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Original Article

Development Strategy for Rural Transportation Services in Island Cluster of Pangkep Regency

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Abstract - *Pangkajene is an island regency that has 115 island clusters, with characteristics of the outermost, remote, and inland areas. So, it needs the role of transportation, especially in sea transportation, which is the mobility of the island community in connecting with other islands. This research aims to identify and provide an overview of efforts to develop sea transportation services to the community in Pangkep Regency, especially those in the islands. Researchers used observation, interview, and documentation methods with qualitative descriptive analysis techniques. By looking at the existing conditions of port facilities and fleets (ships, boats and docks) that serve community mobility in the islands of Pangkajene Regency. Strategies are needed to improve rural transportation services for island clusters that are adequate according to the water conditions on each island and have certainty on shipping safety guarantees.*

Keywords *- Service development, Rural transportation, Development strategy, Accessibility, Transport policy.*

1. Introduction

Indonesia is an island that has 17,504 islands and 5.9 million km^2 of juridical sea area, and there are 2.55 million km^2 of Exclusive Economic Zone (EEZ) area, a coastline length of about 94,000 km, and 2.95 million km^2 of island waters. As an island, strengthening the transportation connectivity system is needed so that relations within the island and between islands can run smoothly and support the development of a region's economy [1]. Ferry transportation services are essential for coastal areas to meet the demanding needs of the population [2]. In addition, improving transportation accessibility significantly influences regional economic growth [3]. Network connectivity between islands can be realized through a reliable and resilient marine transportation system supported by adequate infrastructure [4]. Maritime transport is essential to sustain economic development, given its ability to provide cheaper solutions than other modes of transportation [5]. In the case of islands, connectivity is based on a hub and spoke network model and is influenced by layering and dominance/subordination relationships [6]. Inter-island connectivity can be realized through a reliable and resilient transportation system supported by adequate infrastructure [4]. However, not all archipelagic areas in Indonesia can be passed by national shipping vessels due to the depth of the sea. Therefore, pelra transportation is needed to help reach areas that are difficult for national shipping ships to enter. Traditional shipping is traditional transportation that can serve the distribution of consumer goods, especially to remote and isolated areas that are difficult for modern ships to enter [7, 8]. With the development of National Shipping transportation side by side with Pelra transportation, it can reach underdeveloped, remote, outermost, and border areas '3TP' so that the economy in the region can increase. In 2018, the government granted 124 units of Pelra ships to local governments [9]. Three of them were for South Sulawesi. The areas that received them were Bulukumba, Pangkep, and Selayar [10]. The addition of the number of Pelra ships in several regions is to facilitate shipping activities in remote areas. In archipelagic countries like Indonesia, sea transportation and ports are essential to connect around a thousand islands and facilitate billions of tons of trade [11].

Ports are essential facilities for the functioning of the global economy, as well as for the region they serve [12, 13]. The services provided within the port must have high-quality standards and reliable infrastructure. Thus, the port can serve as a shipping network connectivity for more distant markets, and customers will see the port as one of the possible options [14, 15]. Ports are an important part of transportation related to technological advances in the maritime industry, driving drastic changes in the policies of these ports [16, 17]. Ports are also the gateway to global trade and are considered a catalyst for the economic development of countries as thousands of

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ports around the world handle seaborne trade [18]. Ports are essential for the functioning of the global economy and the regions they supply [12, 13]. Ports are connected to inland transportation facilities as transit points to help connect exporters and importers inland to the port and facilitate regional and cross-border trade [19]. The services provided within the port must be high-quality, and the infrastructure must be in place. Only then can the port attract shipping lines to use the port for further markets, and only then will customers see the port as one of the possible options [14].

Regarding the efficiency of port operations, coordination and collaboration of loading operation planning and traffic scheduling are required, and optimization and collaborative coordination can improve port operations. When these two are separated, it often results in vessels spending more waiting time while passing through the channel and/or longer loading time at the berth, which greatly affects the productivity and efficiency of the port [20]. The mainland areas are Pangkajene, Balocci, Bungoro, Labakkang, Ma'rang, Segeri, Minasa Te'ne, Tondong Tallasa, and Mandalle sub-districts.

Meanwhile, the island region consists of 4 sub-districts, namely Liukang Tupabbiring, Liukang Tupabbiring Utara, Liukang Kalukuang Masalaima (abbreviated; Kalmas), and Liukang Tangaya. The four sub-districts of the Pangkajene islands are located in the western part of Pangkep Regency, which is part of the Spermonde archipelago group.

Generally, the island's area ranges from 3-48 ha [21]. The four island sub-districts in Pangkep Regency have several marine potentials, such as tourism, fisheries, seaweed cultivation, etc. However, they have not yet developed their potential, so they are lagging behind other areas that have high accessibility. To connect with the mainland, people in the islands rely on sea transportation. The community's movement is done to fulfil daily needs, office administration, and social and cultural needs. This research aims to identify and provide an overview of the sea transportation service strategy in supporting the community's survival for cultural, social, and economic activities, as well as developing an adequate rural transportation network with certainty on shipping safety guarantees.

Various studies related to sea transportation in Pangkep Regency, such as safety studies of traditional shipping transportation [21-23], pioneer sea transportation performance [24], Potential generation of goods and passenger movements [25], as well as determining the location of warehouse construction and the shortest route sequence in food distribution). This study discusses the condition of sea transportation services, both national shipping and traditional shipping. It determines strategies for developing sea transportation services in the island districts in Pangkep Regency to establish connectivity with the main islands and improve the community's economy.

2. Methods

Data collection in this study was carried out by direct observation at the Maccini Baji Port, Pangkajene Dock, and Kassi Kebo Dock, which are docks located on the mainland that are the place of transfer of cargo and passengers (islanders) to and from the destination island cluster. Then, there will be unstructured interviews with the community of sea transportation service providers and users, including national shipping transportation crews and traditional shipping 'pelra' transportation entrepreneurs (drivers and owners). Interviews were conducted to find out their perceptions of the condition of sea transportation services and the needs of service users. Documentation was conducted by collecting various documents such as distance and travel time of the voyage. The qualitative descriptive analysis method was carried out by considering the existing conditions of sea transportation facilities and infrastructure adapted to the needs of users and providers of sea transportation.

3. Discussion

3.1. Geographical and Social Conditions

Pangkep Regency is located on the west coast of South Sulawesi Province. Its astronomical cluster position is between 40-40' South latitude to 80-00 South latitude and 1100 East longitude to 119048'67" East longitude, with an area of 1,112.29 km2. The highest average air temperature in Pangkajenne and Islands Regency in 2023 was 29.1oC, which occurred in October with an air pressure of 1,011.6 mb, wind speed of 4 knots, and sunshine of 98 hours. The lowest average temperature occurred in February, which amounted to 26.3oC with a wind speed of 3 knots, air pressure of 1,008.8 mb, and 34 hours of sunshine. Then, the rainiest days occurred in February, namely 26 days with rainfall of 1,035mm3 [26]. Geographically, the island districts closest to the mainland are Liukang Tupabbiring and North Liukang Tupabbiring districts bordering the Pangkajene district. The Tupabbiring district area is far from the capital of Pangkep Regency, namely the closest Mattiro Adae, with a distance of ± 18 km from the capital. At the same time, the furthest is Mattiro Ujung, with a distance of about ± 111 km from the Regency Capital [25]. Liukang Tupabbiring Utara district has a distance to the Regency Capital, namely the closest Mattiro Baji Village, with a distance of ± 15 km and the farthest Mattiro Walie and Mattiro Bulu Villages, with a distance of about ± 30 km from the Pangkep Regency Capital area [27]. The number of island groups in the Islands Sub-district is 115 islands, with details of 73 inhabited islands and 42 uninhabited islands. Population mobility to the Regency Capital for administrative, socio-cultural, and economic matters. The community's basic needs in Liukang Tupabbiring and Liukang Tupabbiring Utara districts are channeled from the mainland area of Pangkep Regency [28]. Going through Pangkajene Port/Dock, Maccini Baji Port/Dock, and Kassi Kebo Port/Dock. The distance traveled between the islands, and the destination port varies, depending on the shipping route, as well as the capability and capacity of the ship.

Table 1. Number of island clusters per district

Village	Island Name	Area (km^2)	Number of populations
Mattiro Deceng	Badi	9,00	1.958
	Pajenekang	2,00	1.121
	Balang Lompo	8,00	2.602
Mattiro Sompe	Langkadea	0,70	1
Mattiro Ujung	Pandangan	10,00	658
	Kapoposang	5,00	461
Mattiro Dolangan	Podang-podang Lompo	3,00	867
	Lamputang	1,20	391
	Pala	1,20	241
	Cengkeh	0,50	2
Mattiro Bone	Bonto Sua	3,50	1.067
Mattiro Adae	Sanane	2,50	1.032
Mattiro Langi	Sarappo Lompo	11,50	1.504
Mattiro Matae	Gondong Bali	91,00	924
Mattiro Bintang	Balang Caddi		140
Kecamatan Liukang Tupabbiring Utara			
Mattiro Walie	Samatellu Lompo	39,00	1.376
	Samatellu Pe'dda	20,00	33
	Samatellu Borong	15,00	139
	Salebbo	20,00	353
Mattiro Bombang	Salemo	10,00	1.747
	Sakula	9,00	538
	Sagara	3,00	375
	Sabangko	1,00	176
Mattiro Kanja	Sabutung	14,00	1.412
Mattiro Uleng	Kulambing	3,00	100
	Bangko-Bangkoang	2,00	838
Mattiro Labangeng	Laiya	3,00	866
	Polewali	2,00	164
Mattiro Bulu	Karanrang	3,00	2.248
Mattiro Baji	Satando	4,28	420
	Saugi	2,00	422
	Sapuli	1,20	429
Liukang Tangayya District			
Sabalana	Sabalana	12,00	1.019
	Matalaang	2	374
	Sanane	4,00	168
	Makarangana	1,20	161
	Lilikang	1,10	135
	Santigian	12,00	1.019
Balo-Baloang	Balo-Baloang Lompo	13,20	591
	Balo-Baloang Caddi	12,10	90
	Sumanga	10,11	662
	Sanipa	9,10	229
	Pelokan	7,01	379
	Langkoitang	8,01	428
Sabaru	Sabaru	11,40	750
Sapuka	Sapuka	14,20	1.769
	Inggalungan	13,10	250
	Kembang Lernari	12,10	569
Tampaang	Tampaang	11,60	222
	Aloang	10,10	328

	Kawassang	9,10	214
	Sapinggang		246
Sailus	Sailus Besar	18,60	1.417
	Sailus Kecil	17,40	600
	Makaranganan	14,30	417
	Marabatuan	10,49	324
Liukang Kalmas District			
Satanger	Satanger	17,50	839
Kapoposang Bali	Kapoposang Bali	10,40	642
Doang-Doangan Lompo	Doang-Doangan Lompo	4,00	639
	Bangko-Bangkoang		639
Dewakkang Lompo	Dewakkang Lompo	10,90	1.112
	Dewakkang Caddi	8,00	300
	Bangkauluang	2,00	83
Marasende	Marasende	12,40	929
Kanyurang	Banko-Bangkoang	83,90	909
	Butung-Butungan	2,10	303
	Kanyurang Caddi	1,40	686
Kalu-kalukuang	Kalu-kalukuang	23,00	2.051
Sabaru	Sabaru	11,40	750

Liukang Tangayya and Liukang Kalma's districts are the furthest from the mainland and are the capital of Pangkep Regency. These two districts are the most difficult areas to reach from Pangkajene Regency. Liukang Tangaya district is the closest to the Regency Capital, namely Sabaru Island, which is ± 243 km from the capital of Pangkajene Regency, and the farthest Poleonro Island, with a distance of ± 500 km [29].

The islands in Liukang Tangayya district are closer to West Nusa Tenggara Province, and for economic activities, they interact more with communities in West Nusa Tenggara Province. Liukang Kalmas district, which has the closest distance, is Dewakkang Village, with a distance of ± 97 from the Regency Capital, and the farthest is Pamnas Village, with a distance of ± 293 km from the Capital of Pangkep Regency [29]. Community mobility in these two districts with Pangkajene Regency is dominated by office administration and social and cultural affairs. Basic needs in Liukang Tangayya district are supplied from Pangkep, Makassar, and West Nusa Tenggara. However, the price of basic commodities in this area is higher than in other of the Pangkep Regency.

3.2. Condition of Rural Transportation Services

3.2.1. Condition of Ports

Ports throughout history have been an important type of transportation, and ports can dominate the local economy of coastal cities [30]. It is widely recognized that ports are critical to the economic development of any coastal country [31]. Therefore, the presence of ports is very important for island countries. This is to access the distribution of various commodities in coastal areas. Sea transportation accessibility to the islands in Pangkep Regency can be accessed through Paotere Port in Makassar and Ports in Pangkep Regency, namely Pangkejene Port, Maccini Baji Port, and Kassi Kebo Port. Each inhabited island also has a port/dock to access other islands, with simple conditions. The Port of Pangkajene is located on a river waterway in the urban centre of Pangkajene District, precisely on the edge of the central market of Pangkep District.

The presence of a traditional market near the port reinforces the port's role in the daily mobility of the island community. In addition to loading and unloading passengers, it is also used to load goods dominated by daily necessities, cabinets, chairs, beds, motorcycles, etc., resulting from shopping for island communities. Loading seafood from the islands, such as fish, squid, and shrimp, is also important to be sold at the Pangkajene market. The transportation fee is IDR 10,000 - IDR 15,000 per trip, and passengers who travel back and forth are charged IDR 15,000 (based on an interview with the owner and driver of Bado 2024. The infrastructure of the Pangkajene dock is very limited by the feasibility standard, so it still requires improvement, especially on the pier facilities and the stacking area. The port's docks are made of simple concrete with very narrow dock facilities. The depth of the sea around the port only allows small vessels (pelra ships) to dock. Maccini Baji Port is located in Labakkang District, which is one of the main ports in Pangkep Regency. It has a working area of Biringkassi (mainland port) and 11 working areas in island sub-districts, namely: Liukang Tangayya district including Balobaloang, Doang-doangang Caddi, Sailus, Longkoitang, and Sapuka islands; Liukang Tupabbiring Utara district includes Sabutung Island and Liukang Tupabbiring district: Balang Lompo and Liukang Kalmas district which includes Pamantauan, Kapoposang Bali, Kalukalukuang and Dewakang Lompo.

The sea depth of Maccini Baji Port can only serve small ships owned by fishermen and passenger carriers with a maximum size of 800GT, and for 1000GT ships can only dock at high tide and low tide the shiploads passengers outside the Port area with ship to ship. The infrastructure of this port is still simple, using simple concrete, and there are no loading and unloading facilities. Ships that do loading and unloading provide their own loading and unloading equipment. In terms of port management, this port also requires improvement, especially in terms of waste management.

Another challenge is that the access road to the port is narrow and inadequate, making it difficult for trucks carrying cargo to reach it. Maccini Baji Port has a strategic role in supporting regional and national economic activities, especially in supporting logistics distribution and inter-island passenger transportation. Maccini Baji is the center of loading and unloading activities of traditional shipping vessels 'Pelra' and national shipping vessels 'Pelnas' in Pangkep Regency. One of the main commodities loaded at this port is cement in bag/sack packaging, which is distributed to various provinces in eastern Indonesia (Kendari, Bau-Bau, Konawe and Kalimantan). This shows the importance of Maccini Baji Port in maintaining the smooth distribution of industrial goods, especially building materials, for development in remote areas.

Kassi Kebo Port is located in a remote area of Ma'rang district. This jetty is a link between mainland Pangkep Regency and nearby islands in Liukang Tupabbiring Utara district, namely Sagara, Salemo, Sabangko, and Sakuala, which use this port to access markets and schools in Ma'rang district. The shallow waters around the port can only be accessed by small boats. There are 15 to 20 boats operating every day, but there is only one regular sailing from Salemo Island; the rest are chartered.

The travel time from each island to Kassi Kebo Port is about 30-45 minutes. Kassi Kebo Port also plays a role in distributing fishermen's catches, such as fish, crabs and other products, to markets in the Ma'rang district. The dock also serves as an entry point for necessities such as foodstuffs, fuel, drinking water, and daily necessities sent from the mainland to the island. The presence of this pier can support local trade activities. In daily activities, traders, fishermen, and small businesses utilize this pier as a distribution and transaction point, making it one of the main veins of the local economy. The Kassi Kebo Port facilities are still far from feasible because the condition of the pier is made of wood and has been damaged so that it can threaten the safety of passengers and luggage and does not support larger port activities (See Figure 1), that there is no lighting making the port unable to operate at night.

Maccini Baji Port

Pangkajene Port

KassiKebo Port

Fig. 1 Ports in pangkep mainland regency

Source: Research Documentation, 2024

Generally, the condition of the ports on the mainland and each island is still inadequate in terms of infrastructure and management, which has not been maximized. The condition of the waters around the port tends to be shallow, causing only relatively small pelra transportation to be able to carry out loading and unloading activities and up and down passengers directly. Meanwhile, for modern ships (national shipping ships) with large sizes, loading and unloading activities and getting on and off passengers are carried out on the ship to sip using the help of traditional boats. However, these ports remain the lifeblood of the people in the Pangkajene islands, supporting local economic activities and strengthening inter-island connectivity.

3.2.2. Condition of Sea Transportation Services

To connect the islands with the mainland, sea transportation facilities are by pelnas ships (ferry transportation) and traditional ships (traditional shipping). Travel time between islands varies depending on the shipping lanes traveled.

3.3. National Shipping Transportation Services

National Shipping ships 'Pelnas' ships are part of the Sea Toll program managed by the Ministry of Transportation. This sea toll program features pioneer ships that connect remote, frontier, underdeveloped, and border islands. *Pelnas* ships are modern in construction and equipped with adequate basic facilities for sea travel, such as passenger cabins and cargo storage areas. The accessibility of these vessels covers remote small islands not served by commercial ships.

The purpose of this *pelnas* transport procurement is to reduce the transportation access gap between small islands and the mainland. With a route that covers several islands in Pangkajene Regency, this ship is one of the means of transportation for people living in coastal areas and remote islands. There are three *Pelnas* transportation operations in Pangkep Regency, namely KM. Sabuk Nusantara 52, KM Amukti Palapa, and KL Sultan Hasanuddin. These National Shipping ships operate mainly to connect islands in Liukang Tangayya and Liukang Kalmas sub-districts with the capital of Pangkep Regency, Makassar, to West Nusa Tenggara. Serving transportation for passengers and goods to support community mobility and logistics distribution in remote areas in the Pangkajene islands. The presence of *Pelnas* ships to serve the farthest district areas, namely Kalmas and Liukang Tangayya districts, is the right choice because *Pelnas* transportation can access long routes at a more affordable cost and has a large enough carrying capacity to be able to transport passengers and goods in significant quantities.

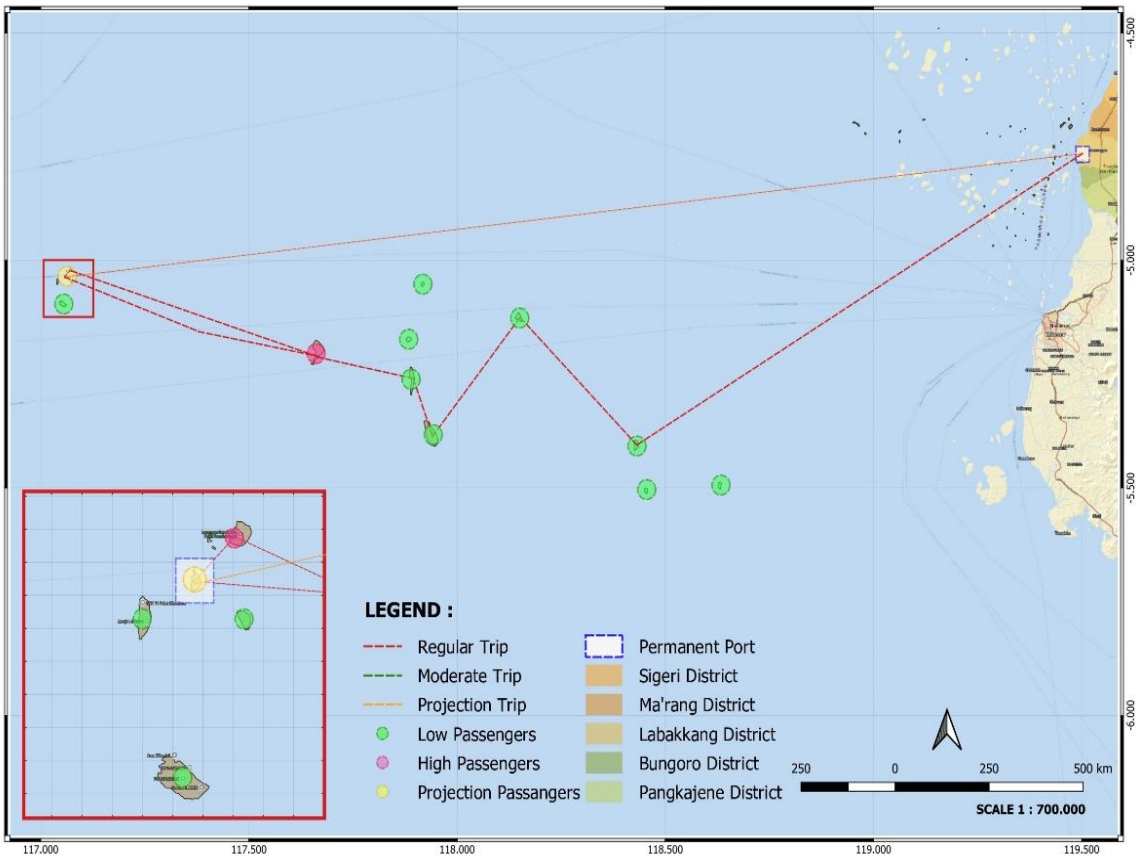

Fig. 2 Ship routes in pangkep islands for liukang kalukaukuang mas

Source: Analysis result, 2024

National Shipping transportation facilities that operate in Liukang Kalmas district are KM. Sabuk Nusantara 52, and KL. Sultan Hasanuddin. With access through Makassar Harbor to Maccini Baji followed by Liukang Kalmas district, with access through the port of Makassar to Maccini Baji, followed by the port in the Liukang Kalmas district, namely Kapoposang Bali Island, Doang-Doangan Lompo Island, Dewakkang Lompo Island, Marasende Island, and Kalu-Kalukuang Island. The national transportation ships that operate in Liukang Tangayya district are KM. Sabuk Nusantara 52 and KM Amukti Palapa. The route is through Paotere Port Makassar to Maccini Baji Port in Pangkep District to the Ports in Liukang Tangayya District, namely Ports in Balo-Baloang Lompo Island, Sabaru Island, Sapuka Island, Tampaang Island, Salius Island to Badas Port in West Nusa Tenggara (See Figure 3).

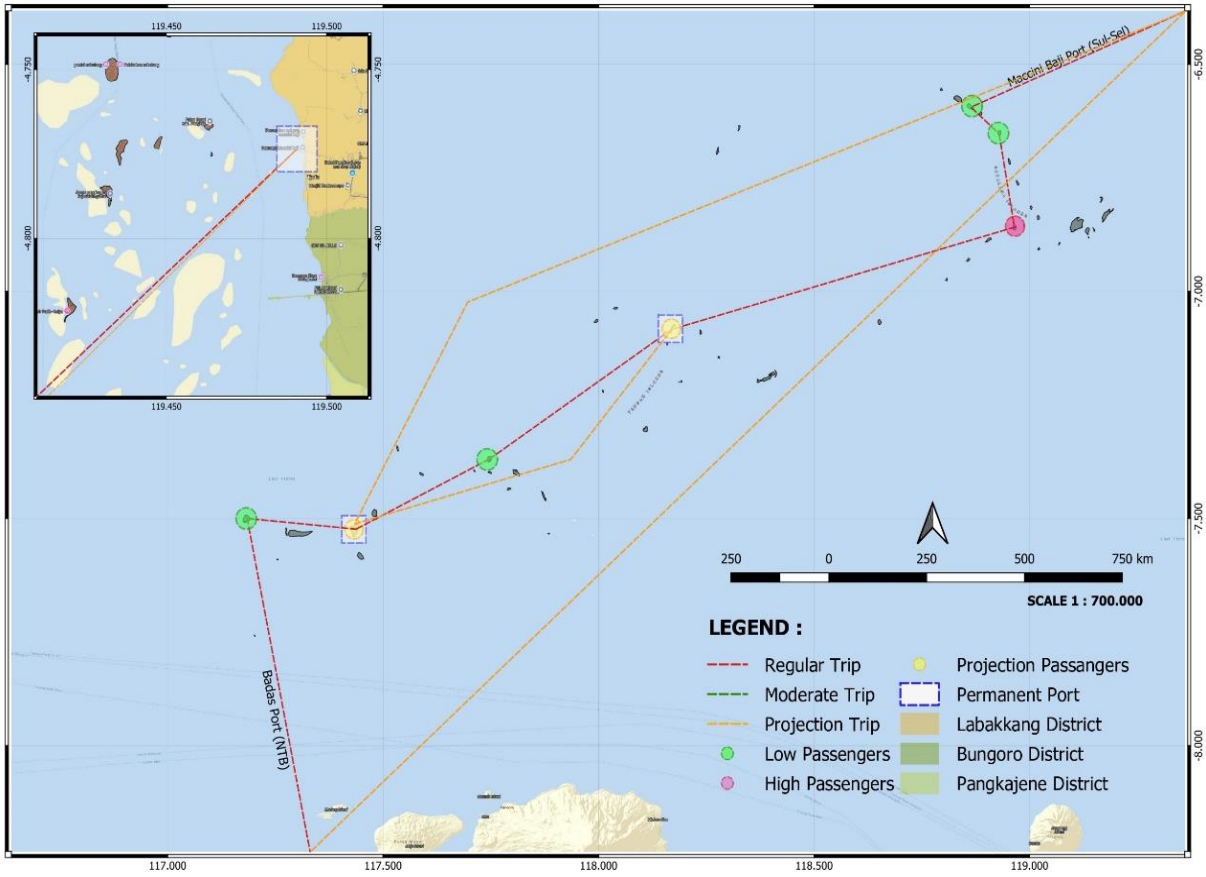

Fig. 3 Ship routes in pangkep islands for liunkang tangayya

Source: Analysis result, 2024

The main commodities transported by the ship are necessities such as rice, sugar, oil, and other essentials for remote islands. Conversely, island communities' agricultural products, fisheries, and handicrafts are transported using this ship to markets on the big island. With its presence, island communities gain easier access to economic opportunities, basic needs, health services, education, and economic opportunities. Government subsidies for this transportation make it more affordable, with the aim of reducing logistics costs, increasing community access, and supporting the economy of remote, outermost and inland areas. The length of the journey to each island varies depending on the shipping route. The following table shows the travel time of the National Shipping fleet.

Table 2. Travel time of the national shipping fleet

KM. Sabuk Nusantara 52		
Departure	Arrival	Cruise Time (Hours)
KM. Sabuk Nusantara		
Maccini Baji	Pulau Dewakkang Lompo	14
Maccini Baji	Pulau Marasande	17
Maccini Baji	Pulau Doang Doangan Lompo	20

Maccini Baji	Pulau Doang Doangan Caddi	22
Maccini Baji	Pulau Kalukkuang	26
Maccini Baji	Pulau Pammantuang	35
Maccini Baji	Pulau Sabaru	39
Maccini Baji	Pulau Balobaloang Lompo	16
Maccini Baji	Pulau Sumanga	65
Maccini Baji	Pulau Matalaang	23
Maccini Baji	Pulau Sapuka	31
Maccini Baji	Pulau Tampaang	48
Maccini Baji	Pulau Sailus Lompo	52
Maccini Baji	Pulau Kapoposang Bali	57
KM. Amukti Palapa		
Bima	Calabai	11,5
Calabai	Lab. Lombok	14
Lab. Lombok	Pulau Salius	18
P. Salius	Pulau Sapuka	12
P. Sapuka	Bima	14
KM. Sultan Hasanuddin		
Makassar	Maccini Baji	5
Maccini Baji	Dewakang Lompo	17
Dewakang Lompo	P. Kalukalukuang	11
P. Kalukalukuang	P. Pamantauang	7
Maccini Baji	P. Kalukalukuang	28
Maccini Baji	P. Pamantauang	35

Source: Results of data analysis, 2023

National transportation passes through several islands before reaching the main island, such as Pangkep, Badas Port, Calabai Port (Bima), Port and Maccini Baji, so it has long cruise hours. The long travel time for national shipping transportation is a weakness for national transportation services, so it becomes a complaint for its users.

3.4. Pelra Transportation Services

Pelra ships are a people's business that ships both individuals and groups. Traditional ship construction is made of wood; over time, many have used fiber, which is small in size. Because of its small size, it can access narrow, shallow waters and rivers in Pangkep Regency with short shipping lanes.

Overall, there are ± 6090 sea transportation fleets operating in the islands of Pangkep Regency, which are dominated by traditional ships of GT 7 and below [29]. Both freight and passenger transportation have different capacities and sizes. Passenger ships usually have a passenger carrying capacity of 10-15 people. These ships are also used to transport fishermen's catches such as fish, seaweed, crabs, squid and lobsters) as well as shopping for daily basic needs (secondary, primary) with a loading capacity of 0.5-1 ton. Traditional shipping vessels serve short routes not covered by large sea transportation. The communities in Liukang Tupabbiring and Liukang Tupabbiring Utara districts rely on pelra transportation to connect them to the main island in the Pangkep district. The pelra transportation routes in Liukang Tupabbiring and Liukang Tupabbiring Utara sub-districts are as follows: The islands in these two districts are close to the capital of Pangkep Regency. Each inhabited island is served by 1-2 ships that connect to the Mainland Pangkep Regency.

Each *pelra* ship that operates only has 1 dock/port of destination as a regular flow. So that the ship does not have to move from one island to another. Thus, the distance and travel time of the voyage become more efficient. The ship has fixed trips with a flexible schedule. The most destination ports are Maccini Baji Port and Pangkajene Port, while Kassi Kebo Port/Dock only has one ship with a fixed trip from Salemo Island.

Pelra's presence can fulfil the daily mobility of the island community to connect with the main island of Pangkep Regency, especially the Liukang Tupabbiring and Liukang Tupabbiring Utara district communities.

Pelra can serve trade activities, social interactions and the distribution of fishermen's catches, which will be brought to the nearest port/dock. This helps fishermen get a better price than if they only sell in the islands' local market. Fish catches can be distributed quickly and in fresh conditions so that the quality of the fish is still maintained until it reaches consumers. With *Pelra* transportation, trade access becomes easier, and market opportunities are wider. Fishermen can improve their standard of living and become a link between island and mainland communities.

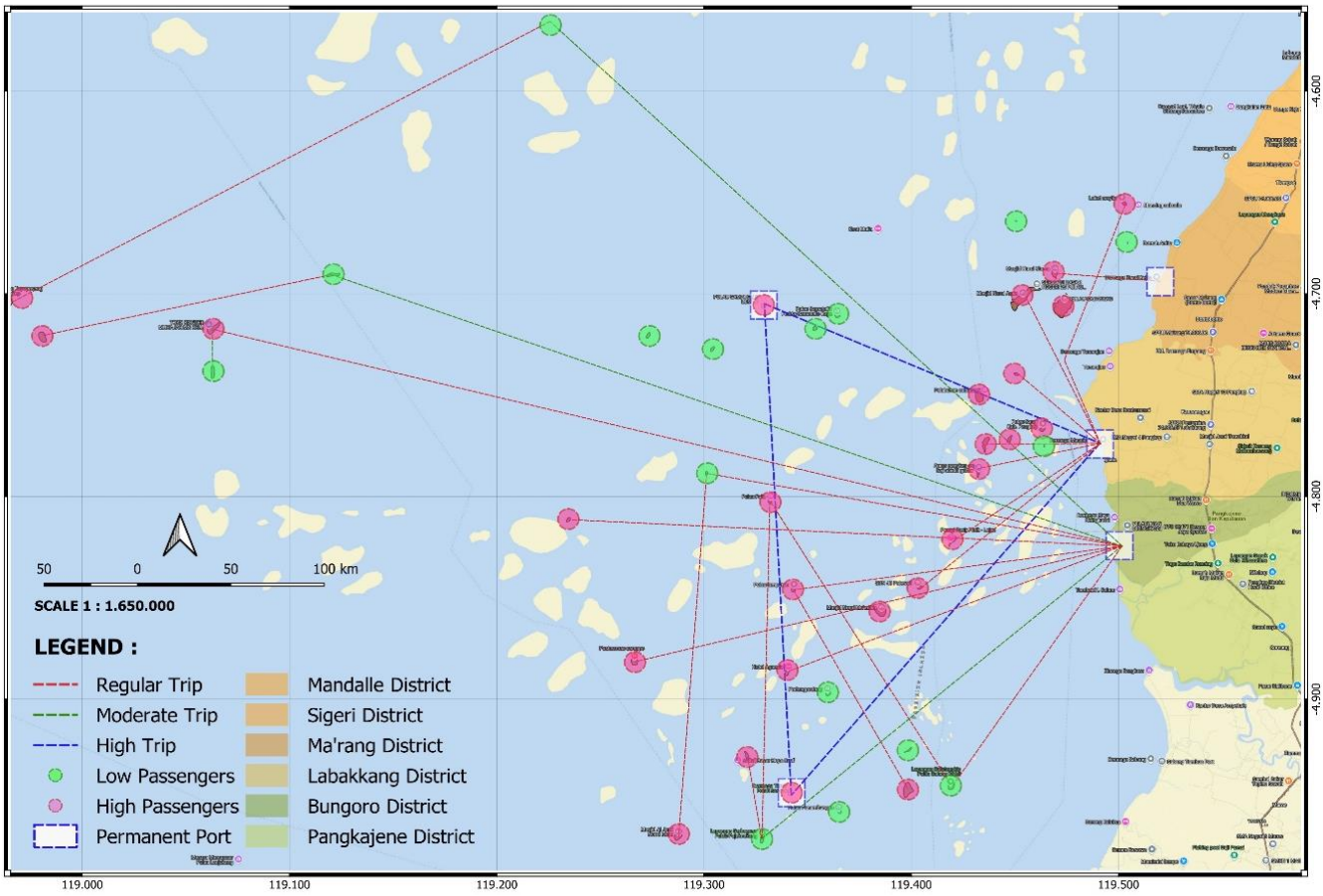

Fig. 4 Ships routes in pangkep islands for topabbiring and north topabbiring districts

Pelra transportation still has a big role in ensuring inter-island connectivity in Pangkep Regency. However, the services provided by this transportation still have various shortcomings, namely operational costs and safety. From operational costs, Pelra does not get fuel subsidies from the government, so operational costs are fairly expensive. From the results of interviews with passengers at the Pangkajne Port/dock, the cost of one trip is 10,000-15,000 per person. Meanwhile, for the ship owner and driver, the profit earned is only around 50,000-100,000 rupiah per day after deducting daily retribution fees and fuel costs. From a safety perspective, the construction of pelra ships is made of wood, so their operation is greatly influenced by weather conditions. Especially in the western season, which occurs around September-February, where high waves and strong winds make it risky for *pelra* operations. Some of the accident cases in the last 2 years are KM ship accidents. Resky, on 02 December 2023, the ship sank around Balang Caddi, Liukang Tupabbiring District. The cause of the accident was a blow [32]. Pelra ship accident (Jolloro type on 02 April 2022, on the Pangkajene River with a cargo of 11 people; the cause of the accident was a collision until it capsized [33]. Accident cases require the government to determine the handling strategy for the feasibility of *pelra* vessels operating in the waters of Pangkep.

3.5. Strategy for Improving Sea Transportation Services in Pangkep Regency

For the Islands region in Pangkep Regency, strengthening the role of *Pelnas* and *Pelra* transportation is needed. *Pelnas* transportation has a safe dock to travel long distances with extreme shipping conditions, such as in Pangkep. *Pelra* transportation plays a role in accessing small islands with shallow and narrow shipping lanes, such as rivers in Pangkep Regency. The problems described above indicate that sea transportation services in Pangkajene Regency are still not optimal with several conditions. Hence, several efforts need to be made as follows.

- Port/dock conditions regarding facilities and infrastructure are inadequate, such as narrow damage, which becomes a challenge in loading and unloading operations, both national and *pelra* transportation. Efforts to revitalize and develop port facilities are urgently needed to increase productivity, safety, and the welfare of the island community.
- The distance traveled by national transportation connecting the main port tends to be long because the shipping route passes through many other islands. Regular shipping is needed for areas located far from the main island, connecting with the mainland of Pangkep

Regency and with Makassar, West Nusa Tenggara and Bima.
- Inadequate transportation facilities for *pelra* transportation that endanger the safety of passengers and luggage. The government should provide proper transportation modes by safety standards and fuel subsidies for national transportation.

4. Conclusion and Recommendation

4.1. Conclusion

Pangkep Regency, as an archipelago with 115 island clusters, relies heavily on sea transportation for connectivity between islands and with the mainland. This research identifies that the development of the rural transportation network of island clusters, especially sea transportation, is essential to support the mobility of island communities in social, economic and cultural activities. A development strategy that suits the water conditions of each island, with guaranteed shipping safety, is key. The diverse geographical and socio-economic conditions between island sub-districts (Liukang Tupabbiring, Liukang Tupabbiring Utara, Liukang Kalmas, and Liukang Tangaya) require a different approach to sea transportation development. Adequate port/dock infrastructure and efficient transportation services are crucial to support economic growth and improve community welfare in the Pangkep archipelago.

4.2. Recommendation

In this study, the authors recommend important points to the parties involved in the development of the Island Cluster marine transportation network, as follows:

- Prioritize developing and improving existing port/dock facilities on the mainland (Pangkajene, Maccini Baji, and Kassi Kebo) and on strategic islands. This includes extending jetties, increasing loading and unloading capacity, and providing supporting facilities such as warehouses and parking areas.
- There is a need to modernize and expand the fleet of ships/boats serving inter-island routes, with a focus on safer, more comfortable, and fuel-efficient vessels. Consider providing subsidies or incentives for sea transportation entrepreneurs to update their fleets.
- Conduct in-depth studies to determine the most efficient and effective shipping routes and establish regular and reliable shipping schedules. Involve local communities in planning to ensure that routes and schedules meet their needs.
- Implement strict shipping safety standards, including regular inspection of vessels/boats, crew training, provision of adequate safety equipment, and reliable navigation systems.
- Encourage the development of local economic sectors in the islands, such as fisheries, tourism and handicrafts. Facilitate market access for local products and provide training to communities to improve the quality of their products.
- Improve coordination between relevant government agencies (Transportation Agency, Marine and Fisheries Agency, Tourism Agency, etc.) to ensure integrated and sustainable marine transportation development.
- Given that Liukang Tangaya district is economically closer to West Nusa Tenggara, consider developing a sea transportation route that connects this area with West Nusa Tenggara while considering connectivity with Pangkajene.
- Implement information systems and technology to monitor vessel movements, inform the public of cruise schedules, and improve the efficiency of port operations.
- Conduct a comprehensive study to deeply understand the transportation needs of communities in each island district, including the types of goods and services most needed, frequency of travel, and preferences for transportation modes.
- Involve local communities in every stage of planning and implementation of marine transportation development programs, from problem identification to evaluation of results. Establish communication forums or working groups involving community representatives, traditional leaders and local businesses.

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