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SUBAK AS A MODEL OF BALI'S FOOD SECURITY BASED ON LOCAL WISDOM AND TRI HITA KARANA

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Abstract

This article examines the sustainability of the Subak system as a model of Bali's food security grounded in local wisdom and the philosophy of Tri Hita Karana. Subak is not merely a traditional irrigation system, but a socio-religious institution that integrates ecological management, social organization, and spiritual values. This study employs a qualitative literature review method by analyzing ten national and international scholarly articles discussing Subak from ecological, socio-cultural, economic, and institutional perspectives. The findings indicate that Subak faces multidimensional challenges, including agricultural land conversion, weakening social cohesion, institutional limitations, and a crisis in farmer regeneration. Nevertheless, the literature also highlights significant opportunities for preservation through strengthening Tri Hita Karana values, reinforcing customary institutions, developing sustainable tourism, diversifying agribusiness, integrating digital technology, and enhancing policy support. Through an integrated and collaborative strategy, Subak can be preserved not only as cultural heritage but also empowered as an adaptive agrarian system capable of sustaining Bali's food security in the era of globalization.

Keywords: subak; food security; local wisdom; Tri Hita Karana; cultural preservation

INTRODUCTION

Bali is internationally renowned as a major tourism destination; however, behind the dominance of tourism lies a deeply rooted agrarian identity embodied in the traditional irrigation system known as Subak. Subak represents a complex system that integrates technical water management with social organization, religious rituals, and ecological ethics. At its philosophical core lies Tri Hita Karana, a worldview emphasizing harmony between humans and God (*parahyangan*), humans and fellow humans (*pawongan*), and humans and nature (*palemahan*).

The recognition of Subak as a UNESCO World Cultural Heritage in 2012 affirms its universal value as a sustainable socio-ecological system. This acknowledgment positions Subak not only as a local cultural asset but also as a global reference for environmentally conscious agricultural management. Nevertheless, global recognition has not automatically guaranteed local sustainability.

Over the past two decades, Subak has faced increasing pressure from rapid tourism expansion, urbanization, and economic transformation. Agricultural land conversion into residential and commercial areas has significantly reduced rice fields and disrupted

irrigation networks. This process has weakened local food production capacity and threatened Bali's food security. In parallel, socio-cultural changes have eroded collective values such as *gotong royong*, ritual participation, and communal decision-making within Subak institutions.

Previous studies emphasize the urgency of revitalizing Subak amid modernization. Some scholars highlight the potential of Subak-based sustainable tourism and agribusiness diversification, while others stress the importance of reinforcing Tri Hita Karana values to enhance social and ecological resilience. However, existing studies are largely fragmented and localized.

Therefore, this article aims to synthesize existing literature to comprehensively analyze the challenges and preservation strategies of Subak within the framework of sustainable food security. The objectives of this study are: (1) to analyze the multidimensional challenges affecting Subak sustainability, and (2) to formulate integrative preservation strategies that strengthen Subak's role in supporting Bali's food security.

METHOD

This study adopts a qualitative research approach using a literature review method. The primary data sources consist of ten peer-reviewed national and international journal articles, selected based on their relevance to Subak, sustainable agriculture, land conversion, Tri Hita Karana, and cultural-based development. Articles published within the last ten years were prioritized, except for seminal works considered essential for theoretical grounding.

Data collection was conducted through systematic searching of academic databases and institutional repositories. The selected literature was analyzed using content analysis techniques. The analytical process involved identifying key themes in each article, including land-use change, socio-cultural dynamics, institutional governance, farmer regeneration, and innovation strategies.

Subsequently, a comparative analysis was performed to identify recurring patterns, divergences, and complementary perspectives among the studies. The final stage involved synthesizing the findings to formulate comprehensive conclusions regarding the sustainability challenges and preservation strategies of Subak. To ensure analytical validity, source triangulation was applied by cross-checking findings across multiple studies and contextualizing them within Bali's socio-cultural and historical background.

RESULTS AND DISCUSSION

Challenges Faced by Subak in Bali

Agricultural Land Conversion

The problem of agricultural land conversion has been exacerbated by rising land prices driven by tourism expansion and residential development. Lestari and Ginting (2021) note that many farmers are increasingly tempted to sell their land due to continuously increasing land values, even though they are aware of the long-term consequences for the sustainability of Subak. This situation places farmers in a difficult dilemma: maintaining agricultural land as part of Bali's cultural identity or selling it for short-term economic gain (Brata & Sartika, 2024).

The ecological impacts of land conversion are equally significant. In addition to the reduction of rice field areas, irrigation water supplies have become more limited, many irrigation channels are damaged, and plastic pollution has begun to interfere with Subak's

water distribution system. This indicates that land conversion not only erodes farmers' economic livelihoods but also threatens the ecological foundation of Subak as a sustainable agrarian system (Lestari & Ginting, 2021).

Therefore, agricultural land conversion must be understood as a multidimensional phenomenon. It represents not merely the loss of productive land, but also environmental degradation and a serious threat to Bali's agrarian cultural identity. These impacts directly reduce local food production capacity, thereby weakening Bali's food security in the long term (Lestari & Ginting, 2021; Brata & Sartika, 2024).

Socio-Cultural Challenges

Another major challenge is the weakening of Subak's social and cultural functions. Brata and Sartika (2024) emphasize that Subak is not only an irrigation system, but also an agrarian cultural heritage deeply embedded in the philosophy of Tri Hita Karana, which promotes harmony between humans and God, humans and fellow humans, and humans and nature. UNESCO recognition has formally acknowledged Subak as a World Cultural Heritage; however, this global recognition has not been fully reflected in local realities.

Ritual practices such as *penyepian carik* and the role of Subak temples have increasingly diminished as agricultural land is converted into housing and tourism facilities. This situation reflects a form of cultural dissonance: on the one hand, Subak is celebrated as a symbol of Balinese culture, while on the other hand, the religious and social practices that sustain its existence are gradually neglected.

This paradox highlights the need to preserve Subak not only in its physical dimensions (land and water infrastructure) but also in its intangible aspects, including rituals, social solidarity, and value systems. The erosion of socio-cultural elements has led to the weakening of collective mechanisms such as *gotong royong* and *paruman*, which have traditionally supported food distribution and agricultural cooperation, thereby affecting Bali's food security.

Institutional and Land Governance Issues

Institutional challenges also pose serious threats to Subak sustainability. A study by Indrawan and Utami (2022) on land consolidation in Subak Sanggulan, Tabanan, reveals that a land consolidation program initiated in 1987 experienced stagnation for more than three decades before being completed in 2019. The primary causes of this prolonged delay included administrative complexity, land tenure disputes, and weak regulatory frameworks governing implementation stages (Indrawan & Utami, 2022; Windia & Astiti, 2015).

Low community participation further aggravated the situation. Land consolidation, which was expected to strengthen Subak's spatial organization, instead became an example of governance failure due to weak synergy between government authorities, local communities, and relevant stakeholders (Indrawan & Utami, 2022).

This condition reflects a governance gap in Subak management. Although Subak has long been recognized as a strong customary institution, in the modern context it often struggles to interact with formal land administration systems. As a result, Subak remains vulnerable to land loss due to insufficient legal instruments to protect its agrarian space. This institutional weakness accelerates the loss of productive land and directly threatens Bali's food security (Windia & Astiti, 2015).

Farmer Regeneration Crisis and Human Resource Quality

Another critical challenge is the crisis of farmer regeneration. Lestari and Ginting (2021) observe that many Subak members are land cultivators rather than landowners, resulting in weaker attachment to Subak institutions. At the same time, younger generations are increasingly reluctant to pursue farming as a livelihood due to its perceived lack of economic viability.

This situation has led to agrarian aging, in which Subak institutions are dominated by elderly farmers while younger generations shift toward non-agricultural sectors, particularly tourism. Consequently, Subak's institutional capacity weakens, both in terms of technical knowledge and leadership succession (Windia & Astiti, 2015).

The regeneration crisis also disrupts the intergenerational transmission of Subak's cultural values. When young people are no longer actively involved in agriculture, values such as mutual cooperation, social solidarity, and ritual participation become increasingly difficult to sustain. In the long term, this crisis poses an existential threat to Subak as a living institution and reduces local food production capacity, thereby undermining Bali's food security.

Strategies for Preserving Subak

Strengthening Identity and Institutional Capacity

One proposed strategy is strengthening Subak's identity through cultural institutions. Brata and Sartika (2024) emphasize the importance of the Subak Museum as a public educational platform to raise awareness of Bali's agrarian history. The museum not only preserves artifacts but also represents Subak as a collective identity that must be projected into the future.

In addition, inter-Subak coordination forums are necessary to harmonize cropping patterns and water distribution. Effective coordination can minimize conflicts arising from water competition. In the modern context, Subak is no longer an isolated local institution but part of a broader agrarian system. Strengthening identity and institutions thus plays a crucial role in ensuring sustainable water management and stable food production in Bali (Windia & Astiti, 2015).

Strengthening Policy and Regulatory Frameworks

Regulation is a key factor in Subak preservation. Lestari and Ginting (2021) highlight the formulation of regional regulations on Sustainable Food Agricultural Land (LP2B) as a strategic effort to control land conversion. However, implementation remains constrained by weak monitoring and limited sanctions for violations.

Indrawan and Utami (2022) demonstrate that participatory land consolidation can serve as an effective solution when managed transparently, fairly, and inclusively. This finding underscores the importance of combining top-down government policies with bottom-up governance based on Subak's customary regulations (*awig-awig*).

Strong and consistent policies are essential for maintaining Subak's agrarian function. Without regulatory intervention, land conversion will intensify and directly reduce Bali's food production capacity. Therefore, Subak-related regulations must be positioned as a core pillar of regional food security policy (Lestari & Ginting, 2021).

Farmer Empowerment and Capacity Building

Farmer empowerment is central to Subak sustainability. Lestari and Ginting (2021) note the existence of the *Hita Lalu* Program, which focuses on strengthening Subak management and increasing agricultural intensification. Brata and Sartika (2024) further emphasize the importance of education, training, and extension services to enhance human resource capacity, particularly among Subak leaders.

Empowerment should not be limited to technical farming skills but should also encompass social, economic, and managerial competencies. Farmers must be equipped with agribusiness skills so that Subak can adapt to modern market demands rather than remain solely a traditional irrigation system.

Capacity building is also a strategic response to the regeneration crisis. By fostering competent young farmers, Subak can maintain sustainable local food production, thereby strengthening Bali's food security.

Economic Diversification and Innovation

Another important strategy involves integrating Subak into creative and sustainable economic activities. Brata and Sartika (2024) stress the importance of orienting Subak toward agribusiness development. Such an orientation can increase farmers' incomes without compromising cultural values.

Moreover, agricultural digitalization offers opportunities to attract younger generations. Technological innovations—such as smart farming applications, digital marketing of Subak products, and smart irrigation systems—can help address the regeneration crisis by making agriculture more modern and appealing.

Economic diversification and innovation not only improve farmers' welfare but also enhance Subak's resilience to external shocks, including global food market uncertainty. Consequently, Subak can function as an adaptive model of Bali's food security in the era of globalization.

Synthesis of Challenges and Strategies for Food Security

The analysis demonstrates that the challenges faced by Subak are multidimensional, encompassing environmental, socio-cultural, institutional, and demographic aspects. Accordingly, preservation strategies must also be multidimensional. Subak faces a paradox: it is globally recognized as cultural heritage, yet locally it experiences an existential crisis. Addressing this paradox requires an integrative approach that synergizes cultural identity preservation, agricultural land protection, farmer empowerment, and sustainable innovation through ecotourism and agricultural digitalization (Brata & Sartika, 2024; Yusnia et al., 2023; Ustriyana et al., 2020).

Through integrated strategies, Subak can be preserved not merely as a cultural symbol but empowered as an adaptive agrarian system relevant to contemporary challenges. Subak's sustainability is directly linked to Bali's food security, as it ensures the availability of local food while maintaining social and ecological harmony. Furthermore, the values embedded in Tri Hita Karana align with global development agendas, particularly SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities and Communities), and SDG 15 (Life on Land). Thus, Subak remains a vital local model with global relevance for sustainable food security based on local wisdom.

CONCLUSION

This study concludes that the sustainability of Subak as a traditional irrigation and agrarian system in Bali depends on the implementation of integrative and collaborative preservation strategies. The literature demonstrates that strengthening cultural identity through institutional and value-based approaches, protecting agricultural land through effective regulatory frameworks, empowering farmers through capacity-building programs, and promoting economic diversification via agribusiness and ecotourism are essential to maintaining the resilience of Subak.

Furthermore, the findings highlight that the long-term viability of Subak is strongly influenced by the synergy between government policies, customary institutions, community participation, and innovation driven by younger generations. In this context, Subak should be understood not merely as a cultural heritage symbol, but as an adaptive socio-ecological system that remains relevant in addressing contemporary challenges related to food security, environmental sustainability, and the preservation of Balinese cultural identity in the era of globalization.

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