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RESEARCH ARTICLE

Assessing Ecotourism Development Indicators in Border Areas of the Greater Mekong Subregion: Insights from Stakeholders

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ABSTRACT

This study aims to assess ecotourism development indicators in the border areas of the Greater Mekong Subregion (GMS) from the stakeholders' perspectives. A quantitative survey approach was employed, collecting data from 385 respondents using a structured questionnaire, focusing on research areas: Xishuangbanna, China and Luang Namtha, Laos. The questionnaire focused on key dimensions of ecotourism development, including environmental conservation, socio-cultural preservation, economic benefits, and cross-dimension cooperation. Statistical analyses, including descriptive statistics and factor analysis (EFA), identified that: 1) From an environmental perspective, the highest priority indicators were biodiversity conservation and renewable energy usage, both with a mean score of 3.14 on a 5-point scale; wetland preservation scored the lowest at 2.89, highlighting an urgent need for targeted conservation efforts. 2) Socio-culturally, stakeholders emphasized the quality of life for residents (mean = 3.11) and community governance quality (mean = 3.06), reflecting the importance of inclusivity and governance in tourism planning. Nonetheless, visitor satisfaction, with a mean score of 2.85, revealed significant room for improvement in meeting tourist expectations. 3) Economically, the top-scoring indicators included community income improvement (mean = 3.13) and rural-urban market linkage (mean = 3.05); Regional economic collaboration (mean = 2.91) and support for small businesses (mean = 2.93) require greater attention to enhance equitable growth and transnational partnerships. 4) Cross-dimensional analysis underscored the importance of policy support for ecotourism (mean = 2.95) and coordination among government, community, and businesses (mean = 3.02), emphasizing the critical role of collaborative governance in addressing the region's shared sustainability challenges. This research provides valuable insights for policymakers and practitioners to enhance sustainable ecotourism development in the GMS region.

1. INTRODUCTION

Globally, ecotourism has emerged as a key tool for sustainable development, offering a pathway to balance environmental preservation, socio-cultural enrichment, and economic growth. With its roots in sustainable tourism principles, ecotourism emphasizes responsible travel to natural areas, fostering environmental education, cultural appreciation, and tangible benefits for local communities (Hvenegaard, 2002). Over the past two decades, the sector has experienced rapid growth, contributing significantly to global tourism revenues while addressing critical global challenges such as biodiversity loss and climate change (Hoang and Pulliat, 2019). However, realizing ecotourism's potential requires strategic planning and localized approaches tailored to specific regional contexts.

Countries such as Thailand, Vietnam, and Cambodia attract millions of visitors annually to their pristine forests, heritage sites, and rural landscapes (Seemann and Antweiler, 2020). The region's allure lies not only in its natural beauty but also in its rich cultural heritage, including centuries-old

traditions, ethnic diversity, and vibrant local communities. However, the rapid expansion of tourism in Asia has raised concerns about environmental degradation, cultural commodification, and unequal socio-economic benefits (Jamil and Puad, 2010). These issues underline the importance of incorporating sustainability into tourism planning and development.

The Greater Mekong Subregion (GMS), spanning Cambodia, China's Yunnan Province and Guangxi Zhuang Autonomous Region, Laos, Myanmar, Thailand, and Vietnam, presents a unique case for ecotourism development. With over 320 million people living within its borders, the GMS boasts unparalleled biodiversity, including critical habitats in tropical rainforests, wetlands, and river basins (Liu and Chamaratana, 2024a). The Mekong River itself, as the lifeblood of the region, sustains diverse ecosystems and livelihoods, making it a critical area for conservation efforts. Moreover, the GMS is a cultural mosaic of over 100 ethnic groups, offering tourists an opportunity to engage with diverse traditions, languages, and lifestyles (Jensen, 1969). Despite its immense potential, the GMS faces several challenges. Unsustainable resource extraction, habitat destruction, and socio-economic disparities threaten the ecological and cultural fabric of the region. Additionally, uneven development across countries complicates efforts to implement cohesive and sustainable ecotourism strategies. Addressing these challenges requires innovative approaches that balance regional collaboration with localized, stakeholder-driven interventions.

Ecotourism represents a unique opportunity for the GMS to achieve inclusive growth while preserving its natural and cultural heritage (Liu and Cheng, 2019). Border areas, in particular, stand out as strategic sites for ecotourism development. These areas often possess the richest biodiversity and cultural diversity due to their intersectional nature. Furthermore, cross-border ecotourism initiatives can facilitate regional economic cooperation, strengthen cultural ties, and address common environmental challenges (Sofie et al., 2015). However, the success of ecotourism depends heavily on the development of robust indicators that measure progress across environmental, socio-cultural, and economic dimensions, as well as cross-dimension. Current research tends to focus on isolated aspects of ecotourism, such as environmental conservation or economic benefits, often neglecting the holistic interplay of these factors (Gallati and Wiesmann, 2011). Additionally, limited attention has been given to stakeholder perspectives, particularly those of local communities, policymakers, and private-sector actors who play critical roles in ecotourism planning and implementation (Liu and Chamaratana, 2024b). This research seeks to address these gaps by incorporating stakeholder insights into the evaluation of ecotourism indicators in the GMS.

The development of sustainable ecotourism in the GMS is hampered by several interrelated issues. There is a lack of consensus on what constitutes effective ecotourism indicators. Many existing frameworks fail to account for the complexity of sustainability, focusing narrowly on either economic growth or conservation without considering socio-cultural impacts (Busbarat et al., 2021). This fragmented approach undermines efforts to create integrated ecotourism strategies. Stakeholder engagement is often inadequate in the GMS, leading to the exclusion of critical voices such as indigenous communities, local entrepreneurs, and regional policymakers. Without a participatory approach, ecotourism initiatives risk alienating local populations, exacerbating inequalities, and compromising long-term sustainability (Mak et al., 2017). Additionally, regional disparities in policy frameworks and priorities create inconsistencies in ecotourism implementation. While some GMS countries have established comprehensive ecotourism policies, others lack the institutional capacity or political will to enforce sustainable practices. These disparities hinder cross-border cooperation, which is essential for addressing shared challenges such as deforestation, over-tourism, and climate change. This study contributes to the growing body of ecotourism research by addressing the critical need for a comprehensive, multi-dimensional framework to evaluate ecotourism development. By integrating environmental, socio-cultural, and economic indicators, the research provides a holistic assessment of ecotourism progress in the GMS. Additionally, the study prioritizes stakeholder perspectives, offering a grounded understanding of the challenges and opportunities in ecotourism development from those directly involved. The research question of this study is: What are the key indicators from the stakeholders' perspectives of sustainable ecotourism development in the border areas of the GMS, and how to develop ecotourism in the GMS region?

From the mentioned research questions, the objective of this study is to identify key indicators of ecotourism development from the perspectives of the stakeholders, focusing on environmental

conservation, socio-cultural preservation, economic sustainability, and cross-dimension factors. It aims to evaluate the current state of ecotourism development in the border areas of the Greater Mekong Subregion. Based on the findings, the study seeks to provide actionable recommendations for balancing environmental, socio-cultural, economic, and cross-dimension to promote sustainable ecotourism development.

2. CONCEPTUAL FRAMEWORK

The conceptual framework for this study is built on a robust review of existing literature, focusing on sustainable ecotourism development in the GMS. It synthesizes insights from global, regional, and local studies to create a multidimensional approach to evaluate ecotourism through environmental, socio-cultural, economic, and cross-dimensional lenses (Weaver, 2005).

The environmental perspective draws from sustainability models, the Pressure-State-Response (PSR) model, emphasizing the role of conservation in mitigating human impact on ecosystems. Key components include biodiversity preservation, renewable energy adoption, and waste management strategie (Woolf et al., 2016). The inclusion of environmental education and policies aligns with the broader principles of sustainable tourism, as discussed by Gallati and Wiesmann (2011), emphasizing the importance of stakeholder awareness and action (Almeida et al., 2021; Gallati and Wiesmann, 2011). Studies in mangrove ecotourism (Indonesia) and Mediterranean tourism sustainability have further highlighted indicators such as wetland preservation and energy efficiency improvement (Baruah, 2020; Feofilovs and Romagnoli, 2017; Yan et al., 2022). These findings underscore the critical role of environmental stewardship in ensuring long-term sustainability.

Socio-cultural dimension focuses on community participation, cultural heritage preservation, and social equity. Authentic cultural representation and equitable community benefits are central to fostering sustainable practices, as demonstrated in research on indigenous tourism initiatives in Malaysia and Kazakhstan (Jaafar et al., 2023; Modica et al., 2018). Key socio-cultural indicators include the quality of life of residents, governance quality, and accessibility to social services. These aspects reflect the importance of inclusivity and cultural sensitivity in tourism planning (Tiberghien et al., 2018; Widodo et al., 2023; Yan et al., 2022)

Economic sustainability is pivotal in creating resilient tourism systems. The economic dimension integrates findings from the Ecotourism Sustainability Maximization (ESM) model, emphasizing indicators such as local employment, innovation in tourism products, and the development of small businesses (Molina et al., 2024). The literature also identifies challenges in ensuring equitable distribution of tourism revenue and fostering cross-border economic collaboration in transnational regions like the GMS (Toan Thanh Bui, 2023). Research on regional tourism competitiveness in Baja California and Pingyao Ancient City underscores the significance of infrastructure investment, foreign direct investment, and sustainable revenue generation as critical enablers of ecotourism (Bernal Escoto et al., 2019; Weng et al., 2019).

Cross-dimensional factors bridge the gaps between environmental, socio-cultural, and economic priorities (Sofie et al., 2015). The conceptual framework draws on collaborative governance models, emphasizing the coordination of governments, communities, and businesses. Studies in Mediterranean coastal tourism and Thailand's mangrove ecotourism highlight the necessity of integrated policies and stakeholder collaboration (Andolina et al., 2021; Cao et al., 2024; Swangjang and Kornpiphat, 2021).

A critical aspect of this framework is its stakeholder-driven approach, which incorporates inputs from policymakers, local communities, and ecotourism operators (Salman et al., 2024). The framework acknowledges the importance of participatory methodologies to align diverse interests and address regional disparities, as highlighted in studies on polarization of community perceptions and rural ecotourism entrepreneurship (Palmer and Chuamuangphan, 2018; Pham et al., 2021). The conceptual framework provides a multidimensional lens to evaluate and enhance ecotourism development in the GMS. By integrating environmental, socio-cultural, economic, and cross-dimensional factors, it aligns theoretical insights with practical challenges, ensuring a comprehensive understanding of sustainable tourism development in transnational contexts. This framework serves as a foundation for assessing and promoting sustainable ecotourism practices tailored to the unique

socio-ecological and economic dynamics of the GMS.

3. RESEARCH METHODOLOGY

This study employed a survey research approach rooted in the positivist paradigm (Babbie, 2010), which allows for the collection and analysis of measurable data to evaluate ecotourism development indicators in the border areas of the GMS. The unit of analysis in this research is individual stakeholders involved in or affected by ecotourism development. This includes 1) Ecotourism operators and businesses, to understand the operational challenges and opportunities in promoting sustainable tourism; 2) Local residents, to capture the socio-economic and cultural impacts on host communities; 3) Tourists, to evaluate the quality, accessibility, and satisfaction with ecotourism experiences (Liu and Chamaratana, 2024b).

3.1. Sampling Design and Sample Size

The research employs a cluster sampling method to ensure the representativeness and precision of data collected from diverse ecotourism stakeholders in the border urban areas of the GMS. This method is chosen due to the likely heterogeneity of the target population and the study's aim to capture varying perspectives across different levels of ecotourism stakeholders.

The cluster sampling design is structured across three hierarchical levels: country, city, and community, reflecting geographic and operational distinctions relevant to ecotourism development (Marshall, 1996). The target population is first stratified into clusters based on national borders within the GMS, specifically China and Lao PDR. Within each country, urban areas proximal to or directly impacted by ecotourism initiatives are selected. These cities are Xishuangbanna, China, and Luang Namtha, Lao PDR. The selected cities are relevant to the study due to their significant engagement in ecotourism activities and their proximity to international borders, which influence cross-border ecotourism dynamics (Nonthapot, 2020). At the community level, ecotourism ventures are further categorized into three distinct types to reflect operational and contextual differences: 1) Natural Reserves; 2) Cultural Heritage Sites; 3) Community-Based Ecotourism Initiatives.

For the sample size of this research, applying the Cochran formula (1977) ensures that the quantitative data collected is robust and reliable for statistical analysis. The Cochran formula is a cornerstone in the realm of survey research because it incorporates both the variability in the population and the desired precision to calculate a statistically valid sample size (Uakarn et al., 2021)
.

The formula is given as:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Where:

n = the sample size

Z = Z value at reliability level or significance level

- Reliability level 95% or significance level 0.05; z = 1.96

- Reliability level 99% or significance level 0.01; z = 2.58

p = the estimated proportion of the population that possesses the attribute of interest (if this is unknown, 0.5 is often used as it is the most conservative estimate)

e = the margin of error (e=0.05)

In this research, the population proportion (p) is unknown, and it is common to use the most conservative estimate, which assumes that p=0.5. This gives the maximum possible sample size estimate because the product of $p(1-p)$ is at its maximum when p=0.5. The formula then simplifies to:

$$n = \frac{Z^2 \cdot 0.5 \cdot 0.5}{e^2}$$

$$n = \frac{Z^2}{4e^2}$$

$$n = \frac{(1.96)^2}{4(0.05)^2} = 384.16$$

Where:

n = the sample size

p = the population proportions

e = acceptable sampling error (e=0.05)

Z = Z value at reliability level or significance level.

- Reliability level 95% or significance level 0.05; z = 1.96

- Reliability level 99% or significance level 0.01; z = 2.58

Therefore, the study collected 385 sample sizes of individual levels.

A total of **385 respondents** are targeted and distributed proportionally across the identified clusters. A proportional sample size is allocated, with 65 respondents from natural reserves in Xishuangbanna and 64 respondents for each remaining cluster, ensuring balanced representation across the selected regions and ventures.

3.2. Research Area

For the study area, this study focuses on border areas within GMS where ecotourism initiatives are operational and demonstrate significant socio-cultural, economic, and environmental interactions. To explore the development of ecotourism in these regions, the cities of Xishuangbanna, China, and Luang Namtha, Lao PDR, have been strategically selected as key study sites.

1) Xishuangbanna, located in China, is distinguished by its rich biodiversity and its reputation as a renowned ecotourism destination. Its proximity to international borders and its integration into broader infrastructural and economic development plans make it an ideal location for analyzing ecotourism's role in promoting sustainable regional growth (Liu et al., 2022). The area exemplifies how diverse natural and cultural assets can be leveraged to support tourism initiatives while preserving ecological integrity.

2) Luang Namtha, in Lao PDR, is another critical location within the GMS due to its emerging ecotourism sector. Known for its community-based ecotourism initiatives and natural attractions, Luang Namtha has become a focal point for ecotourism development. Its strategic position at the intersection of key transnational corridors connecting Laos with neighboring countries provides a unique context for examining the interplay between tourism growth and cross-border connectivity (Polthanee et al., 2021).

The selection of these two cities reflects their representativeness of the diverse socio-cultural, economic, and environmental dynamics within the GMS. These cities also provide measurable data on how ecotourism development shapes local communities and regional collaboration. By examining ecotourism activities in these areas, this research aims to generate insights that contribute to a broader understanding of sustainable tourism development and its implications for regional cooperation and ecological conservation.

3.3. Research Instruments

The research instrument for this study was a questionnaire designed based on insights from a comprehensive literature review and expert recommendations, The questionnaire utilized a five-point inverted scale, where 1 indicated 'strongly disagree' and 5 represented 'strongly agree,' with 5 reflecting the highest level of agreement or importance. To ensure validity, the questionnaire underwent an evaluation using the Index of Item-Objective Congruence (IOC) by three experts. Following this validation, the finalized questionnaire was prepared for data collection. A pre-test was conducted prior to the actual data collection to confirm statistical validity, and the reliability of the questionnaire was assessed to ensure data accuracy and consistency, achieving a reliability score of 0.80.

3.4. Data Analysis

The data analysis for this study is designed to comprehensively evaluate the ecotourism development indicators based on responses from 385 stakeholders. The analysis framework combines descriptive

statistics and exploratory factor analysis (EFA) to ensure a holistic understanding of the research data and to identify key dimensions of ecotourism development. The process of analysis as: 1) Descriptive statistical methods were used to calculate the mean, standard deviation, and frequency distribution for each indicator. 2) EFA was conducted to uncover the underlying structure within the ecotourism development indicators. Before running EFA, the data's suitability was confirmed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. The KMO values exceeded the minimum threshold of 0.5 across all dimensions, and Bartlett's test was significant ($p < 0.05$), ensuring the data's appropriateness for factor analysis. Principal Component Analysis (PCA) with varimax rotation was then used to extract key factors. Factors were retained based on eigenvalues greater than one and the interpretability of the components. The rotated factor loadings provided insights into the clustering of variables, allowing for the identification of distinct dimensions within the dataset.

3.5. Ethical Standards for Human Research

This study was approved by the Human Research Ethics Committee, Khon Kaen University, which has been certified as a human research project subjected to exemption consideration according to Khon Kaen University Record No.4.3.03: 13/2567, Reference No. HE673109, according to the records of the Office of the President Office, Center for Human Research Ethics, Khon Kaen University, with KKU Institutional Review Board Number IRB00012791, dated 25 April 2024.

4. RESULT

4.1. General Information

The study surveyed 385 valid responses included in the analysis. The demographic distribution reflects a diverse group of individuals across age, occupation, education level, income range, and ethnicity, providing a representative dataset for the analysis. The age of respondents ranged from 18 to 60 years, with a mean age of 38.64 years (SD = 12.531), indicating a balanced mix of younger and older participants. The gender distribution showed a higher proportion of females (67.7%) than males (31.0%). Regarding education, the majority of respondents had completed high school or college, with 21.5% holding primary school education and 50.3% being high school graduates or college. Additionally, 18.2% held a graduate degree or higher. Monthly income levels varied significantly, with 13.1% earning over 8,000 RMB (Around 1000 USD), while 41.3% were in the 3,000-5,000 RMB (400-700 USD) range. Ethnic diversity was pronounced, with respondents representing 16 different ethnic groups. Most respondents belonged to the Dai ethnic group (21.8%), followed by the Hani ethnic group (17.9%). Other ethnic groups were also represented, including the Yi (12.7%), Lahu (13.0%), and Wa (7.0%) ethnic groups. Smaller groups, such as the Miao (3.4%) and Jingpo (1.6%), were also included, showcasing the inclusiveness and diversity of the dataset. This representation ensures a wide perspective on ecotourism issues from various ethnic and cultural backgrounds.

4.2. Ecotourism indicators from the stakeholder's perspective in the GMS

In the development of ecotourism indicators in the GMS, it is necessary to study baseline data from the perspective of stakeholders about ecotourism in the GMS to consider each aspect. Based on this study, 385 cases were divided into four main aspects: economic, socio-cultural, environmental, and cross-dimension perspectives, with details as follows.

4.2.1. The Ecotourism Indicators in the Environmental Dimension

The analysis included 14 indicators, with mean values ranging from 2.89 (wetland preservation) to 3.14 (biodiversity conservation and renewable energy usage). The KMO value for sampling adequacy was 0.612, indicating moderate suitability for factor analysis. Bartlett's Test of Sphericity was significant ($p < 0.05$), confirming the appropriateness of the data for PCA (**Table 1**).

Table 1 The environmental perspectives of the sample group (Analysis N=385)

Descriptive Statistics	Mean	Std. Deviation	Analysis N
1. Natural resource conservation	2.96	1.433	385
2. Biodiversity conservation	3.03	1.401	385
3. Waste management	2.95	1.444	385
4. Air quality improvement	3.12	1.433	385

Descriptive Statistics	Mean	Std. Deviation	Analysis N
5. Water resource management	2.98	1.489	385
6. Creation of green spaces	3.02	1.415	385
7. Reduction in greenhouse gas emissions	3.10	1.371	385
8. Energy efficiency improvement	3.08	1.404	385
9. Renewable energy usage	3.14	1.429	385
10. Urban greening coverage	3.00	1.402	385
11. Wetland preservation	2.89	1.422	385
12. Low-carbon tourism initiatives	2.98	1.394	385
13. Environmental education and awareness	3.06	1.405	385
14. Implementation of environmental policies	3.10	1.390	385

The Principal Component Analysis (PCA) with Varimax rotation identified six components, explaining 50.47% of the variance (**Table 2**): 1) Conservation Practices: Natural resource conservation and biodiversity conservation reflect stakeholder priorities on ecological preservation. 2) Awareness and Low-Carbon Initiatives: Indicators environmental education and low-carbon tourism initiatives emphasize the importance of sustainable tourism education. 3) Urban Environmental Improvements: Urban greening coverage and waste management represent efforts to create livable urban environments. 4) Energy and Emission Management: Reduction in greenhouse gas emissions and energy efficiency improvement highlight mitigation measures for climate change. 5) Water and Wetland Management: Water resource management and wetland preservation underline the need for effective water conservation and ecosystem protection. 6) Renewable and Green Initiatives: Renewable energy usage and the creation of green spaces reflect a shift toward green urban development.

Table 2 Rotated Component Matrix in the Environmental Dimension

	Component					
Rotated Component Matrix[a]	1	2	3	4	5	6
1. Natural resource conservation	.673	-.077	-.112	-.024	.011	.064
2. Biodiversity conservation	.185	.077	.156	.122	.512	-.246
3. Waste management	-.321	.408	-.214	.038	-.017	-.565
4. Air quality improvement	.141	-.493	-.367	.303	.030	-.244
5. Water resource management	.243	.038	-.071	.359	-.551	.115
6. Creation of green spaces	.070	.135	-.126	-.621	.078	.087
7. Reduction in greenhouse gas emi	.033	.031	.107	.539	.359	.184
8. Energy efficiency improvement	-.198	-.151	.658	.003	-.066	.060
9. Renewable energy usage	.631	.118	.047	-.058	-.009	-.072
10. Urban greening coverage	-.011	-.055	-.317	.008	.606	.172
11. Wetland preservation	-.095	.200	-.088	.069	-.056	.735
12. Low-carbon tourism initiatives	-.223	.290	-.168	.431	-.212	.066
13. Environmental education and av	.124	.742	-.002	.012	.021	.023
14. Implementation of environment	.154	.178	.598	.154	.058	-.088
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a]						
a. Rotation converged in 16 iterations.						

4.2.2. The Ecotourism Indicators in the Socio-Cultural Dimension

The socio-cultural analysis encompassed 11 indicators, with mean scores ranging from 2.85 (visitor satisfaction) to 3.11 (quality of life for local residents). The KMO value was 0.631, and Bartlett's Test of Sphericity was significant ($p < 0.05$), indicating the adequacy of the data for PCA (**Table 3**). Stakeholders placed higher importance on quality of life for local residents (3.11) and community governance quality (3.06), indicating a focus on enhancing the socio-cultural fabric of local

communities. However, lower scores for visitor satisfaction (2.85) highlight areas for improvement in meeting tourist expectations.

Table 3 The Socio-cultural Perspectives of the Sample Group (Analysis N=385)

Descriptive Statistics	Mean	Std. Deviation	Analysis N
1. Community participation	2.99	1.396	385
2. Cultural tradition preservation	2.93	1.417	385
3. Visitor satisfaction	2.85	1.458	385
4. Quality of life for local residents	3.11	1.393	385
5. Education and skill development	2.96	1.381	385
6. Accessibility to health systems	2.99	1.425	385
7. Equality and fairness in community	2.99	1.454	385
8. Community-friendly activities	2.97	1.441	385
9. Community governance quality	3.06	1.385	385
10. Accessibility to social welfare	2.94	1.446	385
11. Urban safety and security	2.94	1.495	385

The PCA extracted four components, accounting for 54.54% of the variance (**Table 4**): 1) Community Engagement: Community participation and governance quality highlight the importance of inclusive decision-making processes in ecotourism planning. 2) Education and Development: Education, skill development, and visitor satisfaction underscore the role of capacity-building in sustainable tourism. 3) Social Equity and Welfare: Indicators like fairness in the community and accessibility to social welfare emphasize the socio-economic benefits of ecotourism. 4) Cultural and Community Activities: Cultural tradition preservation and community-friendly activities reflect the importance of safeguarding local cultural heritage.

Table 4 Rotated Component Matrix in the Socio-cultural Dimension

Rotated Component Matrix[a]	Component			
	1	2	3	4
1. Community participation	.085	-.028	-.141	.761
2. Cultural tradition preservation	-.686	-.024	-.002	.117
3. Visitor satisfaction	-.149	.602	.011	-.023
4. Quality of life for local residents	.265	.502	-.188	.162
5. Education and skill development	.010	.649	.129	-.085
6. Accessibility to health systems	.543	.152	-.145	.289
7. Equality and fairness in community	.039	.135	.698	.209
8. Community-friendly activities	.271	.052	-.358	-.586
9. Community governance quality	.397	-.308	.179	.027
10. Accessibility to social welfare	.531	-.140	.341	-.158
11. Urban safety and security	.064	-.068	.553	-.169
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a]				
a. Rotation converged in 13 iterations.				

4.2.3 The Ecotourism Indicators in the Economic Dimension

Economic indicators (12 variables) showed mean values ranging from 2.91 (regional economic collaboration) to 3.13 (community income improvement) (Table 5). The KMO value was 0.626, and Bartlett's Test of Sphericity was significant ($p < 0.05$), validating the data for PCA. While community income improvement (3.13) scored the highest, regional economic collaboration (2.91) and support for small businesses (2.93) highlight areas for enhanced cooperation and support to maximize ecotourism's economic potential.

Table 5 The Economic Perspective of the Sample Group (Analysis N=385)

Descriptive Statistics	Mean	Std. Deviation	Analysis N
1. Tourism revenue	2.98	1.345	385
2. Local employment opportunities	2.96	1.413	385
3. Urban economic growth rate	2.91	1.433	385
4. Community income improvement	3.13	1.442	385
5. Infrastructure investment	2.98	1.420	385
6. Support for small businesses	2.93	1.410	385
7. Private sector investment	2.98	1.422	385
8. Regional economic collaboration	2.91	1.369	385
9. Rural-urban market linkage	3.05	1.415	385
10. Innovation in ecotourism products	3.09	1.397	385
11. Increase in tourism enterprises	2.98	1.381	385
12. Attraction of foreign investment	3.05	1.390	385

Five components were extracted, explaining 50.32% of the variance (**Table 6**): 1) Tourism Revenue and Growth: Tourism revenue and urban economic growth emphasize the economic benefits of ecotourism. 2) Support for Businesses: Indicators such as infrastructure investment and support for small businesses highlight the role of local businesses in sustainable tourism. 3) Income and Employment: Community income improvement and local employment opportunities underscore the potential for ecotourism to enhance livelihoods. 4) Private Sector Engagement: Private sector investment and rural-urban market linkages represent the role of partnerships in promoting sustainable tourism. 5) Innovation and Investment: Innovation in ecotourism products and attraction of foreign investment reflect the growing interest in ecotourism as an innovative economic driver.

Table 6 Rotated Component Matrix in the Economic Dimension

Rotated Component Matrix[a]	Component				
	1	2	3	4	5
1. Tourism revenue	-.719	-.029	.035	.021	-.129
2. Local employment opportunities	.133	.063	.119	.682	.081
3. Urban economic growth rate	.617	.036	.083	-.071	-.320
4. Community income improvement	-.145	.217	.755	.131	-.055
5. Infrastructure investment	-.056	-.627	-.145	-.095	-.157
6. Support for small businesses	.110	.648	.006	.002	-.029
7. Private sector investment	-.082	.041	.063	-.028	.648
8. Regional economic collaboration	-.099	.103	-.519	.358	.177
9. Rural-urban market linkage	.275	-.527	.398	.258	.243
10. Innovation in ecotourism products	-.023	-.001	.187	.016	-.634
11. Increase in tourism enterprises	.228	.101	.165	-.620	.289
12. Attraction of foreign investment	.462	.173	-.300	.326	-.043
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a]					
a. Rotation converged in 8 iterations.					

4.2.4. Cross-dimensional Indicators (Integrating Environmental, Economic, and Social Dimensions)

This section examined five cross-dimensional indicators integrating environmental, socio-cultural, and economic dimensions (**Table 7**). The KMO value was 0.574, indicating moderate adequacy, and Bartlett's Test was significant ($p < 0.05$). The mean values for these indicators ranged from 2.95 (policy support) to 3.02 (coordination of government, community, and businesses), highlighting the critical role of collaborative governance in addressing ecotourism challenges in the GMS.

Table 7 The cross-dimension perspective of the sample group (Analysis N=385)

Descriptive Statistics	Mean	Std. Deviation	Analysis N
1. Policy support for ecotourism	2.95	1.390	385
2. Regional cooperation on ecotourism	2.98	1.455	385
3. Sustainable tourism education	3.01	1.428	385
4. Collaboration among stakeholders	2.99	1.442	385
5. Coordination of government, community, and businesses	3.02	1.446	385

Two components were extracted, explaining 54.02% of the variance (**Table 8**): 1) Policy and Coordination: Policy support and government-community-business coordination emphasize the importance of governance in sustainable ecotourism. 2) Regional Cooperation and Collaboration: Indicators like regional cooperation and stakeholder collaboration reflect the need for integrated efforts across borders.

Table 8 Rotated Component Matrix in the Cross-Dimension

Rotated Component Matrix[a]	Component	
	1	2
1. Policy support for ecotourism	.552	.115
2. Regional cooperation on ecotourism	.281	.729
3. Sustainable tourism education	-.398	.097
4. Collaboration among stakeholders	.326	-.734
5. Coordination of government, community, and businesses	.677	.003

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a]

5. DISCUSSIONS

Based on the findings of this study, several key recommendations are proposed to enhance ecotourism development in the GMS. Efforts should focus on strengthening wetland preservation through targeted conservation projects, stricter land-use regulations, and community-based initiatives. To address visitor satisfaction, improving tourism infrastructure, enhancing cultural education, and offering unique ecotourism experiences are essential. Regional economic collaboration and support for small businesses require attention, with a need to foster cross-border partnerships, improve market access, and encourage innovation in ecotourism products. Policy coordination and governance should be strengthened to align environmental, socio-cultural, and economic goals through multi-stakeholder collaboration. Additionally, capacity-building programs to enhance environmental awareness and skill development are critical for ensuring long-term sustainability. Expanding renewable energy usage and promoting green initiatives further align with regional sustainability goals. Finally, fostering integrated collaboration among governments, businesses, and communities across all dimensions is vital for achieving balanced and sustainable ecotourism development.

6. CONCLUSION

This study analyzed ecotourism development indicators in the Greater Mekong Subregion (GMS) across four dimensions: environmental, socio-cultural, economic, and cross-dimensional perspectives. Key findings reveal that stakeholders prioritize biodiversity conservation (mean = 3.14) and renewable energy usage (mean = 3.14), highlighting strong environmental commitments, but wetland preservation (mean = 2.89) scored the lowest, indicating a need for improvement. Socio-cultural indicators emphasize quality of life for residents (mean = 3.11) and community governance quality (mean = 3.06), yet visitor satisfaction (mean = 2.85) suggests areas for better tourist experiences. In the economic dimension, community income improvement (mean = 3.13) and rural-urban market linkage (mean = 3.05) were top priorities, while regional economic collaboration (mean = 2.91) requires enhancement. Cross-dimensional indicators underline the importance of policy support (mean = 2.95) and coordination of government, community, and businesses (mean =

3.02) in promoting sustainable ecotourism.

These findings underscore the need to strengthen wetland preservation, enhance visitor satisfaction, and foster regional collaboration. By addressing these gaps, stakeholders can advance sustainable ecotourism in the GMS, balancing environmental, socio-cultural, and economic goals effectively.

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