

MINISTRY OF EDUCATION  
AND TRAINING

ACADEMY OF SCIENCES  
AND VIETNAMESE TECHNOLOGY

**ACADEMY OF SCIENCE AND TECHNOLOGY**

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**ESTABLISHING THE SCIENTIFIC BASIS TO SERVE  
SOCIO-ECONOMIC DEVELOPMENT AND  
ENVIRONMENTAL PROTECTION OF THE CU LAO  
CHAM ISLAND CLUSTER IN QUANG NAM PROVINCE  
AND LY SON IN QUANG NGAI PROVINCE**

**Summary of the Doctoral Dissertation in Earth Sciences**

Discipline: Geography of Resources and  
Environment  
Code: 9 44 0220

**Hanoi - 2024**

The project was completed at: Academy of Science and Technology  
- Vietnam Academy of Science and Technology

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The dissertation is examined by Examination Board of Graduate  
University of Science and Technology - Vietnam Academy of  
Science and Technology at ..... (time, date.....)

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## INTRODUCTION

### 1. The Rationale of the Project

Over the past decades, Vietnam's seas and islands have held special significance for the country's socio-economic development (SED) and national defense and security (NDS). The richness and diversity of resources in the marine and island regions present a significant advantage for developing the maritime economy, supporting, and boosting the domestic economy. Vietnam's system of islands plays a crucial role in establishing strongholds to protect national sovereignty at sea and serves as a strategic base for developing the maritime economy. However, the socio-economic development of Vietnam's seas and islands in general remains slow compared to national demands and has not yet fully realized its inherent potential. Therefore, creating a comprehensive development strategy to rationally exploit and utilize the natural resources of these marine and island regions over the long term is an urgent issue.

The Central Coastal Region and the island clusters of Cu Lao Cham and Ly Son covered in this study boast abundant natural conditions and resources favorable for developing various maritime economic sectors. These areas also serve as "gateways" for international exchange and hold significant importance for ensuring NDS. Nevertheless, the development process has led to several issues affecting resources and the environment. Meanwhile, the socio-economic development of these islands remains at a low level, and development plans have not fully assessed the potential and strengths of the region. Although some studies have been conducted on this territory, their comprehensiveness is limited and mainly focused on serving specific goals. For these reasons, the researcher has undertaken the dissertation titled: "Establishing a Scientific Basis for Socio-Economic Development and Environmental Protection in the Cu Lao Cham Island Cluster, Quang Nam Province, and Ly Son Island Cluster, Quang Ngai Province."

## **2.Objectives**

Establish the theoretical basis for a comprehensive assessment of natural resources, socio-economic factors, and environmental resources to propose orientations and solutions for socio-economic development and environmental protection of the Cu Lao Cham and Ly Son island clusters towards sustainable development.

## **3. Hypothesis**

Hypothesis 1: The islands within the clusters of Cu Lao Cham and Ly Son possess diverse and distinctive natural conditions, resources, and socio-economic characteristics typical of marine and island geography. However, there are notable differences between the two island clusters, which constitute important resources for socio-economic development and environmental protection in the studied area.

Hypothesis 2: The evaluation of the geographical and resource conditions of the Cu Lao Cham and Ly Son island clusters provides guidance for rational spatial resource utilization, socio-economic development, and environmental protection tailored to the unique characteristics of these two territorial areas under study.

## **4. New Findings**

Summarize and propose theoretical and methodological foundations for the integrated assessment of resources for the socio-economic development of coastal marine and island areas under the concept of sustainable development.

Conduct an integrated assessment of natural resources, socio-economic factors, and establish a scientific basis for socio-economic development directions linked with nature conservation and environmental protection, considering the specific conditions of selected marine and island areas.

## **5. Research Methods**

- Methods of comprehensive assessment of natural resources and natural resources for economic development

- Field survey methods
- System Analysis
- PP maps and GIS
- PP experts

## **6. Thesis Structure**

In addition to the introduction, conclusion, and references, the results of the thesis are presented in 03 chapters:

Chapter 1: Theoretical basis for comprehensive assessment of natural conditions and natural resources in service of socio-economic development and environmental protection for sea and island territories

Chapter 2: Resources for socio-economic development and environmental protection of Cu Lao Cham island clusters, Quang Nam province, and Ly Son, Quang Ngai province

Chapter 3: Orientations and solutions for socio-economic development and environmental protection of the Cu Lao Cham island cluster, Quang Nam, and Ly Son, Quang Ngai

## CHAPTER 1.

# THEORETICAL BASIS FOR COMPREHENSIVE ASSESSMENT OF NATURAL CONDITIONS AND NATURAL RESOURCES IN SERVICE OF SOCIO-ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION FOR SEA AND ISLAND TERRITORIES

### 1.1. Overview of Relevant Research Works

#### *1.1.1. Research Works on Comprehensive Assessment of Natural and Socio-Economic Conditions for Practical Purposes*

##### *1.1.1.1. Research Works on Comprehensive Assessment of Natural and Socio-Economic Conditions for Practical Purposes in the World*

The strong development of natural sciences in general during the 20th century, including geography and related disciplines such as ecology, environmental science, and economics, has especially focused on the research and evaluation of natural conditions and resources for the exploitation and use of natural potential. This has helped establish scientific and practical bases for socio-economic development in many countries, particularly in the former Soviet Union, Eastern and Western Europe, and the United States.

In the former Soviet Union and the Russian Federation, starting in the late 19th and early 20th centuries, classic works were published on the study and assessment of the geographical conditions of Russia. Scientists developed the theory of natural zones on the Earth's surface (V.V. Dokutsaev), which laid the foundation for the development of geographical science. This theory was further refined in the process of assessing the geographical conditions of the country for development purposes (L.S. Berg, 1913; A.G. Isachenko, 1961; F.N. Milkov, 1967; D.L. Armand, 1975). Subsequently, research on the application of geography for the development of production and economic sectors gained attention from many geographical scientists. Initially, research was focused on individual geographical factors such as climate and soil for agricultural zoning (G.A. Kuznetsov, 1975). Later, studies

expanded to consider the importance of geographical factors in zoning, rational use, and optimal exploitation of territories, not just for a single industry, but for the simultaneous development of various types of production (M. Ruzichka, M. Miklas, 1980; G.T. Naranhicheva, 1984; A.G. Isachenko, 2009). Over time, as landscapes were altered by both subjective and objective factors, geographers expanded their research to analyze human impacts on the natural landscape and propose orientations for the rational use of resources (A.G. Isachenko, 1985; M.I. Lopurev, 1995; V.A. Nicholaev, I.V. Kopun, V.V. Xuxuev, 2008).

#### *1.1.1.2. Research Works on Comprehensive Assessment of Natural and Socio-Economic Conditions for Practical Purposes in Vietnam*

In Vietnam, research on the exploitation and use of natural resources has received attention relatively early, especially after the country gained full independence. With support from international partners and the development of experience, Vietnam has achieved significant successes in both scientific theory and in developing national and local development strategies, plans, and policies from five-year plans to long-term strategies for the 21st century.

For over 30 years, Vietnamese scientists, particularly those in the field of geography, have focused on applied research through integrated landscape assessment for multi-purpose development at various levels. They have utilized both traditional methods and modern geographical sciences (Pham Quang Anh, 1991; Pham Hoang Hai et al., 1990, 1997; Nguyen Cao Huan, 2004, 2008; Truong Quang Hai, 2007). A number of development plans, including national socio-economic development plans, regional economic development strategies, and sectoral planning, have been formulated, with long-term national strategies approved and implemented by the government. These plans are essential for realizing sustainable development goals.

Through this analysis, it is evident that research on the synthesis of natural potentials and resources for practical application purposes has been highly effective, providing valuable insights that

will be inherited and referenced in this thesis.

### ***1.1.2. Overview of Studies on Comprehensive Assessment of Territorial Geographical Conditions and Spatial Orientation of Socio-Economic Development Applicable to Sea and Island Areas***

#### *1.1.2.1. Related Research Works in the World*

In addition to studies on the comprehensive assessment of natural resources for practical purposes, numerous research works have focused on the comprehensive assessment of geographical conditions and spatial orientation of socio-economic development, as well as environmental protection in coastal and island areas. These studies are crucial for linking socio-economic development with the rational use of territory, natural resources, and environmental protection. Many countries, including the Russian Federation, China, Japan, Thailand, Singapore, the Philippines, Indonesia, and Malaysia, have produced significant research and practical lessons applicable to the rational use of sea and island areas.

#### *1.1.2.2. Research Works in Vietnam: Ly Son and Cu Lao Cham Island Clusters*

In Vietnam, research on the synthesis of resources (both natural and social) and the relationship between humans and the environment in the context of multi-purpose development in sea and island areas has attracted attention not only from geographical scientists but also from experts in related fields and authorities at various levels. This is affirmed by documents such as Resolution No. 69-NQ/TW, dated February 9, 2007, which outlines the strategy for marine economic development up to 2020, and Resolution No. 36-NQ/TW, dated October 22, 2018, which sets the strategy for sustainable marine economic development in Vietnam by 2030 with a vision to 2045.

Several studies in this area include Pham Hoang Hai (editor) et al. (2010), which assessed the natural conditions and resources for the socio-economic development of Ly Son Island and other coastal



islands of Vietnam, aiming at sustainable development models for island districts and coastal island systems. Phan Thi Thanh Hang (project leader) conducted research on the scientific basis, orientation, and solutions for sustainable socio-economic development in Ly Son and Phu Quy island districts. Additionally, Le Van Huong (2020) addressed the scientific arguments and solutions for population distribution to ensure sustainable development, security, and defense in Vietnam's coastal islands. Other notable works include Uong Dinh Khanh's research on harmonizing biodiversity conservation with sustainable livelihoods and socio-economic development in the Cu Lao Cham-Hoi An biosphere reserve, offering models for local livelihoods that preserve indigenous traditions.

## **1.2. Theoretical and Methodological Issues Establishing Scientific and Practical Bases for the Development of Island Clusters**

### ***1.2.1. Overview of Integrated Approach Theory in Research***

The study of a territory should not only focus on natural conditions and resources but also include socio-economic conditions, cultural aspects, and environmental life. Three key principles guide the research methodology:

A complex is a system, but not every system is complex. The key feature of a composite body is its internal interconnectedness. As a system, the composite body can be studied using systems analysis.

The synthesis, through close internal relationships and the influence of external factors, acquires new qualities that depend on the nature of the combination of components in each locality.

The relationships between components at the present stage are "materialized" through the identification of the flows of matter, energy, and information. The real quality of the territory is regarded as a whole, resulting from both natural evolution and social productive activity.

### ***1.2.2. Overview of Methodology for Comprehensive Assessment of Natural Resources in Marine and Island Areas for Socio-Economic Development and Environmental Protection***

- General viewpoints on synthesizing natural resources for the economic development of sea and island areas.
- Research approach.
- The system of selection criteria for general assessment of coastal and island areas.
- 1.2.3. Specific Criteria Applied in the Aggregate Assessment of Sea and Island Areas for Socio-Economic Development  
Specific criteria in the assessment include:
  - Criteria for assessing the position of the island system.
  - Criteria for capacity and ability to meet resource demands.
  - Criteria for distance from land.
  - Criteria for the level of convenience and safety of sea traffic.
  - Criteria for natural conditions.
  - Criteria for resource potential.
  - Criteria for the level of risk and natural disasters.
  - Criteria for environmental conditions.

## CHAPTER 2.

### RESOURCES FOR SOCIO-ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION OF CU LAO CHAM ISLAND CLUSTERS, QUANG NAM AND LY SON PROVINCES, QUANG NGAI PROVINCE

#### 2.1 Resources for socio-economic development and environmental protection of Cu Lao Cham island cluster

##### 2.1.1 *Natural resources*

###### 2.1.1.1 *Space position resources*

In terms of position, Cu Lao Cham is located at the mouth of the Thu Bon River estuary (Cua Dai Chiem - Cua Dai), making it a natural fortress that shields and protects the mouth of the Cua Dai River, which serves as the entrance to the Hoi An commercial port urban area.

The island cluster includes Hon Lao, which is the largest island, and seven smaller islands: Hon Ong Island to the East-South, Hon Tai Island to the South-Southeast, Hon Dai Island to the South-Southwest, Hon Me Island to the South-Southwest, Hon La Island to the West, The Mother Dry Island to the West, and The Baby Dry Island located to the west of Cu Lao Cham island.

###### 2.1.1.2 *Natural resources*

The island cluster is the elongated, descending part towards the southeast of the Bach Ma - Hai Van - Son Tra granite block of the Hai Van complex, from the early Triassic period, which characterizes the stage of copper granite collision with the crustal origin, consisting of two phases of intrusion and vein. The geological structure forms a diverse terrain, including mountains, valleys, beaches, and the sea around the island, as well as highly abrasive sea shelves.

The high temperature creates favorable conditions for the development of residential livelihoods, especially agriculture, fisheries, and marine and island tourism.

The water source for the Cu Lao Cham island cluster depends almost entirely on rainfall, with an average annual rainfall of 2,504.57mm. The largest daily and monthly rainfall in Cu Lao Cham, based on real data from September 2004 to the present, only reaches the average daily and monthly rainfall of Vietnam.

The average air humidity ranges from 80% to 90%, with the highest humidity occurring in December (88%-90%), and the lowest in July (76%-77%). During the southwest monsoon season, humidity can drop to 25%-35%.

In terms of oceanography, the wave regime in the study area is closely related to the monsoon type and the prevailing wind direction. The east-north wave predominates during the northeast monsoon season from October to April of the following year, remaining stable and accounting for 75% during the 12th month. In the summer months, waves predominantly come from the west-southwest, reaching 61% in July. The average wave height is 1-3m, with heights up to 6m typically occurring in November, December, and January.

### *2.1.1.3 Geo-forces - resources from the surface of the earth's geographical crust*

–Ecosystem resources and biodiversity: As one of Vietnam's 16 marine protected areas, Cu Lao Cham Marine Protected Area holds important "geodesic" potential for biodiversity, both on the islands and in the surrounding waters.

–Estuary resources: The sea and island ecosystems of the Cu Lao Cham island cluster are closely linked to the nutrient sources provided by the river systems in the Vu Gia - Thu Bon basin through the Cua Dai River before blending into the marine environment.

–Land resources: Land resources, arable land, and water resources in the island cluster are very limited, which is a disadvantage and limitation for the development of new forms of livelihoods, especially tourism and services. This reduces the capacity to accommodate and serve visitors.

– Water source: The island cluster does not have regular rivers, only four small temporary streams, which are nearly depleted by the middle to the end of the dry season.

## **2.1.2 Social resources**

### *2.1.2.1 Human resources*

In 2021, the population of Hon Lao was 1,935 people, a decrease of 306 people compared to 2016 (2,241 people), following a continuous decline since 2010 (2,416 people), reducing the population density from 136 to 118 people/km<sup>2</sup>. However, the number of people visiting Cu Lao Cham has increased.

It is an island with a long history of exploration, as reflected by the presence of relics from the Sa Huynh and Cham Pa cultures. The Bai Ong relics, which are over 3,000 years old, belong to the Prehistoric period (Pre-Sa Huynh), while the remaining relics date back to over 2,000 years (late Sa Huynh period).

### *2.1.2.2 Livelihood resources*

According to a report from Tan Hiep Commune, in the past, local livelihoods primarily relied on sea exploitation. Currently, the BTB Zone has contributed to the development of community ecotourism. As a result, people have been trained in alternative livelihoods based on marine exploitation, forest resources, marine services, shore services, production and processing, animal husbandry, and handicrafts.

Scientists suggest that the waters around Cu Lao Cham are becoming a significant resource for the region through the "spillover effect."

### *2.1.2.3 Social and humanistic conditions*

The Cu Lao Cham island cluster vividly demonstrates the harmonious combination of culture and nature, with the connection between the cultural heritage of Hoi An Ancient Town and Cu Lao Cham Island Area. The establishment of the DTSQ has resolved contradictions and inadequacies in managing and utilizing resources in the Hoi An World Cultural Heritage Area.

#### *2.1.2.4 Building resources for resource restoration and environmental protection*

Coral restoration in Cu Lao Cham IPA has resulted in the restoration of hard corals over an area of 5,200 m<sup>2</sup>, with 6,005 coral fragments relocated and fixed in two main areas, Bai Vac (2,500 m<sup>2</sup>) and Bai Huong (2,000 m<sup>2</sup>), as well as two nursery areas to provide additional coral seedlings for restoration in Rang Me and Hon Tai, with areas of 300 and 400 m<sup>2</sup> respectively.

#### *2.1.4 Environmental issues in the socio-economic development of Cham Islands*

The environment of the Cu Lao Cham island cluster is affected by pollution sources from the upper reaches of the Vu Gia - Thu Bon rivers. The discharge of domestic wastewater from urban and rural areas, as well as tourism activities, have contributed to significant pollution levels.



*Figure 2.1. Waste and incinerators at Cu Lao Cham Island*

## **2.2 Resources for socio-economic development and environmental protection of Ly Son Island**

### *2.2.1 Natural resources*

#### *1. Space position resources*

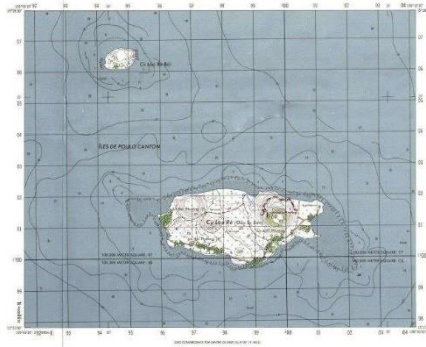
– Located on the main route into and out of the East Sea of the Dung Quat Economic Zone, Ly Son Island is 25 nautical miles east of the deep-water seaport and Dung Quat Economic Zone.

– It is one of 11 baseline points in Vietnam's territorial waters.

–It is adjacent to the updraft waters of the South Central Sea along the South Central coastal strip from Binh Dinh to Ninh Thuan. As one of Vietnam’s 16 marine protected areas, Ly Son is designated as a transitional provincial marine nature reserve from 2021 to 2030.

–Ly Son plays a key role in connecting with the far sea space, including the Paracel and Spratly Islands in the East Sea.

–It is situated at the midpoint of the waters of the Central Economic Zone.



**Figure 2.2:** Marine space - islands of Ly Son island cluster in 1964

## 2. Natural resources:

Ly Son is the remnant of a volcano with five craters formed 25-30 million years ago. The columnar basalt terrain forms magnificent sea walls, creating many geomorphological heritages of scientific, educational, and recreational value. Additionally, rainwater on Ly Son Island makes it a "heavenly storehouse," with an average total annual rainfall of 1,457.4 mm/year.

## 3. Source of "geopolitical resources" for economic development and livelihood:

The Ly Son Marine Protected Area, according to Decision No. 742/2010/QĐ-TTg, approved the planning of Vietnam's marine protected areas until 2020. The area of the Ly Son Marine Protected Area is 7,925 hectares. Ly Son has the second-largest coral reef area after Phu Quy Island. The diversity of species in the coral reefs

around Ly Son Island ranks among the highest in Vietnam, comparable to Cu Lao Cham Island.

#### 4. Natural terrestrial biodiversity resources:

Ly Son has 898.91 hectares of lowland dry forest, recognized as one of the two important terrestrial areas in Quang Ngai by the world. This ecosystem features the presence of the Central turtle, a typical species, but agricultural activities, especially sand extraction for coastal farming, have negatively impacted this habitat.

### 2.2.2 Social resources

#### 1. Human resources

Ly Son has a high population density, with 18,923 people in 2021, and a population density of 1,820 people/km<sup>2</sup>. This high fluctuation in population, combined with limited land area, places significant pressure on the resources of the island.

#### 2. Livelihood resources

**Table 2.1: Average fluctuation of residential land area/Ly Son person compared to Quang Ngai province and the whole country**

Parameter	Average residential land fund			Compare
	Ly Son District	Quang Ngai Province	Nationwide	
ha/person	0,0033	0,0091	0,0076	2.8 times less than the general budget of Ngai district and 2.3 times less than the national budget
m <sup>2</sup> /person	33	91	76	

According to the table, the residential land area for people in the Ly Son island cluster is very small, 2.8 times smaller than the general population of Quang Ngai province and 2.3 times smaller than the national average. Therefore, rational allocation and use of



residential land is an urgent issue for stabilizing the livelihoods of the population on Ly Son Island.

### *3. Social and humanistic resources*

The residents of the Ly Son island cluster have a long tradition of agricultural production and fishing, which have always been the economic pillars of the community and continue to play a significant role in the island's life and economy.

#### ***2.2.3 Environmental issues in the socio-economic development of the island cluster***

Groundwater pollution and salinity: Groundwater in Ly Son island district has shown signs of contamination with organic compounds (nitrates).

Soil pollution and degradation: The soil environment in Ly Son is at risk of serious pollution and degradation.

Depletion of sand resources around the island and sea encroachment: Sand exploitation for onion and garlic farming is a significant problem. Additionally, tourism activities, aquaculture, seafood processing, and industrial activities contribute to environmental pollution, including waste management challenges.

## CHAPTER 3.

### **ORIENTATIONS AND SOLUTIONS FOR SOCIO-ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION OF CU LAO CHAM ISLAND, QUANG NAM, AND LY SON, QUANG NGAI ISLANDS**

#### **3.1. Aggregate assessment of natural potential, natural resources, and socio-economic potential for economic development orientations of Cu Lao Cham island cluster.**

##### ***3.1.1. Assessment results***

Regarding the fishery industry: With the advantages of its location and resource potential, this industry has very strong advantages and development potential in Cu Lao Cham. The assessment results show that in the fishing industry, most of the assessment indicators, such as the geographical location of the islands and archipelagos, are related to fishing grounds. The Cu Lao Cham island cluster is considered an important landing and fishing ground in the development strategy of Quang Nam province.

In the field of conservation and development of biodiversity resources: Forest resources and biodiversity in natural wetlands are mainly found on the Cu Lao Cham island cluster, as well as in some areas of protection forests and mangroves.

Regarding the tourism and service industry: The island cluster consists of 8 islands: Hon Lao, Hon Dai, Hon Mo, Hon Kho Mae, Hon Kho Con, Hon La, Hon Tai, and Hon Ong. These islands stand out due to their diverse and rich ecosystems, cool climate all year round, potential for cultural diversity, and many ancient architectural works (more than 20 ancient architectural works) and other cultural relics.

Regarding the potential for livelihood development: The Cu Lao Cham Marine Protected Area was established with the mission of preserving the values of natural resources and human resources, with a focus on coral reefs, seagrass beds, and primeval forest ecosystems (HST) on the island. The area links the forests and the

sea to preserve biodiversity. After the protected area officially operated, with the efforts of the people and the government, the quality of the environment significantly improved, biological resources were preserved intact, and people's livelihoods shifted from precarious fishing to sustainable tourism services.

### ***3.1.2. Orientation of the sustainable development model of Cu Lao Cham island cluster***

#### *3.1.2.1. Development orientation*

Orientation for sustainable livelihood development:

- Priority one: Mobilize a part of the population to participate in the protection, care, and restoration of biodiversity resources both in forests and under the sea.

- Second direction: A part of the community participates in the development of non-timber forest products under the guidance of the Management Board of Cu Lao Cham Nature Reserve Area.

- Third direction: Develop medicinal herbs as both medicines and raw materials for traditional medicine processing and treatment establishments through the model of building medicinal gardens under the forest canopy and outside the edge of special-use forests of Cu Lao Cham.

- Fourth direction: Develop tourism products associated with Cu Lao Cham Nature Reserve, such as resort tourism, eco-tourism, and cultural tourism based on cultural, historical, and spiritual values.

- Fifth direction: Form semi-wild natural animal farming areas and develop aquaculture and seafood areas of natural origin in Cu Lao Cham with the technical guidance of the staff of the Wildlife Conservation Area.

- Sixth direction: Formation of conservation enterprises (social enterprises).

Orientations for ecotourism development: One of the goals of ecotourism development is to benefit local people. It is suggested that accommodation in the BTB area should be built in the style of cultural architecture and with natural materials

close to local traditions to meet the interests of local people and harmonize with environmental protection. Therefore, the Cu Lao Cham island cluster should only be developed as a destination for visitors, with a very short stay for tourists. The visitors will stay overnight in harmonious local motels according to DLST standards.



*Figure 3.1: Bai Huong community organizes tour guides*

### *3.1.2.2. Proposal of development solutions*

Solutions for sustainable livelihood development in the sea area and islands of Cu Lao Cham island cluster: Strengthen state management of biodiversity, promote the ability to mobilize resources to develop human resources for management and conservation of biodiversity in Cu Lao Cham - Hoi An biosphere reserve.

Solutions for ecotourism development: Plan the route along the coastal area of Cu Lao Cham sea and islands, organize and provide accommodation services, manage tourist transportation, attract sponsorships, and provide training for tourism human resources.

## **3.2. Combining natural and natural resources, socio-economic potential for the economic development orientation of the Ly Son island cluster**

### *3.2.1. Assessment results*

For the fishery industry: The assessment results show that the Ly Son island cluster has great potential for the development of fisheries. Of the 5 indicators selected for evaluation, 3 indicators are very favorable. The 2 most important evaluation indicators for seafood fishing are the location of fishing grounds and seafood resources, both of which are considered very favorable, as Ly Son is

located near the central fishing grounds and the two fishing grounds of Hoang Sa and Truong Sa. Additionally, it is very convenient to access other fishing grounds in the country from Ly Son.

For the agriculture and forestry sector: Ly Son island cluster has suitable potential for agricultural and forestry development due to its gentle terrain, favorable climatic conditions, and fertile basalt soil suitable for many different crops, along with abundant labor resources and a long tradition of agricultural farming. However, the limiting factors are irrigation water and land availability, so the goal is to develop agriculture and forestry to meet the minimum needs of people on the island and serve tourism development, marine economic sectors, and environmental protection, ecosystems, and water resources.

For the establishment of conservation zones: The Ly Son island cluster may establish marine geological conservation zones associated with marine biodiversity protection.

### ***3.2.2. Orientation of the sustainable development model of Ly Son island cluster***

#### *3.2.2.1. Development orientation*

Based on the scientific and practical facilities of the Ly Son island cluster, preliminary development orientations for a number of main and potential production and economic sectors have been proposed in order of priority:

Fisheries → Tourism services → Agriculture → Forestry  
→ Services - trade

#### *3.2.2.2. Orientations for the use of territorial space of Ly Son island cluster*

Fisheries: Aquaculture (vegetables, seaweed, lobster, etc.) should be arranged around the island and can be moved to avoid storms and northeast monsoons, as well as to take advantage of seasonal food sources.

Maid services need fisheries. "Land planned for repair and warehousing services" is located in the southeast of An Hai, near the mooring and shelter area of ships, with an area of 2 hectares.

Exploitation of tourism - service functions: Build a road for tourists to visit the geological traces of the two volcanoes (the only ones in Vietnam), Thoi Loi and Gieng Tien, as well as scenic spots such as Hang Pagoda and Hang Cau along the exposed rock strip on the northern edge of Lon Island. Ecotourism, resort, and research should be developed in areas on the slopes of Thoi Loi, Gieng Tien, Hon Tai, and Hon Soi mountains. For Hon Soi, it can be planned and renovated into an ecological hill garden (farm). Arrange "Land reclaimed into a beach" in the south of the island in An Hai and An Vinh communes for types such as swimming, resort, and other tourism activities. Arrange "Sea surface for tourism, sightseeing on and under the sea, and marine conservation" around the island (Large and Small) within a depth of <50m, for activities such as sightseeing, swimming, diving, and visiting underwater biodiversity like corals, seagrasses, seaweeds, and fish.

Agriculture, forestry, and fishery: Arrange "Garden-farm planning land" in Tay village of An Hai commune, and possibly Hon Vung mountain in An Vinh village or some areas in An Binh commune, into farms with various types of fruit trees (coconut, guava, jackfruit, papaya, etc.) and ornamental trees, along with raising animals such as cows, pigs, and chickens. "Short-term agricultural crop land" should be arranged in the low-lying area at the foot of the Big Island, which accounts for about 50% of the total area of the Big Island. "Land for planting forestry trees, restoring and protecting forests" should be in Thoi Loi mountainous area, An Hai commune, and the mountains of Gieng Tien, Hon Tai, and Hon Soi in An Vinh and most of An Binh.

Service and trade: Arrange "Service-commercial planning land" near the wharf of Tay An Vinh village, covering an area of 2 hectares.

## CONCLUSIONS AND RECOMMENDATIONS

### I. Conclusion

A comprehensive assessment of natural resources, economic, social, and human resources of sea and island areas for the purpose of socio-economic development, environmental conservation, and protection towards sustainable development is an extensive geographical research direction. This study area, which includes sea and island regions with specific characteristics and natural resources, requires new approaches, especially integrated and systematic approaches. These approaches should be applied to the various components of nature, natural resources, economic and social characteristics, as well as environmental factors, which have different characteristics but are all directly related to the sea.

According to the general principles and guidelines of this approach, the methods for conducting the assessment should focus on, emphasize, and consider the assessment objects as part of a complete system of nature, formed by two territorial spatial subsystems: the "island" subsystem and the "sea" subsystem. These subsystems have quite different characteristics but are always interconnected and mutually influential.

Based on this approach, the thesis has aimed to address and solve the following basic research content:

1. The thesis has provided an overview of the research, including theoretical and methodological issues, and specifically proposed a set of criteria and indicators to establish a scientific basis for both theory and practice in the comprehensive assessment of natural resources, economic, social, and human resources. This is aimed at promoting socio-economic development, environmental conservation, and protection towards the sustainable development of sea and island areas.

2. The thesis has assessed and clarified the potential of natural resources, economic, social, and environmental resources of the Cu Lao Cham island cluster in Quang Nam province and the Ly Son island cluster in Quang Ngai province. This assessment contributes to supplementing and updating data on nature, natural

resources, socio-economic and environmental factors for the study of Vietnam's coastal island system and for the sea-island territorial areas being studied in the marine economic development strategy. The results of the assessment have clarified the development potential of traditional economic sectors and strengths that align with the resources available for development in each selected island cluster.

3. Based on the assessment results and practical needs in the development of island clusters, the thesis has proposed orientations for economic development and spatial use of the sea and island areas of Cu Lao Cham and Ly Son, with development priorities in the following order:

For the Cu Lao Cham island cluster, the development priorities are: conservation →forestry →tourism →fishery services.

For the Ly Son island cluster, the development priorities are: fishery →tourism-services →agriculture →forestry →services and trade.

4. The thesis proposes solutions for socio-economic development and environmental protection in association with conservation efforts. It also proposes suitable models for socio-economic development, balancing conservation and livelihood development, stabilizing people's lives, and contributing to ensuring national security and defense for the Cu Lao Cham and Ly Son island clusters in particular, and for the entire central coastal region, sea, and island areas.

## **II. Recommendations**

The research results of the thesis serve as a basis for orienting and proposing models for the conservation of natural resources, biodiversity, historical and cultural relics associated with the livelihoods of people in a territory, contributing to the protection of the territorial environment towards sustainable development. However, the thesis still has a number of issues that need attention:

- The models proposed directly for the study areas of the Cham Islands, Quang Nam Province, and Ly Son Island District, Quang Ngai



Province, are still general and highly theoretical. As a result, the application of these models in production practice depends on many factors, among which two main groups stand out: the input parameters of the locality applying the model. These parameters reflect the natural conditions, natural resources, material and technical infrastructure of the locality, as well as economic and social resources; market factors; labor qualifications; and other factors specific to the locality itself.

- For the Cu Lao Cham island cluster, Quang Nam Province, further research is needed to propose and apply appropriate models in resource exploitation and management, as well as biodiversity conservation in the Cu Lao Cham – Hoi An Biodiversity Area (such as community-based natural resource management models, natural resource regeneration and restoration models, biodiversity conservation models, and models for transforming resource-based livelihoods to sustainable non-resource-based livelihoods).

- For the Ly Son island cluster, Quang Ngai Province, the current plans for Ly Son are still overlapping, unsuitable for its potential, and not highly practical, leading to contradictions in the use of land and other resources. To address this situation, Ly Son needs a new master plan for socio-economic development that aligns with its potential and importance. Furthermore, Ly Son's strategic position highlights its significance for national sovereignty, security, and defense. The island's coastal locations are ideal for the arrangement of defense on land, at sea, and in the air, ensuring the national defense security for Ly Son Island Cluster, the Paracel Islands, and the country as a whole.

To overcome the above shortcomings, more comprehensive, detailed, in-depth, synchronized, and systematic research is needed. Continued research is necessary to achieve more complete results.

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