Dolphin Ecotourism: Applying the "Tri Mandala" Framework to Balance Tourism, Conservation, and Culture in North Bali

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Abstract: Dolphin ecotourism in Lovina, North Bali, poses ecological risks due to uncontrolled human interactions and limited community awareness. To address these challenges, a culturally grounded yet environmentally conscious framework is essential. This study introduces the *Tri Mandala* concept, rooted in the *Tri Hita Karana* philosophy, which emphasizes harmony between humans, nature, and spirituality. The research employs qualitative analysis, including stakeholder interviews and field observations, to assess cultural and environmental synergies. The *Tri Mandala* organizes ecotourism activities into three spatial zones: *utama* (sacred), *madya* (intermediate), and *nista mandala* (profane), each serving distinct functions. A minimum dolphin observation distance of 50 meters is recommended to reduce ecological disruption. This zoning model promotes balanced interactions among stakeholders, fostering sustainability and cultural integrity. Future adaptations should incorporate ecological, spatial metrics and cross-cultural testing to enhance relevance. This approach highlights the need for context-sensitive methodologies in ecotourism planning, balancing local values with scalable conservation strategies.

Keywords: ecotourism; *tri mandala model*; *tri hita karana*; dolphin; Lovina

1. Introduction

Ecotourism has emerged as a key attraction for tourists by integrating natural landscapes with specific socio-cultural elements (Wang and Tong, 2012). Furthermore, tourism in certain areas has been utilized to address poverty and promote environmental conservation in developing nations (Mustika et al., 2012; van Egmond, 2007). However, the development of high-quality ecotourism

necessitates environmental awareness, community participation, and effective mechanisms for local involvement in ecotourism management (Wang and Tong, 2012). A prominent form of community-developed ecotourism is wildlife tourism, such as cetacean (whale and dolphin) watching (Neves, 2010; Orams, 2002). According to data from 2008/2009, cetacean watching attracted 13 million tourists from 119 countries, contributing USD 2.1 billion to local economies and generating 13,000–19,000 jobs worldwide (Cisneros-Montemayor et al., 2010; Mustika et al., 2012; O'Connor et al., 2009; Parsons, 2012). In the Indonesian context, wildlife-based tourism like dolphin watching has demonstrated significant multiplier effects, where every USD 1 spent by tourists generates up to USD 3.2 in local economic value through accommodation, food, and handicraft sectors (Mustika et al., 2013). Nevertheless, not all tourists are attracted to wildlife ecotourism; many prefer cultural tourism, especially in Bali and Yogyakarta, as well as coastal tourism across Indonesia. Dolphin watching in Bali is a prime example of wildlife ecotourism.

Dolphin ecotourism in Bali has emerged as a leader in leveraging marine resources to drive local economic growth. This aligns with Sustainable Development Goal (SDG) 14, which emphasizes marine ecosystem conservation and economic development through aquatic tourism (Bappenas, 2020). While this has significantly benefited local communities by enabling them to optimize their potential, it also poses challenges, such as the potential decline of local culture due to shifting paradigms. Lovina in North Bali, a prime example of culturally rich ecotourism, is the first site for dolphin-watching activities. The Lovina Tourism Area is celebrated as a coastal destination, with dolphin watching serving as its iconic attraction. The movement patterns of dolphins along the coast have created opportunities for local communities and tourism operators. Fishermen, alongside their fishing activities, provide transportation services to take tourists offshore to observe dolphin behaviour. However, the rapid expansion of these tourism services has not been matched by the number of dolphins surfacing, resulting in chaotic scenarios where tourists seem to chase dolphins from all directions. This highlights the urgent need for comprehensive regulations involving all tourism stakeholders, including guidelines for *jukung* positioning, codes of conduct for operators, and rules for tourists during dolphin-watching activities.

Community participation in dolphin-watching activities remains limited, as evidenced by the chaotic and unregulated patterns of observation, including boat operators chasing dolphins and maintaining excessively close distances. Despite these challenges, dolphin ecotourism has attracted over 10,000 international tourists in 2024, including visitors from China, India, Russia, France, Australia, the Netherlands, Germany, the United States, the

United Kingdom, and Italy (PPID Buleleng Regency, 2024). However, dolphin watching poses significant risks to dolphin populations, as they may become targets for hunting (Bejder et al., 1999; Constantine et al., 2004; Lusseau, 2006; Taylor et al., 2007). Furthermore, population declines are often exacerbated by uncontrolled tourist interactions, driven by factors such as boat noise and litter (Foord et al., 2025; Milinski, 1997; Spadoni et al., 2025). Consequently, dolphin-watching practices in ecotourism must harmonize local cultural practices with community participation, emphasizing not only economic gains but also environmental conservation.

Ecotourism is frequently assessed based on tourist satisfaction, serving as a key indicator of sustainable tourism and a means to attract more visitors or generate positive referrals (Akama and Kieti, 2003; Birtles et al., 2002; Kazmierow et al., 2000; Kozak and Rimmington, 2000; Lecturer and Carr, 2003; Turner et al., 2002). Balinese culture, particularly the *Tri Hita Karana* philosophy, serves as a vital bridge between development and sustainable tourism (Prihadi et al., 2024). The diverse cultural traditions in Bali indirectly support the implementation of wildlife ecotourism, particularly dolphin ecotourism. For instance, the *Melasti* ceremony, a purification ritual involving the transport of sacred objects to the sea, creates a peaceful environment for dolphins, as traditional boats (*jukung*) abstain from chasing them during this period. Nevertheless, despite the richness of Balinese Hindu culture and traditions, there is still a lack of effective synergy between these cultural elements and tourism practices, hindering their optimal integration. As a result, there is a need to restructure dolphin ecotourism by incorporating the roles of various stakeholders, such as academics, businesses, government, local communities, tourists, and the media (Hendriana, 2019). This approach, rooted in cultural and local wisdom, holds greater significance compared to other ecotourism frameworks developed by earlier researchers.

Mendrofa et al. (2014) assessed coastal ecotourism using the 10 Ecotourism Suitability Indices (IKS), concluding that Sorake Beach is suitable for coastal ecotourism development through the creation of tourism zones, culturally significant attractions, and the preservation of the beach's natural authenticity via collaboration between local communities and regional governments. Hengky (2017a, 2017b, 2017c, 2018) highlighted the importance of developing unique coastal characteristics to enhance environmental carrying capacity and generate local income and employment opportunities. Putra et al. (2018) focused on coastal management strategies, particularly the development of coastal ecotourism potential, emphasizing the need to support coastal ecosystem livelihoods through tourism activities. Sarinastiti and Wicaksono (2020) employed a more structured approach, using variables such as aesthetic value, educational value, socio-cultural value, and economic value, though their

coastal ecotourism mapping was limited to describing destination distributions based on these variables. They also discussed coastal ecotourism management for leveraging coastal potential through community empowerment and economic improvement.

Sánchez-Prieto et al. (2021) proposed a framework for ecotourism scenario projections, incorporating past conservation attitudes, participatory models, and income-generating potential. This approach was supported by Hadmoko et al. (2021), who developed a GIS-based classification system for coastal typology to analyze a location's readiness for ecotourism development. Idris (2022) explored an ecotourism model using the travel cost method, which significantly influenced tourist visitation rates. Li et al. (2022) studied coastal areas, identifying the OptiPres model as a flexible framework for researching historic buildings in regions vulnerable to climate change. Additionally, some coastal areas are highly susceptible to damage, particularly from climate change, necessitating policies for climate mitigation and adaptation to preserve biodiversity (Châles et al., 2023; Techera, 2023). Westerlaken et al. (2022, 2024) proposed a comprehensive roadmap for sustainable destination practices in Lovina, including a code of ethics, multi-stakeholder platforms for co-management, education and awareness programs, licensing and certification systems, visitor management plans, monitoring and evaluation systems, community-based tourism models, and collaborative networks for knowledge sharing and innovation. However, there is no standardized or practical regulation for coastal management, as each location has unique characteristics.

Coastal ecotourism development is a complex and systematic process that requires an integrated approach to balance ecological sustainability, economic viability, and socio-cultural preservation. While previous research has assessed coastal areas using spatial frameworks combining ecotourism principles with ecological, economic, and social variables, a critical gap remains in holistically addressing the interconnectedness of coastal-upland systems and the role of local wisdom in sustainable tourism.

This study addresses the central question: How can the *Tri Mandala* spatial framework be synergized with sustainable ecotourism principles to develop a holistic model for dolphin-based tourism in Lovina that ensures environmental conservation, socio-economic benefits, and cultural preservation? By mapping dolphin migration routes, defining mobility and viewing zones, and integrating regulatory, technological, and cultural variables including Hindu community beliefs, this research aims to create a comprehensive management model. The approach not only aligns with short- and long-term sustainability goals but also strengthens the harmony between human activity, nature, and Balinese local wisdom, ultimately supporting ecosystem protection, community well-being, and cultural integrity.

2. Literature Review

2.1 Tourism in North Bali

Tourism in Bali has a rich history, beginning in 1924 with the arrival of the Batavia ship in Singaraja, North Bali (Picard, 1997). However, tourism development was initially concentrated in South Bali (Gouyon, 2005), a trend that persists today. The tourism sector faced significant challenges following the 2002 and 2005 Bali bombings, which led to a sharp decline in tourist numbers (Putra and Hitchcock, 2006). Recovery began in 2006/2007, with annual tourist visits surpassing 1 million (Baker and Coulter, 2007; PPID Buleleng Regency, 2024). However, the COVID-19 pandemic in 2021 caused an unprecedented drop, with fewer than 50 tourists visiting due to restrictions on travel and human interactions (Subadra and Hughes, 2022; Wibowo and Hariadi, 2024).

Despite these challenges, tourism remains a vital part of Bali's economy, particularly in North Bali. While North Bali shares similar physiographic features with South Bali, it offers a more serene and relaxed environment (Berkmoes et al., 2009; Gouyon, 2005). Historically, limited transportation options and a travel time exceeding three hours hindered tourist visits to North Bali for dolphin ecotourism. To address this, the Bali provincial government has enhanced transportation infrastructure, reduced travel time and improved accessibility. These efforts have contributed to a growing interest in dolphin ecotourism. Since 2007, the government prioritized the development of nature-based and agro-tourism in North Bali, with Lovina emerging as a key destination (Mustika et al., 2012). By 2024, tourist visits to North Bali increased by 35%, with 10,306 tourists specifically visiting for dolphin ecotourism (PPID Buleleng Regency, 2024). As a result, dolphin ecotourism continues to be a major draw for tourists in North Bali.

2.2 Dolphin Ecotourism in North Bali

Dolphin watching in Lovina, North Bali, began in the 1980s and has since become a vital source of income for local communities (Mustika et al., 2012, 2013, 2015; O'Connor et al., 2009; Westerlaken et al., 2022). The Lovina region, situated in the Bali Sea, offers an optimal habitat for marine mammals, including whales, dolphins, and dugongs, due to its rich marine biodiversity (Mustika and Ratha, 2011; Westerlaken et al., 2022). Indonesia is home to nearly one-third of the world's cetacean species, as well as one species of Sirenia, making it a global hotspot for marine wildlife (Wiadnyana et al., 2004). This unique biodiversity has positioned dolphin ecotourism as a key attraction for tourists.

The dolphin-watching industry in Lovina expanded significantly in the 1990s (Hoyt, 2001), reflecting broader global trends in animal-based tourism (Kline, 2021). However, studies by Mustika et al. (2012) and Heenehan et al. (2017)

reveal that the focus of dolphin-watching activities often shifts from the dolphins to the behavior of boat operators, which can detract from the tourist experience. Over 100 traditional *jukung* boats operate daily along the coast, transporting tourists to observe dolphins. Lovina's waters host at least 10 cetacean species, including Stenella longirostris (spinner dolphins; dwarf or S.I. roseiventris and Hawaiian S.I. longirostris subspecies), Grampus griseus (Risso's dolphins), Lagenodelphis hosei (Fraser's dolphins), Stenella attenuata (pantropical spotted dolphins), Tursiops aduncus (Indo-Pacific bottlenose dolphins), Globicephala macrorhynchus (short-finned pilot whales), Balaenoptera edeni (Bryde's whales), and Pseudorca crassidens (false killer whales) (Mustika et al., 2013). Spinner dolphins are the most frequently targeted species for ecotourism activities. Given the ecological significance of these species, conservation efforts are critical to ensure their protection. Additionally, there is an urgent need to regulate the operations of *jukung* boats to minimize disturbances to dolphin populations and enhance the sustainability of dolphin ecotourism.

2.3 Tri Hita Karana and Ecotourism

Tri Hita Karana (THK) is a foundational philosophy in Balinese Hinduism, emphasizing three harmonious relationships: between humans and God (*Parahyangan*), among humans (*Pawongan*), and between humans and nature (*Pelemahan*). In ecotourism, *Parahyangan* involves preserving Bali's cultural and spiritual heritage and integrating these elements into tourism practices (Ardana et al., 2024). This approach not only enhances the cultural experience for domestic and international tourists but also promotes sustainable tourism by fostering an understanding of Balinese Hindu traditions and ceremonies. Sacred areas designated as *Parahyangan* are protected from development and direct human interaction, ensuring spiritual integrity and environmental conservation, which indirectly support sustainable tourism (Boakes et al., 2022; Wijayanti et al., 2020). *Pawongan* emphasizes social harmony through community participation in ecotourism, integrating traditional practices into tourism strategies to strengthen cultural resilience. This integration fosters a balance between cultural preservation and tourism development, enabling communities to uphold their traditional values (Astawa et al., 2020; Prihadi et al., 2024). Meanwhile, *Pelemahan* focuses on responsible tourism practices that minimize ecological impacts and promote a harmonious relationship between humans and nature (Suryawan et al., 2024).

Suwetha (2015) and Wiwin (2021) highlight that THK serves as a framework for balancing these relationships, forming the foundation for sustainability. These cultural values are deeply embedded in Balinese communities as local wisdom, contributing to Bali's economic sustainability (Putra et al., 2014; Sutapa

et al., 2023). Additionally, THK guides the moral and ethical development of Balinese people, shaping their daily lives and interactions (Parimartha, 2011; Peters and Wardana, 2014; Sitiari et al., 2024).

The THK approach in ecotourism seeks to harmonize human, natural, and spiritual elements, distinguishing it from global ecotourism models that primarily focus on environmental conservation and community empowerment (Prihadi et al., 2024; Loureiro et al., 2024). The integration of local wisdom influences the perceptions of local communities, particularly fishermen, in developing sustainable tourism practices. It also provides knowledge and preventive measures against harmful practices like dolphin hunting, encouraging a shift toward dolphin watching to enhance local economies (Chen, 2011; Dalpaz et al., 2024). Thus, the principles of *Tri Hita Karana* serve as a vital foundation for ecotourism models that promote cultural preservation, economic well-being, and environmental protection.

2.4 Tri Mandala Concept

The *Tri Mandala* concept originates from Balinese Hindu cosmology, dividing space into three hierarchically structured zones: *utama* (sacred), *madya* (intermediate), and *nista* (profane). This spatial model has been traditionally applied in temple architecture (*sanggah*) and village layouts (*desa pekraman*) to maintain harmony between humans, nature, and the divine (Picard, 1997; Widyapuspita et al., 2021). In contemporary contexts, *Tri Mandala* has been adapted for cultural landscape management and sustainable tourism planning, particularly in Bali's coastal regions (Artayasa, 2022; Aryani and Tanuwidjaja, 2013; Riyanto and Bhattacarya, 2022). For instance, studies highlight its role in zoning marine protected areas, where utama zones restrict high-impact activities to preserve ecological sanctity, while *madya* and *nista* zones accommodate controlled tourism (Darma et al., 2020; Subrata et al., 2025). Despite its potential, empirical applications of *Tri Mandala* in dolphin ecotourism remain underexplored, particularly in reconciling spatial sacredness with wildlife mobility and tourist accessibility, a gap this study addresses.

While existing studies have extensively documented the socio-economic impacts of dolphin ecotourism and the cultural significance of Balinese spatial concepts like Tri Hita Karana, critical gaps remain in two key areas. First, the application of *Tri Mandala* as a practical spatial framework for coastal ecotourism management has been largely overlooked, with most research focusing on its architectural or terrestrial uses. Second, few studies have examined how sacred spatial zoning (*utama-madya-nista*) can be integrated with wildlife mobility patterns and modern tourism infrastructure, a necessary balance for sustainable dolphin tourism.

This study addresses these gaps by proposing *Tri Mandala* as a bridging framework that aligns Balinese cultural cosmology with marine ecotourism

planning in Lovina. By empirically mapping dolphin migration routes onto *Tri Mandala* zones and assessing community perceptions, the research offers a novel approach to culturally grounded conservation, while advancing theoretical debates in cultural geography (sacred space dynamics) and tourism geography (Indigenous knowledge in sustainable development). The findings aim to provide actionable insights for policymakers and set a precedent for integrating local wisdom into coastal resource management globally.

3. Method and Theory
3.1 Method
3.1.1 Data Collection
This study employs a qualitative research methodology to address challenges in dolphin ecotourism, utilizing data collection techniques such as surveys, participatory observation, structured interviews, and focus group discussions (FGDs) to explore the social, historical, and ideological dimensions of the local community (Gounder, 2012).

The Qualitative approach to examine dolphin ecotourism development through purposive sampling of 30 key stakeholders, including tourism officials from provincial/district offices, marine resource managers from Buleleng District Fisheries Department, tourism operators, local communities, academic experts, and media representatives (Table 1). Structured interviews were conducted using a 22-item instrument over a two-month period to collect data on governance frameworks, human-wildlife interactions, socioeconomic impacts, and cultural perceptions of marine space.

Table 1. Key Informant Background

No.	Stakeholder	Detail Participants	Participants
1	Government	Tourism Office of Buleleng Regency	4
		Department of Fisheries and Marine Affairs of Buleleng Regency	1
2	Academics	Tourism Expert (Academic)	2
3	Tourism Business Actors	PHRI Buleleng Regency	1
4	Transportation Services	Tour Guide (Captain Jukung)	3
5	Tourism Manager	Community Monitoring Group (Pokmaswas)	2
		Tourism Awareness Group (Pokdarwis)	2
		Management Board	2
6	Community Figures	Traditional Village Head	6
7	Tourists	Foreign/Domestic Tourists	5
8	Mass Media	RRI and Shanti Singaraja Communication and Information	2
Total			30

Source: Author processed data, 2024

The interview results were analyzed using MICMAC (Matrix of Cross-Impact Multiplications Applied to Classification) to assess interrelationships among 21 identified tourism development variables (Table 2). Complementary field surveys were conducted over three weeks, employing systematic behavioral observation techniques including GPS tracking, plotting, and vessel-based transects to document dolphin (Tursiops aduncus) movement patterns. The methodology incorporated temporal considerations aligned with Balinese cultural calendars and integrated participatory GIS mapping with local ecological knowledge. This comprehensive approach enabled spatial analysis of dolphin distribution relative to tourist activity zones while maintaining methodological rigor through adherence to established marine mammal research protocols. The design specifically addresses gaps in marine tourism carrying capacity assessment, indigenous knowledge application in coastal management, and multi-stakeholder governance models in ecotourism contexts.

Table 2. Sustainability Variables of Lovina Tourism Area Development

No.	Variable	No.	Variable
1	Traveler Expectations	12	Accessibility
2	Traveler Preference	13	Sanitation Infrastructure
3	Tourism Awareness Group	14	Dolphin Threats
4	Tourist Motivator	15	Tourism Area Regulation
5	Tourism Accommodations	16	Coral Reef Threats
6	Community Income	17	Tourist Attractions
7	Watershed Regulation	18	Stakeholder Committee
8	Natural Resource Conflict	19	Institutional Governance
9	Local Wisdom	20	Tour Guide Activities
10	Locally Generated Revenue	21	Coastal Litter Problems
11	Tourism Management Budget Policy Support		

Source: Rosalinda et al., 2022 and Soesanto, 2021 with modification.

The research was carried out in Lovina, North Bali, Indonesia, a region renowned for its high frequency of dolphin sightings compared to other areas, making it a prime location for dolphin ecotourism (Mustika et al., 2012, 2013). The geographical morphology of Lovina, particularly its role as a feeding ground, contributes to its attractiveness to dolphins (Perrin et al., 1992). Furthermore, the presence of specific dolphin species near the coast distinguishes Lovina's ecotourism offerings (Raudino et al., 2018). Figure 1 provides a spatial visualization of the research location.

3.1.2 MICMAC Analysis

The Matrix of Cross Impact Multiplication Applied to a Classification (MICMAC) method was employed to examine the relationships and interdependencies among variables (Godet, 1994). This analytical approach enables the identification of key variables based on their driving and dependence power, thereby highlighting the most influential factors within the system (Soesanto, 2021). The outcomes of the MICMAC analysis are illustrated in Figure 2. The study employed MICMAC) analysis to examine the 21 key variables identified in Table 1, assessing their interrelationships through a coded influence scale ranging from 0 (no influence) to 3 (strong influence). These variables were systematically categorized into four distinct quadrants: Quadrant I (Influential Variables) representing high-impact drivers, Quadrant II (Relay Variables) containing unstable elements that propagate systemic changes, Quadrant III (Dependent Variables) consisting of outcome factors, and Quadrant IV (Excluded/Independent Variables) comprising autonomous factors.
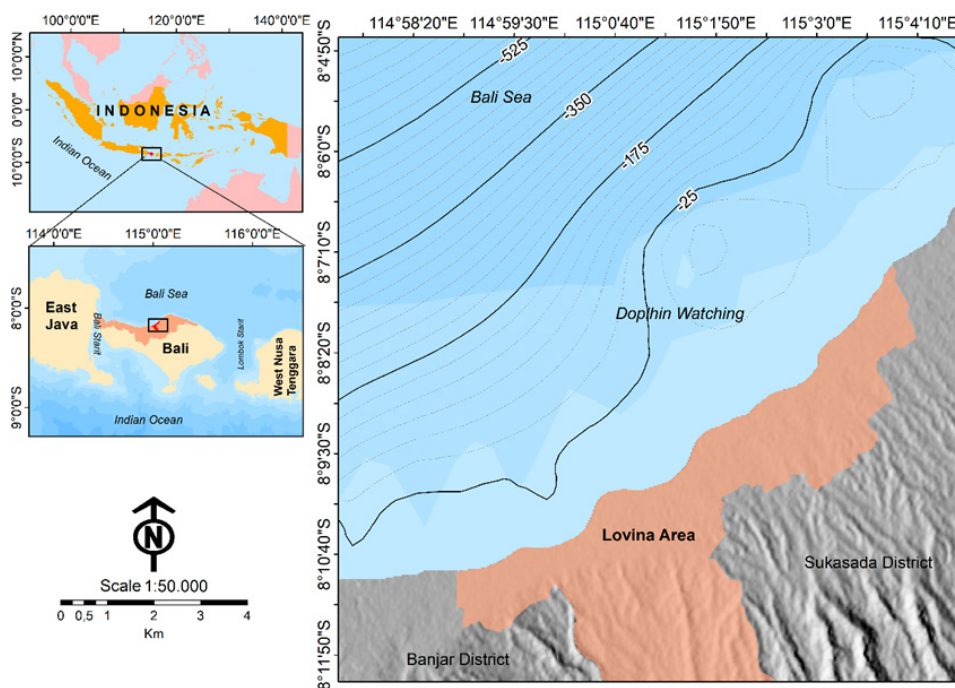

Figure 1. Research Location in the Marine of Lovina, North Bali, Indonesia (Original Processing Data)
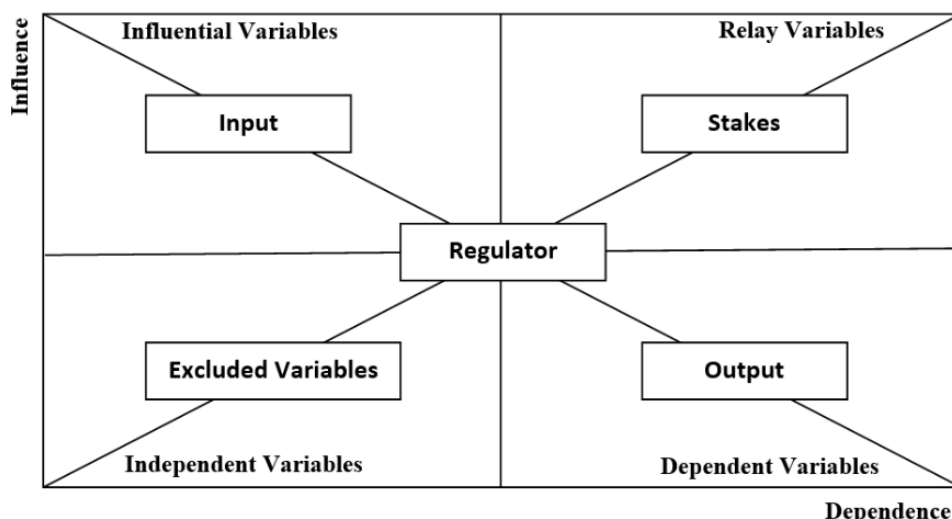
Figure 2. MICMAC Analysis. Source: modification from Chatziioannou and Alvarez-Icaza (2017) and Godet (1994)

For the spatial integration with the *Tri Mandala* framework, particular emphasis was placed on Quadrant II variables due to their critical role as indicators of system instability and their capacity to generate cascading effects throughout the ecotourism system when perturbed. This analytical approach aligns with complex adaptive systems theory in tourism geography, where such relay variables - including tourist density fluctuations, dolphin behavioral adaptations, and governance dynamics - represent pivotal leverage points for sustainable coastal zone management. The selection of Quadrant II variables for Tri Mandala integration provides a novel methodological contribution by bridging Western systems analysis with Indigenous Balinese spatial planning principles, particularly in addressing the dynamic interplay between marine wildlife behavior, tourism pressures, and cultural landscape resilience. This dual analytical framework offers both theoretical advancements in understanding socio-ecological systems in marine ecotourism contexts and practical applications for spatial zoning strategies that accommodate both ecological sensitivities and tourism development imperatives.

The analytical tools used in this study enable the integration and simultaneous processing of multiple variables through a systematic application. The outcomes of data processing using the MICMAC method are anticipated to pinpoint the most influential variables in sustainable tourism management. The first stage entails analyzing the characteristics of coastal tourism, including the potential of coastal resources and the market dynamics of coastal ecotourism. The second stage involves evaluating the commitments of stakeholders or key

players in the tourism sector. Stakeholders are identified using the hexahelix concept, and their roles, functions, levels of commitment, and existing commitments are assessed as part of the model design for subsequent phases. This stage combines various influential variables obtained from MICMAC analysis and in-depth interviews. The second model provides a framework for conducting the primary tourism activity in the Lovina Tourism Area, specifically dolphin watching. The current practice, which resembles dolphin hunting and is a central concern in this study, is expected to transition toward sustainability, emphasizing sustainable dolphin-watching practices. The detailed research framework is illustrated in Figure 3.
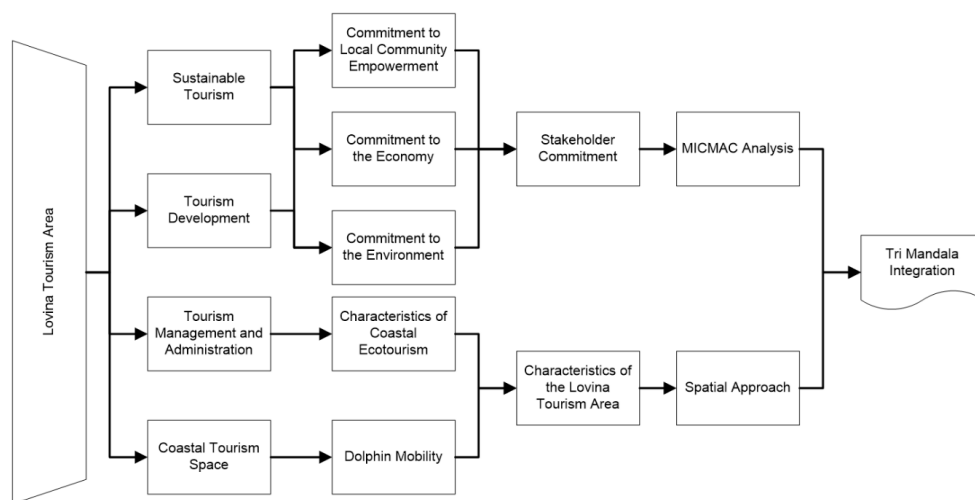

Figure 3. Tri Mandala Research Framework (Original Author Research Framework)

3.1.3 Tri Mandala Model

The model integrates qualitative methods with Fennell's (2015) ACE Tourism framework, which combines adventure, culture, and ecotourism. However, this framework was adapted by incorporating Dalem (2022) approach, resulting in the *Tri Mandala* concept, which integrates local wisdom and tourist-related variables. *The Tri Mandala* concept is illustrated in Figure 4. Additionally, a spatial approach using Geographic Information System (GIS) technology was employed to map dolphin ecotourism areas and identify optimal dolphin-watching routes (Mandowen and Mambrasar, 2021).
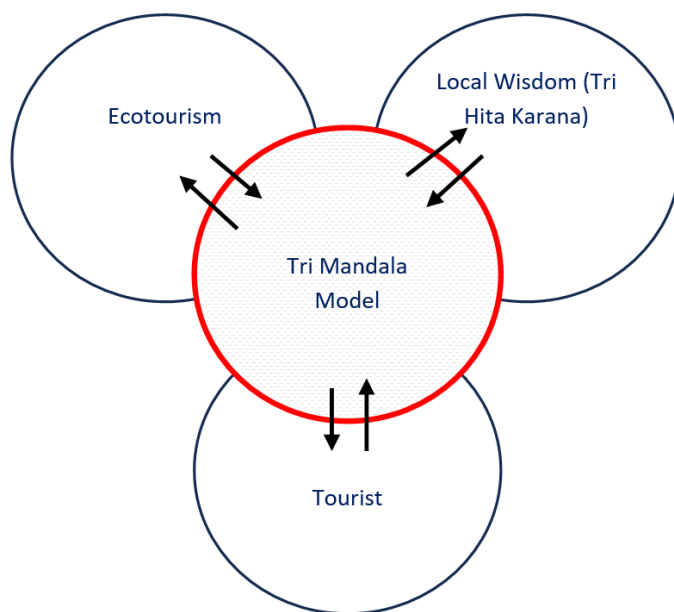
Figure 4. General Concept of the *Tri Mandala* Model (Original Concept adaptation from Fennell's, 2015)

The incorporation of MICMAC results into the *Tri Mandala* spatial model was achieved through systematic extraction and verification of Quadrant II variables, which represent critical instability factors in the ecotourism system. This integration process involved thematic analysis of three core *Tri Mandala* variables - ecotourism sustainability indicators, local wisdom manifestations, and tourist behavior patterns - to establish their spatial correlations within the sacred (*utama*), intermediate (*madya*), and profane (*nista*) zones. The synthesis of these analytical dimensions was further refined through a comprehensive literature review of cultural landscape management in marine tourism contexts (Snyder, 2019), ensuring the conceptual model's alignment with both traditional Balinese cosmology and contemporary sustainable tourism principles.

A triangulation approach was employed to validate the research findings through two rounds of Focus Group Discussions (FGDs) involving key stakeholders, including government representatives, academics, local communities, and tourism operators (Table 1). This participatory process ensured that the interrelationships within the *Tri Mandala* model were thoroughly examined and critically assessed from multiple perspectives, thereby enhancing its applicability to dolphin ecotourism management in Lovina. Comparative analysis of pre- and post-implementation data was conducted to evaluate the model's alignment with on-the-ground conditions, assessing whether the developed *Tri Mandala* framework effectively synergized with the ecological,

socio-cultural, and economic realities of the study area. This methodological rigor not only strengthens the model's credibility but also ensures its practical relevance for sustainable tourism planning, bridging the gap between theoretical spatial zoning (*Tri Mandala*) and real-world ecotourism governance. The iterative validation process further refines the model's capacity to balance wildlife conservation, cultural preservation, and tourism development, a critical consideration for marine ecotourism destinations globally.

The Tri Mandala model framework incorporates comprehensive identification of tourism area commitments and characteristics, including stakeholder motivations, expectations, and preferences, to evaluate the model's effectiveness in sustainable tourism governance for government entities, local communities, and visiting tourists. Critical to this analysis is recognizing that successful ecotourism development fundamentally depends on multi-stakeholder commitment and alignment of interests (Dewi, 2014). The model specifically examines coastal ecotourism market characteristics through three analytical dimensions: (1) tourist behavioral patterns within the destination, (2) service quality and visitor satisfaction metrics, and (3) strategic differentiation planning for coastal ecotourism activities. These interdependent factors are assessed through systematic stakeholder interviews, with results visualized through comparative graphical representations to demonstrate the *Tri Mandala* model's capacity to harmonize ecological preservation with tourism development imperatives.

3.2 Theory

Bali's tourism development is fundamentally rooted in Balinese culture, which is deeply inspired by Hindu teachings and the *Tri Hita Karana* philosophy, positioning tourism as a vehicle for cultural actualization. This symbiotic relationship fosters dynamic, mutually reinforcing growth between tourism and culture, ensuring synergistic, harmonious, and sustainable development that benefits community welfare, cultural preservation, and environmental conservation (Governor of Bali, 2015). Sustainable tourism strategies serve as the most appropriate paradigm and foundation for stakeholders in tourism planning and development. A comprehensive, multi-perspective approach is essential to formulate accurate and integrated actions addressing challenges and constraints, thereby preventing the decline of tourism product life cycles. Sustainable tourism development transcends mere economic gains through increased visitor numbers; it must uphold environmental protection and socio-cultural preservation as core principles.

Sustainable tourism development maintains equilibrium among three fundamental pillars: economic viability, socio-cultural acceptability,

and environmental sustainability (Aris et al., 2020). Indonesia's Minister of Tourism and Creative Economy Regulation No. 9/2021 on Guidelines for Sustainable Tourism Destinations provides a comprehensive framework for managing sustainable destinations, emphasizing four criteria: (1) sustainable management, (2) socio-economic sustainability, (3) cultural sustainability, and (4) environmental sustainability. As an ideal concept, sustainable tourism is critical for long-term resilience against global challenges such as climate change, resource depletion, and geopolitical instability. Ecotourism, as defined by the UNWTO (2012), represents "tourism that fully accounts for current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities." Aligned with this, The International Ecotourism Society (TIES) defines ecotourism as "responsible travel to natural areas that conserves the environment and improves local well-being" (Nugroho, 2011).

The development of ecotourism services within management systems is intrinsically linked to conservation areas, though clear demarcations for ecotourism zoning remain undefined. Drawing upon Berkes and Fast's integrated coastal management framework - the Lisbon Principles for sustainable ocean governance (Gale and Hill, 2016) - this study adopts five foundational tenets: (1) the responsibility principle, (2) subsidiarity principle, (3) adaptive management principle, (4) precautionary principle, and (5) participation principle. These principles extend beyond coastal management to provide a holistic approach for marine and coastal activities, emphasizing responsible governance, decentralized decision-making, adaptive strategies, environmental risk mitigation, and stakeholder engagement. Effective ecotourism development requires meticulous planning and environmentally sensitive management strategies that simultaneously benefit conservation efforts and local communities.

Theoretical foundations posit that ecotourism development must be grounded in scientific assessment, as not all locations are suitable for ecotourism designation. Site selection must consider sustainability principles encompassing three core "eco" elements (Gale and Hill, 2016): (1) ecological compatibility (environmentally friendly operations), (2) economic viability (local community benefits), and (3) community evaluation (incorporating local perspectives). This tripartite framework aligns with Page and Connell (2020) conceptualization of ecotourism as a specialized form of nature-based tourism characterized by: natural setting preservation, ecological sustainability, and environmental education components. These theoretical constructs inform the development of a Coastal Ecotourism Model for Lovina Tourism Area, addressing critical research questions about balancing tourism growth with marine conservation

through: Spatial Zoning Integration: Applying Lisbon Principles to dolphin habitat protection, Community-Centric Design: Implementing participatory governance models, and Educational Infrastructure: Developing interpretive programs about marine ecosystems.

4. Results and Discussion

This study identifies three significant findings that underscore the relationship between tourism and cultural preservation through ecotourism, as conceptualized in the *Tri Mandala* framework. First, the *Tri Mandala* concept is successfully integrated into dolphin ecotourism, merging cultural preservation and local wisdom to promote sustainable tourism development. Second, the research emphasizes the critical role of stakeholder commitment to sustainable tourism, elucidating how stakeholders can effectively balance tourism, cultural heritage, and local wisdom. Third, the study examines tourist motivations, expectations, and preferences, revealing that the integration of tourism and cultural elements significantly enhances visitor satisfaction and overall experience.

4.1 Tri Mandala Model in Dolphin Ecotourism
4.1.1 MICMAC Result

The MICMAC analysis revealed inter-variable relationships through a 0-3 coding system evaluating influence levels, identifying eleven variables with particularly strong systemic impacts: Institutional Governance (IG), Tourist Attraction (TW), Tourist Accommodations (TA), Locally Generated Revenue (LGR), Dolphin Threats (DT), Coral Reef Threats (CRT), Tour Guide Activities (TGA), Natural Resource Conflict (NRC), Stakeholder Committee (SC), Tourist Motivation (TM), and Coastal Litter Problems (CLP) (Figure 5). Notably, only three variables demonstrated consistently strong influence across the system - Tourist Attraction (TW), Dolphin Threats (DT), and Coral Reef Threats (CRT) - all classified within Quadrant II (Figure 6), indicating their role as key drivers with both high influence on other factors and relative independence from external pressures.

Figure 6 demonstrates the strategic classification of all variables into distinct quadrants based on their systemic interactions, revealing critical patterns for coastal ecotourism management. Quadrant I contains six variables, with three key elements - Motivation, Expectations, and Preferences - serving as foundational supports for *Tri Mandala* model implementation due to their capacity to generate impactful policy interventions. Quadrant II's five variables exhibit high instability, where any modifications create ripple effects across other quadrants, making them crucial framework components when combined with interview findings and literature review conclusions.

	1: TAR	2: IG	3: TMBPS	4: SC	5: TAG	6: LW	7: WR	8: SI	9: TW	10: TA	11: A	12: MW	13: TE	14: TP	15: CI	16: LGR	17: CLP	18: DT	19: CRT	20: TGA	21: NRC
1 : TAR	0	2	1	3	2	3	2	1	3	2	1	3	2	2	0	2	3	3	3	2	2
2 : IG	3	0	1	3	1	2	1	1	3	1	1	3	2	2	1	2	2	2	2	2	2
3 : TMBPS	2	1	0	3	1	1	1	1	2	1	2	2	1	2	1	3	2	2	2	2	2
4 : SC	2	2	3	0	2	2	1	1	3	1	1	3	1	2	2	3	1	2	3	2	2
5 : TAG	2	2	3	3	0	2	1	3	3	2	2	3	1	2	2	2	3	3	3	3	2
6 : LW	2	1	1	3	3	0	2	2	3	1	1	2	1	2	1	1	1	2	2	1	2
7 : WR	2	1	2	3	2	2	0	3	3	1	1	2	1	1	1	3	3	3	3	1	2
8 : SI	2	2	1	3	1	2	3	0	3	3	1	3	2	1	2	3	3	3	3	1	2
9 : TW	3	3	1	2	2	2	1	3	0	2	3	3	2	1	2	2	3	3	3	3	2
10 : TA	3	3	1	2	2	2	1	3	2	0	3	3	2	1	2	2	3	3	3	3	2
11 : A	2	1	3	2	2	1	1	1	2	2	0	2	1	2	1	3	1	0	3	1	1
12 : MW	2	2	1	3	2	1	1	3	3	3	3	0	3	3	1	1	3	3	0	3	2
13 : TE	2	2	1	3	2	1	1	3	3	3	3	3	0	3	1	1	3	3	3	3	2
14 : TP	2	2	1	3	2	1	1	3	3	3	3	3	3	0	1	1	3	3	3	3	2
15 : CI	1	3	2	3	2	1	1	2	3	3	1	2	2	1	0	2	2	3	2	2	2
16 : LGR	3	1	1	3	1	1	1	3	3	2	2	2	1	1	0	2	2	2	1	1	1
17 : CLP	2	2	2	3	3	1	1	3	3	2	1	1	1	1	1	2	0	2	2	1	1
18 : DT	3	3	2	3	3	3	2	3	3	2	1	0	0	1	2	1	3	0	3	3	2
19 : CRT	3	3	2	3	3	3	2	3	3	1	1	0	0	0	1	2	1	3	0	3	2
20 : TGA	3	3	2	3	3	2	1	1	3	1	2	0	0	1	2	1	2	3	2	0	1
21 : NRC	3	2	2	3	2	2	1	3	3	2	1	0	0	0	2	1	3	3	3	3	0

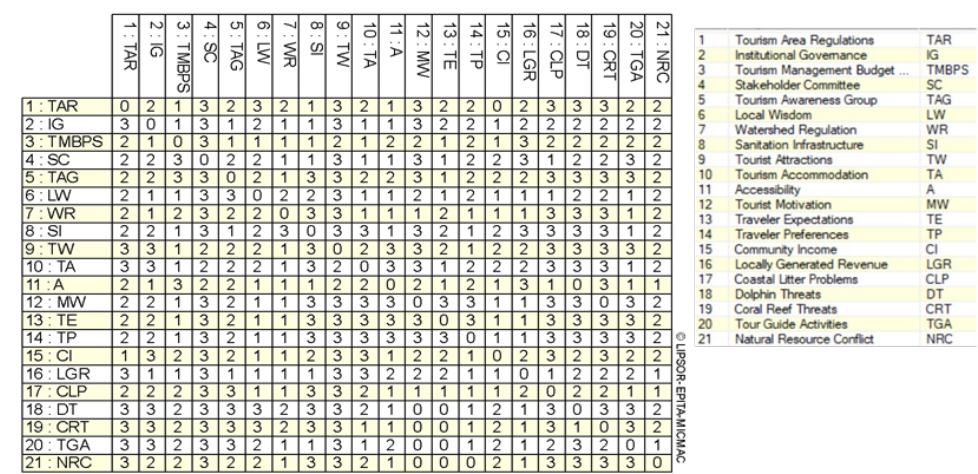|		
1	Tourism Area Regulations	TAR
2	Institutional Governance	IG
3	Tourism Management Budget ...	TMBPS
4	Stakeholder Committee	SC
5	Tourism Awareness Group	TAG
6	Local Wisdom	LW
7	Watershed Regulation	WR
8	Sanitation Infrastructure	SI
9	Tourist Attractions	TW
10	Tourism Accommodation	TA
11	Accessibility	A
12	Tourist Motivation	MW
13	Traveler Expectations	TE
14	Traveler Preferences	TP
15	Community Income	CI
16	Locally Generated Revenue	LGR
17	Coastal Litter Problems	CLP
18	Dolphin Threats	DT
19	Coral Reef Threats	CRT
20	Tour Guide Activities	TGA
21	Natural Resource Conflict	NRC

Figure 5. Matrix of Potential Influences (Source: MICMAC processed result, 2024)

The eight variables in Quadrant III demonstrate dependency on Quadrant II's dynamics, particularly evident in the Commitment variable which requires specific implementation mechanisms and responds directly to changes in Quadrant II's core elements: Tourist Attraction (TW), Dolphin Threats (DT), and Coral Reef Threats (CRT). Quadrant IV contains the largest cluster (seven variables), including Local Wisdom which functions paradoxically as both a simplifying/eliminating factor through its community-rooted nature and occasionally as a perceived less-relevant element in formal management systems.
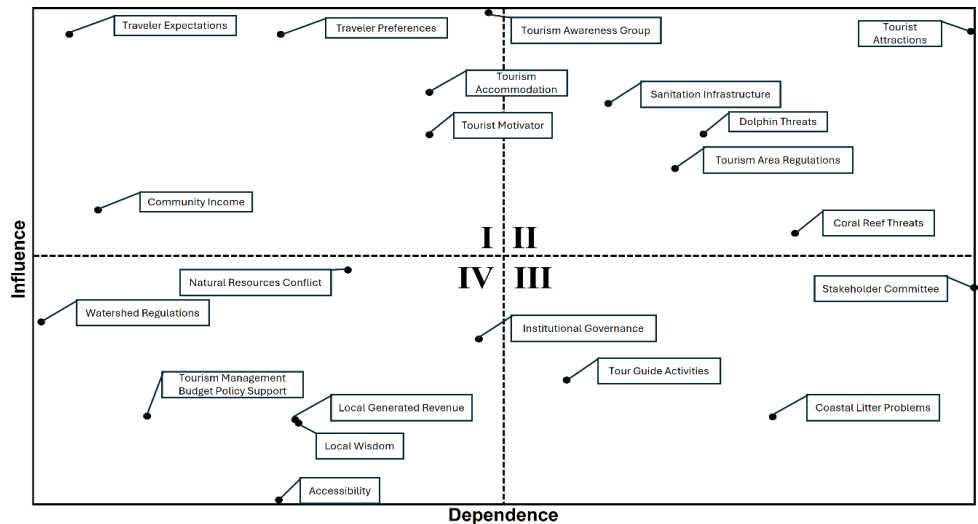
Figure 6. Variable Categories in Each Quadrant (Source: MICMAC processed result, 2024)

4.1.2 Tri Mandala Model Integration

The *Tri Mandala* framework was operationalized through systematic integration of MICMAC analysis outputs and verified interview conclusions, establishing a robust foundation for model development. Key *Tri Mandala* variables - ecotourism sustainability indicators, tourist behavior patterns, and local wisdom manifestations - were cross-referenced with Quadrant II MICMAC results demonstrating strong systemic interactions (Table 3), achieved through semantic alignment of variable definitions. The synthesized findings were further refined through comparative analysis with existing literature to establish implementation boundaries and feasibility parameters for cultural-ecological compatibility.

Table 3. Integration of *Tri Mandala* Variables, MICMAC analysis, and Interview Results

Variable		Interview (Conclusion and Verification)	Study literature	FGD I Result
Tri Mandala	MICMAC (Kuadran II)			
Ecotourism	1. Tourist Attraction 2. Dolphin Threats 3. Coral Reef Threats	1. Dolphin watching remains the primary attraction. 2. Diversification through supplementary marine activities such as snorkeling and diving. 3. Implementation of mandatory buffer zones between vessels and dolphins.	1. Regulated Observation Distances: Maintain a 50–100 m buffer (ANZECC, 2000; Constantine et al., 2004; Mustika et al., 2013; Westerlaken, 2024) to reduce disturbance and align with global standards. 2. Experience Diversification Framework: Combine dolphin watching with other attractions for sustainable ecotourism (Mustika et al., 2012; Orams, 2002).	1. Limited Area for Activity Diversification: Tourism zone (~2.5 km²) restricts activity diversification and capacity. 2. Vessel Proximity Risks: Boats <50 m increase collision risks in dense, narrow corridors. 3. Science-Based Distance Protocol: Maintain ≥50 m to reduce dolphin stress (science-based guideline).

Variable		Interview (Conclusion and Verification)	Study literature	FGD I Result
Tri Mandala	MICMAC (Kuadran II)			
Tourist	Sanitation Infrastructure	1. No standardized bins every 200–300 m increases pressure. 2. Limited Resting and Interpretation Facilities: Lack of rest and interpretation areas.	New attractions boost visitors (+40–60% in 3 yrs) but increase waste (0.8–1.2 kg/visitor/day) and noise (>120 dB within 500 m) (Westerlaken et al., 2022; Spadoni et al., 2025).	1. Local Government and Industry: Sustainable dolphin tourism needs long-term commitment and 50 m rule enforcement. 2. Academic Partnership in Tourism Planning: Universities provide capacity studies and community-based monitoring.
Local Wisedom	Tourism Area Regulation	1. Science-based protocols for dolphin watching. 2. Government-Led Management Systems: Task forces, dedicated funding, and integration with provincial plans.	Balinese Tri Hita Karana & Tri Mandala improve tourism with higher visitor satisfaction (+28–35%), stronger conservation compliance (+40–50%), and fairer revenue sharing (+25–30%) (Trianasari et al., 2021; Prihadi et al., 2024).	1. Dual Governance System: Synergy between adat institutions and Buleleng Regency enhances local management. 2. Formalized Customary Regulations: Codification of awig-awig for Lovina Beach governance. 3. Cultural Framework Harmonization: Integrating Tri Hita Karana with Tri Mandala supports authentic, SDG-aligned tourism.

Source: Processed Data, 2024

This preliminary model underwent first-stage triangulation via Focus Group Discussions (FGDs) involving multidisciplinary experts including Buleleng Regency tourism officials, academic specialists, traditional *jukung* boat captains, and representative domestic/international tourists (Figure 7), ensuring the framework's practical applicability while maintaining theoretical rigor. The participatory validation process specifically addressed: (1) spatial congruence between MICMAC-derived management priorities and Tri Mandala's sacred zoning principles, (2) operationalization challenges in marine versus terrestrial cultural landscapes, and (3) stakeholder-specific adaptation requirements for implementation.

Figure 7. First Discussion Group Forum (Source: Original Photo by Made Dwipayana).

The integrated findings presented in Table 3 were subsequently visualized through the *Tri Mandala* conceptual model (Figure 8), which was developed through a synthesis of FGD outcomes, coastal ecotourism characteristics, MICMAC analysis, and stakeholder interviews. A primary consideration was maintaining a 50-meter vessel approach distance established through FGD to minimize dolphin behavioral disruption while incorporating Balinese cultural governance principles into the spatial zoning framework. These distances aim to minimize disturbance to marine animals and respect their territorial boundaries. The 50-meter boundary is optimal for dolphin observation via *jukung* (traditional boats), allowing dolphins to exhibit natural behaviors such as resting, traveling, socializing, diving, and milling (Christiansen et al., 2010; Quintana Martín-Montalvo et al., 2021; Shane et al., 1986; Stensland et al., 2007; Stockin et al., 2008).

Figure 8. *Tri Mandala* in Dolphin Ecotourism (Source: Original Model by I Putu Ananda Citra)

The *Tri Mandala* model addresses a critical gap in culturally based tourism management by operationalizing abstract Balinese cosmological concepts (*Tri Hita Karana*) into a tangible spatial framework with clearly demarcated zones: sacred (*utama*) core habitats, intermediate (*madya*) observation corridors, and service (*nista*) access areas. However, the model's innovation lies not merely in its theoretical foundation but in its applied spatial mapping transforming cultural principles into enforceable marine zoning that harmonizes ecological threshold), traditional law (*awig-awig*), and modern management protocols. This geospatial implementation enables precise governance of: (1) vessel traffic density, (2) visitor activity distribution, and (3) habitat protection levels, while serving as a replicable template for other Indigenous coastal communities navigating tourism-conservation trade-offs.

4.1.3 Tri Mandala Model Mapping

The *Tri Mandala* concept has been operationalized into spatial information to define the boundaries of *nista mandala*, *madya mandala*, and *utama mandala*. This step is essential, as interviews with stakeholders revealed significant issues in dolphin-watching practices. Georgia (Ph.D. student), an Australian tourist, emphasized (interview, 07 November 2024):

> *"Behavioral changes, better timing, and stricter control over the number of boats are needed, particularly to prevent disruptions to dolphin migration routes when they surface."* She further noted, *"Compared to Australian destinations, the regulations here are less stringent, and there is a noticeable lack of environmental awareness among both operators and tourists."*

This perspective was supported by *jukung* captains, including Ketut Lana and Komang Budiastra (*Jukung* Captain), who highlighted the unregulated behavior of boat operators (interview, 23 November 2024):

> *"Many captains cut across migration routes due to a lack of awareness and enforcement. Although the Western Foundation and Yayasan Bali Bersih have established regulations and distributed brochures to fishing groups, the lack of oversight makes these efforts ineffective. Most violations could be minimized with proper supervision."*

Spatial information is crucial for guiding both tourists and *jukung* operators in dolphin observation activities. The *Tri Mandala* concept has been integrated into this spatial framework to ensure sustainable practices. Figure 9 illustrates the findings from a three-day survey of dolphin migration routes, demonstrating consistent patterns in their movement. The observation distance for *jukung* is maintained at 50 meters, as recommended by Westerlaken (2021, 2024), to minimize disturbance to dolphin habitats. The *utama mandala* encompasses the 50-meter zone around the dolphins, while the *madya mandala* serves as the observation area, ensuring that boats do not intrude into the sacred zone. The *nista mandala* regulates boat circulation, requiring a 50-meter buffer before crossing the dolphins' path or entering the *utama mandala* from the shore. This integrated approach ensures the protection of dolphin habitats and promotes a harmonious relationship between humans and nature, making the *Tri Mandala* model a valuable tool for dolphin ecotourism in Lovina.

The *Utama*, *Madya*, and *Nista Mandala* zones constitute a fluid spatial framework that adapts to the dynamic movement patterns of dolphins, though our three-week behavioral tracking study revealed consistent dolphin migration routes with minimal spatial deviation. Critical to this zoning system is vessel positioning relative to dolphin pods—when vessels approach from the north, they must avoid crossing southward through dolphin paths unless returning to shore, with all return routes requiring counter-directional movement away from active observation areas to mitigate collision risks among *jukung* (traditional boats) and minimize acoustic disturbance. Within the *Madya Mandala* observation zone, vessels must maintain parallel tracking of dolphin movements rather than direct pursuit, as the study documented

stable northeast-southwest transit corridors that enable predictable, low-impact viewing. This protocol directly supports the ecological integrity of the *Utama* zone (core habitat). While the spatial expression of these zones shifts daily with cetacean movement, the 50-meter buffer radius remains fixed as a regulatory constant, creating an innovative "sliding-zones" management model that combines static protective distances with dynamic spatial boundaries, an approach that increased observed comfort behaviors. The system's efficacy stems from its synchronization of three elements: Balinese spatial cosmology (*Tri Mandala*), marine mammal ethology, and navigation constraints, offering a replicable framework for coastal communities managing dolphin tourism amid changing marine conditions.
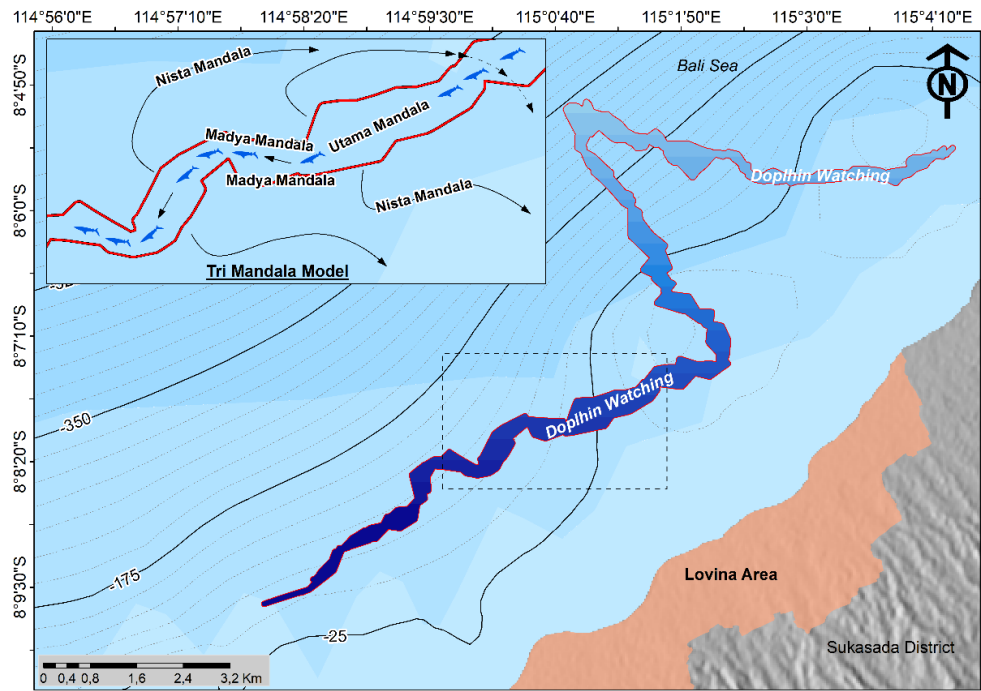
Figure 9. Mapping of the *Tri Mandala* Model (Source: Original Processing Data, 2024)

The operationalization of this framework necessitates robust institutional support through formalized regulations from both governmental authorities and local customary institutions, requiring the establishment of a co-management system that integrates modern monitoring technologies with traditional governance structures. To enhance vessel tracking efficacy, we propose mandatory digital registration and real-time GPS plotting of all *jukung* boats, creating a centralized monitoring system that reduces unauthorized incursions into protected zones. This technological integration elevates the critical role

of regional government in administering the *Tri Mandala* model through three key mechanisms: (1) legislative endorsement of zoning boundaries, (2) compliance enforcement infrastructure, and (3) visitor management systems. The second-phase FGD (Figure 10) served as a critical validation platform, engaging 26 stakeholders across government agencies (The Buleleng Tourism Office and the Buleleng Regency Department of Fisheries and Marine Affairs), customary leaders (*Bendesa Adat*), Academics, tourism operators (*Jukung* Owner Association), and domestic/international visitor representatives to assess model feasibility.

The second FGD concluded that the *Tri Mandala* zoning system can be implemented by providing guidance to *jukung* captains to understand and monitor dolphin-watching activities within a 50-meter distance. Furthermore, areas outside the Primary (*Utama*), Intermediate (*Madya*), and Outer (*Nista*) *Mandala* zones hold potential for alternative attractions such as coral reef diving and snorkeling, supported by additional regulatory frameworks. A phased implementation of the *Tri Mandala* model is necessary, as the full adoption of new systems requires gradual adaptation.

Figure 10. Second Discussion Group Forum (Source: Original Photo by Ketut Adhinugraha Satya Bhakti)

The local government, specifically the Buleleng Regency Tourism Office, will support the *Tri Mandala* model through programs aimed at enhancing tourism in the Lovina area. Given these considerations, sustainable tourism principles must remain central to the *Tri Mandala* framework. Additionally, government commitment will determine whether this model can effectively position Lovina as a sustainable tourism destination. Equally critical are the coastal ecotourism characteristics—encompassing visitor motivations, expectations, and preferences—which must align with the *Tri Mandala* implementation. These three dimensions are integral to the design of the *Tri Mandala* model, ensuring its coherence with ecotourism objectives.

The *Tri Mandala* concept embodies a balance between human behavior, nature, and stakeholders, including government and local communities. This framework enhances dolphin ecotourism by creating a cohesive tourism experience that integrates attractions, location, and atmosphere. A key strength of the *Tri Mandala* model is its incorporation of spiritual and cultural elements to regulate ecotourism development—a unique feature not typically found in other ecotourism destinations. Additionally, the model can be implemented through interactive spatial information, providing a clear hierarchy for dolphin ecotourism activities. This integration fosters harmony and establishes a commitment to sustainable tourism development. However, the model has limitations, as it does not fully account for ecological considerations due to research constraints.

The adaptation of the *Tri Mandala* model to other regions is feasible, provided that these areas fully comprehend the conceptual meaning of *Tri Mandala*. However, if local cultural adaptations necessitate modifications, the 50-meter distance regulation should remain a fixed parameter, as altering this boundary is not recommended. Despite these challenges, research by Faluti et al. (2024), Patabang et al. (2023), and Suhartapa and Sulistyo (2021) confirm that comprehensive tourism attractions significantly boost tourist motivation. Furthermore, Riezal and Rosidi (2018) emphasize the role of affordable accommodations, noting that North Bali's lower costs compared to South Bali serve as an additional draw for tourists.

4.2 Tri Mandala in Sustainable Tourism
4.2.1 Commitment Stakeholder

The commitment to harmonizing dolphin ecotourism, local wisdom, and tourist engagement for local economic development is the cornerstone of the *Tri Mandala* model. This commitment is particularly evident in the regulation of tourism activities, especially the behavior of traditional boat operators (*jukung*), who also function as fishermen in the tourism area. These operators

must actively protect dolphin habitats, populations, and migration routes. Such protection can only be realized through comprehensive regulations rooted in Balinese local wisdom, such as the *Tri Hita Karana* philosophy. These traditional regulations, which hold more sway than national laws in Bali, govern human behavior and are believed to bring negative consequences if violated. Therefore, spatial zoning is essential to ensure compliance among both locals and tourists (Mitchell et al., 2016). The *Tri Mandala* concept is deeply connected to Balinese spiritual beliefs, including *sanga mandala*, *tri angga*, *sukat* (measurements), *natah*, *ragam rias*, and *warna* (Suyoga, 2017; Wiwin, 2021).

Commitment is a central concern for the Lovina community, as government support plays a pivotal role in ensuring the resilience and sustainability of dolphin ecotourism. The sustainability of dolphin ecotourism will positively impact various aspects, particularly local economic growth and community empowerment. The Buleleng government has indirectly supported sustainable dolphin ecotourism through development plans detailed in Buleleng Regent Regulation No. 7 of 2019, which outlines the Master Plan for Tourism Development (RIPPARDA) of Buleleng Regency for 2020-2025. Eny (Head of the Tourism Destination Division of Buleleng Regency) emphasized the implementation of this regulation, stating that (interview, 25 November 2024):

> *"Dolphin watching is a flagship attraction in Lovina, and the Bali Provincial Marine and Fisheries Resource Management Agency has introduced a code of conduct that explicitly prohibits swimming and photographing with dolphins."*

Mila (Head of the Tourism Resources Division), stated that the development of the Lovina Tourism area is consistently geared towards sustainable tourism (interview, 26 November 2024):

> *"The Buleleng Tourism Office has demonstrated its commitment to sustainable tourism by prioritizing the conservation of coral reefs and dolphins, which are central to the tourism resources in the Lovina Tourism Area."*

Strong constructive collaboration and commitment are critical for sustainable tourism management, requiring collaboration not only from the government but also from all stakeholders. Fishermen play a vital role as facilitators of change in dolphin ecotourism, promoting mutually beneficial relationships with local communities (Hallwass et al., 2024). Three key commitments are prioritized for sustainable tourism development in Lovina: environment, economic, and local community empowerment.

Figure 11 demonstrates that most stakeholder commitments are rated highly. However, the low rating in environmental commitment underscores

challenges such as limited community awareness, inadequate government support for dolphin conservation, and a shortage of human resources with expertise in dolphin behavior and conservation. The moderate rating in economic commitment reflects suboptimal tourism services and infrastructure development, often hindered by the need for mediation between local cultural practices and government administrative processes. Additionally, construction in Bali is restricted, as buildings cannot exceed the height of a coconut tree, further limiting development opportunities.
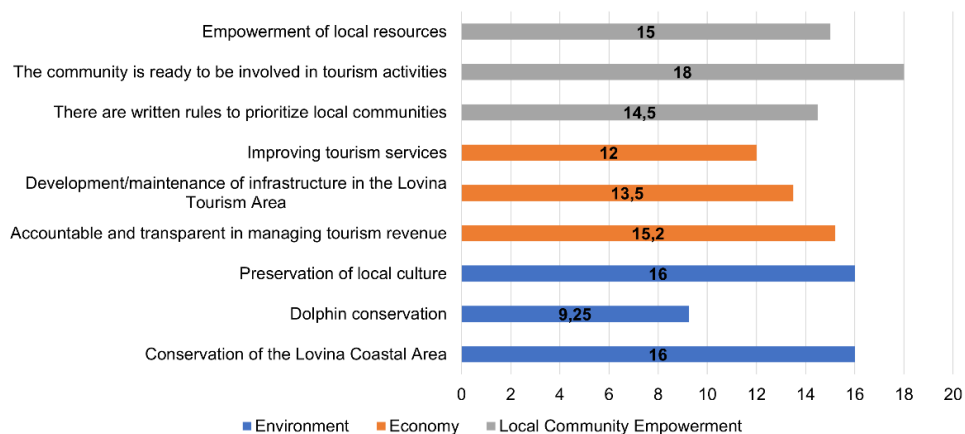
Figure 11. Stakeholder Commitment to Sustainable Tourism in the Fields of Environment, Economy, and Local Community Empowerment (Source: Original Processing Data, 2024)

Furthermore, this study indirectly explores tourist commitment as a demonstration of support and assurance, alongside the commitments of local governments (The Buleleng Tourism Office and the Buleleng Regency Department of Fisheries and Marine Affairs) and stakeholders (PHRI Buleleng Regency Community Monitoring Group (Pokmaswas), Tourism Awareness Group (Pokdarwis), and Management Board) toward sustainable tourism. Six primary commitments from tourists highlight their engagement in fostering sustainable tourism development in Lovina, including:

[1] Commitment to Environmental Conservation:
    a. Avoid littering, particularly on beaches and in marine areas.
    b. Minimizing single-use plastic by carrying reusable water bottles and shopping bags.
    c. Ensuring dolphins are not disturbed or fed during marine tourism activities to preserve the marine ecosystem's balance.
    d. Opting for eco-friendly transportation methods, such as walking or cycling, to lower carbon emissions.

[2] Commitment to Respecting Local Culture and Traditions (Local Wisdom):
   a. Dressing appropriately when visiting sacred or culturally significant locations.
   b. Adhering to local customs and social norms.
   c. Refraining from cultural exploitation negatively impacts local communities.
   d. Valuing and engaging with local arts and traditions to honor cultural heritage.

[3] Commitment to Supporting the Local Economy:
   a. Buying locally made products from SMEs, including handicrafts and traditional Buleleng cuisine.
   b. Choosing accommodations managed by local communities to bolster their economic well-being.
   c. Hiring local tour guides with extensive knowledge of Lovina's ecosystems and cultural heritage.
   d. Engaging in community-based tourism initiatives organized by local residents.

[4] Commitment to Being a Responsible Tourist;

[5] Commitment to Educating Oneself About Sustainable Tourism Practices Prior to Visiting;

[6] Commitment to Promoting Awareness About the Importance of Preserving Lovina Through Social Media and Other Platforms:
   a. Participating in conservation initiatives, such as beach clean-ups or environmental volunteer programs.
   b. Adhering to established boundaries for marine and ecotourism activities to reduce adverse effects on the environment.

The local government, through the Buleleng Regency Tourism Office, demonstrates its commitment by organizing an annual event known as the Lovina Festival. In addition to supporting sustainable tourism, the local government's commitment extends to environmental conservation, addressing the impacts of tourism growth. This is evident in the establishment of an integrated waste management system, known as 3R (Reduce-Reuse-Recycle), in the Lovina tourism area, which aims to protect and preserve the environment. This initiative holds significant importance, as research by Trianasari et al. (2021) and Wiener (2013) indicates that events within tourism areas play a crucial role in shaping visitor perceptions through dynamic activities. Consequently, the implementation of such events is expected to enhance local economic benefits by increasing tourist arrivals. However, challenges such as waste accumulation, traffic congestion, and noise pollution necessitate careful harmonization to ensure

that events not only stimulate economic growth but also preserve the integrity of coastal ecotourism environments given these concerns, the commitment of local communities and businesses is essential to complement governmental efforts. Collaborative actions—overseen by traditional stakeholders—are required to regulate and maintain the stability of Lovina's tourism zone.

4.2.2 Motivation, Expectations, and Preferences of Tourists

The popularity of dolphin watching in North Bali's Lovina region stems from its strong alignment with tourist motivations, expectations, and preferences. Despite being limited to traditional boats as the sole observation method, dolphin watching in Lovina must be developed into a memorable tourism experience. This effort must compete with other dolphin-watching destinations that offer diverse observation methods, such as diving or small aircraft (Arcangeli and Crosti, 2009; Hoyt, 2001). To achieve this, stakeholders must work together to enhance dolphin ecotourism by increasing their involvement in dolphin-watching activities. Such engagement will positively influence tourists, with each stakeholder's role adapted to their specific typology (Gaitree and Ian, 2015). When stakeholders collectively commit to sustainability, dolphin ecotourism can deliver comprehensive benefits, including business opportunities, marine protection, economic growth, and improved livelihoods for local residents. Nevertheless, challenges persist, such as difficulties in managing certain stakeholders, declining local community participation, and revenue leakage within the tourism sector (O'Connor et al., 2009; Wiener et al., 2009).

Tourist motivation, expectations, and preferences in ecotourism must be grounded in realistic, comprehensive, and responsible information. The primary driver for tourists is motivation, which fulfills their needs and provides intrinsic satisfaction during their travel experiences (Fennell, 2015). This motivation creates a sense of imbalance in individual desires, prompting tourists to visit. According to Iso-Ahola (1982), there are two main motivations for travel: (1) seeking novelty in contrast to one's current environment, and (2) escaping from one's present environment as a form of retreat from problems or monotonous routines. These motivations are inherently private or interpersonal.

Expectations are the foundation for why ecotourism becomes a destination (Cutaș et al., 2011). According to Hughes et al. (2011), four key elements fulfill expectations in wildlife tourism: sensory impressions, emotional affinity, reflective response, and behavioral response. The *Tri Mandala* Model effectively addresses these expectations in dolphin ecotourism. By fostering harmony and constructive collaboration, tourists can enjoy a structured yet natural dolphin-watching experience, observing dolphin patterns and habitats firsthand. The first sensory impressions, tourists witness dolphins in their natural habitat,

displaying authentic behaviors, while also enjoying the breathtaking sunrise before the dolphin-watching activity. While emotional affinity, observing dolphins swimming in groups, interacting across sizes, and performing graceful leaps fosters a deep emotional connection. Then reflective response, while direct interaction with dolphins is not feasible, tourists are guided to coral reef areas to explore underwater beauty, creating a sense of constructive collaboration with the dolphins that inhabit North Bali's waters. Finally, behavioral response, tourists are encouraged to maintain ocean cleanliness by avoiding littering, recognizing the importance of preserving marine wildlife populations. The *Tri Mandala* Model, through its comprehensive approach, aims to fulfill these expectations, offering tourists a compelling reason to engage in dolphin ecotourism.

The evaluation of motivation, expectations, and preferences in Lovina indicates predominantly positive outcomes (>70%) (Figure 12). While motivation scores were generally high, the relaxation category scored below 80% due to the nature of dolphin-watching activities, which occur in the early morning and involve constant movement, leaving little time for beachside relaxation. Expectations, however, revealed areas for improvement, with three out of four categories scoring below 80%. Challenges include *jukung* boats anchoring on coral reefs, tour guides approaching dolphins too closely, and limited access to ticket information for dolphin-watching activities. The absence of standardized pricing also complicates the selection of *jukung* captains as guides. Preferences showed that 50% of tourists favored dolphin-watching as the primary activity, though the lack of alternative sustainable activities limits further engagement. Notably, 100% of tourists preferred a tranquil dolphin ecotourism experience, highlighting their desire for authentic and less crowded destinations.
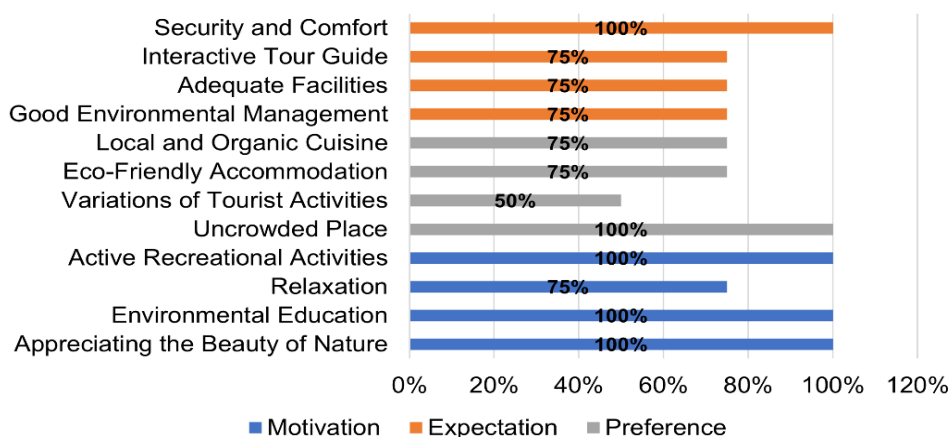

Figure 12. Tourist Motivations, Expectations, and Preferences for Dolphin Ecotourism (Original Processing Data)

Studies by Curtin (2010) and Hughes et al. (2005) emphasize that wildlife tourism, which creates memorable and positive experiences for tourists, leaves a lasting impression. Additionally, preserving natural environments is essential for sustainability, as prioritizing excessive utility values can lead to the degradation of natural habitats (Lovelock and Robinson, 2005; Tisdell and Wilson, 2004). Tourists who visit dolphin ecotourism sites are often those with a specific interest in wildlife, particularly dolphins. This is consistent with research by Lemelin (2007, 2008) and Lindsey et al. (2007), which indicates that niche wildlife tourism destinations attract tourists who are specifically interested in those elements—such as dolphins or coastal ecosystems. Nevertheless, dolphin ecotourism requires further development, particularly in facilitating interactions, to strengthen tourist perceptions and meet their expectations of engaging with dolphins rather than simply observing them (Janik, 2015; Lucrezi, 2024; Tischer et al., 2020). Establishing clear guidelines and procedures is essential to ensure a harmonious and sustainable interaction between tourists and wildlife.

5. Conclusion

The *Tri Mandala* model for sustainable tourism management can be effectively implemented in the Lovina area, provided there is dedicated support from local government, academics, local community, tourism business actors, and tourists themselves. The spatial zoning within *Tri Mandala* serves not only as a representation of Balinese cultural traditions but also as a regulated area for tourism operators (particularly boat operators) and visitors to conduct dolphin watching activities. The implementation of *Tri Mandala* follows a phased and systematic approach to ensure comprehensive acceptance among local communities and businesses, while maintaining its purpose of providing recreational attractions for visitors to Lovina.

The sustainability of *Tri Mandala* fundamentally depends on clear regulatory frameworks established by local government and traditional authorities, encompassing both administrative policies and customary laws. Without such governance structures, the dolphin watching zones risk reverting to unregulated practices. Furthermore, continuous innovation in tourism offerings within the Lovina area is essential to meet evolving tourist motivations, expectations, and preferences, thereby preventing product stagnation. Such diversification can enhance local economic benefits while maintaining environmental conservation standards, particularly regarding the protection of dolphin habitats. The limitation of this study focuses specifically on the *Tri Mandala* spatial zoning system, particularly the delineation of sacred spaces (*Utama*, *Madya*, and *Nista Mandala*) which are intrinsically linked to Balinese cultural traditions.

When adapting the *Tri Mandala* model to other regions, these zones may be modified or expanded according to local customary practices. However, any adaptation should maintain three fundamental spatial components: a core zone, an observation area, and clearly designated access points. Furthermore, while the 50-meter minimum distance regulation should be retained as a baseline standard, this parameter may be increased depending on the observed wildlife species. Under no circumstances should closer proximity be permitted, as this would compromise established ecotourism principles. Additionally, ecological considerations should be incorporated into sustainable tourism models, particularly for wildlife tourism, through the establishment of specific zoning systems. Furthermore, spatial metrics focusing on landscape conditions can serve as additional considerations for delineating more specific zoning systems at both micro and macro scales. This recommendation is intended to guide future researchers in developing models that integrate local wisdom effectively.

Acknowledgments

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