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Developing Low Carbon Tourism in Mok Cham Pae Subdistrict, Mae Hong Son Province, Thailand

Thanawut Limpanitgul[1], Supika Vanitchung[2] and Jutatip Junead[3]

Abstract

This study focuses on low-carbon tourism development using the BCG model as a guideline in Mok Cham Pae Subdistrict, Mae Hong Son Province, Thailand. It addresses the tourism industry's economic importance, Thailand's sustainable tourism development goals, and the global challenge of climate change. The study integrates theoretical concepts like ecotourism, green tourism, community participation, tourists' preferences, and greenhouse gas emissions assessment. Through a mixed-method approach, including quantitative surveys and qualitative interviews, the study evaluates community readiness, tourist behaviors, environmental impacts, and tourism routes. Findings highlight stakeholders' readiness for sustainable initiatives, tourists' interest in eco-friendly experiences, and the need for infrastructure development and carbon reduction strategies. The research contributes academically by offering insights into sustainable tourism management and providing guidelines derived from the BCG model. These guidelines aim to promote community involvement, preserve natural and cultural resources, and support Thailand's sustainable tourism objectives.

Keywords: *Upgrading Tourism Activities, Low Carbon Tourism, BCG Model, Mok Cham Pae Subdistrict, Mae Hong Son Province.*

INTRODUCTION

The tourism industry is considered a major driver of the economy and attracts foreign currency to sustain continuous development. Thailand aims to develop tourism as a "Preferred Destination" to enhance its competitiveness globally, generate income, and distribute income fairly and sustainably. The United Nations World Tourism Organization forecasts that by 2030, (UNWTO,2022) there will be 1.8 billion international tourists. This potential encourages countries to develop national tourism plans to attract tourists and contribute to sustainable tourism practices.

Given the importance of tourism, it's crucial to consider its value and conservation alongside natural resources. Thailand is rich in natural tourism resources and has a diverse cultural heritage. (Tourism Authority of Thailand, 2022) Sustainable tourism development is vital to conserve these resources while promoting long-term benefits. (Juan Pablo Morea, 2021) As a result, there is a recognition of the necessity to integrate the human dimension in conservation (Bennett et al., 2016)

The current global climate change situation is a result of increased carbon dioxide emissions, leading to drastic climate changes, more frequent and severe natural disasters, and biodiversity loss. (Thomas, 2017). The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases. (The United Nations, 2022) Tourism activities contribute to environmental impact, such as energy consumption, hotel stays, and recreational activities, contributing to global warming. Therefore, sustainable tourism practices that prioritize environmental, community, and cultural preservation are essential. such as Life Cycle Assessment (LCA). LCA is a widely accepted method that has proven effective for assessing the environmental impacts of packaging, agriculture and the cattle industry, food harvesting and processing, several

[1] Thammasat Business School, Thammasat University , Thailand, . Email: thanawut@tbs.tu.ac.th

[2] Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Thailand. Email: supika@g.swu.ac.th

[3] Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Thailand. Email: jutatipj@g.swu.ac.th. (Corresponding author)

industrial sectors, and services such as waste management systems (Margallo et al., 2014). Thailand is rich in natural tourism resources and has cultural richness in food, lifestyles, cultures, and local wisdom. This presents a good opportunity to support sustainable tourism within the country, effectively manage community resources, reduce energy and local resource waste, avoid environmental pollution in tourist areas, and develop or transform products using systematic technology or innovation. Applying the BCG Model is model at applying the concepts of bioeconomy, circular economy and green economy to develop high value products and services that are eco-friendly and require less resource input, while conserving natural and biological resources (MHESI, 2021) to sustainable, eco-friendly, and green tourism not only helps preserve the environment but also brings happiness from traveling. This aligns well with today's global situation, where cooperation to save energy and protect the environment is crucial. The tourism industry has historically followed an expansion-driven mindset, often neglecting the consequences of climate change. While such an approach has driven the industry's dynamic evolution, it has also led to substantial carbon emissions. Learn how two creative new projects are driving change in the sector. (Saleth, & Varov, 2023)

This research project aims to contribute academically by providing knowledge on Low Carbon Tourism management using the BCG model in Mok Cham Pae Subdistrict, Mae Hong Son Province. It gathers data on green tourism activities, local community history, community needs for green tourism management, and assesses the environmental impact and tourism routes. The findings will empower communities to participate in collaborative activities for sustainable tourism development, benefiting the community, province, and national tourism sector.

LITERATURE REVIEW

This objective delves into the natural and cultural resources in Mok Cham Pae Subdistrict that are vital for Low Carbon Tourism. It includes biodiversity hotspots, scenic landscapes, historical and cultural sites, and the readiness of local communities to engage in sustainable tourism practices.

Theoretical concepts like ecotourism and green tourism are pivotal here. Weaver, (2018) . Ecotourism emphasizes responsible travel to natural areas, focusing on conservation and community benefits. Green tourism extends this by integrating sustainability throughout the tourism supply chain, from operations to guest experiences.

Cohen & Uphoff, (1981) community participation concepts are significant for understanding how local communities can actively participate in and benefit from tourism development. This involves strategies for community engagement, capacity building, and collaborative decision-making. Weaver & Lawton, (2017)

In regards to studying tourist behavior and preference, this objective aims to understand the preferences of tourists who opt for low carbon tourism routes in Mok Cham Pae Subdistrict. It examines factors such as eco-friendly accommodations, nature- based activities, cultural immersion, and support for local communities. (Department of Tourism, 2023).

Tourists' preferences encompass concepts like environmental awareness, a quest for unique experiences, support for sustainable practices, and cultural interactions. These concepts guide the investigation into tourists' decision-making processes and overall satisfaction with their travel experiences.

Evaluating greenhouse gas emissions: This objective focuses on assessing the greenhouse gas emissions generated by low carbon tourism (Saleth & Varov, 2023) activities in the study area. It involves quantifying emissions from transportation, energy consumption, waste management, and other tourism-related activities.

In accordance to U.S. Environmental Protection Agency, (2022), Greenhouse gas emissions assessment concepts provide the framework for calculating emissions based on activity data and region-specific emission factors. This assessment is crucial for identifying emission hotspots and devising strategies to mitigate

environmental impacts. By integrating these research objectives and theoretical concepts, your study aims to not only assess the feasibility and environmental impact of Low Carbon Tourism but also contribute to sustainable tourism planning and management. It aligns with global initiatives promoting responsible tourism practices, conservation of natural resources, community empowerment, and enhanced tourist experiences. (Tourism Authority of Thailand, 2022)

METHODOLOGY

This research employed mixed methods research combining quantitative and qualitative research approaches.

Population and Key Informants

The population and sample group was 385 Thai eco-tourists who travelled to ecotourism destinations in Mok Cham Pae Subdistrict, Mae Hong Son Province. Cochran, (1963) at the reliability level of 95%, with error less than 5% was used. Simple random sampling was applied to select the sample.

Key informants in this study is someone involved in green tourism in the Ban Mok Cham Pae Subdistrict, Mae Hong Son Province. Key informants were selected using the purposive selection method with a pre-existing list of potential participants. Additionally, the snowball selection method was applied to identify key informants who met the criteria based on recommendations from existing key informants. The researcher determined the number of key informants following the criteria established by Nastasi and Schensul (2005) and Miles and Huberman (1994). They suggested conducting in-depth interviews with approximately 5 to 30 informants and focus group discussions with around 5 to 10 participants. Moreover, the principles of data sufficiency (Onwuegbuzie and Leech, 2007; Flick, 1998) and data saturation were applied. In this research, data saturation was reached when repeated interviews with more than five informants revealed no new insights. A total of 30 key informants were selected, including representatives from government agencies (5), local business operators (10), members of the Thai community council (5), and local residents of Mok Cham Pae Subdistrict (10) (McMillan and Schumacher, 1997).

Research Tools: Questionnaire - The questionnaire is designed as a checklist in a Likert scale rating format, following Likert's scale model. This was used to examine the behavior and demands of the tourists, and the reliability was found to be 0.89. The semi-structured interviews were conducted to explore various aspects such as community context, tourism resources, strengths, weaknesses, opportunities, and threats, as well as the requirements of communities for low-carbon ecotourism using the BCG Model in Mok Cham Pae Subdistrict, Mae Hong Son Province. Lastly, the quality evaluation of ecotourism attractions developed by the Ministry of Tourism and Sports, (2023) was employed to evaluate the ecotourism attractions in Mok Cham Pae Subdistrict, Mae Hong Son Province.

Data Collection: The source of the primary data collection included the questionnaire, survey, interviews, participant observation, and focus group from June 2023 to March 2024. The sources of the secondary data included the documents and information about ecotourism, the articles published in the international journals located on the Scopus database, and the published researches on Thai-Journal Citation Index Centre and Scopus.

Data Validation: The researcher allowed the key informants to check the data themselves (member checks). The interviewer read the feedback on the wording or the aspects given by the key informants for clarity, and asked for the additional opinion if they had more perspectives to add at the end of each topic interview to ensure that the recorded data was consistent with that provided by the key informants. After the agreement and confirmation that the data was accurate, it was considered the reliable data. Any incomplete data could be supplemented by the informant.

Data Analysis: The quantitative data was analysed using the computer program for social analysis in order to determine the percentage, mean, frequency, and standard deviation (SD), t-test, independent-sample approach, one-way analysis of variance (ANOVA), and pair comparison. The qualitative data was analysed by applying the content analysis approach, synthesized with the concept of Colaizzi, (1978), and validated with the triangulation approach, which was the concept of Cohen & Manion, (1994) and Miles & Huberman, (1994), before being summarised with the descriptive approach.

According to IPCC Guideline 2006 for National Greenhouse Gas Inventory (IPCC et. al., 2006), the common simple methodological approach for GHG emission per unit as following formula:

GHG Emissions (kg CO_2 eq) = Activity Data (unit) × Emission Factor (kg CO_2 eq/unit)

The emission factor is the coefficient that quantity the GHG emissions depend on the activities and technology of each gas emitting source. This study uses country-specific emissions values which is derived from actual measurement and report by Thailand carbon label 2022.

RESULTS

The potential of low carbon tourism development resources in Mok Cham Pae Subdistrict, Mae Hong Son Province is presented in the table form using SWOT framework.

Table 1: SWOT analysis of Mok Cham Pae Subdistrict, Mae Hong Son Province

Strengths	Weaknesses	Opportunities	Threats
S1: The unique culture of Yunan, China, is highlighted, such as traditional attire, Yunnan-Chinese cuisine, and tea ceremonies. S2: The border area allows for tourism connections with countries in the Indochina group (Laos, Myanmar, and Southern China). S3: There is potential and diversity in tourism, including cultural aspects, natural attractions, lifestyles, and history. Tourists can choose suitable types of tourism. S4: The country features beautiful landscapes and natural environments, with cool weather almost all year round. S5: Transportation is convenient, with international airports in Chiang Mai and Mae Hong Son provinces. S6: Medical and health services are readily available and can instill confidence in tourists. S7: The cost of tourism in the area is relatively low compared to other regions. S8: The location is close to Mae Hong Son City, making travel convenient and time-efficient. S9: Stakeholders in the area collaborate well in developing the region.	W1: The gap between high-season and low-season tourism is significant. W2: Tourism tends to concentrate heavily, with tourists often visiting specific tourist attractions. W3: Income distribution from tourism is not yet widespread. W4: Accessing communities via public transport is not convenient for accessing tourist attractions and connecting areas. W5: Tourism activities in the tourism development zone are not year-round. W6: There is a lack of parking spaces for tourists in the Thai Love Village community area. W7: There is a lack of quality public spaces to promote social activities, tourism, and the economy of the community. W8: There is a lack of easily accessible and systematic tourism information in the community. W9: There is a lack of proactive public relations channels for tourism in the area. W11: The transfer of Yunnan-Chinese cultural knowledge to the younger generation is limited, such as tea cultivation and local cuisine.	O1: The Northern Region is a top tourist destination chosen by tourists as their final destination. O2: Modern information technology systems allow tourists to access travel information easily and quickly. O3: It is an area linked with neighboring countries, with Thailand being the central hub for tourism in the ASEAN region. O4: The government places importance on revitalizing the tourism sector at both national and local levels, with measures to promote domestic tourism. O5: Both Thai and foreign tourists appreciate the hospitality and kindness of the locals in the Thai Love Village area. O6: State policies in opening up trade borders between Thailand and Myanmar contribute to promoting tourism. O7: Mae Hong Son province promotes community-based tourism and aims for sustainable development of tourist attractions. O8: Government agencies issue land use certificates to locals affected by smog problems, allowing them to cultivate the land. O9: Modern technology, such as Facebook and Youtube, serves as effective platforms for promoting community tourist attractions.	T1: Economic slowdowns: global economic downturns affect the income of tourists worldwide. T3: Tourists' behaviors have changed, such as smaller group tours, shorter travel durations, and cost-saving tourism. T4: Urban warfare situations from neighboring countries. T5: Limited flight availability. T6: Most tourists focus on touring and staying overnight in Mae Hong Son province, with only a small portion visiting and staying in other areas. T7: Integrated development and government-driven community development efforts lack continuity and alignment with development goals.

Strengths	Weaknesses	Opportunities	Threats
	W12: There is a severe and prolonged smog problem that occurs during certain periods.		

Quality evaluation results of ecotourism attractions at Mok Cham Pae Subdistrict, Mae Hong Son Province

The results of the quality evaluation of ecotourism attractions at Mok Cham Pae Subdistrict, Mae Hong Son Province, showed the potential of ecotourism attractions acquired from the ecotourism quality evaluation form (Department of Tourism, Ministry of Tourism and Sports, 2016) completed by three experts in tourism. The evaluation was conducted twice. The evaluation results before the development process based on the participation of Mok Cham Pae Subdistrict, Mae Hong Son Province (June 2023) showed that the overall quality standard of Mok Cham Pae Subdistrict, Mae Hong Son Province was at a satisfactory level, with 63 points, or 63% , and the symbol was ★★★. After the development process based on the participant development approach within 10 months (during June 2023–March 2024), the overall quality standard was at an excellent level, with 81 points, or 81%, and the symbol was ★★★★★.

Table 2: Quality evaluation results of ecotourism attractions at Mok Cham Pae Subdistrict, Mae Hong Son Province

Quality Evaluation Results of Ecotourism Attractions at Mok Cham Pae Subdistrict, Mae Hong Son Province	Before (score A*B)	After (score A*B)
1) Potential of ecotourism		
1.1 Tourism attractiveness and natural sources of learning	8	8
1.2 Natural resources fertility	8	8
1.3 Connection between the local cultures and natural resources	6	10
1.4 Safety of natural resources for tourism	4	4
Total score for no. 1 (40 points)	*26*	*30*
2) Potential of area utilisation for sustainability		
2.1 Management of tourist attractions utilisation	3	5
2.2 Management of tourist services	3	4
2.3 Management of tourism activities	3	5
2.4 Management of follow-up and evaluation of the change of area results from tourism	2	4
Total score for no. 2 (20 points)	*11*	*18*
3) Management of providing knowledge and raising awareness		
3.1 There is a service centre to provide the information and facilities for the tourists.	2	3
3.2 Knowledge about saving energy and effective waste management to the tourists is provided.	2	3
3.3 Knowledge about the value and conservation of natural resources is provided to the tour guides and surrounding communities.	3	4
3.4 There are the knowledgeable staff who are experts in ecosystems and conservation to provide service to the tourists, entrepreneurs and communities.	3	3
Total score for no. 3 (20 points)	*10*	*13*
4) Participation of community in tourism activities		
4.1 The local community takes part in tourism management.	8	10
4.2 The community earns income from tourism.	8	10
Total score for no. 4 (20 points)	*16*	*20*
Total score (100 points)	*63*	*81*

The study on the readiness and needs of stakeholders in the community for the development of low-carbon tourism in Mok Cham Pae Subdistrict, Mae Hong Son Province, revealed the following:

There is a strong readiness among community members to embrace and participate in low-carbon tourism initiatives. Stakeholders express a need for infrastructure development, particularly in transportation management within the community, to promote eco-friendly travel options such as walking, cycling, and the use of alternative energy vehicles. There is a demand for activities that promote the reduction of carbon emissions, with an emphasis on participating in and supporting local initiatives aimed at carbon offsetting and reducing environmental impact. Communication and promotion strategies are desired to engage guests and tourists in reducing greenhouse gas emissions and supporting local businesses and products. Overall,

stakeholders in Mok Cham Pae Subdistrict are eager for the development of Low Carbon Tourism and are actively seeking ways to contribute to sustainable tourism practices in their community.

Tourists show a strong interest in participating in Low Carbon Tourism activities, indicating a positive attitude towards eco- friendly travel. There is a preference for tourism routes that emphasize sustainable practices and reduce carbon emissions, such as walking or cycling tours, visits to eco-friendly attractions, and engagement in activities that promote environmental conservation. Tourists express a desire for information and guidance on low- carbon tourism options, including access to public transportation, availability of eco- friendly accommodations, and opportunities to support local communities in their sustainability efforts.

The study highlights the importance of effective communication and promotion strategies to educate tourists about the benefits of low- carbon tourism and encourage their active participation in eco- friendly activities during their visit. Overall, the findings suggest that tourists are increasingly interested in Low Carbon Tourism experiences and are seeking opportunities to contribute to environmental conservation while enjoying their travel experiences in Mok Cham Pae Subdistrict, Mae Hong Son Province.

The study results on the behavior and preferences of tourists towards low carbon tourism routes in Mok Cham Pae Subdistrict, Mae Hong Son Province are as follows:

From surveying a total sample group of 385 tourists, it was found that the majority were males, comprising 225 individuals (58.44%), followed by females with 131 individuals (34.03%), and LGBTQ++ individuals with 29 individuals (7. 53%). Regarding age distribution, the majority fell within the age range of 27 - 44 years (Gen Y) , accounting for 206 individuals (53. 50%) , followed by the age range of 45 - 59 years (Gen X) with 131 individuals (34. 03%) , those below 27 years (Gen Z) with 36 individuals (9. 35%) , and those aged 60 years (Gen B) and above with 12 individuals (3.12%).

For educational levels, the majority had completed undergraduate degrees, totaling 209 individuals (54. 28%), followed by those with higher education levels than undergraduate degrees, comprising 128 individuals (33. 25%) , and those with educational levels lower than undergraduate degrees, totaling 48 individuals (12.47%).

Concerning average monthly income, the majority had incomes ranging above 35,001 Thai baht per month, constituting the highest percentage (36.15%), followed by incomes ranging between 25,001-35,000 Thai baht (34.68%), 15,001-25,000 Thai baht (25.02%), and below 15,000 Thai baht (4.15%). Regarding daily travel expenses, the majority spent between 1,001-3,000 Thai baht per day (42.35%), followed by expenses ranging from 3,001-4,000 Thai baht (27.79%), 4,001-5,000 Thai baht (18.96%), and below 1,000 Thai baht (10.90%). In terms of travel companions, the majority traveled with family, totaling 132 individuals (34. 29%) , followed by traveling with friends, comprising 130 individuals (33.77%), traveling with partners or spouses, totaling 80 individuals (20. 78%) , solo travelers, totaling 28 individuals (7. 27%) , and traveling with organizations/schools/universities, totaling 15 individuals (3.89%).

Tourists' top 5 needs for the Low Carbon Tourism route model of Mok Cham Pae Subdistrict, Mae Hong Son Province are as follows: First priority: Tourists seek accommodation or hotels that are convenient, comfortable, and safe. Mean=4.42, S.D.=0.77, Second priority: Tourists want to learn about and experience the ecosystem in tourist attractions. Mean=4.41, S.D.=0.69, Third priority: Tourists prefer accommodation that allows easy travel to tourist attractions and convenient access to public transportation. Mean= 4. 41, S. D.= 0. 76, Fourth priority: Tourists expect sustainable management and operations in tourist destinations, such as waste management systems or sufficient trash bins for tourists without harming the environment. Mean= 4. 40, S.D.=0.76 and Fifth priority: Tourists desire to support green activities of the community or environmentally-friendly accommodations. Mean=4.40, S.D.=0.71**,** One-way ANOVA analysis to determine the relationship between the generation gap of the sample group and the tourists' needs for the Low Carbon Tourism route

model of Mok Cham Pae Subdistrict, Mae Hong Son Province, based on the research hypothesis revealed that each age group in the sample had significantly different average opinions regarding the desire to promote green community activities or environmentally friendly accommodations, with a statistically significant F- test value of 3.525 and *p*-value of 0.015, and the significant difference in the desire to learn about lifestyles was statistically observed, with an F-test value of 3.199 and *p*-value of 0.023. While the average opinions in other aspects did not differ significantly, as shown in Table 3.

Table 3: Tourist's needs and preferences for low carbon tourism classified by generation.

Tourists' needs for the Low Carbon Tourism route model of Mok Cham Pae Subdistrict, Mae Hong Son Province	**Generation**				**Statistical Test**	
					F-test	***p*-value**
	Gen Z	Gen Y	Gen X	Gen B		
Want a place to stay or a hotel that is convenient, comfortable, and safe.	4.41	4.41	4.45	4.42	0.063	0.979
The need to learn and experience the ecosystem (eco-system) in tourist destinations.	4.22	4.44	4.42	4.25	1.331	0.264
Want to travel to an environmentally friendly destination.	4.27	4.40	4.44	4.25	0.720	0.540
Want to promote green activities in the community or environmentally friendly accommodations.	4.41	4.49	4.24	4.58	3.525	0.015*
The accommodation needs to provide convenient travel access to tourist destinations and easy access to public transportation.	4.49	4.41	4.38	4.42	0.210	0.889
I want the local community in tourist areas to be friendly to visitors and provide excellent hospitality to tourists.	4.41	4.41	4.37	4.25	0.236	0.871
If you want to travel to tourist destinations, there must be management in accordance with the policy framework and sustainable tourism practices.	4.46	4.44	4.30	4.58	1.216	0.303
Want tourist attractions to provide convenient, uncomplicated, easily understood, and straightforward services?	4.43	4.35	4.45	4.42	0.601	0.615
Want to stay in accommodations that are energy-efficient, do not intrude on nature, and use natural materials in constructing various rooms?	4.33	4.39	4.35	4.67	0.613	0.607
Demand for value and suitability is aligned with the quality of tourism products and services.	4.60	4.35	4.36	4.33	0.990	0.398
Rules, regulations, and various other regulations related to tourism should be appropriate.	4.49	4.34	4.41	4.17	0.710	0.547
Convenience is desired when traveling to the area or tourist destination.	4.52	4.24	4.40	4.58	1.871	0.134
The desire to learn about different lifestyles or cultures different from your local tourist destination where you reside.	4.70	4.26	4.25	4.17	3.199	0.023*
Want to travel to areas with diverse tourism resources?	4.43	4.21	4.32	4.25	0.796	0.497
Want to support tourism destinations that have sustainable tourism management, focus on environmental conservation, and preserve local culture and ways of life that are unique to the community?	4.59	4.17	4.27	4.25	2.057	0.106
Reputation, souvenirs, and historical and cultural tourism destinations.	4.32	4.15	4.24	4.42	0.567	0.637

Remark: ** refers to a statistical significance with the reliability of 95%.

From the study results of travel behavior among different sample groups of tourists, it was found that there are varying service demands in different areas. The study found that:

Tourists traveling alone prefer to learn about different lifestyles or cultures from the local tourist destinations where they reside Mean= 4.62, S.D. = 1.859. Tourists traveling with family prefer a place to stay or a hotel that is convenient, comfortable, and safe Mean= 4.53, S.D. = 0.724. They also have a strong desire to promote green activities in the community or environmentally friendly accommodations Mean= 4.53, S.D. = 0.646. Tourists traveling with friends prefer to travel to an environmentally friendly destination Mean= 4.56, S.D. = 0.557. Tourists traveling as couples have the highest desire to learn and experience the ecosystem (eco-system) in tourist destinations Mean= 4.30, S.D. = 0.644, They also seek tourist attractions to provide convenient, uncomplicated, easily understood, and straightforward services Mean= 4.30, S.D. = 0.664. Tourists traveling with organizations/schools/universities have similar preferences for a place to stay or a hotel that is convenient, comfortable, and safe Mean= 4.47, S.D. = 0.743. They also have similar desires to learn about and experience the ecosystem (eco-system) in tourist destinations Mean=4.47, S.D. = 0.834, as shown in Table 4

Table 4: Tourist's needs and preferences for low carbon tourism classified by travelling methods.

Tourist needs for the Low Carbon Tourism route model of Mok Cham Pae Subdistrict, Mae Hong Son Province	**Traveling alone**	**Traveling with family**	**Religion Traveling with a group of friends**	**Traveling with a romantic partner or spouse**	**Traveling with an organization, school, or university**
Want a place to stay or a hotel that is convenient, comfortable, and safe?	4.35	4.53	4.50	4.15	4.47
The need to learn and experience the ecosystem (eco-system) in tourist destinations.	4.31	4.35	4.55	4.30	4.47
Need for accommodation that can travel easily to tourist attractions.	4.52	4.42	4.50	4.20	4.33
Want to promote green activities in the community or environmentally friendly accommodations?	4.31	4.53	4.41	4.20	4.40
Want to travel to an environmentally friendly destination?	4.31	4.33	4.56	4.29	4.27
Want to travel to tourist destinations, there must be management in accordance with the policy framework and sustainable tourism practices.	4.42	4.47	4.44	4.20	4.40
I want the local community in tourist areas to be friendly to visitors and provide excellent hospitality to tourists.	4.38	4.32	4.57	4.21	4.40
Want tourist attractions to provide convenient, uncomplicated, easily understood, and straightforward services?	4.31	4.39	4.50	4.30	4.20
Want to stay in accommodations that are energy-efficient, do not intrude on nature, and use natural materials in constructing various rooms?	4.38	4.44	4.40	4.26	4.27
Demand for value and suitability is aligned with the quality of tourism products and services.	4.49	4.35	4.47	4.18	4.60
Rules, regulations, and various other regulations related to tourism should be appropriate.	4.38	4.33	4.48	4.29	4.27
Convenience is desired when traveling to the area or tourist destination.	4.42	4.38	4.34	4.24	4.27

Tourist needs for the Low Carbon Tourism route model of Mok Cham Pae Subdistrict, Mae Hong Son Province	Traveling alone	Traveling with family	Religion Traveling with a group of friends	Traveling with a romantic partner or spouse	Traveling with an organization, school, or university
The desire to learn about different lifestyles or cultures different from your local tourist destinations where you reside.	4.62	4.26	4.34	4.11	4.60
Want to travel to areas with diverse tourism resources?	4.41	4.18	4.37	4.18	4.40
Want to support tourism destinations that have sustainable tourism management, focus on environmental conservation, and preserve local culture and ways of life that are unique to the community?	4.41	4.21	4.33	4.10	4.40
Reputation, souvenirs, and historical and cultural tourism destinations.	4.38	4.20	4.21	4.16	4.27

The study encompasses the results of a SWOT analysis for potential analysis, quality evaluation findings of ecotourism sites, stakeholders' requirements for Low Carbon Tourism development, and tourists' behavior and preferences regarding Low Carbon Tourism routes in Mok Cham Pae Subdistrict, Mae Hong Son Province.

To measure the results of low- carbon tourism, we measure the amount of greenhouse gases generated from tourist activities, energy use and upstream emission. Activity data is collected using by the in- depth interview. The results show the amount of greenhouse gas emissions from all travel activities, which reflect how high or low the impact of low-carbon tourism will be compared to the impact of general tourism activities. The research team is able to design low-carbon tourism activities along with calculating greenhouse gas emissions in the Mok Cham Pae Subdistrict, Mae Hong Son Province, as shown in Table 5.

Table 5: The results of the assessment of greenhouse gas emissions from low carbon tourism activities in Mok Cham Pae Subdistrict, Mae Hong Son Province.

Attraction	Low Carbon tourism activities	$kgCO_2eq$/ head
Khuean Nai Mok Reservoir	• Boating in Chinese Style to Enjoy Nature Scenery (Using solar cells to produce electricity for lighting)	0.00
	• Enjoying Chinese tea on the boat (Using 100 grams of Organic Green Oolong Tea and a reusable container)	0.51
Pang Tong Royal Project Development Center	• A walking tour to admire the architecture of Pangtong Palace	0.00
	• Feeding sheep with fresh organic Napier grass (1 kg)	<0.01
	• Riding horses to visit the farm, a distance of 500 meters (during day time)	0.00
	• Choosing to buy a sheep wool scarf souvenir weighing 150 grams.	6.20
	• Choosing to buy a sheep wool sweater a souvenir weighing 650 grams.	14.46
Mae Hong Son Bamboo Complex	• Trekking in the forest for a short distance to study nature and learn about different bamboo species	0.00
	• Playing in the natural waterfall	0.00
Wat Mok Cham Pae	• Paying respects to the sacred without lighting incense	0.00

Attraction	Low Carbon tourism activities	$kgCO_2eq$/ head
Phu Klon Country Club Hot Springs	• Activities of massag the body with natural klon 100 % from phu klon is unique mud mask from hot spring mineral mud of Mae Hong Son Province	0.00
	• Soaking your feet in a natural outdoor hot mineral water foot spa	0.00
	• Thai massage	1.94
Namtok Pha Suea - Tham Pla National Park	• Playing in the natural waterfall	0.00
	• Studying the natural heritage of plant species by walking	0.00
Pang Oung	• Camping tents near lake at Pang Oung	0.00
	• Stargazing by the lake	0.00
	• bamboo raft ride, Pang Ung Lake	0.00
	• Walking to see the lake view on the dam's edge	0.00
Ban rak thai village	• Alms-round in the morning	0.00
	• Cycling tour to explore Ban Rak Thai village	0.00
	• Ride a bike around Mok Reservoir	0.00
	• Rode a three-wheeled motorcycle to explore the community, covering a distance of 3.5 kilometers.	0.06
	• Coffee Workshop (100 grams)	1.02
	• Green tea royal jelly workshop (150 grams)	1.33
	• Purchased a pack of dried Oolong tea leaves (500 grams) as a souvenir	2.54
Wat Pa Rakthai	• Practice Vipassana meditation	0.00
	• Paying respects to the sacred without lighting incense	0.00
	• Forest garden Tour on foot	0.00

Remark:**Thai National LCI Database,TIIS-MTEC-NSTDA (with TGO electricity 2016-2018)

This low carbon tourism activities in Mok Cham Pae, Thailand, that are distinct from other areas. These activities comprise boating in Chinese style to enjoy nature scenery (using solar cells for lighting) , trekking in the forest for nature exploration and bamboo species learning, and a unique massage activity using 100 % natural klon mud from Phu Klon and hot spring mineral mud from Mae Hong Son Province for a mud mask. Additionally, bamboo raft rides on Pang Ung Lake are part of this initiative, with greenhouse gas emissions calculated at 0 kg CO_2 eq.

Guidelines for managing Low Carbon Tourism with the BCG model in Mok Cham Pae Subdistrict, Mae Hong Son

Bioeconomy (B)

Smart Farming Technologies

Implementation: Introduce precision agriculture tools such as drones for monitoring crop health, automated irrigation systems to optimize water use, and soil sensors to assess nutrient levels.

Organic Farming Practices: Promote organic farming practices by using natural fertilizers, crop rotation, and biological pest control to maintain soil health and reduce chemical usage.

Eco-Tourism Integration: Develop farm-to-table experiences where tourists can participate in farming activities and learn about organic farming techniques, thus creating a direct link between agricultural production and eco-tourism.

Quality Assurance: Establish certification processes for organic products to ensure quality and build trust with consumers and tourists.

Circular Economy (C)

Systematic Utilization of Local Products

Design for Reuse and Recycling: Encourage local artisans to create products designed for longevity and multiple uses, such as upcycled crafts and durable goods.

Waste Reduction Programs: Implement community-wide programs for composting organic waste and recycling materials like plastics, glass, and paper.

Local Production Networks: Create networks of local producers and service providers to facilitate the exchange and reuse of resources within the community.

Education and Awareness: Conduct workshops and educational programs to raise awareness about the benefits of a circular economy and train residents and businesses in sustainable practices.

Green Economy (G)

Sustainability Framework

Pollution Reduction Initiatives: Introduce measures to reduce air and water pollution, such as banning single-use plastics and promoting the use of biodegradable alternatives.

Chemical-Free Practices: Advocate for the use of non-toxic cleaning products and sustainable building materials in the hospitality industry.

Conservation Programs: Establish protected areas and conservation projects to preserve natural habitats and biodiversity.

Community and Tourist Engagement: Organize activities like tree planting, wildlife monitoring, and eco-friendly workshops to involve both the community and tourists in conservation efforts.

Additional Strategies

Promote secondary cities for tourism to reduce overcrowding in main cities.

Enhance the value of local products and services, fostering community pride and identity.

Implement systematic tourism management, ensuring cleanliness, convenience, and safety.

Utilize technology, innovation, and creativity to develop tourism products and services, considering resource costs and environmental impact.

Promote Geographical Indication (Gra Tiam Mae Hong Son or Mae Hong Son Garlic) (GI) products developed by the Ministry of Commerce, showcasing unique cultural diversity and encouraging domestic tourism. These guidelines aim to create a sustainable and low-carbon tourism model that benefits both the community and the environment in Mok Cham Pae Subdistrict.

Promote the use of vehicles that do not require energy or consider using alternative energy for transportation, such as not allowing large vehicles into the community or choosing to use electric trains to transport tourists into the community.

Information about tourist routes in linking areas for traveling to tourist attractions by public service vehicles is provided.

The community should have activities to participate in and support local and community activities that reduce carbon emissions, at least one activity such as reforestation activities.

The community has activities that are the main initiative to lead the local and community to reduce carbon emissions.

The community has activities or a list of local and community tourist routes to reduce carbon emissions, such as walking tours, trekking in the forest, playing in the natural waterfall, bamboo raft rides, foot spas, reforestation activities, etc.

The community has a drink menu. Low-carbon food or local food that comes from raw materials in the community, such as drinks and food that comes from organic oolong tea.

The community should have activities to participate in with tourists towards carbon offsetting or reduction of emissions. Carbon dioxide gas, such as planting trees. Electric cycling activities with exercise bicycles for tourists.

There is support or leadership in doing tourism activities that reduce carbon emissions together with the community or as a source to gather knowledge to guide the community, such as being a pilot shelter for installing solar panels.

The community should support the use of local ingredients to prepare seasonal and local food. to reduce food transportation out of season or food from foreign countries. Including promoting the economy within the community.

DISCUSSION

Resource Potential and Community Readiness Analysis: The study reveals significant potential in Mok Cham Pae Subdistrict, Mae Hong Son Province, for developing low-carbon tourism. The community shows a strong readiness to embrace sustainable practices, indicating a conducive environment for eco-friendly tourism initiatives. The implementation of these environmental measures should lead to increased local support for the development of tourism, as this is fundamental for the sustainability of local communities. In conclusion, reactivating tourism in a responsible way requires future actions based on an approach that supports governments, enterprises, and local communities to achieve sustainable goals. (UNWTO, 2020b)

Tourists' demographics, travel behavior, and preferences highlight varying service demands among different traveler groups. Understanding these preferences is key to tailoring tourism offerings and enhancing visitor satisfaction. ANOVA analysis reveals significant differences in tourists' opinions based on age groups, emphasizing the importance of targeted marketing and service customization. With the research of (Sperandei et al., 2016), some differences arose in expectations and perceived performance among varying age groups and lengths of stay. Top tourist needs prioritize convenience, safety, eco-friendly accommodations, learning experiences, and support for local community initiatives, reflecting a strong demand for sustainable tourism options. with the study of Srivastava et al., (2024) who posited that travelers who are aware of green hotels might choose to stay at such establishments, which encourages the hospitality industry to adopt more sustainable practices. This demand for eco-friendly accommodations can also influence other hotels to follow suit. Individuals who are impressed by the sustainable practices of green hotels are likely to share this information with others (Hameed et al., 2022), and activities that promote environmental conservation, This is consistent with Luong, (2023) showing a link between place attachment and eco-destination image, implying that connection to eco-destinations improves the view of the destination as environmentally friendly.

Greenhouse Gas Emissions Evaluation: The assessment of greenhouse gas emissions from low-carbon tourism activities provides crucial insights into their environmental impact. These insights are instrumental in

formulating effective carbon reduction strategies, contributing to the overall sustainability of tourism practices in the region. Policy Statement is Thailand's development plan and policies. The country has announced its commitment to achieving "carbon neutrality" by the year 2065, which is a delay from the global target year of 2050 set to maintain global temperatures, as reported by CIMB Thai Bank PCL, (2023), with the research findings on activities This unique initiative includes low-carbon tourism activities in Mok Cham Pae, Thailand, that are distinct from other areas. These activities comprise boating in Chinese style to enjoy nature scenery (using solar cells for lighting), trekking in the forest for nature exploration and bamboo species learning, and a unique massage activity using 100% natural klon mud from Phu Klon and hot spring mineral mud from Mae Hong Son Province for a mud mask. Additionally, bamboo raft rides on Pang Ung Lake are part of this initiative, with greenhouse gas emissions calculated at 0 kg CO2 eq. with Thailand Greenhouse Gas Management Organization (Public Organization), (2022). This guideline defines the life cycle greenhouse gas (GHG) assessment methodology based on the Life Cycle Assessment (LCA) concept. This guideline defines the life cycle greenhouse gas (GHG) assessment methodology based on the Life Cycle Assessment (LCA) concept; covering raw material acquisition, manufacture, use, and final waste disposal, including related transport phases in all stages. The evaluation of greenhouse gas emissions from low-carbon tourism activities provides valuable insights into the environmental impact of such initiatives, aiding in the development of effective carbon reduction strategies in Thailand.

CONCLUSION

Conclusions based on the specified objectives and study findings: Resource Potential and Community Readiness Analysis: The study uncovers substantial potential for Low Carbon Tourism development in Mok Cham Pae Subdistrict, Mae Hong Son Province. The community's high readiness to adopt sustainable practices sets a favorable stage for eco-friendly tourism initiatives, indicating a promising environment for growth in this sector.

Tourists' Behavior and Preferences Study: Tourists exhibit a strong inclination towards Low Carbon Tourism experiences, prioritizing sustainable practices, eco-friendly accommodations, and activities that contribute to environmental conservation. This reflects a growing demand for responsible and sustainable tourism options among travelers.

Greenhouse Gas Emissions Evaluation: The assessment of greenhouse gas emissions from low-carbon tourism activities provides crucial insights into their environmental impact. These insights are instrumental in formulating effective carbon reduction strategies, contributing to the overall sustainability of tourism practices in the region.

Guidelines for Management of Low-carbon Tourism: The guidelines derived from the BCG Model offer a holistic framework for managing low-carbon tourism effectively. By emphasizing the principles of bioeconomy, circular economy, and green economy, these guidelines pave the way for sustainable tourism models that align with environmental conservation goals.

Stakeholders' Readiness and Needs: Stakeholders in Mok Cham Pae Subdistrict demonstrate a strong commitment to low-carbon tourism, emphasizing the necessity of infrastructure development, carbon reduction initiatives, and robust communication and promotion strategies. Addressing these needs is critical for fostering sustainable tourism practices and enhancing stakeholder engagement in environmental conservation efforts.

Tourists' Behavior and Preferences: The study highlights diverse service demands among different traveler groups, emphasizing the importance of tailored tourism offerings to meet varying preferences. Targeted marketing and service customization are pivotal in enhancing visitor satisfaction and promoting sustainable tourism experiences.

SWOT Analysis Results: The SWOT analysis identifies key strengths, weaknesses, opportunities, and threats relevant to Low Carbon Tourism development. Leveraging strengths, addressing weaknesses, seizing opportunities, and mitigating threats are essential strategies for promoting sustainable tourism growth and resilience in the face of challenges.

Quality Evaluation of Ecotourism Attractions: The quality evaluation outcomes demonstrate significant improvements in ecotourism attractions' quality post-development efforts. This underscores the positive impact of community involvement and development initiatives on enhancing tourism experiences and sustainability standards.

In conclusion, the study affirms the potential and enthusiasm for Low Carbon Tourism in Mok Cham Pae Subdistrict, Mae Hong Son Province. Effective management strategies, infrastructure enhancements, targeted marketing, and community collaboration are pivotal in unlocking this potential and fostering sustainable tourism development in the region.

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