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Pilot Project Analysis of Seaplane Ecosystem Development as a Strategy to Improve the Local Business Economy

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Abstract

Indonesia, as the world's largest archipelagic country, requires adaptive transportation systems to improve connectivity among island regions. The Selayar Islands in South Sulawesi have strong marine tourism potential, particularly in destinations such as Taka Bonerate National Park and other small island areas, but limited accessibility continues to constrain tourism growth and local economic development. This study analyzes the potential development of a seaplane ecosystem as a pilot project strategy to improve inter-island connectivity and strengthen the local business economy in the Selayar Islands. A qualitative descriptive approach with a case study design was employed. Primary data were obtained through interviews and coordination with relevant stakeholders, including a government aviation authority representative and a private seaplane operator, while secondary data were collected from tourism reports, transportation statistics, regulatory documents, and previous studies. The data were analyzed descriptively and supported by SWOT analysis using IFAS and EFAS matrices. The findings show that Selayar has strong potential for seaplane development due to its archipelagic geography, marine tourism attractions, and need for faster access to remote destinations. Tourist visits remained substantial from 2021 to 2024, while aircraft visits to H. Aroeppala Airport were unstable. The IFAS score of 2.79 and EFAS score of 2.70 place seaplane development in a moderate to strong strategic position. However, implementation faces regulatory, technical, and economic barriers. The study concludes that seaplane development is feasible as a controlled pilot project if supported by regulatory harmonization, public-private partnerships, infrastructure readiness, environmental safeguards, and integration with premium marine tourism packages and local MSMEs.

Introduction

The Selayar Islands are a regency in South Sulawesi Province, characterized by an archipelago consisting of large islands and surrounding smaller ones. This geographical situation makes accessibility a major challenge in supporting community mobility, logistics distribution, and, most importantly, tourism development (Iamtrakul et al., 2025; Junaid et al., 2025; Chelabi et al., 2025). Although this region has significant marine tourism potential with prime destinations such as Taka Bonerate National Park, Baloiya Beach, and a cluster of small islands limited land and sea transportation infrastructure prevents domestic and international tourists from reaching their full potential. Very slow connectivity and relatively high shipping costs hinder economic and tourism growth, making Selayar a leading destination in eastern Indonesia (Taharuddin et al., 2025; Sulistiana et al., 2025; Salsabilla & Parantika, 2026).

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In the context of archipelagic regional development, the presence of transportation modes that adapt to geographical conditions is crucial (Widhyharto et al., 2025; Mau et al., 2025). One potential alternative is the use of seaplanes. Seaplanes are a form of air transportation capable of taking off and landing in water without the need for a land runway. This offers significant flexibility, particularly in areas with limited airport infrastructure. Seaplane operations can shorten travel distances between islands, increase tourist mobility, and open up new access to hard-to-reach areas. Thus, seaplanes have the potential to be a strategic instrument for developing local economies, particularly in tourism, MSMEs, and the service trade (Visiana, 2025; Blanza, 2025; Handoko et al., 2023).

However, the development of the seaplane ecosystem in Indonesia, particularly in the Selayar Islands, faces several obstacles (Prayitno et al., 2025; Wibowo et al., 2026; Wulandari et al., 2025). In particular, national regulations regarding the operation of water aerodromes remain a very limited topic. Furthermore, there are currently no detailed regulations on certification, operational standards, or authority for water aerodrome management (Rao, 2025; Arti & Kalbuana, 2026; Khanna & Swami, 20025). First, legal regulations for private operators or regional governments planning to expand seaplane services are very difficult to develop. Second, there is an overlapping authority between the Directorate General of Civil Aviation (DJPU), which oversees civil aviation, and the Directorate General of Sea Transportation (DJPL), which has jurisdiction over water areas. This situation requires close cross-sectoral coordination to ensure seaplane implementation is carried out in accordance with the principles of safety, security, and sustainability (Putra et al., 2025; Nugraha et al., 2026)

In addition to regulatory aspects, technical and economic aspects are also important considerations (Strigari et al., 2025; Kumar & Suthar, 2024; Singh, 2023). From a technical perspective, seaplane operations are heavily influenced by weather conditions, ocean waves, and the availability of supporting facilities such as docks, navigation, and rescue (SAR) systems. Economically, seaplane businesses must consider local and international tourists, demand for tourist routes, and operational sustainability. If well-designed, a seaplane ecosystem can provide a multiplier effect on the regional economy through tourism visits, the growth of supporting transportation businesses, accommodation, culinary delights, and local creative industries (Saksono et al., 2022; Sailesh, 2025; Mulyantini et al., 2025).

Several other regions in Indonesia have conducted seaplane trials, serving as educational resources. For example, the trial in Gili Iyang, Sumenep (2021), conducted by the Ministry of Transportation through the Transportation Policy Agency (BKT). The trial results demonstrated the significant operational capabilities of seaplanes on small islands, but remained constrained by regulatory aspects and the readiness of supporting facilities. Furthermore, the trial in Mertasari Beach, Bali (2024) demonstrated the need for clearer technical standards regarding runway location, passenger safety, and cross-zone permits. Both studies could provide valuable comparisons in formulating a seaplane development strategy in the Selayar Islands.

With this, great capabilities are needed so that it becomes a very big challenge to develop, so this research focuses on the Analysis of the Pilot Project for the Development of the Seaplane Ecosystem in the Strategy to Increase the Business Economy in the Selayar Islands of South Sulawesi. This research is expected to provide an academic reflection of the regulatory, technical, economic, and social aspects that must be possessed to support the success of the seaplane pilot project. The results of the study will later generate policy recommendations that can be used as a reference by regional governments, national regulators, and the private sector

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in improving seaplane services comfortably, effectively, and sustainably (Issa-Zadeh & Garay-Rondero, 2025).

Methods

Type and Research Approach

This study employed a qualitative descriptive approach with a case study design. This approach was selected because the study focused on analyzing the potential development of a seaplane ecosystem in the Selayar Islands and its relevance as a strategy to improve transportation connectivity and the local business economy. The case study design was considered appropriate because the research examined a specific regional context, namely the Selayar Islands, by considering geographical conditions, tourism potential, transportation limitations, regulatory challenges, and the possible role of seaplanes in supporting island-based economic development.

Research Location

The research was conducted in the Selayar Islands Regency, South Sulawesi Province. This location was selected because Selayar is an archipelagic region with strong marine tourism potential but limited transportation connectivity. Several destinations, including Taka Bonerate National Park, Baloiya Beach, and other small island destinations, require faster and more reliable access to support tourism development and local economic activities. The geographical characteristics of Selayar, including scattered islands, coastal areas, and marine tourism routes, make it relevant for examining the feasibility and strategic role of seaplane transportation.

Types and Sources of Data

This study used primary and secondary data. Primary data were obtained through interviews, coordination, and field-related information from relevant stakeholders, particularly those related to aviation, tourism, and seaplane operation planning. These data were used to understand regulatory readiness, technical feasibility, operational challenges, and stakeholder perspectives regarding the implementation of seaplane services in Selayar.

Secondary data were collected from official documents, tourism statistics, transportation data, aviation regulations, previous studies, and relevant publications. The secondary data included tourist visit data to the Selayar Islands from 2021 to 2024, aircraft visit data at H. Aroeppala Airport from 2021 to 2023, information on the absence of official aircraft visit data for 2024, and technical information regarding seaplane aircraft types that may be suitable for inter-island routes. Regulatory documents, including Law No. 1 of 2009 on Aviation and relevant Ministry of Transportation regulations, were also reviewed to identify regulatory barriers and policy needs related to seaplane operations and water aerodrome development.

Data Collection Techniques

Data were collected through interviews, observation-based information, and documentation. Interviews and coordination were conducted with relevant stakeholders to obtain information on the potential, constraints, and strategic requirements for seaplane development in Selayar. Observation-based information was used to identify geographical and technical conditions that may affect seaplane operations, including island distribution, coastal access, potential water landing areas, seasonal weather conditions, and the need for supporting infrastructure.

Documentation was used as the main technique for collecting quantitative and policy-related data. The documents reviewed included Selayar tourism reports, transportation statistics, aviation-related regulations, previous research, and relevant institutional or media information

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concerning flight connectivity to Selayar. The tourist visit data and aircraft visit data were used to strengthen the empirical basis of the analysis, while the regulatory and technical documents were used to support the discussion of barriers, opportunities, and development strategies.

Data Analysis Technique

The data were analyzed descriptively using qualitative interpretation and SWOT analysis. First, data reduction was conducted by selecting information relevant to the research focus, including tourism demand, air connectivity, technical suitability of seaplane aircraft, regulatory constraints, infrastructure readiness, and economic opportunities. Second, the data were displayed in narrative descriptions and tables, including tourist visit data, aircraft visit data, technical suitability of seaplane aircraft, and a summary of key quantitative data supporting seaplane development in Selayar.

Third, the findings were interpreted to identify the potential, barriers, and policy strategies for seaplane ecosystem development. The SWOT analysis was applied to classify internal factors into strengths and weaknesses and external factors into opportunities and threats. Each factor was then assessed using IFAS and EFAS matrices by assigning weights and ratings based on the relevance of each factor to the development of the seaplane ecosystem. The total IFAS and EFAS scores were used to determine the strategic position of seaplane development in Selayar and to formulate SO, WO, ST, and WT strategies.

Research Stages

The research was conducted through several stages. The first stage involved identifying the research problem and reviewing literature related to seaplane transportation, island connectivity, tourism development, and regional economic growth. The second stage involved collecting data from tourism reports, transportation statistics, regulatory documents, previous studies, and stakeholder-related information. The third stage involved organizing the data into descriptive tables and thematic categories. The fourth stage involved conducting SWOT analysis through IFAS and EFAS matrices. The final stage involved interpreting the results and formulating strategic recommendations for the development of seaplane services in the Selayar Islands.

Result and Discussion

Potential for Developing the Seaplane Ecosystem as a Mode of Transportation in the Selayar Islands

The research shows that the Selayar Islands have strong potential for developing a seaplane ecosystem. Geographically, the islands consist of numerous small islands with long coastlines and relatively calm waters during certain seasons, which are highly suitable for seaplane take-off and landing. In terms of transportation needs, mobility for both local communities and tourists remains limited, as sea routes require long travel times and the existing regular flights to Aroepala Airport are insufficient. From a tourism perspective, Selayar offers prime attractions such as Taka Bonerate National Park, Baloiya Beach, and international diving spots. These destinations require faster and more reliable connectivity to attract domestic and international tourists, and seaplanes present a strategic solution to bridge this accessibility gap.

The interview findings provide further empirical support for the potential development of a seaplane ecosystem in the Selayar Islands. The interview data were obtained from a government aviation authority representative and a private seaplane operator. These stakeholders generally viewed seaplane development as a relevant strategy for improving inter-island connectivity, strengthening tourism access, and supporting the local business economy.

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From the government aviation authority perspective, seaplane operation was perceived as more than an alternative mode of transport. It was viewed as a strategic policy instrument for overcoming accessibility barriers in an archipelagic region. As the government informant stated, *"we see seaplane as a strategic opportunity to accelerate inter-island connectivity and support the development of the region's leading tourism sector."* This statement indicates that seaplane development is closely connected to Selayar's geographical condition, where several tourism destinations are difficult to reach quickly through conventional sea and land transportation.

Regulatory readiness also emerged as a central concern in the interview findings. The government informant explained that *"we are currently preparing regional regulations and coordinating with the Ministry of Transportation regarding operational permits and maritime aviation safety."* This finding shows that seaplane implementation requires institutional coordination because its operation involves both aviation and marine areas. Therefore, the pilot project cannot rely only on geographical suitability or tourism demand. It also requires clearer technical rules concerning water aerodromes, operational permits, maritime aviation safety, and the division of authority among relevant institutions. The informant further emphasized that *"the geographical condition of Selayar, with its small islands, is highly supportive. In addition, the central government also provides support through priority tourism development programs."* This confirms that the regional context supports seaplane development, although its implementation must still be supported by stronger regulatory and institutional frameworks.

The interviews also revealed several practical barriers that must be addressed before seaplane services can operate sustainably. The government informant stated that *"the main challenges are infrastructure and high operational costs, as well as maritime aviation regulations that are still in the harmonization stage."* This statement highlights three key obstacles. First, Selayar still needs supporting infrastructure such as water aerodrome facilities, docks, safety equipment, and operational support systems. Second, the high cost of seaplane operation may limit its affordability, particularly for local passengers. Third, regulatory uncertainty may delay implementation if coordination among aviation, maritime, and local government authorities is not clearly established. These findings suggest that seaplane development should begin as a controlled pilot project rather than immediate full-scale commercial operation.

From the perspective of the private seaplane operator, the development of seaplane services was seen as a major opportunity for the tourism sector. The private operator explained that *"in our view, seaplane is a major opportunity because it will bring more tourists. It can actually complement the existing marine tourism services."* This statement suggests that seaplane services are not necessarily perceived as a threat to existing tourism businesses. Instead, they may strengthen the tourism ecosystem by providing faster access to marine destinations and supporting existing services such as island tours, diving packages, accommodation, and local transportation. The same informant further stated that *"there may be competition, but the opportunity for collaboration is greater. Tourists who come by seaplane can be served through marine tourism packages."* This finding indicates that seaplane operation may create an integrated tourism business model in which air access and marine tourism services support each other.

The private operator also identified Selayar's natural beauty, tourism promotion, and government support as important factors for strengthening the feasibility of seaplane development. However, the operator also acknowledged that the project still faces barriers related to high operational costs, unclear maritime aviation regulations, and limited water aerodrome facilities. These findings are consistent with the government informant's view and

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show that both public and private stakeholders recognize the same basic requirements for implementation. Seaplane development in Selayar therefore requires not only market interest, but also infrastructure investment, safety preparation, regulatory clarity, and cooperation among government, private operators, and local tourism actors.

In terms of market potential, the interview findings suggest that seaplane services may initially be more suitable for international tourists and premium domestic tourists. International tourists are more likely to prioritize time efficiency, comfort, and direct access to marine tourism destinations, while domestic tourists may still consider ticket prices as a major factor. For this reason, seaplane services in Selayar should not initially be positioned as mass public transportation. A more realistic initial model would be to integrate seaplane services with premium tourism packages, diving tourism, island-hopping experiences, and exclusive access to remote marine destinations. This model would allow the pilot project to test market demand while reducing the risk of low passenger occupancy.

The interview findings also indicate that seaplane development could generate wider economic benefits for local communities. The government informant explained that *"seaplane will increase the number of tourists, thereby affecting regional revenue, hotels, restaurants, transportation, and local MSMEs."* In relation to community participation, the same informant stated that *"we will involve the community through socialization, tourism training, and MSME empowerment so that they can receive direct benefits."* These statements show that seaplane development has the potential to generate a multiplier effect if it is connected with local economic activities. Increased tourist arrivals may stimulate demand for homestays, restaurants, local transportation, tour guiding, souvenir businesses, and other tourism-related MSMEs.

Environmental management also emerged as an important issue in the interview findings. The government informant emphasized that *"we will apply strict rules regarding landing routes and fuel waste management so that the marine ecosystem remains protected."* This statement is particularly important because Selayar's tourism potential depends strongly on the quality of its marine and coastal environment. Therefore, seaplane development must be designed with environmental safeguards, including landing route regulation, waste management, marine ecosystem protection, and coordination with conservation authorities. Without environmental control, the development of seaplane services could create new risks for the very tourism assets it seeks to promote.

Table 1. Tourist Visits to Selayar Islands, 2021–2024

Year	Domestic Tourists	International Tourists	Total Tourists
2021	6,060	22	6,082
2022	20,778	195	20,973
2023	16,030	163	16,193
2024	14,101	394	14,495

Source: Selayar Tourism Office Reports, 2021–2024.

Table 2. Flight Frequency at H. Aroeppala Airport, Selayar, 2021–2024

Year	Aircraft Visits
2021	145
2022	55
2023	84
2024	Not yet available

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Source: BPS Selayar and Transportation Statistics

The data show that flight frequency at H. Aroeppala Airport was unstable during the 2021–2024 period. In 2021, there were 145 aircraft visits, but this number decreased sharply to 55 in 2022. In 2023, aircraft visits increased slightly to 84, indicating a partial recovery of air connectivity. However, official BPS data for 2024 were not yet available. Available information indicates that scheduled flights to Selayar were suspended for almost one year, despite plans to reopen subsidized flights. This condition suggests that conventional air transportation has not yet provided stable and reliable connectivity for Selayar, thereby strengthening the relevance of seaplane development as an alternative mode of transportation.

Table 3. Estimated Technical Suitability of Seaplane Aircraft for Selayar Routes

Aircraft Type	Estimated Passenger Capacity	Route Suitability
Cessna Caravan Amphibian	6–9 passengers	Short inter-island routes
Kodiak 100 Amphibian	6–10 passengers	Short inter-island routes
Twin Otter Series 400 Amphibian	15–19 passengers	Medium-capacity island connectivity

These aircraft types are relevant for the geographical conditions of Selayar because they can support direct access to small islands and marine tourism destinations without requiring conventional runways. The Cessna Caravan Amphibian and Kodiak 100 Amphibian are suitable for premium tourism, small-group travel, and flexible access to remote destinations. Meanwhile, the Twin Otter Series 400 Amphibian offers larger passenger capacity and is more suitable for routes with higher demand or integrated tourism packages. Therefore, these seaplane models may support faster connectivity, exclusive tourism experiences, and the development of island-based tourism services in Selayar.

Table 4. Summary of Key Quantitative Data Supporting Seaplane Development in Selayar

Data Category	Available Figure
Total tourist visits in 2021	6,082 tourists
Total tourist visits in 2022	20,973 tourists
Total tourist visits in 2023	16,193 tourists
Total tourist visits in 2024	14,495 tourists
International tourists in 2024	394 tourists
Aircraft visits in 2021	145 aircraft visits
Aircraft visits in 2022	55 aircraft visits
Aircraft visits in 2023	84 aircraft visits
Aircraft visits in 2024	Not yet available

The quantitative data indicate that Selayar has a continuing tourism market and a clear need for improved transportation connectivity. Tourist visits increased significantly in 2022 and remained substantial in 2023 and 2024, showing that Selayar continues to attract visitors despite fluctuations in annual tourist numbers. The increase in international tourists in 2024 also suggests growing foreign interest in Selayar's marine tourism potential. However, air connectivity remained unstable, as shown by the sharp decline in aircraft visits from 2021 to 2022 and only partial recovery in 2023. Since official aircraft visit data for 2024 were not yet available and scheduled flights were reportedly inactive for much of the year, the development

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of seaplane services can be considered a relevant alternative to support more reliable access to island destinations and strengthen the local tourism-based economy.

Regulatory, Technical, and Economic Barriers in Implementing the Seaplane Pilot Project in Selayar

Despite its potential, several barriers hinder the implementation of a seaplane pilot project in Selayar. From a regulatory standpoint, the absence of specific technical regulations on water aerodromes is a major gap. Law No. 1 of 2009 on Aviation and Ministerial Regulation No. 83 of 2017 only cover general aviation matters without addressing the operational specifics of seaplanes, while ICAO Annex 14 Volume II on water aerodromes has not yet been fully adopted into national legislation. Technically, Selayar lacks essential infrastructure such as dedicated docks, marine navigation aids, and safety equipment. Furthermore, human resources are not yet adequately prepared, as pilots, technicians, and ground-handling staff lack certifications for seaplane operations. Seasonal weather conditions, including high waves and strong winds, also pose challenges for reliable scheduling. Economically, high initial investment costs are required to procure a fleet of seaplanes, and the operational costs are significantly higher than those of sea transportation. Without subsidies or fiscal incentives, commercial sustainability would be difficult. Moreover, the limited purchasing power of the local population suggests that the primary target market for seaplane services would be middle- to upper-class tourists.

Policy Strategies for the Success and Replication of the Seaplane Pilot Project in Other Archipelagic Regions

To ensure success and replicability, several policy strategies are needed. On the regulatory side, the government should establish specific national technical rules for seaplane operations, including standards for water aerodromes, safety procedures, and operator certification, while also adopting ICAO Annex 14 as an international benchmark. In terms of infrastructure and investment, the development of waterbases in strategic Selayar locations can be pursued through public-private partnerships (PPP). At the same time, fiscal incentives or initial subsidies should be provided to attract operators, and private investors should be engaged in both fleet procurement and facility management. From an economic and social perspective, integrating seaplane services into local tourism packages would create direct benefits for micro, small, and medium enterprises (MSMEs). Local communities could be empowered as providers of supporting services, including culinary businesses, homestays, and land transport. Additionally, setting capacity limits for tourists in accordance with sustainable tourism principles would help reduce environmental pressures while ensuring long-term benefits.

Practical Implications for Access to Taka Bonerate National Park

Findings from fieldwork and coordination conducted between 2021 and 2025 suggest that access to Taka Bonerate National Park remains a challenge when relying solely on existing connections through Aroepala Airport and conventional air transport. The introduction of seaplanes offers a viable alternative by enabling faster and more direct routes to premium tourism destinations in the Selayar Islands. Current seaplane models available in the market can be adapted to local geographical conditions, thus providing a sustainable and innovative solution for enhancing tourism connectivity and supporting regional economic development.

Government Participation

The role of the government is to encourage and support the development of air transportation based on seaplane aircraft as a new, effective, and efficient mode of transport aimed at

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improving the mobility of people and goods. This initiative is expected to contribute to economic growth in archipelagic regions and foster sustainable tourism. The government's participation as a catalyst for regional development through air transportation can be realized in several ways. First, by providing subsidies for sustainable air transportation services to ensure affordability and long-term viability. Second, by enhancing the promotion of local cultural heritage as a key attraction in each region, thereby strengthening tourism competitiveness. Third, by collaborating with private stakeholders in infrastructure development and in advancing appropriate technologies for managing marine products. Finally, by undertaking regulatory reforms that enable more efficient operations of seaplane-based air transportation and open opportunities for broader accessibility across island regions.

Synthesis of Findings

Based on the analysis of the research problems, it can be concluded that seaplanes hold significant potential in enhancing connectivity for Selayar as an archipelagic region with leading tourism destinations. However, the main challenges lie in the absence of specific regulations, the limited readiness of infrastructure and human resources, and relatively high operational costs. An integrated policy strategy that encompasses regulatory frameworks, infrastructure development, investment, and community empowerment is crucial for the success of the pilot project. If effectively implemented, the Selayar model could be replicated in other archipelagic regions across Indonesia.

SWOT Analysis

Building on the findings, this study applies a SWOT analysis to design strategies for developing the seaplane ecosystem in Selayar, particularly to strengthen the region's economic and business potential. The SWOT approach is carried out through Internal Factor Analysis Summary (IFAS) and External Factor Analysis Summary (EFAS), adjusted to the geographical conditions, tourism prospects, and economic opportunities of the area.

In this framework, the weighting formula assigns values to each factor based on its level of importance, with a total weight of 1.00. The score for each factor is obtained by multiplying the assigned weight by the rating. For the internal analysis (IFAS), the rating scale is set as: 4 = very strong, 3 = strong, 2 = weak, and 1 = very weak. For the external analysis (EFAS), the scale measures responses to opportunities and threats: 4 = very good response, 3 = good response, 2 = poor response, and 1 = very poor response. The total score obtained from these calculations determines the strategic position, where a score of ≥ 3.0 indicates a strong position, between 2.0–3.0 indicates a moderate position, and < 2.0 indicates a weak position.

IFAS (Internal Factor Analysis Summary)

Table 5. Internal factors are divided into Strengths and Weaknesses.

Internal Factors	Weight	Rating	Score	Description
Strengths				
S1. Direct access to small islands without an airport	0.15	4	0.60	Geographical advantage of seaplane
S2. Potential as a unique tourist attraction	0.12	4	0.48	Experience of flying over the sea
S3. Fast travel time	0.10	3	0.30	Efficient travel
S4. Flexible operations	0.08	3	0.24	Adaptable to demand (land & sea)

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S5. Supports rapid goods distribution	0.07	3	0.21	Adds local economic value
Weaknesses				
W1. High operational and maintenance costs	0.15	2	0.30	Fuel and maintenance expensive
W2. Limited passenger capacity	0.08	2	0.16	Requires larger seaplane fleet
W3. Limited infrastructure	0.10	2	0.20	No existing water aerodrome base
W4. Human resources require specialized skills	0.08	2	0.16	Lack of certified seaplane pilots
W5. Complicated regulations	0.07	2	0.14	Time-consuming administration
Total IFAS	1.00		2.79	Position: Moderate–Strong

EFAS (External Factor Analysis Summary)

Table 6. External factors are divided into Opportunities and Threats

External Factors	Weight	Rating	Score	Description
Opportunities				
O1. Increasing trend of marine and eco-tourism	0.15	4	0.60	Local and international tourism market
O2. Government support for inter-island connectivity	0.12	3	0.36	Includes tourism development programs
O3. Low competition in the seaplane industry	0.10	3	0.30	Stable customer base
O4. Selayar as an archipelagic district	0.10	3	0.30	Enables integrated travel packages
O5. Seaplane technology	0.08	3	0.24	Connects sea and air transport hubs
Threats				
T1. Seaplane operation regulations	0.15	2	0.30	Sea transport fares are lower
T2. Fluctuating fuel prices & exchange rates	0.10	2	0.20	Affects ticket prices
T3. Weather conditions	0.08	2	0.16	Risk of delays
T4. Other modes of transport	0.07	2	0.14	Hinders expansion
T5. Uncertain tourist demand (global issues)	0.05	2	0.10	Potential decline in demand
Total EFAS	1.00		2.70	Position: Moderate–Strong

SWOT Matrix for Selayar Seaplane

Table 7. SWOT Matrix for Seaplane Ecosystem Development in the Selayar Islands

Strengths (S)	Weaknesses (W)
S1. Access to small islands without an airport	W1. High operational costs
S2. Unique tourist attraction	W2. Limited passenger capacity

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S3. Fast travel time	W3. Requires specialized infrastructure
S4. Flexible operations	W4. Limited skilled human resources
S5. Rapid goods distribution	W5. Complex regulations
Opportunities (O)	**Threats (T)**
O1. Increasing marine tourism trends	T1. Operation regulations
O2. Government support	T2. Fuel price fluctuations
O3. Industry competition	T3. Weather conditions
O4. Archipelagic region	T4. Other transport modes
O5. Seaplane technology	T5. Uncertain tourist demand

SWOT Strategies

SO Strategies (Strengths + Opportunities)

The SO strategies aim to leverage internal strengths to maximize external opportunities. First, the integration of seaplane services with tourism resort packages (S1, S2, O1, O3) can create unique travel experiences, attract more tourists, and stimulate local economic growth. Second, flexible operations that can adapt to both land and sea conditions (S1, S4, O4) enhance accessibility to remote islands while optimizing service efficiency. Third, the project can take advantage of government support for the development of waterbase aerodromes (S1, S4, O2, O4), ensuring infrastructure readiness and facilitating sustainable operations.

WO Strategies (Weaknesses + Opportunities)

The WO strategies focus on overcoming internal weaknesses by exploiting external opportunities. Providing ticket subsidies or public service obligations (W1, W5, O2) can make seaplane travel more affordable and attract a wider range of passengers. Collaboration with hotels and travel agencies (W3, O3) can stabilize occupancy rates and promote tourism packages that complement seaplane services. Additionally, infrastructure funding through government programs (W3, O2) can address the lack of facilities and ensure operational efficiency.

ST Strategies (Strengths + Threats)

The ST strategies utilize strengths to mitigate potential external threats. Offering added value through faster travel times and unique experiences compared to conventional ships (S3, S5, T4) positions seaplanes as a competitive alternative. Diversifying services to include both cargo and passenger transport (S2, S5, T2, T5) reduces the impact of market fluctuations and demand uncertainties. Finally, planning routes that minimize weather-related risks based on meteorological data (S3, T3) ensures reliability and safety for passengers.

WT Strategies (Weaknesses + Threats)

The WT strategies aim to reduce internal weaknesses and external threats simultaneously. Deploying a fuel-efficient fleet (W1, T2) helps manage high operational costs and mitigate the impact of fluctuating fuel prices. Establishing backup routes and seasonal scheduling (W4, T3) ensures operational continuity during adverse weather conditions. Lastly, early preparation of regulatory documents (W5, T4) prevents administrative delays and facilitates smoother project implementation.

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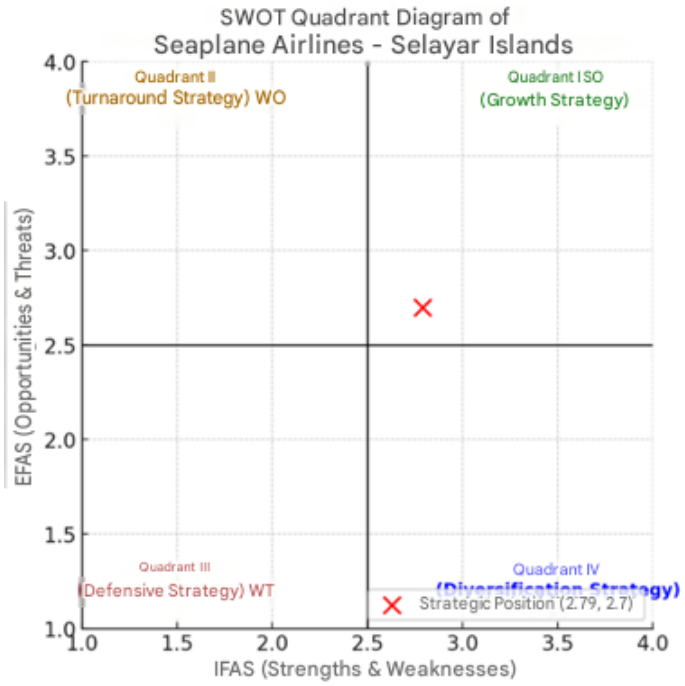

Figure 1. SWOT Quadrant Diagram for Selayar Seaplane Development

The SWOT quadrant diagram indicates that the seaplane ecosystem development in the Selayar Islands is positioned in a moderate to strong strategic condition, as reflected by the IFAS score of 2.79 and the EFAS score of 2.70. This position suggests that the internal strengths of Selayar, including direct access to small islands, tourism uniqueness, faster travel time, and operational flexibility, are sufficient to support development, although they are still constrained by infrastructure limitations, operational costs, skilled human resources, and regulatory complexity. At the same time, the external environment provides promising opportunities through marine tourism growth, government support, low competition in the seaplane industry, and the strategic character of Selayar as an archipelagic region. However, these opportunities must be managed carefully because threats such as regulatory uncertainty, fuel price fluctuations, weather conditions, competition from existing transport modes, and uncertain tourist demand may affect operational sustainability.

The strategic implication of this position is that seaplane development in Selayar should be implemented through a selective and controlled growth strategy rather than immediate large-scale commercialization. The pilot project should prioritize routes with strong tourism demand, especially access to Taka Bonerate and other premium marine tourism destinations, while simultaneously strengthening regulatory preparation, water aerodrome infrastructure, safety systems, and cooperation between government, private operators, and local tourism actors. This strategy allows Selayar to use its geographical and tourism advantages while gradually reducing operational and institutional risks before wider replication in other archipelagic regions.

Significance of the Study

The significance of this study is supported by previous research and relevant theories, providing a strong scientific foundation. Research has shown that seaplane transportation is highly effective for reaching island areas that are otherwise difficult to access using conventional boats or land-based aircraft, as evidenced in regions such as the Maldives, the Philippines, and Alaska. Gibson et al. (2019) found that the availability of seaplane services

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can increase international tourist visits by 20–30% in island regions. Early-stage pilot projects are commonly employed to assess technical and economic feasibility before committing to large-scale investments. Furthermore, Rahman (2021) highlights that fast transportation in small island communities enhances logistics distribution efficiency and reduces operational costs, while theories of regional economic development (Todaro & Smith) emphasize that improved connectivity serves as a key driver of local economic growth.

From a theoretical perspective, the Business Ecosystem Theory (Moore, 1993) suggests that a transportation ecosystem requires coordinated collaboration between government, private sector, local communities, and supporting industries such as hospitality and tourism. Transport Connectivity Theory (Rodrigue, 2020) similarly highlights that higher connectivity creates opportunities for multi-sector economic development, including tourism, trade, and services. The Pilot Project Theory underscores the importance of trial phases to evaluate cost-benefit ratios, operational risks, and community acceptance before full-scale implementation. Additionally, Local Economic Development Theory positions transportation infrastructure as a catalyst for SME growth, foreign investment, and job creation. Geographically, Selayar Regency is composed of multiple islands with limited accessibility, making both sea and air transport essential, particularly for supporting tourism development.

Improved transportation accessibility presents a significant opportunity for tourism in Selayar. Renowned destinations such as Takabonerate National Park, Pinang Beach, and other marine attractions have high potential to attract both domestic and international tourists. However, limited transportation infrastructure often restricts visitor numbers. The introduction of seaplane services can reduce travel times from Makassar and other areas, facilitating easier access to tourist sites. This improvement in accessibility can enhance the appeal of Selayar as a destination, as convenience and efficiency are key factors in tourists' travel decisions. Increased tourist arrivals also have a positive multiplier effect on the local economy. Higher demand for hotels, restaurants, SMEs, and land transportation services is expected, while seaplane services can create new business opportunities such as exclusive "Island Hopping" packages. Consequently, local communities can directly benefit from increased economic activity and income circulation.

Competitive Advantage in Selayar Tourism

Selayar possesses a unique competitive advantage over other destinations in South Sulawesi due to the potential use of seaplane transportation. This distinctive mode of travel can serve as a differentiating factor in tourism promotion, appealing to international tourists who value unique experiences, such as aerial views of islands and surrounding seas. By integrating seaplane services into the tourism offering, Selayar can position itself as a premium destination, enhancing its global tourism image and supporting long-term strategic branding as a world-class tourist location (Zhang et al., 2025; Daud et al., 2024; Mahendar, 2025).

Challenges and Constraints

Despite its promising potential, the development of seaplane services in Selayar faces several challenges. Infrastructure is a primary concern, including the need for specialized seaplane docks, safety facilities, and other supporting amenities. Regulatory hurdles also exist, as obtaining operational permits requires coordination between the Ministry of Transportation, local government, and private operators. Operational costs, including relatively high ticket prices, necessitate careful market segmentation to target middle- and high-income tourists. Additionally, there is a shortage of skilled human resources, including trained pilots, technicians, and support staff, which could limit operational efficiency and service quality.

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Development Strategies

To address these challenges, a multi-pronged development strategy is recommended. Public-private partnerships (PPP) can facilitate the smooth implementation of infrastructure and regulatory requirements, with the private sector managing flight operations (Al Abdulkader et al., 2025; Jash et al., 2025). Targeting premium market segments, particularly international and high-income domestic tourists, can ensure profitability while positioning seaplane services as a unique travel experience. Seaplane services should also be integrated into broader tourism packages, such as sightseeing flights or island-hopping tours, enhancing the overall visitor experience. Capacity building for local human resources through training and certification programs is crucial to support seaplane operations and related tourism services, ensuring sustainable development and community involvement (Markatos et al., 2024; Samunderu, 2024; Bing et al., 2025).

Long-Term Impacts

The development of seaplane services in Selayar is expected to generate substantial long-term benefits. It can become an iconic feature of Selayar tourism, attracting higher numbers of domestic and international visitors, which in turn contributes significantly to regional GDP. Additionally, seaplane services can stimulate the creation of a more integrated and advanced tourism business ecosystem, promoting sustainable economic growth, job creation, and investment opportunities for the local community. By combining strategic transport connectivity with unique tourist experiences, Selayar can solidify its position as a world-class island destination.

Conclusion

The development potential of the seaplane ecosystem in Selayar is significant, supported by favorable geographic conditions, the need for improved connectivity across island regions, and the growing opportunities in marine tourism. Seaplanes are considered a strategic mode of transportation capable of enhancing accessibility and contributing to regional economic growth. However, the main obstacles to seaplane development lie in regulatory, technical, and economic aspects. National regulations have not yet specifically addressed the operation of water aerodromes and seaplanes, supporting infrastructure remains limited, and investment and operational costs are relatively high. In addition, the readiness of human resources and seasonal weather conditions pose additional challenges for implementation. To address these challenges, policy strategies should focus on three key areas. First, regulatory frameworks must be developed based on international technical standards, such as ICAO Annex 14. Second, infrastructure and investment initiatives should include the construction of strategic waterbuses through public private partnerships (PPP) and the provision of investment incentives. Third, economic and social strategies should integrate seaplane services with tourism packages and empower local SMEs within the framework of sustainable tourism. The pilot project of seaplane operations in Selayar serves as an initial model for national policy. Through this trial, the government can evaluate regulatory feasibility, business models, and socio-economic impacts before applying similar programs in other island regions across Indonesia. Overall, seaplane development in Selayar represents a strategic opportunity to enhance connectivity, promote tourism, and stimulate local economic growth, provided that regulatory, technical, and social considerations are carefully managed.

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