourism, conflicts between farmers and other businesses such as livestock, and conflicts of interest between farmers and investors and entrepreneurs who want to profit from the tourism economy.

Regarding the theme of Tourist Attractions along the Pakerisan Watershed as a World Heritage Site, several points can be raised regarding conservation efforts and its utilization as a tourist destination as follows.

1. The tourist attraction along the Pakerisan Watershed is the only area of Cultural Heritage in Gianyar Regency with the densest population of cultural heritage sites. As a cultural heritage area, the Pakerisan Watershed is protected by Law Number 11 of 2010 concerning Cultural Heritage, and has been designated as a world heritage site by UNESCO.
2. The designation of the Pakerisan Watershed along with its cultural and landscape heritage as a world heritage site does not mean that the responsibility for its preservation is solely the government's responsibility, but it is our collective responsibility, especially since the cultural heritage area along the Pakerisan Watershed is utilized as a world tourist destination in reality. The utilization and management of cultural heritage in tourism is like

a double-edged sword with two different sides, which can have both positive and negative impacts. The positive impact is the preservation of cultural heritage, as it provides economic benefits to the local community. Meanwhile, the negative impact is the damage/destruction of cultural heritage objects, due to the commercialization of cultural heritage.

3. Law Number 11 of 2010 concerning Cultural Heritage serves as a legal umbrella for its preservation and utilization, in addition to the active participation of local governments through local regulations to sharpen and function as guidelines for its utilization.

Temples (*Pura*) in the Pakerisan Watershed as a Cultural Asset

The identification of socio-cultural and ritual activities in the Pakerisan Watershed shows that in this area there are a series of sacred sites (temples) that serve as spiritual tourism destinations for visitors and as places for performing rituals for Hindus in Bali. Some of these sacred sites include:

1. Pura Tirta Empul is located at the headwaters of the Pakerisan River Watershed (DAS) in Manukaya Village, Tampaksiring District, Gianyar Regency/City, Bali Province. The temple courtyard structure is divided into four courtyards: the main mandala (*jeroan*), the middle mandala (*jaba tengah*), and the outer mandala (*jaba*). The main mandala courtyard is actually divided into three sections: the first section is the northernmost, the second section is separated by a dividing wall. The first section is marked by a Tepasana building and other structures. The second section is marked by a sacred spring on the east side and a statue complex on the west side in front of the candi bentar. The third section is a bathing complex. This section is divided into three parts: the west, central, and east (Banyun Cokor). The outer mandala courtyard is marked by a wantilan and an old swimming pool. According to the Manukaya inscription, this temple was founded by King Candrasingha Warmadewa in 884 Caka (962 AD), and this historical data is mentioned on a stone inscription (Jaya Stambha) kept in Pura Sakenan, Manukaya Let Village. The cultural heritage objects found at Pura Tirta Empul include: Lingga Yoni, Nandi Statue, and Lion Statue. And a structure: Tepasana. In Hindu mythology, based on the Usana Bali manuscript, Pura Tirta Empul is better known in the story of Maya Denawa. The mythology tells of a battle between the troops of God Indra and the demon Maya Denawa. In the story, it is said that the demon Maya Denawa managed to create a poisonous spring (*tirta cetik*) to defeat the troops of God Indra. Meanwhile, God Indra managed to create holy water to revive his troops.
2. Pura Pegulingan is located in Basangambu Hamlet, Manukaya Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. It was rediscovered in 1982 when the community planned to build a paduraksa. The Pura Pegulingan site was discovered in 1982 when the community was about to erect a large padmasana. Based on archaeological data, this temple is estimated to have been established in the 9th century AD. In the inner courtyard, there are shrines and a candi. The cultural heritage at this temple includes: a stupa and other findings such as clay seals, Gana reliefs, gold Buddha statues, and building fragments.
3. Pura Mangening is located in a valley flanked by the Pakerisan River on the east and a tributary of the Pakerisan on the west. It is located in Sarasidi Hamlet, Tampaksiring Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. The mandala structure of Pura Mangening is divided into three parts: the main mandala, the middle mandala, and the outer mandala. Important cultural heritage found at Pura Mangening includes a Prasada building, a lingga, and two statues believed to date from the 11th-12th century AD.
4. Pura Gunung Kawi is located in Penaka Hamlet, Tampaksiring Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. It covers an area of 14.87 hectares. Antiquities found in Pura Gunung Kawi include: Jero Gede, a sacred space within a rectangular room. In this space, there is a rectangular altar in the middle. The Gunung Kawi cliff temple complex includes: Candi Lima, Candi Empat, Pasar Agung, and the Candi Sepuluh complex. Experts estimate that the Gunung Kawi temple complex was built during the reign of King Anak Wungsu in the 11th century AD. This temple was built to honor King Udayana and his family and relatives. This is evidenced by the inscription in Kadiri Square script on the door of the temple which reads "*rwanakira*" meaning: his two sons, and "*haji lumah ing jalu*" meaning the king was enshrined in Pakerisan. The Gunung Kawi temple complex and its hermitage niches appear to be divided by the Pakerisan River. At this site, several groups of temples were found, namely: Candi Lima and the Pasar Agung complex on the east side of the river, and Candi Empat, Candi Sepuluh, and hermitage niches on the west and southeast sides of the river.

Subak Temple as a Cultural Asset (Case Study Subak Pulagan)

Subak has been recognized worldwide as a unique unity of landscape, cultural value, community organization, and belief system that cannot be found anywhere else in Southeast Asia. UNESCO has assessed subak as an irrigation system that can sustain the original culture of the Balinese people. On June 29, 2012, after the 36th session in Saint Petersburg, Russia, UNESCO designated four subak landscapes in Bali as World Cultural Heritage (WCH) sites that must be preserved and protected by the global community with world heritage status for the cultural landscape category, reflecting a special geographical area that embodies the combination of human labor and nature, which is a manifestation of the Tri Hita Karana philosophy (Windia & Wiguna, 2013). A proud cultural achievement for the Indonesian nation, especially Bali.

According to Martiningsih & Eka (2011) ritual activities in subak are still believed to be something that should not be violated in their implementation. This is because the rituals in subak are closely related to the beliefs of the Hindu subak community. As evidenced by their research in Wongaya Betan Subak, Mengesta Village, Tabanan Regency, the rituals performed by subak members include (1) *mapag toya* (fetching water); (2) *mesaba* (ritual before harvest), and *nangluk merana*. In addition, subak members also perform personal rituals such as: (1) *ngendagin* (starting land cultivation), (2) *ngurit* and *mawiwit pantun* (sowing rice), (3) *ngerasakin* (preparing for planting), (4) *nandur* (during planting), (5) *tutug kambuhan* (ritual when the rice is 42 days old), (6) *nyungsung* (ritual when the rice is 2 months old), (7) *mabukungkung* (ritual when the rice is 82 days old), (8) *maikuh lasan* (when the rice starts to bear fruit), (9) *niki kaki* and *niki manuh* (during and after harvest), (10) *mantenin* (ritual when the rice is stored in the barn), (11) *mrelina dewa nini* (melting the dewa nini), (12) *nyepi* (no activities). Additionally, there are some incidental rituals that are performed as needed by the subak, such as pemelaspasan (inauguration) when the subak builds facilities related to subak, such as *jineng* (rice barn) and pura subak.

In the Pakerisan Watershed, there are several subaks that have stood the test of time, and one of them is Subak Pulagan. Subak Pulagan is a subak that has embraced organic farming in its rice cultivation techniques, ensuring that all nutrient intake and pest and disease management for its crops are done organically. Apart from this unique characteristic, Subak Pulagan is also home to a subak temple called *Pura Ulun Suwi*. The locals believe that this temple holds various items and equipment used for religious ceremonies, known as *yadnya*, not only for the people in the area but for the entire Balinese community.

Darmanta et al. (2013) also discovered that one major challenge faced by subak is the uncontrollable conversion of agricultural land, resulting in the shrinking of subak's farming land. Managing land below 0.5 hectares makes it difficult for farmers to meet the basic needs of their households. This phenomenon needs to be addressed through policy approaches and government protection to prevent land conversion and ensure that farmers feel protected, thus strengthening their determination to preserve subak.

Existence of the Pakerisan Watershed as a World Cultural Heritage Landscape

The Cultural Landscape World Heritage of Bali Province encompasses several components, including subak (farmers and institutions), forest areas, springs and lakes, terraced rice fields, river areas, and water resource infrastructure (irrigation, channels, and dams), rural settlement areas, and sacred areas, such as temples.

At the beginning of the Pakerisan Watershed was designated as one of the World Cultural Heritage (WCH) sites, including four temples namely Tirta Empul Temple, Mengening Temple, Pegulingan Temple, Gunung Kawi Temple, and three Subak areas including Pulagan Subak, Kumba Atas Subak, and Kumba Bawah Subak in the Tampaksiring District, Gianyar Regency. Therefore, these four temples and three Subak areas are part of the Pakerisan Watershed that must be preserved in accordance with UNESCO's mandate as the institution issuing the WCH certificate. According to the UNESCO Operational Guidelines (2008), cultural landscape is a geographically distinct area with unique characteristics resulting from the interaction between nature and humans (Windia & Wiguna, 2013). Referring to these guidelines, a cultural landscape will contain several elements such as natural features, culture, and human activities.

Subak, as a vital part of the Pakerisan Watershed, functions as an irrigation system that goes beyond technical purposes, involving social, economic, and ritual activities. A subak is characterized by essential components like 1) the physical system component, which is the rice fields, 2) the irrigation system component, 3) the social system component, which includes subak members, and 4) the ritual system component, consisting of a series of subak temples.

In a broader sense, the global recognition of subak as a World Heritage demonstrates that its existence is on par with other sites around the world that need to be preserved. This designation has a positive impact on promoting cultural tourism, which has the potential to bring economic benefits and drive efforts towards the conservation and development of subak in the future.

The major challenge in the Cultural Landscape of Bali Province is to ensure the sustainability of subak from upstream to downstream, encompassing social, economic, cultural, and ecological aspects. In the upstream area, actions are needed to preserve water sources and forest areas that serve as ecosystem services and have cultural and traditional values. In the downstream area, policies are required to protect the conversion of rice fields for other purposes, maintain the concept of traditional farming and indigenous settlements, and provide incentives for farmers focused on improving the welfare of rice farmers, increasing the added value of agricultural products, and strengthening the supporting factors for rice cultivation.

Therefore, in order to address the challenges of preserving the Cultural Landscape of Bali Province, an integrated management is needed to encompass all policies of protection, utilization, and development of sustainable Bali Subak. Integrated management involves all stakeholders with interests in achieving the 5 priority strategies for sustainable subak management, namely:

1. Protection and improvement of livelihoods for the community
2. Conservation and promotion of ecosystem services
3. Conservation of cultural artifacts
4. Directed development of cultural tourism and education
5. Infrastructure and facility development.

Transformation of Social and Cultural Life

The lifestyle of a community is not only about work, education, and family life, but it goes far beyond that, encompassing social organization, ceremonies and customs, as well as religious life. However, within a society or village, there are various lifestyles, but in this discussion, this paper will only focus on one of them, which is social issues. This was done because social issues have the most significant impact on the community's way of life.

The lifestyle of society has changed due to development and globalization, directly impacting social life. This change will affect the surrounding environment, as social changes will lead to changes in behavior and perspectives (Jalaluddin, 2007). Society's assets will be disrupted if social changes occur, as stated by Flora (2007), who mentioned 7 assets that must be maintained for harmonious community life. These assets include natural assets, human assets, building assets, financial assets, political assets, cultural assets, and social assets. Changes in behavior also occur in Balinese farmers (*subak*) facing various issues (Surata, 2013). The current problem faced by subak is the lack of young generations willing to work as subak managers. This is due to the uncertainty of income in agriculture, leading young people to choose other sectors like tourism, services, or other fields. The younger generation's understanding of the noble values of subak and agriculture for Balinese and Indonesian society is lacking. If the younger generation is not involved in solving subak issues, the cultural landscape of subak will degrade. For subaks with UNESCO's WCH certification, this phenomenon is concerning and requires immediate attention as it will affect the cultural identity of society, especially the younger generation. According to Surata (2013), losing identity means losing valuable assets for future generations in facing economic, social, ecological, and cultural challenges.

The communities around the watershed play a crucial role in the sustainability of the river environment. Research indicates varying levels of awareness and behavior among these communities. Studies have shown that the understanding of land use and watershed ecosystems by the community has improved through socialization efforts, leading to wiser land use and support for sustainable watershed ecosystems (Chen et al., 2023; Putri et al., 2023). However, challenges persist, with limited knowledge of watershed environments among residents and diverse behaviors towards watershed protection influenced by sociodemographic factors and attitudes (Firdaus et al., 2021). Furthermore, community behavior in managing waste around the river still shows shortcomings, such as poor waste separation practices and the habit of littering that impact the river's preservation (Nefilinda et al., 2023).

Efforts to increase awareness and behavior of the community are crucial in building a sustainable river environment and ensuring the long-term health of the watershed. A better understanding of environmental sustainability means that the people around the Tukad Pakerisan watershed are aware that saving the watershed is a necessity for collective safety and the continuity of life along the Pakerisan watershed (Wiasta et al., 2016). By developing ecopedagogy, the consequence of this is the collaboration between teachers and students in completing the learning subject, with teachers acting as facilitators. This type of learning model will encourage teachers and students to be more active in integrating ethnosciences and modern sciences. Additionally, ecological-based learning is essential to introduce the fundamental nature of the environment towards the sustainability of human life. Hence, ecological-based learning is necessary to be included as a mandatory curriculum from elementary to high school levels.

The study conducted by Budiasa et al. (2021) emphasizes the importance of raising awareness among the

community and stakeholders regarding the types of plants to be planted in ecological restoration projects. It is recommended to focus on plants with high Importance Value Index (INP) percentages, such as bamboo and coconut trees. These plants are not only easy to cultivate but also offer significant economic benefits. Their strong root systems are capable of effectively retaining and absorbing high amounts of water, making them suitable for riverbank stabilization along the Tukad Pakerisan river. Furthermore, through plant inventory and analysis in the watershed area, it will be possible to identify the dominant plant species in the upstream, midstream, and downstream areas, as well as determine the types of plants with robust root systems that are most effective in water retention.



Figure 1. Vegetation in the Upper Tukad Pakerisan Watershed
Source : (Budiasa et al., 2021)



Figure 2. Vegetation in the Middle of the Tukad Pakerisan Watershed
Source: (Budiasa et al., 2021)



Figure 3. Vegetation in the Lower Tukad Pakerisan Watershed
Source: (Budiasa et al., 2021)

The position of the Watershed (DAS) is very crucial in an integrated planning sequence, so the logical consequence is to maintain the sustainable use of forest, land, and water resources. Poor planning can lead to watershed degradation, which adversely affects the sustainability of life around the watershed. To create a holistic

watershed management approach, integrated, comprehensive, sustainable, and environmentally sound planning is needed, considering the watershed as a management unit. Thus, in the event of a disaster, whether it is flooding or drought, mitigation can be carried out comprehensively, covering the watershed from upstream to downstream. Discussing watersheds, we cannot separate from the riparian zones around the watershed that function as protectors along the river flow. The Pakerisan River passes through four districts in Gianyar Regency with a length of 34.5 km and is a world heritage site. There are 23 weirs on the river, irrigating 3,650.92 hectares of rice fields, with an average discharge of 1,751.5 m³/s from 15 permanent springs (Public Works Department of Gianyar Regency, 2012). Given that the Pakerisan River is a central water source for many rice fields in Gianyar Regency, it is essential to take action to protect the riverbanks.

Efforts are being made to strategically restore the functioning of ecosystems in riverbank areas. One way to achieve this is through "ecological restoration," which involves conserving and rehabilitating protected areas. Ecological restoration is a form of conservation management that aims to bring a specific habitat or ecosystem back to its original state before degradation. The concept of eco-hydraulic protection can be implemented by utilizing local vegetation, such as slope plants, to stabilize the riverbank. By inserting 60 cm long plant stems into the soil and backfilling them, the plants will be able to effectively bind the riverbank. It is crucial for the community living around the river to actively participate in the preservation of forests along the river, as this concept of ecological restoration heavily relies on their awareness and involvement. Additionally, the inventory results can serve as a valuable reference for both the government and the community in their efforts to preserve the riverbanks and prevent erosion and environmental damage in the watershed area, including the Tukad Pakerisan River. By doing so, the rich vegetation in the Tukad Pakerisan Watershed, which is a cultural heritage site, can be safeguarded for future generations.

CONCLUSION

This research concludes that local wisdom and social capital play a crucial role in sustainable development, particularly in water conservation in the Pakerisan Watershed in Bali. Local knowledge and social capital are often overlooked, yet they are essential in raising environmental awareness and ecosystem sustainability. Proper watershed management, including riverbank protection and ecological restoration, is crucial in preventing erosion and maintaining environmental preservation. The traditional Subak irrigation system, linked to Hindu beliefs and various rituals, plays a significant role in organic farming in the Pakerisan Watershed. The main challenge is ensuring the sustainability of Subak from upstream to downstream, especially amidst social changes and the lack of young generations willing to work in Subak. The Pakerisan Watershed holds remarkable cultural value, including the Tri Hita Karana principle reflected in the Subak system. The village of Tampaksiring in Bali, with several temples that are spiritual tourist destinations, adds cultural and spiritual value to the area. This study can serve as a reference for the government and communities in preserving riverbanks and vegetation along the Tukad Pakerisan river. Ecologically-based learning and ecological restoration can help maintain the sustainability of the Pakerisan Watershed.

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**Reflection: The Value of Local Wisdom as a Competitive Social Capital in Sustainable Development
(Case Study of Socio-Cultural Life in Pakerisan Watershed)**

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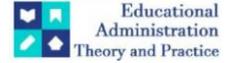
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ABSTRACT

This paper presents empirical findings from field research and writer observations. Focused on the Pakerisan Watershed (DAS), this study examines the preservation of water resources through the revitalization of local knowledge and a social capital approach. Despite the rarity of research on the role of local knowledge in water preservation, it is crucial for empowering culturally rich communities. The Pakerisan Watershed, integral to Subak irrigation in Bali, challenges the notion that Bali solely prioritizes tourism, especially as it has been nominated by UNESCO as a natural cultural heritage site. This research investigates how social capital contributes to resilience amidst environmental challenges and natural disasters. Despite some initial ignorance, the involvement of local knowledge and social capital is vital for fostering community awareness of environmental issues. To ensure food and biosecurity, further examination of the implementation of social activities and the role of local knowledge in farmers' lives is warranted.

Keywords: Local Knowledge, Social Capital, Cultural Heritage, Sustainable Development.

INTRODUCTION

The sociocultural aspects of life encompass various aspects such as family mobility (Zittoun et al., 2018) the influence of professional culture on individual behavior (Naumović, 2006), lifestyle changes in retirement that affect post-work sociocultural life (Rachmawati et al., 2022), the importance of socialization skills, autonomy, and intelligence in software development (Gluz et al., 2016), and the sociocultural dynamics between masters and slaves in a historical context (Salau, 2011). These diverse cases illustrate how sociocultural factors influence individuals and communities in different settings, ranging from experiences of family mobility to interactions with cultural resources in entrepreneurial efforts, retirement lifestyles, software engineering approaches, and historical slave systems. Understanding the complexity of sociocultural life requires an interdisciplinary approach that considers psychological, economic, technological, and historical perspectives to comprehend the diverse nature of human interactions and societal structures.

Local wisdom plays a crucial role as a competitive social capital in sustainable development by encouraging community participation, preserving cultural heritage, and promoting environmental conservation. Studies on the *Nyadran Kali* tradition in Semarang (Hapsari et al., 2023), the ecotourism sector in Padusan Village, Mojokerto (Suwanan et al., 2023), and the values of local wisdom in Fakfak Regency (Marini & Suharto, 2022) highlight how

local wisdom can enhance accountability, transparency, and community participation, thus contributing to good governance and community development. Furthermore, research on the *sasi* tradition in Raja Ampat, West Papua, and the CSR program of PT Bank Rakyat Indonesia (Suwandi et al., 2022) demonstrates how locally-based practices can protect natural resources and support sustainable development initiatives. Therefore, harnessing local wisdom as a competitive social capital not only preserves traditions but also drives sustainable development efforts through community engagement and environmental management.

RESULTS

The Existing Condition of the Pakerisan Watershed

The community is a collection of individuals bound by unity in various aspects such as cultural background, religion, regional traditions, and others. The diversity within the community is a divine provision to ensure social dynamics in life, fostering interactions among its members. Each community has its own unique identity, differing in principles from one another. The community serves as an environment that can influence the development of individual potentials.

Social life in Bali is generally a communal society with a very high work ethic. The communal character is very visible from the communal life, the habit of *gotong royong* which is always reflected in every activity carried out by the Balinese people. The social life of Balinese people is strongly tied to Balinese Hindu culture, where Balinese Hinduism is a religious belief for most Balinese people, as well as the people in the Tukad Pakerisan Watershed.

Bali Island does not have natural resources derived from mining materials like Sumatra Island with coal mines, Kalimantan Island with oil mines, and Irian Jaya Island with its gold mines. In improving the standard of living and welfare of its people, the economy of Bali Island tends to rely more on the natural resources and culture it possesses. These natural resources and cultural wealth include the beauty of nature, traditions, customs, cultural heritage sites, and other unique features. These resources are utilized to increase income and welfare by developing tourism services. With the increasing number of tourists visiting Bali Island, it encourages the local community to be more creative in creating something with exchange value, even exchange value closely related to commodities. Commodities have double value, on one hand, they have "use value" and on the other hand, they have "exchange value". In relation to tourism, the people of Bali emphasize more on economic value. In line with its development, the people of Bali tend to choose professions more in the tourism industry. These professions include becoming tour guides, establishing travel agencies, car rentals, accommodations, hotels, and selling various types of souvenirs (Soenaryo, 2012).

Among the eight regencies and one city in Bali Province, each regency has its own unique characteristics and potentials. These characteristics and potentials include flatland areas, mountainous regions, and coastal or beach areas. Each regency has its own potentials and distinctive features to be developed as tourist destinations, ultimately leading to an improvement in their standard of living and welfare.

The Cultural Landscape of Bali Province (LBPB) was designated as a UNESCO World Heritage Site on June 29, 2012, during the UNESCO meeting in Pittsburg, Russia. The official proposal submitted by the government for UNESCO recognition was titled Cultural Landscape of Bali Province, Subak as Manifestation of Tri Hita Karana Philosophy. This title was chosen because the proposed area for World Heritage Site status is closely related to the subak irrigation system in Bali. The areas that received recognition to be listed on the UNESCO World Heritage List are: (i) Subak Catur Angga Batukaru Landscape, located in the Penebel District, Tabanan Regency and in the Sukasada District, Buleleng Regency; (ii) Pura Taman Ayun, in Badung Regency; (iii) Pakerisan River Watershed Subak Landscape, in Gianyar Regency; and (iv) Pura Ulun Danu Batur and Lake Batur, in the Kintamani District, Bangli Regency. All the landscapes mentioned above are closely related to the existence of the subak system.

Gianyar Regency, as one of the districts in Bali, is known for its flat terrain. Internationally, Gianyar Regency is recognized as the "art district". With this title, Gianyar Regency has become a major tourist destination for both domestic and international travelers. As a world-renowned tourist destination, Gianyar Regency possesses its own distinct characteristics and uniqueness that sets it apart from other districts in Bali. The natural and cultural richness, including the beauty of its landscapes, traditions, cultural heritage, art, and other unique aspects, are what attract tourists. One of the cultural heritages that is utilized as a tourist attraction is the Pakerisan Watershed.

Preserving the environment is an urgent necessity that cannot be postponed any longer. It is not only the responsibility of the government or national leaders, but the responsibility of every individual on Earth, from infants to the elderly. Everyone should make an effort to save the environment around us according to their own capacity. No matter how small the effort we make, it has a huge benefit in creating a habitable Earth for our future generations.

Water is a renewable natural resource that can be found everywhere, although its quantity and quality are still

limited in terms of geographical presence and availability, both geographically and seasonally. Therefore, increasing its use will result in greater human intervention in water resources. This will allow changes in the hydrological system and cycle of the region, such as uneven distribution and presence of water, both spatially and temporally, as well as a decrease in water quality (Muqaddas et al., 2024). At the same time, the efficiency of water utilization and usage is decreasing, often neglecting the watershed area from which the water originates (Ismail, 2009).

Rivers play a crucial role as a source of water, serving as a versatile natural resource for the survival and sustenance of living beings. Water is indispensable in this life, irreplaceable by any other substance or material. However, if not properly safeguarded, it can pose significant dangers. Rivers must be maintained in their natural state, protected, and preserved to enhance their functions and benefits, while controlling their environmental impact (Subagyo, 1992).

In Indonesia, rivers can be found everywhere with their respective classes. Rivers are utilized for daily needs such as transportation, bathing, washing, and more. In certain areas, rivers can even be used to support food and drink. Rivers, as a water source, play a crucial role in meeting the needs of the community, serving as a primary support system in enhancing national development and as a relatively safe transportation means to connect one region to another.

Water or rivers can be a source of disaster if not properly managed, both in terms of its benefits and its protection. This can be seen in the case of Tukad Pakerisan in Bali. Tukad Pakerisan is one of the major rivers that crosses four districts in Gianyar regency, with a length of 34.5 km, and is a world heritage site. There are 23 dams in the river that irrigate a total of 3650.92 hectares of rice fields, with an average discharge of 1751.5 m³/s, sourced from 15 natural springs (Gianyar Regency Public Works Department, 2012). With such issues and the connection to the community's lifestyle and environmental preservation, it is interesting to explore the social and cultural aspects in the Tukad Pakerisan watershed.

Subak as the Foundation of Social and Cultural Life in the Pakerisan Watershed

The subak system comprehensively reflects the philosophical principle of Bali's *Tri Hita Karana* ("three sources of goodness"), which is the harmonious relationship between *parhyangan* (God), *pawongan* (human beings), and *palemahan* (the environment). The subak temple rituals promote the harmonious relationship between humans and their surroundings through active human involvement in ritual concepts that emphasize dependence on the life-giving forces of the universe. The subak system holds remarkable universal values, with criteria such as the ancient philosophical concept of *Tri Hita Karana*, being a democratic and egalitarian system, and serving as a unique institution (Martiningsih & Eka, 2011).

Geographically, Tampaksiring Village is located in the Tampaksiring District, Gianyar Regency, Bali Province. It is bordered to the north by Manukaya Village, to the south by Sanding Village, to the west by Tegal Alang District, and to the east by Bangli Regency. Tampaksiring Village covers an administrative area of 8.68 square kilometers, consisting of 13 Banjar Dinas and 7 Desa Adat. According to the 2010 census, the population of Tampaksiring Village is 9,925 people, with 5,082 males and 4,843 females living in 2,597 households. There are a total of 201 RTMs with 764 family members. The population growth rate of Tampaksiring is 0.40% with a population density of 1,139 people per square kilometer.

The current social issues that are arising include the decline in agricultural labor in rural areas, especially farm workers, pollution of waste and waste in irrigation channels, damage to agricultural supporting infrastructure such as irrigation channels and farm roads, as well as funding support and capacity development for farmers. Various cases of social conflicts occurring in the research villages include conflicts between parties in the utilization of tourist visit fees, conflicts between core and buffer areas related to Subak tourism, conflicts between farmers and other businesses such as livestock, and conflicts of interest between farmers and investors and entrepreneurs who want to profit from the tourism economy.

Regarding the theme of Tourist Attractions along the Pakerisan Watershed as a World Heritage Site, several points can be raised regarding conservation efforts and its utilization as a tourist destination as follows.

1. The tourist attraction along the Pakerisan Watershed is the only area of Cultural Heritage in Gianyar Regency with the densest population of cultural heritage sites. As a cultural heritage area, the Pakerisan Watershed is protected by Law Number 11 of 2010 concerning Cultural Heritage, and has been designated as a world heritage site by UNESCO.
2. The designation of the Pakerisan Watershed along with its cultural and landscape heritage as a world heritage site does not mean that the responsibility for its preservation is solely the government's responsibility, but it is our collective responsibility, especially since the cultural heritage area along the Pakerisan Watershed is utilized as a world tourist destination in reality. The utilization and management of cultural heritage in tourism is like

a double-edged sword with two different sides, which can have both positive and negative impacts. The positive impact is the preservation of cultural heritage, as it provides economic benefits to the local community. Meanwhile, the negative impact is the damage/destruction of cultural heritage objects, due to the commercialization of cultural heritage.

3. Law Number 11 of 2010 concerning Cultural Heritage serves as a legal umbrella for its preservation and utilization, in addition to the active participation of local governments through local regulations to sharpen and function as guidelines for its utilization.

Temples (*Pura*) in the Pakerisan Watershed as a Cultural Asset

The identification of socio-cultural and ritual activities in the Pakerisan Watershed shows that in this area there are a series of sacred sites (temples) that serve as spiritual tourism destinations for visitors and as places for performing rituals for Hindus in Bali. Some of these sacred sites include:

1. Pura Tirta Empul is located at the headwaters of the Pakerisan River Watershed (DAS) in Manukaya Village, Tampaksiring District, Gianyar Regency/City, Bali Province. The temple courtyard structure is divided into four courtyards: the main mandala (*jeroan*), the middle mandala (*jaba tengah*), and the outer mandala (*jaba*). The main mandala courtyard is actually divided into three sections: the first section is the northernmost, the second section is separated by a dividing wall. The first section is marked by a Tepasana building and other structures. The second section is marked by a sacred spring on the east side and a statue complex on the west side in front of the candi bentar. The third section is a bathing complex. This section is divided into three parts: the west, central, and east (Banyun Cokor). The outer mandala courtyard is marked by a wantilan and an old swimming pool. According to the Manukaya inscription, this temple was founded by King Candrasingha Warmadewa in 884 Caka (962 AD), and this historical data is mentioned on a stone inscription (Jaya Stambha) kept in Pura Sakenan, Manukaya Let Village. The cultural heritage objects found at Pura Tirta Empul include: Lingga Yoni, Nandi Statue, and Lion Statue. And a structure: Tepasana. In Hindu mythology, based on the Usana Bali manuscript, Pura Tirta Empul is better known in the story of Maya Denawa. The mythology tells of a battle between the troops of God Indra and the demon Maya Denawa. In the story, it is said that the demon Maya Denawa managed to create a poisonous spring (*tirta cetik*) to defeat the troops of God Indra. Meanwhile, God Indra managed to create holy water to revive his troops.
2. Pura Pegulingan is located in Basangambu Hamlet, Manukaya Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. It was rediscovered in 1982 when the community planned to build a paduraksa. The Pura Pegulingan site was discovered in 1982 when the community was about to erect a large padmasana. Based on archaeological data, this temple is estimated to have been established in the 9th century AD. In the inner courtyard, there are shrines and a candi. The cultural heritage at this temple includes: a stupa and other findings such as clay seals, Gana reliefs, gold Buddha statues, and building fragments.
3. Pura Mangening is located in a valley flanked by the Pakerisan River on the east and a tributary of the Pakerisan on the west. It is located in Sarasidi Hamlet, Tampaksiring Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. The mandala structure of Pura Mangening is divided into three parts: the main mandala, the middle mandala, and the outer mandala. Important cultural heritage found at Pura Mangening includes a Prasada building, a lingga, and two statues believed to date from the 11th-12th century AD.
4. Pura Gunung Kawi is located in Penaka Hamlet, Tampaksiring Village/Sub-district, Tampaksiring District, Gianyar Regency/City, Bali Province. It covers an area of 14.87 hectares. Antiquities found in Pura Gunung Kawi include: Jero Gede, a sacred space within a rectangular room. In this space, there is a rectangular altar in the middle. The Gunung Kawi cliff temple complex includes: Candi Lima, Candi Empat, Pasar Agung, and the Candi Sepuluh complex. Experts estimate that the Gunung Kawi temple complex was built during the reign of King Anak Wungsu in the 11th century AD. This temple was built to honor King Udayana and his family and relatives. This is evidenced by the inscription in Kadiri Square script on the door of the temple which reads "*rwanakira*" meaning: his two sons, and "*haji lumah ing jalu*" meaning the king was enshrined in Pakerisan. The Gunung Kawi temple complex and its hermitage niches appear to be divided by the Pakerisan River. At this site, several groups of temples were found, namely: Candi Lima and the Pasar Agung complex on the east side of the river, and Candi Empat, Candi Sepuluh, and hermitage niches on the west and southeast sides of the river.

Subak Temple as a Cultural Asset (Case Study Subak Pulagan)

Subak has been recognized worldwide as a unique unity of landscape, cultural value, community organization, and belief system that cannot be found anywhere else in Southeast Asia. UNESCO has assessed subak as an irrigation system that can sustain the original culture of the Balinese people. On June 29, 2012, after the 36th session in Saint Petersburg, Russia, UNESCO designated four subak landscapes in Bali as World Cultural Heritage (WCH) sites that must be preserved and protected by the global community with world heritage status for the cultural landscape category, reflecting a special geographical area that embodies the combination of human labor and nature, which is a manifestation of the Tri Hita Karana philosophy (Windia & Wiguna, 2013). A proud cultural achievement for the Indonesian nation, especially Bali.

According to Martiningsih & Eka (2011) ritual activities in subak are still believed to be something that should not be violated in their implementation. This is because the rituals in subak are closely related to the beliefs of the Hindu subak community. As evidenced by their research in Wongaya Betan Subak, Mengesta Village, Tabanan Regency, the rituals performed by subak members include (1) *mapag toya* (fetching water); (2) *mesaba* (ritual before harvest), and *nangluk merana*. In addition, subak members also perform personal rituals such as: (1) *ngendagin* (starting land cultivation), (2) *ngurit* and *mawiwit pantun* (sowing rice), (3) *ngerasakin* (preparing for planting), (4) *nandur* (during planting), (5) *tutug kambuhan* (ritual when the rice is 42 days old), (6) *nyungsung* (ritual when the rice is 2 months old), (7) *mabiukungkung* (ritual when the rice is 82 days old), (8) *maikuh lasan* (when the rice starts to bear fruit), (9) *niki kaki* and *niki manuh* (during and after harvest), (10) *mantenin* (ritual when the rice is stored in the barn), (11) *mrelina dewa nini* (melting the dewa nini), (12) *nyepi* (no activities). Additionally, there are some incidental rituals that are performed as needed by the subak, such as *pemelaspan* (inauguration) when the subak builds facilities related to subak, such as *jineng* (rice barn) and *pura subak*.

In the Pakerisan Watershed, there are several subaks that have stood the test of time, and one of them is Subak Pulagan. Subak Pulagan is a subak that has embraced organic farming in its rice cultivation techniques, ensuring that all nutrient intake and pest and disease management for its crops are done organically. Apart from this unique characteristic, Subak Pulagan is also home to a subak temple called *Pura Ulun Suwi*. The locals believe that this temple holds various items and equipment used for religious ceremonies, known as *yadnya*, not only for the people in the area but for the entire Balinese community.

Darmanta et al. (2013) also discovered that one major challenge faced by subak is the uncontrollable conversion of agricultural land, resulting in the shrinking of subak's farming land. Managing land below 0.5 hectares makes it difficult for farmers to meet the basic needs of their households. This phenomenon needs to be addressed through policy approaches and government protection to prevent land conversion and ensure that farmers feel protected, thus strengthening their determination to preserve subak.

Existence of the Pakerisan Watershed as a World Cultural Heritage Landscape

The Cultural Landscape World Heritage of Bali Province encompasses several components, including subak (farmers and institutions), forest areas, springs and lakes, terraced rice fields, river areas, and water resource infrastructure (irrigation, channels, and dams), rural settlement areas, and sacred areas, such as temples.

At the beginning of the Pakerisan Watershed was designated as one of the World Cultural Heritage (WCH) sites, including four temples namely Tirta Empul Temple, Mengening Temple, Pegulingan Temple, Gunung Kawi Temple, and three Subak areas including Pulagan Subak, Kumba Atas Subak, and Kumba Bawah Subak in the Tampaksiring District, Gianyar Regency. Therefore, these four temples and three Subak areas are part of the Pakerisan Watershed that must be preserved in accordance with UNESCO's mandate as the institution issuing the WCH certificate. According to the UNESCO Operational Guidelines (2008), cultural landscape is a geographically distinct area with unique characteristics resulting from the interaction between nature and humans (Windia & Wiguna, 2013). Referring to these guidelines, a cultural landscape will contain several elements such as natural features, culture, and human activities.

Subak, as a vital part of the Pakerisan Watershed, functions as an irrigation system that goes beyond technical purposes, involving social, economic, and ritual activities. A subak is characterized by essential components like 1) the physical system component, which is the rice fields, 2) the irrigation system component, 3) the social system component, which includes subak members, and 4) the ritual system component, consisting of a series of subak temples.

In a broader sense, the global recognition of subak as a World Heritage demonstrates that its existence is on par with other sites around the world that need to be preserved. This designation has a positive impact on promoting cultural tourism, which has the potential to bring economic benefits and drive efforts towards the conservation and development of subak in the future.

The major challenge in the Cultural Landscape of Bali Province is to ensure the sustainability of subak from upstream to downstream, encompassing social, economic, cultural, and ecological aspects. In the upstream area, actions are needed to preserve water sources and forest areas that serve as ecosystem services and have cultural and traditional values. In the downstream area, policies are required to protect the conversion of rice fields for other purposes, maintain the concept of traditional farming and indigenous settlements, and provide incentives for farmers focused on improving the welfare of rice farmers, increasing the added value of agricultural products, and strengthening the supporting factors for rice cultivation.

Therefore, in order to address the challenges of preserving the Cultural Landscape of Bali Province, an integrated management is needed to encompass all policies of protection, utilization, and development of sustainable Bali Subak. Integrated management involves all stakeholders with interests in achieving the 5 priority strategies for sustainable subak management, namely:

1. Protection and improvement of livelihoods for the community
2. Conservation and promotion of ecosystem services
3. Conservation of cultural artifacts
4. Directed development of cultural tourism and education
5. Infrastructure and facility development.

Transformation of Social and Cultural Life

The lifestyle of a community is not only about work, education, and family life, but it goes far beyond that, encompassing social organization, ceremonies and customs, as well as religious life. However, within a society or village, there are various lifestyles, but in this discussion, this paper will only focus on one of them, which is social issues. This was done because social issues have the most significant impact on the community's way of life.

The lifestyle of society has changed due to development and globalization, directly impacting social life. This change will affect the surrounding environment, as social changes will lead to changes in behavior and perspectives (Jalaluddin, 2007). Society's assets will be disrupted if social changes occur, as stated by Flora (2007), who mentioned 7 assets that must be maintained for harmonious community life. These assets include natural assets, human assets, building assets, financial assets, political assets, cultural assets, and social assets. Changes in behavior also occur in Balinese farmers (*subak*) facing various issues (Surata, 2013). The current problem faced by subak is the lack of young generations willing to work as subak managers. This is due to the uncertainty of income in agriculture, leading young people to choose other sectors like tourism, services, or other fields. The younger generation's understanding of the noble values of subak and agriculture for Balinese and Indonesian society is lacking. If the younger generation is not involved in solving subak issues, the cultural landscape of subak will degrade. For subaks with UNESCO's WCH certification, this phenomenon is concerning and requires immediate attention as it will affect the cultural identity of society, especially the younger generation. According to Surata (2013), losing identity means losing valuable assets for future generations in facing economic, social, ecological, and cultural challenges.

The communities around the watershed play a crucial role in the sustainability of the river environment. Research indicates varying levels of awareness and behavior among these communities. Studies have shown that the understanding of land use and watershed ecosystems by the community has improved through socialization efforts, leading to wiser land use and support for sustainable watershed ecosystems (Chen et al., 2023; Putri et al., 2023). However, challenges persist, with limited knowledge of watershed environments among residents and diverse behaviors towards watershed protection influenced by sociodemographic factors and attitudes (Firdaus et al., 2021). Furthermore, community behavior in managing waste around the river still shows shortcomings, such as poor waste separation practices and the habit of littering that impact the river's preservation (Nefilinda et al., 2023).

Efforts to increase awareness and behavior of the community are crucial in building a sustainable river environment and ensuring the long-term health of the watershed. A better understanding of environmental sustainability means that the people around the Tukad Pakerisan watershed are aware that saving the watershed is a necessity for collective safety and the continuity of life along the Pakerisan watershed (Wiasta et al., 2016). By developing ecopedagogy, the consequence of this is the collaboration between teachers and students in completing the learning subject, with teachers acting as facilitators. This type of learning model will encourage teachers and students to be more active in integrating ethnosciences and modern sciences. Additionally, ecological-based learning is essential to introduce the fundamental nature of the environment towards the sustainability of human life. Hence, ecological-based learning is necessary to be included as a mandatory curriculum from elementary to high school levels.

The study conducted by Budiasa et al. (2021) emphasizes the importance of raising awareness among the

community and stakeholders regarding the types of plants to be planted in ecological restoration projects. It is recommended to focus on plants with high Importance Value Index (INP) percentages, such as bamboo and coconut trees. These plants are not only easy to cultivate but also offer significant economic benefits. Their strong root systems are capable of effectively retaining and absorbing high amounts of water, making them suitable for riverbank stabilization along the Tukad Pakerisan river. Furthermore, through plant inventory and analysis in the watershed area, it will be possible to identify the dominant plant species in the upstream, midstream, and downstream areas, as well as determine the types of plants with robust root systems that are most effective in water retention.



Figure 1. Vegetation in the Upper Tukad Pakerisan Watershed
Source : (Budiasa et al., 2021)



Figure 2. Vegetation in the Middle of the Tukad Pakerisan Watershed
Source: (Budiasa et al., 2021)



Figure 3. Vegetation in the Lower Tukad Pakerisan Watershed
Source: (Budiasa et al., 2021)

The position of the Watershed (DAS) is very crucial in an integrated planning sequence, so the logical consequence is to maintain the sustainable use of forest, land, and water resources. Poor planning can lead to watershed degradation, which adversely affects the sustainability of life around the watershed. To create a holistic

watershed management approach, integrated, comprehensive, sustainable, and environmentally sound planning is needed, considering the watershed as a management unit. Thus, in the event of a disaster, whether it is flooding or drought, mitigation can be carried out comprehensively, covering the watershed from upstream to downstream. Discussing watersheds, we cannot separate from the riparian zones around the watershed that function as protectors along the river flow. The Pakerisan River passes through four districts in Gianyar Regency with a length of 34.5 km and is a world heritage site. There are 23 weirs on the river, irrigating 3,650.92 hectares of rice fields, with an average discharge of 1,751.5 m³/s from 15 permanent springs (Public Works Department of Gianyar Regency, 2012). Given that the Pakerisan River is a central water source for many rice fields in Gianyar Regency, it is essential to take action to protect the riverbanks.

Efforts are being made to strategically restore the functioning of ecosystems in riverbank areas. One way to achieve this is through "ecological restoration," which involves conserving and rehabilitating protected areas. Ecological restoration is a form of conservation management that aims to bring a specific habitat or ecosystem back to its original state before degradation. The concept of eco-hydraulic protection can be implemented by utilizing local vegetation, such as slope plants, to stabilize the riverbank. By inserting 60 cm long plant stems into the soil and backfilling them, the plants will be able to effectively bind the riverbank. It is crucial for the community living around the river to actively participate in the preservation of forests along the river, as this concept of ecological restoration heavily relies on their awareness and involvement. Additionally, the inventory results can serve as a valuable reference for both the government and the community in their efforts to preserve the riverbanks and prevent erosion and environmental damage in the watershed area, including the Tukad Pakerisan River. By doing so, the rich vegetation in the Tukad Pakerisan Watershed, which is a cultural heritage site, can be safeguarded for future generations.

CONCLUSION

This research concludes that local wisdom and social capital play a crucial role in sustainable development, particularly in water conservation in the Pakerisan Watershed in Bali. Local knowledge and social capital are often overlooked, yet they are essential in raising environmental awareness and ecosystem sustainability. Proper watershed management, including riverbank protection and ecological restoration, is crucial in preventing erosion and maintaining environmental preservation. The traditional Subak irrigation system, linked to Hindu beliefs and various rituals, plays a significant role in organic farming in the Pakerisan Watershed. The main challenge is ensuring the sustainability of Subak from upstream to downstream, especially amidst social changes and the lack of young generations willing to work in Subak. The Pakerisan Watershed holds remarkable cultural value, including the Tri Hita Karana principle reflected in the Subak system. The village of Tampaksiring in Bali, with several temples that are spiritual tourist destinations, adds cultural and spiritual value to the area. This study can serve as a reference for the government and communities in preserving riverbanks and vegetation along the Tukad Pakerisan river. Ecologically-based learning and ecological restoration can help maintain the sustainability of the Pakerisan Watershed.

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