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Sustainable Coastal Resource Management and Community-based Ecotourism: An Integrated Approach for Livelihood Enhancement in Koh Lipe Island, Thailand

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ABSTRACT

Background: Coastal resource management in island communities faces challenges balancing tourism development with ecosystem conservation. This study examined resource management dynamics and ecotourism potential in koh lipe Island, Southern Thailand, inhabited by indigenous urak lawoi people.

Methods: Mixed methods included Rapid Rural Appraisal with 15 key informants, in-depth interviews with 10 households and questionnaire surveys with 205 households. Data were analyzed using descriptive statistics, pearson's correlation coefficient and multiple linear regression analysis.

Result: Resource utilization assessment revealed 49.60% overall utilization, with coastal areas (96.59%) and coral reefs (90.24%) most heavily used. Popular activities included snorkeling (73.11%), scuba diving (51.40%) and social activities (61.40%), though facilities remained limited (10.97%). Three key management factors emerged: human factors (42.90%, opinion level 3.78), community factors (39.00%, opinion level 3.56) and organizational factors (36.10%, opinion level 3.70). Correlation analysis identified significant relationships between snorkeling, scuba diving, vacation rental, fishing and nightlife with resource utilization. Multiple regression analysis explained 43.1% of variance (R^2 adjusted=0.364).

Key words: Community-based ecotourism, Marine ecosystem conservation, Participatory management, Rural livelihoods, Sustainable resource management.

INTRODUCTION

Koh lipe, located within tarutao national park domain in Southern Thailand, exemplifies complex interactions between conservation, indigenous rights and tourism development. The Urak Lawoi people have inhabited this island since 1897, predating protected area establishment in 1974, resulting in unique management arrangements administered by Koh Sarai sub-district organization rather than standard national park jurisdiction (Koh Sarai Sub-district Administrative Organization, 2010). The island attracts approximately 16,993,000 Thai baht worth of tourists annually (Satun Immigration Office, 2010). However, rapid tourism expansion has precipitated environmental degradation, occupational shifts and ecosystem deterioration reflecting broader challenges in balancing economic benefits with ecological sustainability (Nongnaphat, 2009).

Ecotourism offers sustainable alternatives by generating positive effects on local communities while minimizing negative environmental and cultural impacts (World Tourism Organization, 2002; Praptiwi *et al*., 2021). In marine destinations, implementing ecotourism principles becomes critical through integrating nature knowledge, promoting conservation values and facilitating community participation (Strongza *et al*., 2019; Blanton *et al*., 2024). Despite previous development efforts, including 1999 community group formation under Coastal Resources Institute guidance (Coastal Resources Institute, 2000), a critical gap persists in understanding how indigenous coastal communities navigate simultaneous pressures from protected area governance, rapid commercial tourism and cultural preservation imperatives. This research aimed to examine socio-economic characteristics and coastal resource management dynamics, investigate ecotourism activities and their relationship with resource management, identify factors affecting resource-based utilization and synthesize appropriate ecotourism management models for sustainable community development.

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MATERIALS AND METHODS

This study employed a pragmatist mixed-methods paradigm, incorporating qualitative and quantitative methodologies to triangulate findings and maximize construct validity (Creswell and Plano Clark, 2017). The study was conducted in Koh Lipe, Koh Sarai district, Satun province, Thailand. Rapid rural appraisal (RRA) involved 15 key informants purposively selected based on elder status, community history knowledge and diverse occupational backgrounds; sample size was determined by information-saturation principles (Hennink *et al*., 2017). In-depth interviews covered 10 households representing the original Urak Lawoi population. Questionnaire surveys covered all 205 households from Moo 7 (Strongza *et al*., 2019), eliminating sampling error. Instrument validity was ensured through expert panel review (n=3) and reliability was assessed through a pilot test with 20 households. Informed consent was obtained from all participants.

Qualitative data underwent content analysis using analytic induction. Quantitative analysis employed descriptive statistics (mean, standard deviation, percentages), Pearson's product-moment correlation coefficient and Multiple Linear Regression Analysis (Tranmer *et al*., 2020).

$$yi = \beta 0 + \beta 1xi1 + \beta 2xi2 + \ldots + \beta pxip + \in$$

Where,
Yi= Resource-based utilization.
Xi= Ecotourism activity variables.
β0= The y-intercept.
βp= Slope coefficients.
∈= The error term.

RESULTS AND DISCUSSION

Socio-economic characteristics

Data in Table 1 show that household heads had an average age of 38.6 years with predominantly low educational attainment (66.34% no formal education, 28.78% primary level). Most residents (78.54%) were island-born, with 91.22% holding land rights documentation, primarily possessory rights (60.43%). Main occupations included tour boat operation (41.46%), aquatic animal catching (35.20%) and agriculture (35.12%), reflecting tourism influence. Living challenges included drinking water shortage (97.25%), transportation inconvenience (95.12%) and electricity shortage (82.44%), yet 93.17% expressed no relocation desire, indicating strong community attachment. While empowering coastal communities through education and integrated support programs is vital for socio-economic improvement (Gerlie *et al.,* 2025), technical interventions are equally necessary. In this regard, Sabareshwari and Ramya (2018) note that a comprehensive characterization of soil constraints is essential for developing effective management strategies to enhance agricultural productivity.

Economic characteristics

Data in Table 2 showed minimal land holding (0.08 square wah/household) with high land prices (705,300 Baht/ha). Mean annual income was 188,125 Baht with expenditure of 123,430 Baht. Debt affected 72.20% of households. Income sufficiency was reported as sufficient (44.88%), with surplus (27.32%), or insufficient (27.80%), aligning

Table 1: Current social characteristics of lipe households. (n=205)

Item	Unit	Description
1. An average age	Year	38.6
2. Educational level	Percentage	Non education (66.34), primary level (28.78), secondary level (4.88)
3. Religion	Percentage	Buddhist (80.00), muslim (3.42), christianity (11.71) and worship ghosts (4.8)
4. period of residence in Lipe	Percentage	Lived since birth (78.54) move in (21.46)
5. Land rights documents	Percentage	Have (91.22) No have (8.78)
6. Type of land rights documents	Percentage	Possessory right 1(60.43) deed (12.30) NS/NS 3(27.27)
7. Main occupation	Percentage	Agriculture (35.12) catch aquatic animals (35.20) Hired in hotels and resorts (18.54) trade (3.56) drive a tour boat (41.46) restaurant (14.39) doing travel business (1.98)
8. An average period of residence in koh lipe	Year	7.42
9. Housing characteristics	Percentage	Wooden house on raised floors with thatched roof (12.20), wooden house on raised floors with galvanized roof (59.02), wooden house with tile roof (9.76), 2-story wooden house (5.37), half-cement, half-timber house (13.66)
10. Opinions on living problems	Percentage	Transportation in the community is not convenient (95.12), poor hygiene (64.88), lack of drinking water (97.25), shortage of electricity (82.44)
11. Desire to move out of koh lipe	Percentage	Want to move out (6.83), don't want to move out (93.17)

Table 2: Current economic characteristics of lipe households. (n=205)

Item	Unit	Description
An average of land holding size	Square wah/household	0.08
Land price	Baht/ha	705, 300
Demand for selling land	Percentage	Sale (10.24), not sale (89.76)
Household labor	Person/household	Agricultural labor (2.17), fishing labor (2.06), nonagricultural labor (1.34)
An average total income	Baht/year	188,125
An average total expenditure	Baht/year	123,430
Debt	Percentage	Have (72.20), No have (27.80)
Saving fund	Percentage	Have (72.68), No have (27.32)
Sufficiency of income	Percentage	Sufficient (44.88), There's some leftover (27.32), not enough (27.80)

Table 3: The percentage of total people of resource-based utilization in koh lipe. (n=205)

Resource-based utilization1	The percentage
1. Coastal area: Marine resources	96.59
2. Coral reef	90.24
3. Marine lives	42.55
4. Forest	37.07
5. land	91.22
6. Fresh water	22.44
7. Underground water	10.24
8. wild animals	11.46
9. Sea animals	39.51
10. Beach	54.63
Average percentage of resource-based utilization	49.60

Table 4: The percentage of current ecotourism activities in koh lipe. (n=205)

Ecotourism activities 1	Percentage
1. Snorkeling	73.11
2. Scuba driving	51.40
3. Vacation rental	43.11
4. Watch the boat floating ceremony	23.42
5. Kayaking	29.17
6. Fishing	28.79
7. Pitch a tent	34.66
8. Attend a party	33.68
9. Nightlife	40.26
10. Join in drinking	61.40
An average percentage	41.90

Remark: 1 answer more than one activity.

with coastal community economic patterns where tourism creates income opportunities while increasing living costs (Hall, 2001).

Resource utilization and coastal management dynamics

Historical analysis revealed four distinct periods: Urak Lawoi Settlement (1897-1948) based on abundant coastal and forest resources; Transformation period (1949-1974) with commercial emergence; Government Expansion (1974-1997) with intensified resource use and Tourism Industry Expansion (1998-2018) with accelerated luxury development. Consistent with Quang *et al.* (2023), this study identifies technological advancement as the most effective long-term strategy for sustainable spatial planning and policy formulation.

Current resource utilization patterns

Data in Table 3 showed differential pressure across resources. Coastal areas and marine resources (96.59%) were predominantly used for catching marine animals, while coral reefs (90.24%) functioned as natural barriers, food chain support and breeding areas (Sakanan, 1998). Overall resource-based utilization averaged 49.60%. The near-total dependency on coastal areas alongside critically low freshwater (22.44%) and underground water access (10.24%) signals a structural sustainability risk that resource management plans should address to avoid over-dependence on vulnerable marine-facing ecosystems (Orams, 1999).

Ecotourism activities and infrastructure

Data in Table 4 show that snorkeling emerged as the most popular activity (73.11%), followed by drinking activities (61.40%) and scuba diving (51.40%), averaging 41.90% participation. However, ecotourism infrastructure remained limited at 10.97% average (Table 5). Labor utilization in Table 6 and Fig 1 showed local workers dominated (54.24%), followed by foreign (26.25%) and mainland workers (19.26%). The fourfold disparity between activity participation and infrastructure availability implies ecotourism demand greatly outpaces supply, placing strain on the natural resource base while the dominance of local workers indicates meaningful economic benefit circulation within the community (Praptiwi *et al.,* 2021).

Management factors

Three primary factor categories emerged with consistently high community opinion levels (Table 7). Human factors (42.90%, opinion level 3.78) showed that long-term

Table 5: The percentage of current ecotourism facility in koh lipe. (n=205)

Ecotourism facilities	Percentage
1. Restaurant	17.28
2. Minimart shop	16.64
3. Grocery store	14.08
4. Equipment rental shop such as diving suits	12.80
5. Souvenir shop	8.32
6. Tourism bureau	5.12
7. Homestay	4.48
8. Resort	16.80
9. Hotel/guest house	3.20
An average percentage	10.97

Table 6: The percentage of labor utilization for ecotourism in koh lipe. (n=205)

Ecotourism labor utilization	Percentage
Foreign workers	26.25
Local workers	54.24
Mainland workers	19.26
An average percentage	33.25

resource relationships fostered restoration consciousness, with restoration awareness (3.88) and benefit expectations (3.86). Group and community factors (39.00%, opinion level 3.56) demonstrated participatory decision-making capacity, with decision-making opportunities (3.70) and network formation (3.45). Organizational factors (36.10%, opinion level 3.70) showed NGO advocacy (3.80) and government support (3.79). Despite organizational factors yielding the lowest participation percentage, individual items scored highest, suggesting structural barriers to formal engagement rather than disinterest, consistent with Bramwell and Lane (2011) and Pomeroy and Berkes (1997).

Resource utilization effects

Data in Table 8 show that resource transformation effects averaged 3.81 (much level). Most significant effects included decreased coastal marine life from tourism (4.05), land loss through investor sales (4.02) and decreased sea cucumbers (3.98). Positive effects included educational opportunities for children (3.93), improved facilities (3.84) and business diversification (3.74), reflecting ecotourism's potential for balancing conservation and development (Strongza and Gordillo, 2008).

Table 7: Opinion level of people on the factors in coastal resource management for ecotourism. (n=205)

Issue	Level of coastal resource management		
		S.D.	Criteria
1. Human factors			
- People will take care of the coastal resources where they use to make a living.	3.72	1.37	Much
- People are aware of the restoration and conservation of coastal resources.	3.88	1.13	Much
- People expect the benefits from participating in coastal resource management.	3.86	1.20	Much
- People consider their own safety when participating in coastal resource management.	3.72	1.24	Much
- People consider their own safety when participating in coastal resource management.	3.72	1.24	Much
Average	3.78	1.23	Much
2. Group and community factors			
- Community form various networks which were developed for coastal resource management.	3.45	1.39	Much
- Members in community are opportunity to participate in make decisions to conduct any activities for coastal resource management.	3.70	1.29	Much
- Members in community are opportunity to participate in solving problem for coastal resource management at the present.	3.51	1.30	Much
Average	3.56	1.33	Much
3. Organization factors			
- There are sources of capital for supporting from both local and national organization in coastal resource management in several areas.	3.76	1.21	Much
- NGOs in the area to push forward the opinions required from the participation in coastal resource management to the concerning sectors or organizations.	3.80	1.25	Much
- Fish markets and wealthy fishmongers are another factors for the people to make a decision to participate in coastal resource management.	3.76	1.26	Much
- Investors/influencers who have power over the people in the area, who are hard to compromise and participate in coastal management.	3.76	1.33	Much
- The government sectors which are interested and support the participation of coastal resource management	3.79	1.17	Much
Average	3.70	1.25	Much
Total average	3.73	1.27	Much

Note: Criteria: 1.00-1.75: No management, 1.76-2.50: Little level management, 2.51-3.25: Moderate level management and 3.26-4.00 much level management.

Correlation and regression analysis

Correlation analysis identified significant positive relationships between ecotourism activities and resource utilization (Table 9): nightlife (r=0.885, p<0.01), fishing (r=0.759, p<0.01), scuba diving (r=0.498, p<0.05), vacation rental (r=0.479, p<0.05) and snorkeling (r=0.347, p<0.05). Multiple linear regression produced: $Y = 0.521 + 0.335X_1 + 0.261X_2 + 0.439X_3 + 0.505X_4 + 0.278X_5 + 0.608X_6 + 0.112X_7 + 0.875X_8 + 0.455X_9 + 0.188X_{10}$ (R^2=0.431, R^2 adjusted= 0.364, F-significant =0.912, Durbin-Watson=1.852). The strong nightlife correlation challenges traditional frameworks that emphasize only nature-based activities as primary stressors (Fennell, 2008), highlighting the need for comprehensive visitor behavior management extending to evening activities.

Synthesized ecotourism management models

Two complementary models were developed.

Model 1 (Fig 2)

Eco-cultural tourism management emphasizes Urak Lawoi cultural uniqueness through boat-floating festival learning (Traditional biannual ceremony), historical tourism

Table 8: The effect of using coastal resources and transforming coastal resources. (n=205)

Effects	Level regarding the effects of using coastal resources transforming coastal resources		
		S.D.	Criteria
1. They are fighting for fresh water during dry season by digging artesian well.	3.83	1.12	Much
2. Lack of forest products due to the decrease of forest area.	3.80	1.09	Much
3. The decreasing amount of sea cucumbers due to the increasing amount of black sea cucumbers.	3.98	1.10	Much
4. The decreasing amount of coastal marine lives due to tourism activities.	4.05	1.06	Much
5. No land left to make a living because of selling them off to investors.	4.02	0.99	Much
6. The spillage of oil from boats deteriorates water vision around the coastal area.	3.60	1.34	Much
7. The increasing number of the invasion of fishery near the coast.	3.67	1.35	Much
8. Fish shoaling too close to the coast resulting in ecosystem imbalance.	3.88	1.19	Much
9. The nonequivalence of catching sea animals near national park.	3.75	1.32	Much
10. More wastefulness.	3.88	1.17	Much
11. Resources are too exploited for the area to accommodate.	3.70	1.20	Much
12. Enough convenient facilities.	3.84	1.21	Much
13. Children having more chances to study in town.	3.93	1.25	Much
14. Bring in more external resources.	3.77	1.44	Much
15. There are more businesses and various kinds of business.	3.74	1.28	Much
16. Outsiders migrate more.	3.67	1.26	Much
17. Community's way of life has changed.	3.69	1.26	Much
18. Being helped by government and private sectors.	3.69	1.25	Much
Average	3.81	1.22	Much

Criteria: 1.00-1.80: No effect, 1.81-2.60: Little level effect, 2.61-3.40: Moderate level effect, 3.41-4.20: Much level effect and 4.21-5.00 very much level effect.

Table 9: Correlation coefficient between the current ecotourism activities and resource-based utilization.

The current ecotourism activities	Resource-based utilization (y)
1. Snorkeling (x1)	0.347*
2. Scuba diving (x2)	0.498*
3. Vacation rental (x3)	0.479*
4. Watch the boat floating ceremony (x4)	0.401
5. Kayaking (x5)	0.297
6. Fishing (x6)	0.759**
7. Pitch a tent (x7)	0.202
8. Attend a party (x8)	0.403
9. Nightlife (x9)	0.885**
10. Join in drinking (x10)	0.211

Remark: *Significant at 0.05 and **Significant at 0.01.

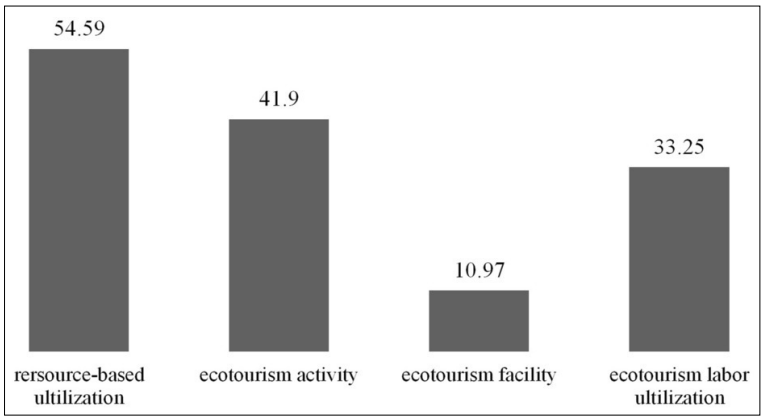


Fig 1: An average of resource-based utilization, ecotourism activity, ecotourism facility.

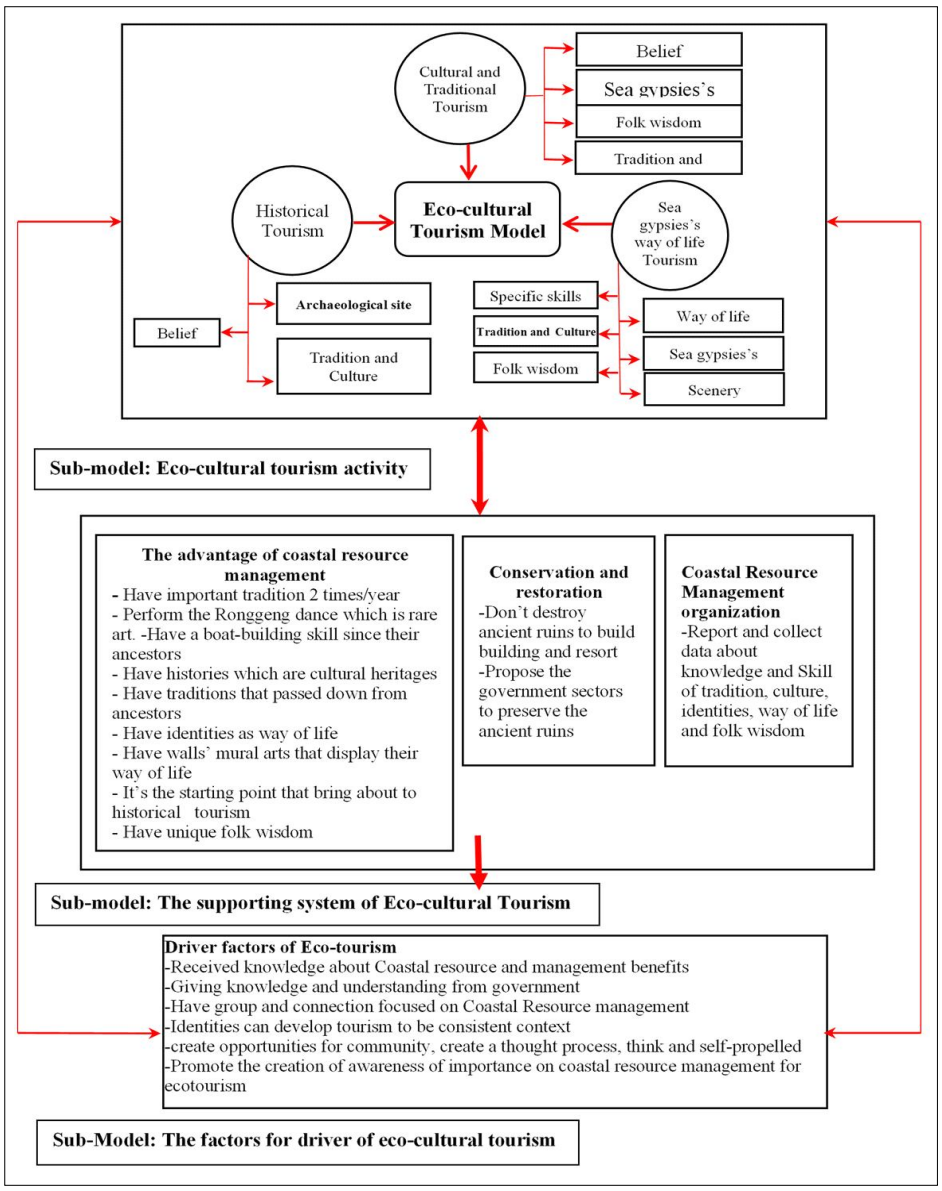


Fig 2: The model of eco-cultural tourism management in koh lipe.

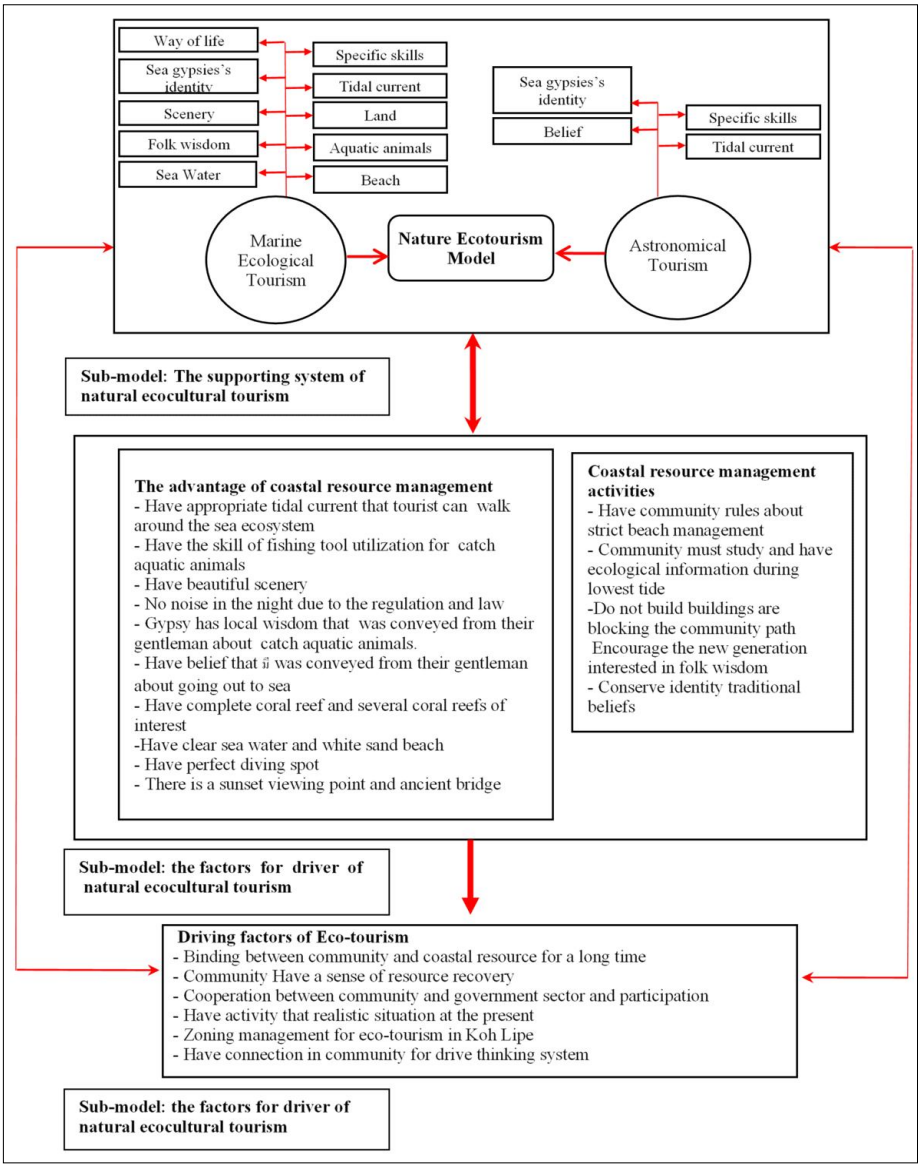


Fig 3: The model of nature ecotourism management in koh lipe.

accessing archaeological sites with local guides and sea gypsy lifestyle tourism through village walkways.

Model 2 (Fig 3)

Nature ecotourism focuses on marine ecological tourism utilizing unique natural resources and low-tide coral observation and astronomical tourism observing solar eclipses, meteor showers and lunar eclipses. Both models incorporate core activities, supporting systems and driving factors (Wearing and Neil, 2009; Ross and Wall, 1999; Boo, 1990).

CONCLUSION

This research provides a comprehensive assessment of coastal resource management dynamics in koh lipe community across four historical periods from initial settlement (1897) through contemporary tourism expansion. Current resource utilization averages 49.60%, with highest pressure on coastal areas (96.59%) and coral reefs (90.24%). Three management factors-human (42.90%), group and community (39.00%) and organizational (36.10%)-emerged with consistently high opinion levels (3.56-3.78). Nightlife and fishing exert the greatest pressure on resource utilization. Two complementary ecotourism management models were synthesized: Eco-cultural tourism emphasizing cultural heritage and traditions and nature ecotourism focusing on marine ecology and astronomical phenomena. Implementation of these models offers significant potential for conflict reduction, income generation and long-term sustainability. Future research should address longitudinal assessment of management strategies, economic valuation of

ecosystem services, climate change adaptation and tourist perspectives on conservation support willingness.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Conflict of interest

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