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Research Article

Converting training ships into pioneer ships: A policy for regional equity

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Article information	Abstract
Received: December 10, 2025 Revision: March 3, 2026 Accepted: March 10, 2026	Maritime transportation serves to support inter-island connectivity within an extensive archipelagic region. Pioneer ships are expected to reach remote, frontier, underdeveloped, and border areas according to the routes needed by communities. Although there are many requests for pioneer ship routes that need evaluation, this situation has been addressed by the Directorate of Sea Transportation by maximizing the function and duties of training ships as educational tools for prospective maritime officers into asset utilization as pioneer ships for public service activities. The purpose of this research is to analyze problem-oriented policies to determine their utilization level and appropriate problem mapping, then formulate effective strategies to support the sustainability of these policies. A descriptive qualitative method was employed to describe in detail the implementation of policies that have been ongoing since 2022, based on Indonesia's transportation framework Sistem Transportasi Nasional (SISTRANAS), for 7 converted ships. IPA quadrant was employed to detect service users' perceptions of providers and operators, and strategy formulation used SWOT analysis, supported by the results of discussion forums involving policymakers, experts, and service users. The analysis revealed that the indicators of accessibility, security, perceived benefits, operational smoothness, and pollution were classified as low priority. Conversely, the indicators of quality, service tariffs, punctuality, safety, regularity, travel speed, and efficiency were categorized as overutilized, with capacity identified as the only indicator demonstrating consistent performance. The positioning in Quadrant I, reflected by a positive vector score ($x = 2.00$; $y = 1.98$), indicates that a more assertive strategy is required, focusing on the optimization of existing facilities, and supported by clear regulatory frameworks that ensure equitable benefits for all stakeholders.
Keywords Conversion; Pioneer ship; Training ship; Sea transportation	

1. Introduction

Social inequality resulting from isolated regions poses a challenge for policymakers (Rahayu et al., 2024; Singh & Ballini, 2025). The state must take an active role in ensuring that all areas within its sovereignty experience equitable justice (Magunna, 2024; Sahin & Kirval, 2025). There is an imbalance between the transportation service fares set by providers and the purchasing power of consumers, due to a mismatch between demand and supply, particularly for an archipelagic country (Mantoro et al., 2025; Sjafrie et al., 2026) with diverse maritime potential (Lau et al., 2024; Dollah et al., 2025), including in the fisheries sector (Hadiningrat et al., 2024), offshore oil and gas drilling (Dirani & Ponomarenko, 2021), coastal economy and tourism (Donesia et al., 2023), and commerce (Utomo et al., 2025). Even the demand for additional inter-island routes has increased (Amin et al.,

2024; Fitri & Taharuddin, 2025), although the implementation of policies related to sea transportation services needs to be developed so that the needs of service users can be well accommodated (Fahrudin et al., 2024; Rahman & Wirjodirdjo, 2025). Analysis of commercial pioneer shipping routes between islands in the commerce and ferry sectors (Fadilla, 2024; Endika, 2025) is expected to reach remote, frontier, underdeveloped, and border areas (3T) so that no region is isolated due to its geographical location (Fauzi et al., 2024), and the primary and secondary needs of communities can be obtained easily at affordable prices (Hidayat et al., 2024). These regions are classified as underdeveloped, frontier, and remote areas, characterized by limited access to infrastructure, services, and economic opportunities compared to other regions (Alhakim & Chandra, 2024). To realize equitable justice, the government must play a role in reducing community needs and regional disparities (Jayawibawa, 2024; Candra, 2025); this transition requires policy support aligned with established maritime regulatory frameworks, thereby ensuring maritime sustainability, which encompasses the provision of services and operational activities that safeguard users' needs over the long term. The realization of maritime sustainability is strongly influenced by institutional commitment, regulatory compliance, and the integration of economic and environmental considerations within shipping operations (Gupta & Prakash, 2023), governing vessel standardization, particularly those concerning safety compliance, seaworthiness criteria, and the certification process for training vessels repurposed into pioneer service vessels (Ahmed et al., 2024; Peng et al., 2025).

Currently operating pioneer ships have not fully accommodated this, which is related to several factors, including limited shipyard availability for pioneer ships (Preto et al., 2024) and suboptimal routes (Annas et al., 2024; Salossa et al., 2025), while ferry demand is increasing (Sari & Gladys, 2024), but the availability of pioneer ships is limited. The government operates several categories of vessels, consisting of 117 pioneer vessel routes, 39 sea toll cargo routes, 6 livestock transport routes, and 16 rede vessel routes, with assignments distributed to PT Peln and through public procurement mechanisms for private operators (**Table 1**).

Table 1 Data on ship's availability for 3T areas.

Type of Ship	Number of Ship's
Pioneer Ships	42 Ships
Rede Ships	16 Ships
Livestock Ships	74 Ships
Private Ships	39 Ships

Data Source: Analysis Data (2025)

This condition has been addressed by the Directorate General of Sea Transportation (DJPL) as an opportunity to maximize the function and role of training ships as educational platforms for prospective maritime officers, providing direct exposure to ship operations and practical competencies that complement theoretical classroom learning, by repurposing these vessels into pioneer ships commercialized for public service activities, while training activities continue to be conducted simultaneously with service operations. The conversion of training vessels into pioneer ships was driven by several strategic considerations, including operational needs, cost efficiency, asset utilization, implementation speed, resource limitations, technological adaptability, and regional service requirements. Operationally, the increasing demand for pioneer vessels in remote and underserved routes necessitated additional capacity without constructing new ships. From an

economic perspective, conversion was significantly more cost-efficient than building new vessels, reducing material expenses, and accelerating deployment (Han et al., 2025). Asset utilization was also optimized, particularly as existing training vessels had become underutilized in their original function. The conversion process offered a faster implementation timeline compared to new shipbuilding, which aligned with budgetary constraints and limited available resources. Furthermore, the existing technological features of training vessels were sufficiently adaptable to operational requirements of pioneer services with minimal modification. Importantly, this conversion supports improved connectivity, logistical accessibility, and public service delivery for remote communities requiring reliable maritime transportation on design suitability, cost efficiency, operational performance, user satisfaction, and regulatory compliance (Ruhayu et al., 2025). Additionally, the findings provide a foundation for future improvements and development, while supporting the overall optimization of vessel asset utilization. By addressing these key aspects, the study contributes to enhancing both the effectiveness and sustainability of maritime services (Tsvetkova & Gammelgaard, 2025).

The conversion of vessel function also necessitates a shift in the roles and competencies of the onboard human resources. Personnel who previously served primarily as instructors and mentors within a maritime training context are now required to operate under commercial service standards focused on public service delivery, passenger safety, and logistics management. To support this transition, compliance with operational standards governed by the International Safety Management (ISM) Code is essential, particularly in relation to safety protocols, risk management, and operational reporting procedures (Hartanti et al., 2024). Additionally, personnel must undergo mandatory certified training in accordance with the Standards of Training, Certification and Watchkeeping for Seafarers Convention (STCW) to ensure technical competence, operational readiness, and adherence to internationally recognized regulatory frameworks (Duong et al., 2024). Consequently, the transformation from a training vessel into a pioneer service vessel demands not only technical and structural modifications to the ship, but also a comprehensive enhancement of human capital capacity to meet international standards of safety, operational efficiency, and service quality required in contemporary maritime transport systems (Veltsin et al., 2025).

Since the implementation of conversion from training ships to pioneer ships began in 2022, there have been frequent discrepancies in ship departure schedules that have resulted in service users suffering financial losses (Nasrullah, 2025), and even ship routes that cannot accommodate strategic areas (Priatno & Sunaryo et al., 2020; Suroyo et al., 2023), as a study that discusses the synchronization between pioneer vessels and the Sea-toll program to ensure that operational aspects and route policies can be optimized (Devintasari et al., 2022), prompting the DJPL to revise routes in 2025. The route changes that occurred represent a form of evaluation designed by the DJPL to maximize public service functions so that the utilization of training ships as pioneer ships can be achieved; the suboptimal operational conditions do not merely result in service inconsistency but also generate broader structural implications for the national logistics system (Pratama et al., 2025). Irregular schedules and misaligned route planning have the potential to increase logistics and distribution costs, which subsequently contribute to the rising prices of essential goods in remote regions. This situation not only affects the economic stability of local communities, but also constrains regional economic growth, particularly in areas that rely heavily on maritime connectivity as their primary distribution channel (Humang et al., 2025). Therefore, the success of converting training ships into pioneer vessels depends not solely on technical and operational adjustments, but also on the reliability and efficiency of service delivery systems that support sustainable regional connectivity in alignment with national equitable development objectives (Lazim et al., 2025). To provide a clearer overview, the spatial distribution map of pioneer vessel routes (**Figure 1**), along with a table outlining the changes in shipping routes implemented in 2025 (**Table 2**).

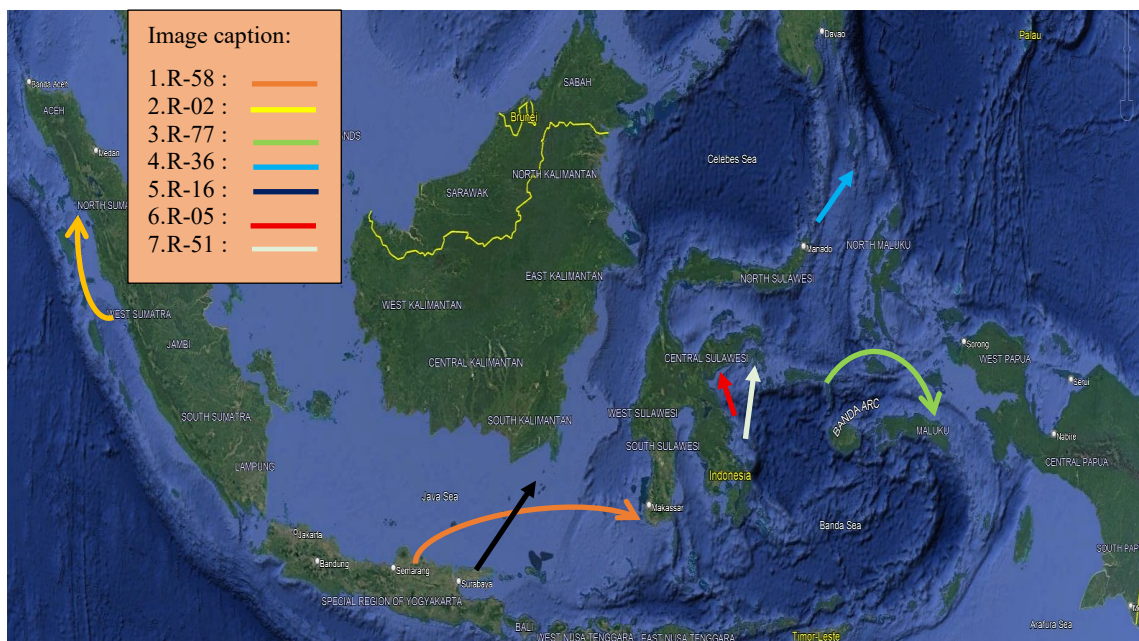


Figure 1 Pioneer ship travel- new route.

Table 2 Route changes due to the conversion of training ships into pioneer ships.

Training Ships	Previous Route	New Route
KL. Sultan Hasanuddin (1200 GT)	R-58 Makassar	Unchanged
KL. Malahayati (1257 GT)	R-8 (Pangkal Kijang)	R-02 Calang
KL. Frans Kaisiepo (1257 GT)	R-27 Ambon	R-77 Ambon
KL. Laksamana Muda John Lie (1257 GT)	R-36 Bitung	New
KL. Bung Tomo (1257 GT)	R-16 Kalianget	Unchanged
KL. M. Husni Thamrin (1200 GT)	R-5 Bengkulu	Unchanged
KM. Barombong (557 GT)	R-51 Kolonodale	New

The purpose of this research is to identify problem-oriented policies, which are derived from real world issues in existing regulations (Wuwung et al., 2024), to determine the extent of their utilization and community response, as well as to appropriately use problem mapping to detect threats, weaknesses, strengths, and opportunities, based on Indonesia’s transportation framework, Sistem Transportasi Nasional (SISTRANAS). This differs from the study by Patimbano (2025), which employed a qualitative descriptive method, focusing on operational and routine maintenance issues that were prevented proper function, as well as the lack of synchronization between local governments and central government agencies. Additionally, Nasrullah (2025) only highlighted the operation of pioneer vessels, which has been shown to reduce cost disparities and strengthen logistics performance in underserved maritime regions. In contrast, Fahrudin (2024) explained that his findings

pertain to the aspect of integrated supervision and monitoring, which has not been well organized. The research will then formulate effective and appropriate strategies to support the sustainability of these policies.

2. Research methodology

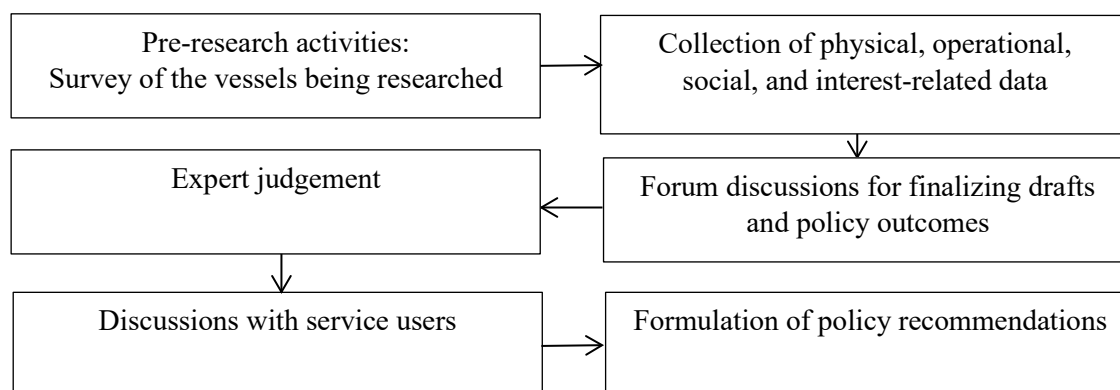
This study employs a qualitative research approach, strengthened with quantitative analysis (Zukhruf et al., 2025) that explains in detail the current conditions of training ships and the extent to which they can benefit society, as well as formulates strategies to support sustainable policies. The problem orientation in this study was established from the outset, beginning with the period when these vessels were initially designed as practical training platforms for prospective merchant marine officers. Although the ships were constructed in accordance with International Maritime Organization (IMO) standards, several spaces originally intended as classrooms or laboratories required reconfiguration and refurbishment to support their new function as public service areas. Furthermore, cargo-handling simulations that previously utilized sample items were replaced with actual loading and unloading activities involving real cargo, necessitating proper cargo-placement mechanisms and layout arrangements to ensure vessel stability and operational safety.

Against this backdrop, the rationale for this study is grounded in the operational developments that have emerged following the 2022 implementation of the policy converting training ships into pioneer vessels. The study further evaluates potential weaknesses and threats that may hinder these developments over time, while identifying opportunities and strengths that can be strategically leveraged to reinforce, sustain, and enhance the long-term effectiveness and continuity of the policy.

2.1 Data collection steps

The research was conducted over 1 year on 7 training ships converted to pioneer ships (KL. Sultan Hasanuddin, KL. Malahayati, KL. Frans Kaisiepo, KL. Laksamana Muda John Lie, KL. Bung Tomo, KL. M. Husni Thamrin, and KM. Barombong) In formulating policies that have broad societal impacts, a high degree of caution is required. Accordingly, the following analytical framework is employed to map problems based on actual conditions in the field, after which a draft problem formulation is prepared and subsequently discussed with relevant organizations and policymakers. The draft is then reviewed by experts to obtain academic and substantive validation, and further disseminated to policy users. This tiered process ensures that the resulting policy document effectively addresses existing regulatory gaps and can be implemented in a practical and sustainable manner. The following illustrates the research flow and the policy determination concept (**Table 3**).

Table 3 The data collection steps used in this research are based on the following model.



Data Source: Tohardi Research Model (2020)

Table 4 Definition of SISTRANAS indicators.

Accessibility	Operating vessels must have accessibility that is easy for passengers to reach, be located at public ports, and not be equipped with excessive security procedures. In addition, the sailing routes must be able to accommodate the needs of service users, particularly in providing access to remote areas
Capacity	The vessel must have adequate capacity to support passenger activities during the voyage and must not exceed the prescribed capacity limits to prevent overcrowding and congestion. For non-passenger cargo, appropriate storage space must be provided to ensure that the physical condition of the goods is not damaged and is protected from potential harm caused by water or fire
Quality	Service quality must be a top priority to ensure passenger comfort when using the service, emphasizing two-way communication whenever passengers require assistance or support. In addition, control systems for passengers, cargo, and navigational safety must comply with applicable regulations and be equipped with risk mitigation measures designed to minimize potential damage
Service Tariff	The fare amount must be clearly stated, with a transaction process that is easy to complete and more affordable compared to other commercial vessels, as its primary objective is to facilitate communities living in 3T regions
Punctuality	Punctuality must be a primary concern, with consistent estimated arrival and departure schedules
Security	The vessel's security must be properly monitored to ensure that passengers feel safe during the voyage. In addition, the sailing route must avoid areas that are dangerous or prone to conflict
Benefits	Operating vessels must be able to provide benefits to service users and contribute to the realization of a fair and equitable standard of living that can be experienced broadly across all segments of society
Safety	Safety equipment to address various risks on board must be complete and ready for use, including in situations such as fire hazards, vessel sinking, man overboard incidents, emergencies requiring abandonment of the ship, and other related conditions
Regularity	Orderliness in various aspects must be ensured, including the orderly placement of safety and security equipment, the orderly provision of facilities for passengers, and the orderly delivery of individual services and other related aspects
Smoothness	The vessel's operational smoothness must be maintained, with no technical issues that could disrupt the voyage or cause recurring damage, thereby preventing delays in arrival
Speed	The vessel's speed must remain consistent and stable, and the crew must be able to accurately calculate the estimated sailing distance based on the vessel's speed
Pollution	Pollution must be minimized by ensuring that all pollution-control equipment functions properly. Waste disposal facilities must be adjusted to the type of waste, and no leakage should occur that could reduce water quality standards
Efficiency	Efficiency in vessel management must be implemented across service delivery, information provision, and other relevant aspects, without cumbersome bureaucracy, so that passengers can receive prioritized services

Data Sources: Analysis (2025)

2.1.1 Pre survey research

The initial phase of the study commenced with the submission of a research approval request to the Directorate General of Sea Transportation (DJPL), relevant policymakers, vessel supervisors and managers, ship masters, and vessel operators. Upon receiving approval, the subsequent step

involved identifying vessel locations and movements, followed by intensive coordination with ship masters to ensure the proper execution of surveys and readiness for data collection activities. The researchers also developed a preliminary set of questions aligned with the research focus and engaged in in-depth discussions with the research team to determine the specific data requirements for subsequent stages. This systematic approach ensured that the entire data collection process was conducted in a structured, relevant, and operationally contextualized manner, thereby enhancing the validity and reliability of the study's findings.

2.1.2 Collection of related data

The next step involved assigning teams to sail along on the vessels to collect and categorize data related to operational performance, the condition of the vessels during sailing and berthing, and the completeness of communication and navigation equipment. Data collection also covered cargo handling equipment, safety and security equipment, electrical power and propulsion systems, passenger facilities, and emergency equipment. In addition, the teams assessed the ease of passenger access to ticketing, the punctuality of vessel departure and arrival schedules, the suitability and regularity of sailing routes, and the regional needs for the vessel service routes. Secondary data collection included ship particulars, ship arrangement, ship displacement, dead weight tonnage, crew capacity, passenger capacity, etc.

The research objects consisted of seven training ships that were converted into pioneer vessels. The respondents were selected using a purposive sampling method, as data collection was based on specific criteria requiring respondents to have authority in decision-making or policymaking according to their respective positions. A total of 200 respondents participated in the study, comprising 5 representatives from the DJPL, 5 policymakers, 7 acting directors, 7 port supervisors (port masters), 7 vessel managers (vendors), 7 ship masters (captains), 13 stakeholders, and 149 passengers from the seven vessels included in the study. The questionnaire design was developed based on the SISTRANAS framework, employing precise and relevant indicators to guide service providers and operators in executing port activities effectively (Rahman et al., 2025). To ensure the robustness of the instrument, validity testing and correlation analysis were performed using r table coefficients with a significance level of $\alpha = 0.05$, while reliability was confirmed with Cronbach's alpha values exceeding 0.60. Complementing the structured questionnaires, qualitative data were also obtained through open-ended interviews, allowing for deeper insights and contextual understanding of operational practices at the ports.

2.1.3 Forum discussions

This study aims to formulate policy problems through a problem-definition process based on the SISTRANAS indicators, namely Accessibility, Capacity, Quality, Service Tariff, Punctuality, Security, Benefits, Safety, Regularity, Smoothness, Speed, Pollution, and Efficiency, with the definitions clearly presented in **Table 4**.

Furthermore, problem specification was carried out using the Importance-Performance Analysis (IPA) data processing technique to assess the relationship between these indicators and the levels of importance and policy performance. The analysis is structured according to the following scheme:

Formulation steps;

$$Tki = \frac{Xi}{Yi} \times 100$$

Description

Tki = Respondent Suitability Level

Xi = Performance Score

Yi = Importance Score

Average step;

Summing the Average Levels of Importance and Satisfaction, Formula:

$$X = \frac{\sum_{i=1}^k x_i}{n}; Y = \frac{\sum_{i=1}^k y_i}{n}$$

X = Quality Average Satisfaction Level for Item i

Y = Quality Average Importance Level for Item i

N = Number of Respondents

Quadrant analysis importance performance analysis (IPA)

Analysis results were then grouped into 4 quadrants with IPA:

- Quadrant I “Top Priority” - Factors that need to be improved (High Importance & Low Performance)
- Quadrant II “Maintain Achievement” - Maintain what has been achieved (High Importance & High Performance)
- Quadrant III “Low Priority” - No focus on products or services (Low Importance & Low Performance)
- Quadrant IV “Tends to be Excessive” - Maintain excessively (Low Importance & High Performance)

Quadrant to detect service perceptions toward providers/operators and loyalty toward service users (Afandi, 2024) and strategy formulation used Strength, Weakness, Opportunity, and Threat (SWOT) analysis with the following scheme:

SWOT analysis formulation

Internal Factor Analysis Summary (IFAS) consists of strength and weakness variables, and External Factor Analysis Summary (EFAS) consists of opportunity and threat variables, aimed at determining calculation indices as the basis for creating SWOT graphs. The steps are as follows:

- Assign scores according to Likert analysis on each SWOT item
- Assign weights with a scale from 1.0 (very important) to 0.0 (not important)
- Calculate ratings on each factor by providing a scale from 4 (highest) to 1
- Rating values for opportunity factors are positive, meaning the greater the opportunity, the rating is +4, but if the opportunity is small, the rating is +1. Rating values for threat factors are the opposite of opportunity variables
- Determine score values by multiplying weights and ratings
- Sum weighted scores to obtain IFAS and EFAS values which are subsequently mapped into the SWOT diagram and the SWOT Matrix design diagram. Their positions are then determined according to the strategic levels presented in **Table 5** and as well as their positions according to the indicators presented in **Table 6**.

Table 5 Strategy level SWOT analysis.

Internal Score	External Score	Strategy
S > W (+)	O > T (+)	<i>Growth</i>
S > W (+)	O < T (-)	<i>Diversification</i>
S < W (-)	O > T (+)	<i>Turn-around</i>
S < W (-)	O < T (-)	<i>Defensive</i>

- SWOT diagram mapping (IFAS and EFAS)

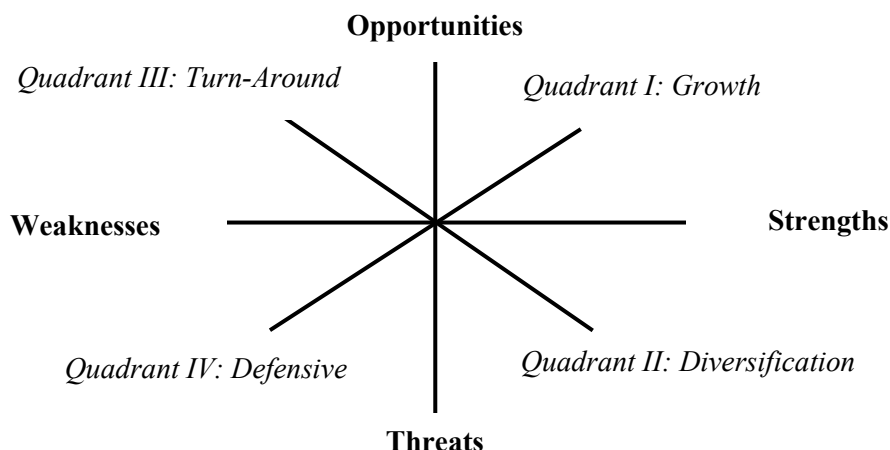


Table 6 SWOT matrix design diagram.

EFAS \ IFAS	Strengths	Weakness
	SISTRANAS Indicators	SISTRANAS Indicators
Opportunities	S-O Strengths-Opportunities	W-O Weaknesses-Opportunities
SISTRANAS Indicators	Strategi S-O	Strategi W-O
Threats	S-T Strengths-Threats	W-T Weakness-Threats
SISTRANAS Indicators	Strategy S-T	Strategy W-O

2.1.4 Collaborative analysis design problem policy

The collaborative design employed in this study was developed to comprehensively determine the level of importance and usefulness of the policy, drawing upon SISTRANAS indicators that are assumed to represent actual conditions as well as the evolving dynamics of policy issues arising from the decision-making process. These indicators function not only as performance measurement tools but also as analytical instruments that enable the identification of root problems, the detection of implementation gaps, and the assessment of the extent to which the policy addresses public needs. To understand the tendencies between the levels of importance and usefulness, and to establish priority areas for intervention, this study applies the Importance-Performance Analysis (IPA), which systematically maps stakeholders' perceptions of the policy's effectiveness.

The results of the IPA serve as the basis for formulating more comprehensive strategies through the categorization of strengths, weaknesses, opportunities, and threats. This SWOT approach allows for the identification of internal and external factors influencing policy outcomes, while also facilitating the development of adaptive and long-term strategic responses. By mapping the analytical findings onto a SWOT diagram, the study produces a framework that is not merely descriptive but also strategic, thereby generating policy recommendations that are more relevant, implementable, and aligned with the social, economic, and geographical dynamics present within the policy environment. The policy design scheme is illustrated in **Figure 2**, whereas the problem-oriented quadrants are presented in **Table 7**.

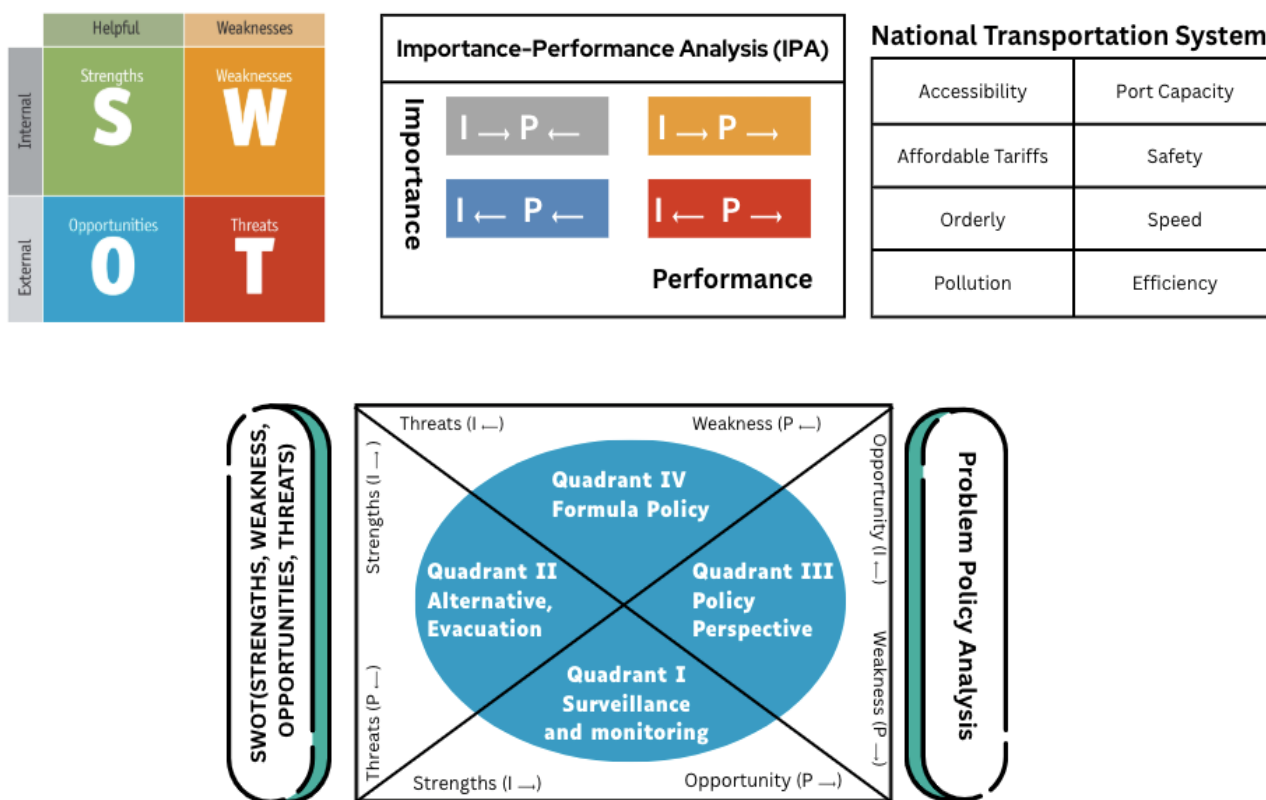


Figure 2 Sustainable policy design with a problem-oriented approach.

Table 7 Quadrant and category problem-oriented approach.

Quadrant	Category
Quadrant I (Surveillance and Monitoring) Strengths-Opportunities	This strategy leverages the available strengths and opportunities through continuous surveillance and monitoring efforts to ensure that performance can be maintained at an optimal level.
Quadrant II (Alternative, Evacuation) Threats-Strengths	This strategy addresses existing threats by leveraging organizational strengths while formulating viable alternatives and preparing evacuation measures, ensuring that the most critical issues are treated as top priority.
Quadrant III (Policy Perspective) Opportunities-Weaknesses	This strategy focuses on utilizing available opportunities while taking internal weaknesses into account, examining issues from a policy perspective, and managing overstated expectations to ensure that policy implementation remains realistic and effective.
Quadrant IV (Formula Policy) Threats-Weaknesses	This strategy responds to existing threats while taking into account internal weaknesses, formulating appropriate policy measures, and assigning the issue to a low-priority category.

2.1.5 Expert judgement, discussion, and recommendations

This stage involved a systematic series of evaluative procedures designed to verify the validity of the policy substance and assess its feasibility for implementation. The initial outcomes from preliminary discussions were synthesized into a draft policy document, which subsequently underwent expert evaluation to obtain critical feedback, strengthen theoretical coherence, and enhance conceptual clarity in alignment with evidence-based policy formulation standards. Following the expert review phase, the revised draft was presented to policy users (implementers) to evaluate operational relevance, assess implementation feasibility within real-world settings, and ensure consistency with practical needs and institutional capacity. The final policy recommendations were formulated through the integration of multiple empirical sources, including survey findings, document analysis, expert judgment, and user consultations, resulting in a comprehensive, well-substantiated, and evidence-driven policy framework. This iterative and participatory methodology ensured that the final recommendations were methodologically sound, contextually appropriate, and strategically actionable within the targeted implementation environment.

3. Results

The 3T regions face several limitations, particularly the shallow depth of their shipping channels, which restricts the entry of vessels with high gross tonnage, along with limited investor support and inadequate port facilities. Nevertheless, these regions cannot be regarded as permanently isolated or underdeveloped. The government plays a role in alleviating the burdens of local communities through the strategic functions of the Directorate General of Sea Transportation (DJPL) in supporting maritime transport, strengthening national mobility, and promoting the development of sovereign regions. These efforts are directed toward achieving equitable public welfare through comprehensive and sustainable strategic policies that strengthen connectivity and support equitable development, in line with the National Economic Acceleration Program and the Masterplan for the Acceleration and Expansion of Indonesia's Economic Development (MP3EI) (Boile et al., 2023; Hudalah et al., 2024).

3.1 Realization of achievements

The condition of training ships used for educational tools is designed to resemble commercial ships in general, having propulsion systems, electricity generators, machinery auxiliaries, navigation equipment, maneuvering equipment, communication equipment, cargo space, loading and unloading equipment, ship mooring equipment, crew cabins, galley, hospital rooms, etc., so that students conducting learning simulations aboard ships can directly use these tools as real practice materials. Thus, if this training ship is converted into a pioneer ship, its construction, quality, quantity, and the completeness of international documentation are adequately supported, making the vessel suitable for use as a means of public maritime transportation. **Table 8** provides the main data for each vessel.

Based on the data above, fares for both passengers and cargo are still very affordable compared to other commercial passenger ships (Zulmarjon, 2023). The Barombong ship has the smallest gross tonnage (GT), yet can accommodate 150 passengers and 18 crew members. This differs from the Husni Thamrin and Sultan Hasanuddin ships, which have the highest passenger capacities, with 17 crew members each. Additionally, a ship with a GT of 1,200 can only accommodate 114 passengers with 17 crew members. The sailing routes are quite diverse, as they traverse areas classified under the 3T category. The map of the vessel routes is shown in **Figure 3**.

3.2 Results of SISTRANAS-based questionnaire

Theoretically, the policy of converting training ships to pioneer ships can be implemented properly according to service quality standards, but it needs to be reanalyzed to determine the usefulness of the policy to service users. Based on SISTRANAS-based questionnaires with IPA analysis, the results of the analysis are presented in **Table 9**.

Table 8 Realization of ships being researched.

Training Ships	Sailing Route (Destination city)	Distance (Miles)	Passenger Fare (Rp/Person)	Cargo Fare (Rp/kg)	Crew Capacity	Ship's Crew
KL. Sultan Hasanuddin (1,200 GT)	Makasar-Selayar				184 persons	17 persons
	Selayar-Jampea	119	25.900	26.000		
	Jampea-Makasar	148	30.700	30.900		
	Makasar-Maccini	186	36.900	37.300		
	Baji	26	8.900	8.900		
	Macini Baji-	73	17.800	15.800		
	Dewakang Lompo					
KL. Malahayati (1,257 GT)	Calang-Sinabang	140	29.400	29.500	114 persons	17 persons
	Sinabang-Lahewa	165	33.500	33.800		
	Lahewa-Banyak	140	29.400	29.500		
	Banyak-Tapak	63	15.900	14.400		
	Tapak-Sinabang	65	16.300	14.700		
	Sinabung-Calang	140	29.400	29.500		
KL. Frans Kaisiepo (1,257 GT)	Ambon-Manipa	50	13.400	12.400	114 persons	17 persons
	Manipa-Kelang	25	8.700	8.700		
	Kelang-Waesala	22	8.200	8.300		
	Waesala-Buano	9	7.800	8.000		
	Buano-Taniwel	38	11.200	10.700		
	Taniwel-Wahai	63	15.900	14.400		
	Wahai-Kobisadar	23.5	8.500	8.500		
KL. Laksamana Muda John Lie (1,257 GT)	Bitung-Biaro	74	18.000	16.000	114 persons	17 persons
	Biaro-Tagulandang	19	7.800	8.000		
	Tagulandang-Buhias	32	10.100	9.800		
	Buhias-Sawang	4	7.800	8.000		
	Sawang-Ulu	4	7.800	8.000		
	Ulu-Makalehi	32	10.100	8.000		
KL. Bung Tomo (1,257 GT)	Surabaya-				114 persons	17 persons
	Mesalembo	150	31.000	31.200		
	Masalembo-	40	11.600	11.000		
	Keramaian	72	17.600	15.700		
	Keramaian-Matasiri	20	7.800	8.000		
	Matasiri-Maradepan	22	8.200	8.300		
	Maradepan-					
	Marabatuan					
KL. M. Husni Thamrin (1,200 GT)	Bengkulu-Enggano	110	24.400	24.500	184 persons	17 persons
	Enggano-Bengkulu	100	24.400	24.500		
KM. Barombong (557 GT)	Kolonodale-Bungku	63	15.900	14.400	150 persons	18 persons
	Bungku-Menui	105	23.600	23.600		
	Menui-Kendari	46	12.700	11.800		
	Baturube-Bangai	110	24.400	24.500		
	Bangai-Bobong	71	17.400	15.500		

Data Source: Data Analysis (2025)

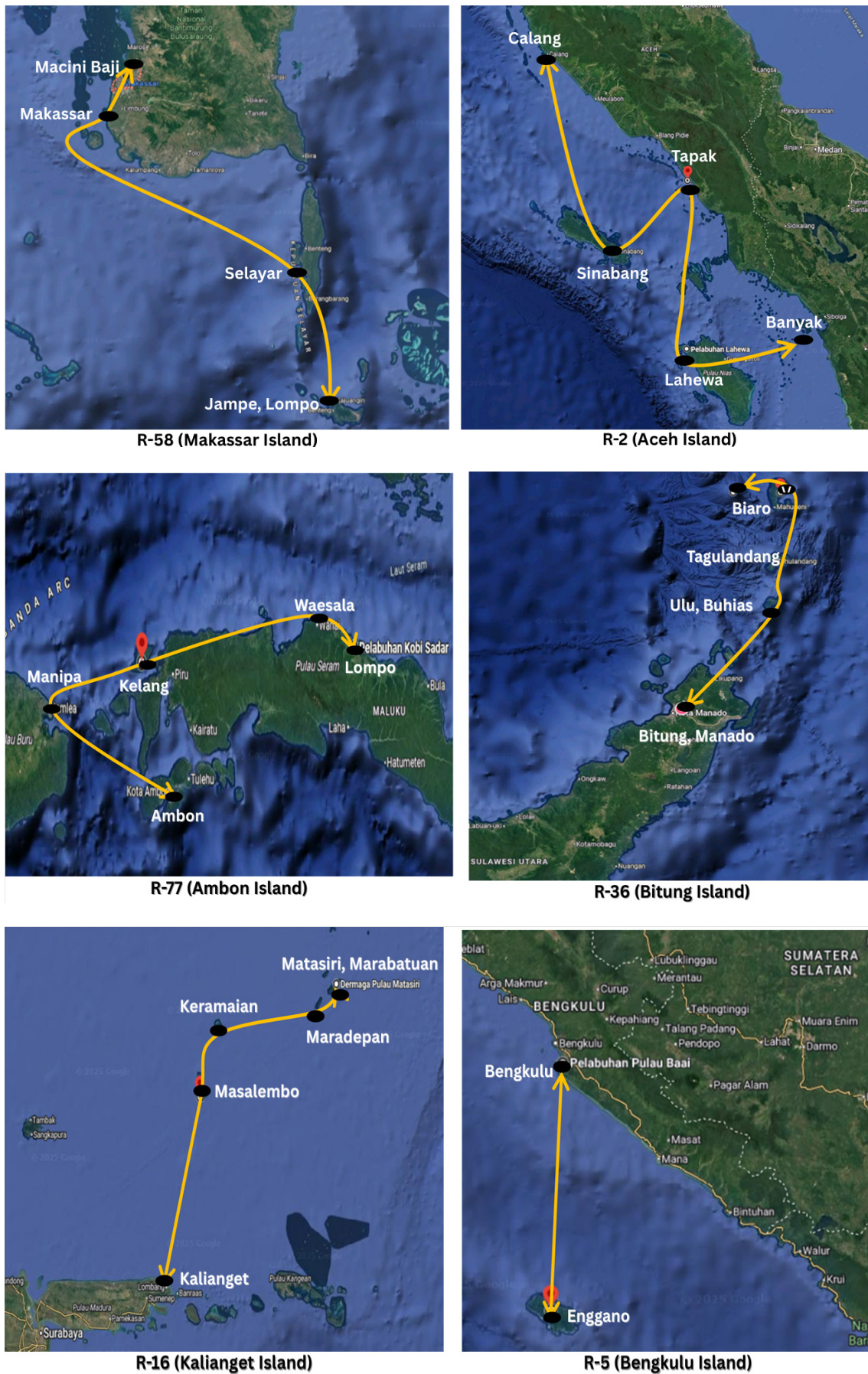


Figure 3 Voyage routes of pioneer vessels.

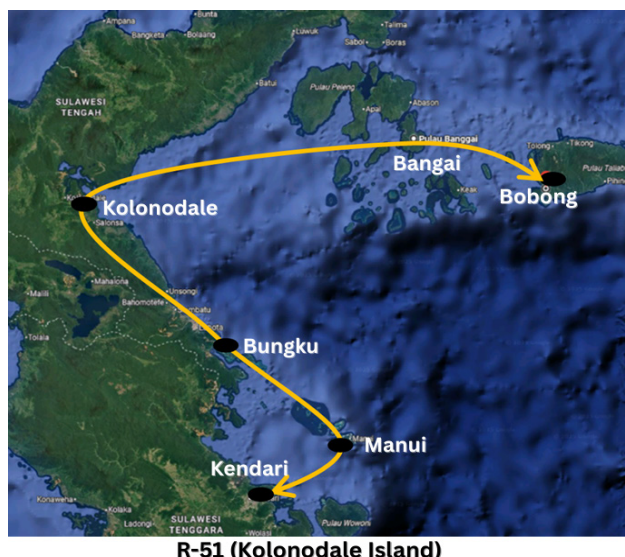


Figure 3 (continued) Voyage routes of pioneer vessels.

Table 9 SISTRANAS-based IPA analysis results.

No	Assessment Indicator	Importance Value	Performance Value	Achievement	Description
1	Accessibility	1.64	1.60	I > P	Low Priority
2	Capacity	1.60	1.60	I = P	Maintain Achievement
3	Quality	1.83	2.29	I < P	Excessive Utilization
4	Service Tariff	1.81	2.32	I < P	Excessive Utilization
5	Punctuality	1.53	1.58	I < P	Excessive Utilization
6	Security	1.56	1.51	I > P	Low Priority
7	Benefits	1.72	1.58	I > P	Low Priority
8	Safety	1.62	1.68	I < P	Excessive Utilization
9	Regularity	1.56	1.59	I < P	Excessive Utilization
10	Smoothness	1.63	1.62	I > P	Low Priority
11	Speed	1.68	1.69	I < P	Excessive Utilization
12	Pollution	1.65	1.64	I > P	Low Priority
13	Efficiency	1.66	1.70	I < P	Excessive Utilization

Based on the analysis results, the finding that five indicators reflect a higher level of importance from the perspective of service providers than the level of performance perceived by users indicates the presence of a significant service quality gap. Such disparities often arise because service providers- particularly managers or implementing institutions- form internal perceptions of what should constitute service priorities; however, these perceptions do not always align with users' evaluations of actual performance. Consequently, user expectations remain only partially fulfilled, suggesting that, although service providers consider these aspects critical, their implementation has not yet succeeded in delivering an adequate service experience. This condition underscores that prioritizing importance alone is insufficient without tangible, consistent, and measurable improvements in service delivery. This discrepancy reflects expectations that have not yet been fully realized in user experience (Hermanto et al., 2025). Furthermore, seven indicators demonstrate a misalignment between the importance of the service and its actual performance, indicating the need

for quality improvements in specific areas to more effectively address user needs and expectations, Studies on public services indicate that gaps between user expectations and perceptions frequently occur, and certain service attributes must be prioritized for improvement (Yanwar & Suhartini, 2024). Meanwhile, only one indicator shows parity between importance and performance, suggesting that this aspect has met the expected service standard. These findings underscore that most service elements still require focused attention and strategic intervention to ensure that policy implementation achieves optimal effectiveness and delivers broader benefits to the public. The results of the analysis are illustrated in **Figure 4** using a Cartesian diagram.

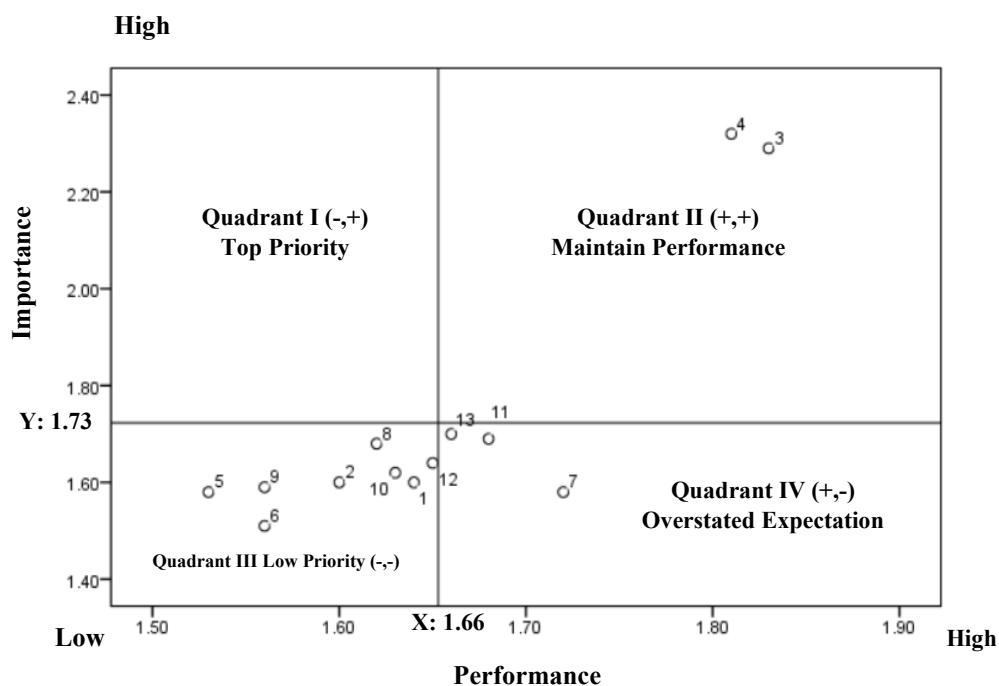


Figure 4 Cartesian analysis diagram.

The total of 13 indicators analyzed using the Importance-Performance Analysis (IPA) method produced a Cartesian diagram with an average value of 1.73 on the X-axis (performance) and 1.66 on the Y-axis (importance). The difference of 0.07 between these values indicates that, overall, service performance is relatively close to the level of importance expected by users, although several areas still require improvement. The mapping results show that no indicators fall within Quadrant I, while Quadrant II contains two indicators that are performing well and should be maintained. Quadrant III comprises eight indicators characterized by equally low levels of importance and performance, suggesting that they do not require immediate intervention. Meanwhile, Quadrant IV contains three indicators in which performance exceeds their level of importance, indicating that resource allocation for these aspects could be optimized. These findings provide a robust analytical basis for evaluating service effectiveness and identifying strategic areas for more targeted policy enhancement (Mubarok et al., 2024).

The results of the IPA analysis are not directly translated into strategic actions; instead, they are first transformed into internal and external factors. Indicators positioned in Quadrant II are classified as Strengths, while those in Quadrant III are categorized as Weaknesses and, subsequently, incorporated into the IFAS matrix. Meanwhile, external factors in the form of Opportunities and Threats are analyzed through the EFAS matrix. Based on the integration of IFAS and EFAS, strategic directions are determined using the SWOT analytical framework, in which Quadrant I represents an

aggressive (SO) strategy, Quadrant II a diversification (ST) strategy, Quadrant III a defensive (WT) strategy, and Quadrant IV a turn-around (WO) strategy. The weighted values and scores from both matrices are then synthesized to identify the most appropriate strategic direction. **Table 10** summarizes the indicators and strategies formulated based on the results of the factor analysis.

Table 10 IFAS and EFAS Analysis.

Indicator Description	Weight	Rating	Score
Internal Factor Analysis Summary (IFAS)			
STRENGTHS			
Fares remain unchanged	0.06	2	0.120
Clear fares	0.06	2	0.116
Fares lower than land and air transportation	0.06	2	0.116
Affordable fares	0.06	2	0.116
Scheduled departures	0.07	2	0.134
Departure times exceeding the schedule	0.08	2	0.166
Scheduled arrivals	0.07	2	0.132
Arrival times exceeding the schedule	0.08	2	0.168
WEAKNESSES			
Safety equipment available	0.06	2	0.112
Safety equipment usable	0.06	2	0.116
Safe shipping route	0.06	2	0.114
Shipping route appropriate	0.06	2	0.110
Smooth loading/unloading of goods/passengers as expected	0.06	2	0.126
Adequate loading and unloading operations	0.06	2	0.116
Navigation/maneuvering equipment appropriate	0.06	2	0.118
Smooth navigation without obstacles	0.06	2	0.122
External Factor Analysis Summary (EFAS)			
OPPORTUNITIES			
Ship access connected to 3T areas	0.096	2	0.192
Ship access reaching 3T areas	0.098	2	0.196
Ship capacity in accordance with passenger needs	0.101	2	0.202
Utilization of capacity fulfilled	0.100	2	0.200
Port capacity accommodated	0.104	2	0.208
Capacity accommodating passenger needs	0.104	2	0.208
THREATS			
Ship efficiency accurate	0.087	2	0.174
Ship efficiency suited to the needs of 3T areas	0.101	2	0.202
Pollution prevention equipment on ships accommodated	0.103	2	0.206
Pollution from ships low	0.105	2	0.210

In the IFAS assessment, the strength indicators are primarily driven by the affordability of service tariffs, despite occasional deviations between the actual vessel arrival and departure times and the published schedule. Moreover, affordable tariff structures can support broader economic objectives, as appropriate financing mechanisms have the potential to enhance infrastructure quality and reduce overall logistics costs (Gurning et al., 2024) Within the weakness indicators, safety equipment, sailing routes, and navigation instruments show relatively comparable scores; however, a notable gap emerges in the smoothness of cargo handling operations. This gap is primarily attributed

to the limited availability of port handling facilities, as only one crane is currently in operation to support loading and unloading activities, However, empirical studies demonstrate that crane performance plays a substantial role in determining the overall efficiency of cargo handling operations and can even serve as a critical consideration in estimating vessel turnaround time (Ningrat et al., 2024).

In the EFAS assessment, the opportunity indicators exhibit relatively similar levels of vulnerability, supported by vessel accessibility to 3T regions, adequate passenger capacity, and a favorable utilization rate among users. For the threat indicators, the efficiency of service fulfillment in 3T areas is perceived as being aligned with passenger expectations, while vessels are also equipped with adequate pollution-control systems, thereby ensuring operational continuity and compliance with environmental standards. There is a growing need to enhance sustainable management efficiency through the adoption of advanced and context-appropriate technologies (Alzate et al., 2024). Moreover, developing a comprehensive understanding of external factors- both those emerging from the current operational environment and those that may arise in the future- is essential for ensuring service resilience and competitiveness (Kishore et al., 2024). In this regard, the optimization of port management and the integration of innovative practices must be seriously considered, as these measures play a crucial role in improving operational performance, strengthening logistics system integration, and supporting the long-term sustainability of maritime transport services in remote and underdeveloped regions (Xiao et al., 2024). **Figure 5** presents the SWOT analysis diagram.

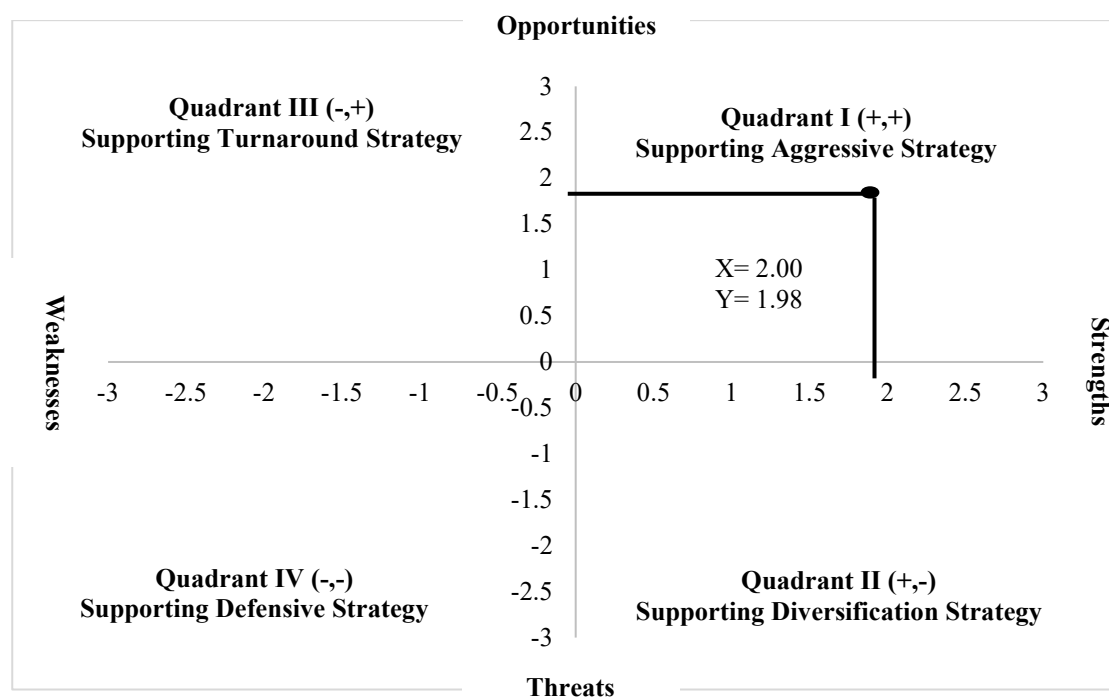


Figure 5 SWOT Diagram.

The SWOT diagram mapping results show a positive outlook, which can be seen from the axis point (X = 2.0 and Y = 1.98), therefore, located in Quadrant I, with a strategy step to support more aggressive action in all matters related to sustainable policies.

3.3 Expert judgement

Subsequently, the analysis results were presented to subject-matter experts for critical evaluation, which generated the following inputs:

- Emphasize service delivery to users, taking into account aspects of vessel facilities, safety, usefulness, security, and comfort.
- The utilization of the current shipping routes provides significant opportunities for regional development, thereby creating potential for investors to collaborate with local governments.
- User accessibility to the official website must be considered, as internet access in some areas remains limited. Therefore, alternative methods must be provided to ensure service users can easily make reservations.

3.4 Discussion with users

The discussion with service users provided several points of input to the researcher, containing various expectations and appreciation for the policy currently being implemented, summarized as follows:

- Service users feel the presence of the government in small, outermost, and underdeveloped islands, although many island regions have not yet fully benefited from the policy.
- Several islands experience limited internet connectivity, and electricity is available only at certain times, causing service users to face difficulties when booking tickets online. Meanwhile, offline ticket booking is only available at specific times.
- The distance between ports and remote islands using land transportation is quite far in several areas, making accurate departure and arrival schedules essential so that service users do not have to wait too long or risk missing the vessel.

4. Discussion

Previous studies emphasize the critical role of maritime transportation in sustaining remote and small island regions. Naufal (2024) shows that the sustainability of these islands depends on improved transportation infrastructure and the availability of pioneer vessels, while Jinca (2024) highlights that inter-island sea transportation, analyzed using Integrated Planning, Importance–Performance Analysis, Problem-Oriented Policy, and SWOT methods, significantly supports economic development and community welfare. However, prior research focuses mainly on infrastructure and system performance, with limited attention to adaptive operational strategies under budget and fleet constraints. Addressing this gap, the present study investigates the optimization of state-owned training vessels as pioneer ships, adopting a problem-oriented policy approach to enhance connectivity, efficiency, and sustainable governance. The findings aim to inform the development of inclusive and resilient maritime transportation policies for small and remote islands.

The results of the questionnaire and its analysis, along with inputs from experts and users, indicate that the policy requires deeper government involvement so that its benefits can be widely felt. If possible, the government should consider adding routes based on user feedback. Although the vessels already meet international certification standards, high-quality services are still essential as key supporting elements. These services require financial support, while operational costs are currently still partially funded by the state budget, making user fares insufficient to cover the full operational needs of the vessels, particularly because most service users come from middle-income groups. Therefore, the government needs fundamental, problem-oriented strategies based on policy analysis.

The SWOT analysis mapping results are in Quadrant I, emphasizing that the designed system must be aggressive in implementing policies, sensitive to problems, and immediately seek solutions, fully supported by all levels, especially policy stakeholders: the government, port authority policy supervisors, vendor policy managers, and policy implementers such as seafarer/ship operators must collaborate and synergize to maintain service quality and minimize risks to achieve service quality for the community/service users. This is reinforced by previous research that discussed performance analysis and fleet requirements, which are closely related to the optimization and efficiency of pioneer ships (Hou et al., 2023; Kamaci, 2025). The X-axis is higher than the Y-axis, with a difference of

0.02, meaning opportunities and strengths can collaborate well, mutually reinforcing each other in seeking opportunities in all fields that can be strengthened, identifying weaknesses and threats from both external and internal organizational sources, then seeking solutions as quickly and effectively as possible so they do not become obstacles in the future.

The SWOT diagram also explains that, in reality, the community greatly feels the benefits of this policy, even though the policy has only been running for 3 years. This can be seen from the analysis results showing high opportunities, although improvements are needed in departure and arrival schedules that are not yet accurate; however, it is necessary to pay attention to the feasibility of the ship, especially its hull, which must be adjusted to the technical engineering of the conversion (Hadi et al., 2023). In terms of strength, this ship is worthy of conducting commercial voyages in terms of safety and security, cargo loading and unloading, suitable places for passengers, and fulfilled logistics systems. Threats that will arise and must be faced if policies and systems are not improved, looking at the SWOT mapping, include degradation of service user trust, resulting in large losses, especially declining company revenue; meanwhile, ship operational costs, such as fuel, food, maintenance, and repairs are quite high. To implement such engineering, relevant infrastructure based on policy analysis is needed to accommodate the converted ships (Sihombing et al., 2025). The weakness is consistency in running routes that are sometimes difficult to reach due to tidal conditions in waters, and not every time are there passengers boarding the ship/placing goods. This becomes a weakness of the routes currently operating for pioneer ships; therefore, this policy needs to be reviewed by utilizing converted or traditional vessels as low-emission feeder routes (Fahrudin et al., 2024). Problem-oriented policy strategies and suggestions recommendations can be summarized as follows:

4.1 Maximizing existing strengths

Training ships currently are ships international standards, both in terms of electronic and celestial navigation equipment, as well as safety, loading, and security equipment, all of which are suitable and can be used properly. Therefore, this strength must be maximized so it can be utilized according to its purpose.

4.2 Service and network expansion

The shipping route network is quite accurate according to the needs of coastal communities, so the advantageous conditions for ships currently must be balanced with populist policies and decision-making so that 3T areas can be reached. If necessary, additional shipping routes should be added to broaden coverage. Quality management must be able to support ship operators, in this case managers and supervisors, so that operational needs for ships, whether sailing, anchoring, or mooring, can be met properly.

4.3 Process and technology innovation

Developing service innovations that prioritize technology is a strategic step to enhance service quality and operational efficiency. The use of online ticket booking applications provides easy access for users, yet it must be complemented by offline booking facilities for communities that are not yet familiar with digital platforms. In addition, the process of shipping commodities by sea must be supported by accurate cargo-calculation technology that is synchronized with a suitable vessel stability management system, ensuring safety, timeliness, and the overall effectiveness of vessel operations.

4.4 Aggressive human resource development

Crew members or ship personnel constitute the frontline in service delivery and quality enhancement; therefore, the crew selection process must be implemented through an integrated and systematic approach. Beyond meeting the required competence and technical skills, additional

priority criteria related to excellent service are essential to ensure optimal performance. Furthermore, intensive and continuous training is required to strengthen crew competence, refine skills, and foster a high level of professionalism, thereby supporting the overall effectiveness and reliability of maritime operations.

4.5 Reputation and branding enhancement

Organizational reputation is a highly significant aspect; the higher the reputation of an organization, the greater the level of public trust it receives. Therefore, effective organizational management is required to strengthen and enhance this reputation. Leveraging modern technology serves as an efficient strategy to facilitate users in accessing ideal services. These efforts can be further supported through targeted public campaigns and service transparency that is openly communicated to the public.

4.6 Expansion of strategic partnerships

The utilization of pioneer ships has proven to reduce the economy of 3T communities because it is cheaper to send goods in large quantities via ships; however, this must be supported by extensive cooperation, and effective marketing needs to be done to increase benefits, such as by providing discounts to attract customers to use services. However, it requires sustainable commitment and good relationships with vendors, managers, and crew, with good marketing to improve quality.

4.7 Enhanced superior services

Existing advantages are leveraged to enhance the quality of superior services, thereby increasing the trust and satisfaction of service users. Comprehensive innovation is essential to strengthen available opportunities while simultaneously mitigating weaknesses and potential threats that may hinder operational performance. Improvements in service quality can be achieved through independent investment initiatives, along with continuous research and development efforts which aim to ensure the sustainable enhancement of service delivery standards.

5. Conclusions

Low priority grouping is found in the indicators of accessibility, security, benefits, smoothness, and pollution. Excessive utilization grouping is found in the indicators of quality, service tariffs, punctuality, safety, regularity, speed, and efficiency, with maintained achievement only in the capacity indicator. The limitations of this study are primarily related to its geographically dispersed setting across multiple islands, which may result in variations in user responses to the available facilities. However, the majority of questionnaire results demonstrated a high degree of consistency, likely due to the similar nature of vessel facilities across different ships.

Mapping points to Quadrant I with positive angle values ($x = 2.00$ and $y = 1.98$), meaning strategies must be more aggressive in managing existing facilities by maximizing benefits supported by definite regulations that benefit all parties involved: policy stakeholders, supervisors, managers, and operators classified as service providers, so that the community, passengers, and entrepreneurs using services can experience satisfaction and receive prime and quality service priorities. To enhance service accessibility and user satisfaction, operators could implement simplified ticketing procedures, provide discounts for customers transporting pre-packaged cargo, and offer complimentary refreshments prior to boarding. Such measures not only improve the overall passenger experience but also strengthen perceived service quality, foster user loyalty, and support the strategic goal of delivering efficient and customer-oriented maritime services.

The problem-oriented strategy directs planning toward a workforce that is not only skilled and competent but also upholds service user priority scales. Reputation is always directly proportional to trust, so quality becomes important in services to attract service users and increase organizational profits.

Service users require ease in accessing and utilizing the services; therefore, the government needs to establish appropriate policies that accommodate all necessary points while ensuring long-term benefits for the company. Although the current achievements remain limited, the company must maintain good consistency to realize these expectations.

In leading studies, the discussion can focus on the necessity of route optimization by mapping other remote areas, supported by consistent publications and well-scheduled operational planning, to ensure systematic and effective connectivity.

Declaration of generative AI in scientific writing

The authors declare that generative AI tools (e.g., ChatGPT) were used only for language editing and improving readability. The authors have reviewed and edited the output and take full responsibility for the content of this manuscript.

CRedit author statement

Mafrisal: Conceptualization, Methodology, Supervision. **Fuad Ardani Rahman:** Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Visualization. **Indira Ari Putri:** Resources, Writing – Review & Editing. **Surya Valenthyho Mallisa:** Software, Validation, Visualization. **Arleiny:** Project Administration, Writing – Review & Editing.

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