









Competitiveness of Traditional Shipping in Sea Transportation Systems Based on Transport Costs: Evidence from Indonesia

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ABSTRACT

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Traditional shipping vessel is a mode of transportation that is part of Indonesia's cultural heritage and still exists today. However, traditional shipping has been deemed unable to compete with the national shipping fleet due to the high transport cost, the low safety level, long travel times, limited capacity, and limited ship repair facilities. In addition, its existence was eliminated with the advent of modern ships. This study aims to analyse the competitiveness of traditional shipping with national shipping freight based on transportation costs. The analysis used is a gap analysis of transportation costs based on variable costs and fixed costs for every traditional shipping route that overlaps with national shipping. Data were obtained by field observations. The results of the analysis show that the competitiveness of traditional shipping has decreased due to the loss of cargo of national ships. It is necessary to optimize the route by restoring the traditional shipping function as a national shipping feeder, especially in the underdeveloped, remote, outermost, and border (UROaB) areas. This study recommends the integration of the national shipping transportation network as a trunk line and traditional shipping as a feeder line. The shipping integration is expected to form a network pattern and generates increase in the demand for traditional shipping cargo.

1. INTRODUCTION

Sea transportation plays an important role in developing archipelagic areas in Indonesia to improve commodity flows, increase intensity and accessibility of product marketing, support the maritime, tourism, and fishery economy, and strengthen national resilience at the border area [1, 2]. As a part of the sea transportation sector, traditional shipping contributes significantly and plays an active role in serving the distribution of goods and the movement of people in local and national transportation networks [3, 4]. The utilization of traditional shipping is found in Indonesia and countries with maritime history and heritage, such as Egypt and China [5, 6].

Traditional shipping is able to be a liaison between islands, especially underdeveloped, remote, outermost, and border (UROaB) areas. The economic turnaround in the UROaB areas relies heavily on the flow of external consumption goods [7]. As a result, the regional development as the growth centre of UROaB is highly dependent on the accessibility of sea transportation [8-10].

Guaranteed fast and reliable logistics distribution is a must in the realization of the National Logistics System, which will become the backbone for increasing Indonesia's economic growth [11-13]. Traditional shipping, as the lifeblood of sea transportation to inland and isolated areas, is expected to be able to play an active role in the logistics distribution network (spoke) in Indonesia. On the other hand, the contribution of traditional shipping to supporting national policies in order to

develop the connectivity system is still experiencing many obstacles, including aspects related to fleet development (ships), financing/capitalization, port infrastructure, cargo share, and regulations, so that national connectivity is still considered low and inefficient [2, 14, 15].

Traditional shipping operation in the UROaB areas is a backbone of transportation, acting as a feeder for national shipping transportation (Sea Highways and Conventional Freight Ships). Traditional shipping is still believed to be a solution to increase the effectiveness of domestic sea transportation, especially in archipelagic areas of Indonesia and areas where land mode infrastructure and facilities are inadequate [16]. With its advantages of reaching remote areas, traditional shipping vessels have a great opportunity as a feeder for the Sea Toll to distribute goods to the UROaB areas [17]. On the other hand, the availability of traditional shipping transportation is still very limited [18], with a relatively very high cost [19]. Traditional shipping is characterized by serving areas with limited port infrastructure, which is expected to encourage economic growth in the UROaB area and open up investment opportunities to increase the value of return loads [20].

The characteristic of the UROaB areas, which is far from the economic centres, is that the number of people is small [21]. This condition causes the movement of people and goods to be optimally served by small vessels with a high frequency, such as traditional shipping [22]. However, the operation of traditional shipping in the UROaB area has consequences,

including being very risky in terms of safety. Because the environmental characteristics in the UROaB are surrounded by shallow waters and high tidal waves. Therefore, the size of traditional shipping vessels with GT 500 will not be safe if facing high waves [23].

Nevertheless, traditional shipping has advantages over other sea transportation modes. Their operation of traditional shipping does not require a massive infrastructure of the origin and destination ports and is able to reach remote ports that are difficult to reach by the national shipping fleet [2, 24, 25]. The rates offered are relatively not very cheap, yet fleet investment is not a capital-intensive business [2, 14].

However, nowadays, the market share of traditional shipping is starting to be taken over by commercial transportation, which has the same service route. Traditional shipping is not able to compete in terms of carrying capacity and ship speed. Generally, traditional shipping does not provide insurance, and in terms of the safety aspect of the age of the ship. The old traditional shipping is very risky to wave conditions [26-28].

The high operational cost of traditional shipping vessels and the inefficient loading and unloading of goods are one of the factors that cause the traditional shipping vessels to be unable to compete with other, more modern commercial ships. In addition, the traditional shipping vessels stay in a port for between three and four weeks to get the cargo. About 10% of the port's time is spent loading and unloading goods [29].

Until now, no research has discussed the operational costs of the traditional shipping vessels. By considering this, it is necessary to study and analyze the gap between traditional shipping costs and national shipping transportation that have overlapping routes based on ship operating costs. Therefore, in the future, it is expected that traditional shipping transportation will serve routes in the UROaB areas so that its function as a feeder becomes more optimal.

2. METHODS

One of the contributions of shipping to the global trade revolution is to make sea transportation very cheap so that shipping costs are not a problem in distributing goods [30]. An analysis of the operational costs of traditional shipping vessels is done based on cost components, namely the components of fixed costs and variable costs [31]. Fixed costs are costs that occur at the beginning of the operation of a transportation system. In this case, the costs are represented in capital costs. Fixed costs are time-dependent and unaffected by the utilization of ship freight, such as depreciation, operational cost management, and repair and docking cost. The longer the age of the ship, the greater the depreciation costs as well as docking costs; the longer the ship is docked, the greater the repair costs. The longer the age of the ship, the greater the depreciation costs, and docking costs. The longer the ship is docked, the greater the repair costs. The increase in costs will greatly burden traditional ship owners in difficult conditions of cargo. Therefore, fixed costs are also considered in this study.

Variable costs are costs incurred when the ship is operating. This fee varies greatly depending on the sailing activities of the ship, such as distance travelled, number of goods, and duration of sailing, as elaborated in the other study [14, 30]. Variable costs include fuel costs when sailing and at the port; crew salaries and allowances; safety costs for goods; overhead

costs; lubricating oil; costs at ports in the form of mooring and anchoring costs; food costs; health costs; laundry costs; freshwater costs; as well as other incidental costs [32].

The transportation cost utilizing traditional shipping vessels is obtained based on primary data by field observations. In contrast, data on transportation costs using national shipping vessels are obtained by the utilization of secondary data adopted from shipping companies. The location of the research is 7 ports of traditional shipping centers, namely Batam (Macobar), Jakarta (Sunda Kelapa), Makassar (Paotere), Kupang (Tenau), Ternate (Bastiong), Ambon (Batu Merah), and Manokwari (Angrem). These 7 locations were selected because they are the ports with the largest number of traditional shipping fleets. In addition, the selected ports can represent the western, central, and eastern regions of Indonesia. The port locations for field observation are shown in Figure 1.

The research flow can be seen in Figure 2. This research begins with the problem of route overlay by traditional shipping and national shipping. There is a large gap in shipping costs, causing traditional shipping to be unable to compete with national shipping. The analysis used includes a comparative analysis of transportation costs by type of ship, by route, and by traditional central shipping ports. The output of the analysis is expected to find out how much the comparison of freight costs and the possibility for traditional shipping to be relocated.



Figure 1. Observation of research locations

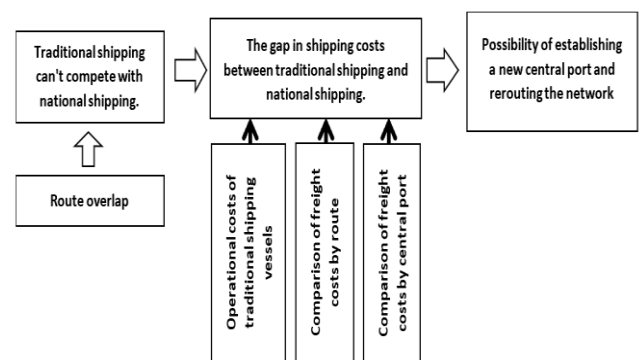


Figure 2. The flow of the research method

3. RESULTS AND DISCUSSION

3.1 Operating cost: traditional shipping

The operational day for traditional shipping vessels is 240 days per year. The data are based on the results of observations and interviews from traditional shipping entrepreneurs and

similar ship masters for sizes above 145–250 GT. The vessels will be on the dock for about 24 to 47 days, and the rest do not do anything. The loading and unloading productivity of traditional shipping vessels at the port depends on the type of cargo and labour components, working hours, infrastructure and work facilities, and the effective working time per day at the port.

The results of the evaluation of the operational activities of traditional shipping vessels show that the operational costs of traditional shipping vessels on certain routes per voyage can be reduced, for example, at the sample location of the traditional shipping centre port, i.e., KLM. Bintang Mapparennu, which sails from Sunda Kelapa to Tanjung Pandan with a voyage of 186 sea miles, requires a total ship operating cost of IDR. 59,103,333, which consisted of non-

fixed costs of IDR. 47,270,000 or 80% of the total ship operating costs and fixed costs of IDR. 11,833,333 or 20% of the total ship operating costs.

As with other traditional shipping vessels at the port center of Paotere, the ratio of variable costs to fixed costs is 84% to 16%. At the port of Kupang, the ratio of variable costs to fixed costs is 85% to 15%. At the port of Makobar, Batam, the ratio of operating costs varies according to the parameters involved in operating the shipping system. The variable-to-fixed-cost ratio is 78% to 22% at Bastiong port, 80% to 20% at Batu Merah port, and 75% to 25% at Angrem Manokwari port, respectively. The amount of variable costs shows that variable components dominate traditional shipping operational expenses. In full, the operational costs of traditional shipping vessels in several sample port centers are tabulated in Table 1.

Table 1. Traditional shipping vessel operating costs per voyage (in IDR)

Port	Sunda Kelapa	Paotere	Kupang	Batam	Ternate	Ambon	Manokwari
Ship name (KLM)	Bintang Mapparennu	Rahmad Setia 02	Fitria Perdana	Putra Sorsel Mandiri	Sahabat Jujur	Empat saudara	Tirta Agung
Route	Tj. Pandang - Sunda Kelapa	Paotere - Maumere	Kupang - Sinjai	Asahan - Makobar	Bastiong - Saketa	Batu Merah - Manipa - Namrole	Manokwari - Wasior
Variable cost							
- Fuel cost	18,720,000	21,840,000	15,600,000	12,480,000	9,360,000	6,240,000	3,900,000
- Goods insurance cost	1,250,000	1,280,000	900,000	900,000	950,000	390,000	325,000
- Crew salaries and allowances	12,000,000	10,500,000	9,000,000	7,500,000	10,500,000	4,000,000	3,200,000
- Laundry fee	300,000	300,000	300,000	300,000	300,000	200,000	200,000
- Freshwater cost	600,000	500,000	400,000	500,000	500,000	200,000	300,000
- Meal cost	6,000,000	6,300,000	4,500,000	3,500,000	7,000,000	2,500,000	1,920,000
- Health Fee	1,200,000	1,050,000	600,000	500,000	700,000	-	-
- lubricating oil cost	2,600,000	2,080,000	1,300,000	1,300,000	1,820,000	260,000	260,000
- Port Fee	3,600,000	2,928,000	1,464,000	1,416,000	2,928,000	408,000	576,000
- Other Overhead Costs	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	500,000	500,000
% Variable cost	80%	84%	85%	78%	82%	80%	75%
Total variable costs (IDR)	47,270,000	47,778,000	35,064,000	29,396,000	35,058,000	14,698,000	11,181,000
Fixed cost							
- depreciation	8,333,333	5,555,556	4,166,667	5,555,556	5,555,556	2,777,778	2,777,778
- Operational Cost Management	2,000,000	2,000,000	1,000,000	1,500,000	1,000,000	500,000	500,000
- Repair/docking costs	1,500,000	1,500,000	800,000	1,000,000	1,000,000	500,000	500,000
Total Fixed Cost (IDR)	11,833,333	9,055,556	5,966,667	8,055,556	7,555,556	3,777,778	3,777,778
% Fixed cost	20%	16%	15%	22%	18%	20%	25%
Total cost (IDR)	59,103,333	56,833,556	41,030,667	37,451,556	42,613,556	18,475,778	14,958,778

3.2 Freight forwarding, traditional shipping

Shipping costs for traditional shipping vessels are influenced by the distance and type of goods. Goods that are economically higher will be more expensive to transport than goods that have a lower economic value. By looking at the cost structure of ships according to voyage distance, then the cost of transporting ships with a bigger payload capacity will be more efficient than ships with a smaller size.

In order to determine the average transportation cost of traditional shipping vessels, monitoring of several types of commodities is carried out based on observations at the ports of Paotere, Sunda Kelapa, Tenau, Manokwari, Ambon, and Ternate. These ports are often or are the main shipping lanes for traditional shipping fleets. Based on the results of field observations and interviews shows that the applicable tariff is largely determined by the market mechanism. Negotiated systems between cargo owners and ships, often overriding the cost per ship mileage. The following Table 2 shows the general

cargo transportation costs for several traditional shipping routes. The general cargo transportation costs vary dependent on transporting distance.

The cost of transporting goods with traditional shipping is different from one route to the others. The traditional ship business is run in the family manner; there is no standard price fixing on people's shipping transportation. The cost of loading is based on an agreement between the owner of the ship and the goods. There is a tendency for the eastern part of Indonesia to have a higher transportation cost of general cargo. Traditional shipping is getting higher. This phenomenon is the same as the phenomenon of the cost of goods transported by national shipping.

Table 2 explains that the general cargo transportation costs vary for each route. At the Sunda Kelapa port centre in Jakarta, among others, the Sunda Kelapa – Tj. Pandan route is IDR. 1,344/ton/sea mile; the Sunda Kelapa – Palembang route is IDR. 1,408/ton/sea mile; the Sunda Kelapa – Pontianak route is IDR. 1,269/ton/sea mile; and the Sunda Kelapa –

Tembilahan route is IDR. 1,395/ton/sea mile.

At the port centre of Macobar Batam, among others, the Makobar – Asahan route for IDR. 1,607/ton/sea mile, the Macobar – Dumai route for IDR. 1,875/ton/sea mile, and the route Macobar – Tj. Pinang for IDR. 2,174/ton/sea mile. The Paotere Makassar port center includes the Paotere – Tenau route for IDR. 1,754/ton/sea mile; the route Paotere – Maumere for IDR. 2,286/ton/sea mile; and the route Paotere – Labuan Bajo for IDR.2,973/ton/sea mile. At the port centre of Tenau Kupang, among others, the Tenau – Sinjai route is IDR. 3,000/ton/sea mile; the Tenau – Kalabahi route is IDR.3,571/ton/sea mile; and the Tenau – Ende route is IDR. 3,521/ton/sea mile. At the Bastiong port centre of Ternate, among others, the Bastiong – Gane Dalam route is IDR. 4,297/ton/sea mile; the Bastiong – Saketa route is IDR. 4,348/ton/sea mile. At the Batu Merah Ambon port centre,

among others, the Batu Merah – Gorom route is IDR. 4,408/ton/sea mile, while the route of Batu Merah – Manipa – Namrole is IDR. 4,333/ton/sea mile. At the port centre of Angrem Manokwari, among others, the Angrem–Wasior route is IDR. 4,333/ton/sea mile, and the Angrem–Biak route is IDR. 5,000/ton/sea mile. The total cost of transporting traditional shipping on several routes in Indonesia is shown in Figure 3.

If the total transportation cost using traditional shipping on several routes in Indonesia is averaged for each traditional shipping centre port, the route at Sunda Kelapa Harbor has the lowest transportation cost with an average cost of IDR. 1,354/ton/sea mile. The most expensive transportation cost is at Angrem Manokwari Port, with an average cost of IDR. 4,667/ton/sea mile. In full, the average transportation cost of traditional shipping by the central port can be seen in Figure 4.

Table 2. General cargo shipping costs of traditional shipping

Route	Freight Cost (IDR / ton)	Distance (sea mile)	Freight Cost / Tons of Distance (IDR. ton /sea mile)
Western Indonesia			
Sunda Kelapa - Tj. Pandan	250,000	186	1,344
Sunda Kelapa - Palembang	500,000	355	1,408
Sunda Kelapa - Pontianak	500,000	394	1,269
Sunda Kelapa - Tembilahan	600,000	430	1,395
Batam - Asahan	450,000	280	1,607
Batam - Dumai	300,000	160	1,875
Batam - Tj. Pinang	100,000	46	2,174
Central Indonesia			
Paotere - Tenau	500,000	285	1,754
Paotere - Maumere	400,000	175	2,286
Paotere - Labuan Bajo	550,000	185	2,973
Tenau - Sinjai	450,000	150	3,000
Tenau - Kalabahi	500,000	140	3,571
Tenau - Ende	500,000	142	3,521
Eastern Indonesia			
Bastiong - Gane Dalam	550,000	128	4,297
Bastiong - Saketa	500,000	115	4,348
Batu Merah - Gorom	850,000	210	4,048
Batu Merah - Manipa - Namrole	650,000	150	4,333
Manokwari - Wasior	650,000	150	4,333
Manokwari - Biak	600,000	120	5,000

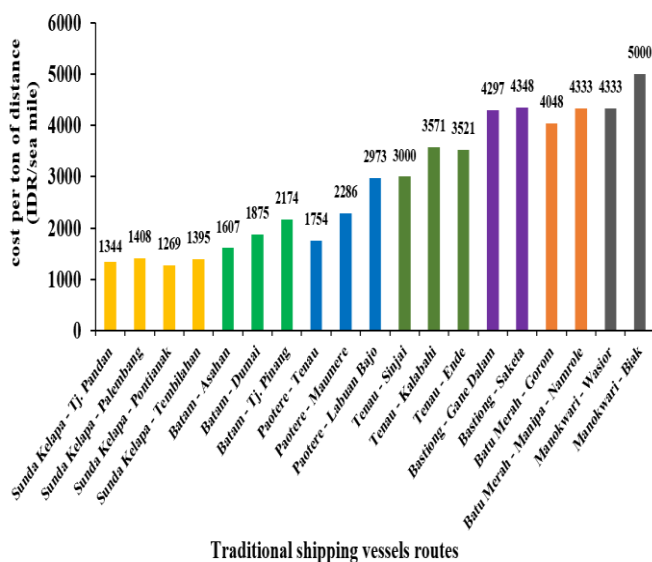


Figure 3. Traditional shipping costs on several routes in Indonesia

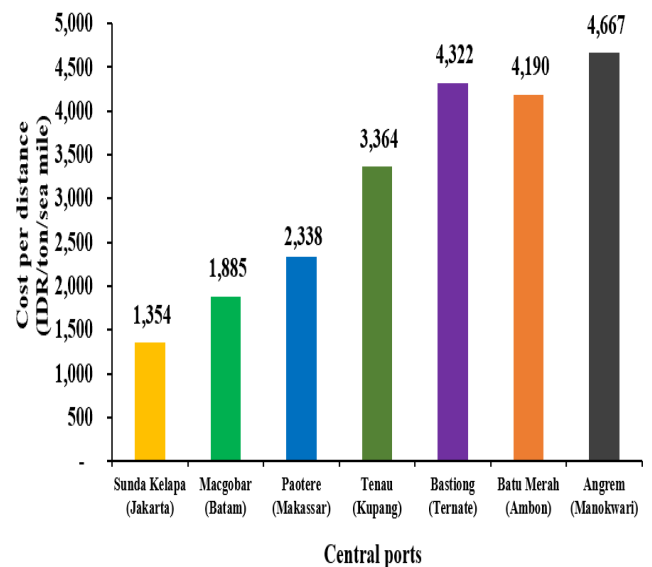


Figure 4. Average transportation cost of traditional shipping by central port

Table 3. General cargo shipping costs of the national shipping vessels

Route	Container Freight Cost 40 ft	Average cost / ton	Distance (sea mile)	Cost/ton/mile
Western Indonesia				
Jakarta – Palembang	19,000,000	475,000	350	1,357
Jakarta – Pontianak	18,000,000	450,000	394	1,142
Central Indonesia				
Makassar - Kupang	23,000,000	575,000	285	2,018
Tenau - Kalabahi	10,000,000	250,000	140	1,786
Eastern Indonesia				
Ambon - Banda	20,000,000	500,000	210	2,381
Ambon - Namrole	11,000,000	275,000	100	2,750
Manokwari - Wasior	11,000,000	275,000	150	2,115
Manokwari - Biak	14,000,000	350,000	120	2,917
Average Cost				2,058

3.3 Analysis of the competitiveness of freight cost between national shipping and traditional shipping

The gap in transportation costs between traditional shipping and national shipping is caused by differences in the cargo capacity that can be transported. In addition, national transportation is also supported by superior ship characteristics, both in terms of speed and level of ship safety. This condition is the reason why most cargo owners prefer to use commercial ships compared to traditional shipping vessels.

The overlap between the routes served by modern vessels and traditional shipping vessels makes it difficult for traditional shipping vessels to compete. Customers, especially the owner of the goods, will prefer to use modern ships compared to traditional shipping ships for several reasons, including lower costs, faster delivery times, larger loading capacity of goods, and the existence of goods safety guarantees (insurance).

Therefore, when comparing commercial vessels and traditional shipping vessels, the traditional shipping vessels will lose in all aspects. For this reason, it is necessary to pay further attention so that traditional shipping can be a feeder for national sea transportation. Therefore, traditional shipping industries will not compete with each other yet support each other in order to see the gap in transportation costs between modern shipping and traditional shipping vessels on routes that can be served simultaneously.

The analysis should cover routes such as Jakarta – Palembang, Jakarta – Pontianak, Makassar – Kupang, Kupang – Kalabahi, Ambon – Banda, Ambon – Namrole, Manokwari – Wasior, and Manokwari – Biak. The complete cost of transportation per tonnage per sea mile for national shipping is presented in Table 3. This indicates the transportation cost of national shipping vessel routes that intersect with traditional shipping routes. It can be seen that the difference between the transportation costs of national shipping and traditional shipping, among others, varies with the miles. The Jakarta - Palembang route has a difference in transportation costs of IDR 151 per tonne per sea mile. The Jakarta – Pontianak route has a difference in transportation costs of IDR 127 per tonne per sea mile.

Therefore, when comparing commercial vessels and traditional shipping vessels, the traditional shipping vessels will lose in all aspects. For this reason, it is necessary to pay further attention so that traditional shipping can be a feeder for national sea transportation. Therefore, traditional shipping industries will not compete with each other yet support each other in order to see the gap in transportation costs between

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There are differences in transportation costs between traditional shipping and national shipping on each route because each route has different distances and returns. Routes in the eastern region of Indonesia tend to have small cargo and long shipping distances causing expensive fuel costs.

A complete comparison of the difference in transportation costs between national shipping and traditional shipping can be seen in Figure 5. It can be seen from Figure 5 that the cost of general cargo transportation of traditional shipping vessels on several routes shows that there is a difference in costs with a tendency toward the eastern part of Indonesia, the higher the transportation costs. For shipping in the western and central regions, Jakarta - Palembang, Jakarta - Pontianak, Makassar - Kupang, the ratio of transportation costs between national ships and traditional shipping vessels is not so significant.

By comparing the transportation costs between national shipping and traditional shipping, the difference can be calculated regarding the shipping distance by performing a simulation based on the sea mile, as shown in Figure 6.

Based on the composition of the gap between the cost of freight transport between national shipping and traditional shipping, it is estimated that overlapping routes that traditional shipping will not be able to compete with national shipping. It

is possible that there will be a decrease in cargo, which has an impact on the continuity of service for the traditional shipping fleet. Some alternatives that might be considered are the provision of subsidies.

It should be noted that the provision of subsidies alone cannot guarantee that the customer, especially the owner of the goods, will switch to traditional shipping transportation because it is influenced by other factors, such as the speed of the ship and the level of safety. Therefore, when calculating the cost of subsidies, it is necessary to pay attention to the time factor and the safety factor of the goods converted into rupiahs. The subsidy can be given to routes that do not intersect with national shipping transportation, such as in underdeveloped, remote, outermost, and border (UROaB) areas, to provide a stimulus to traditional shipping fleets so that the traditional shipping industries can operate without experiencing more losses.

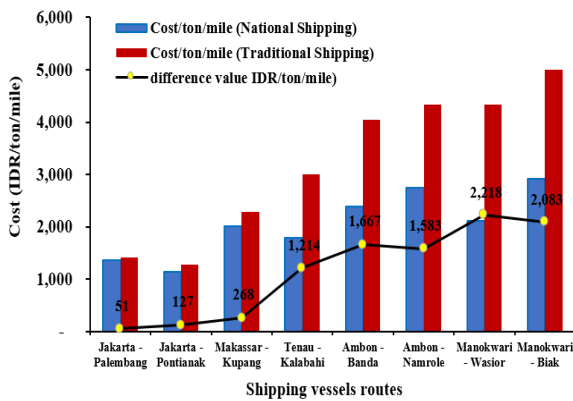


Figure 5. Freight costs of national and traditional shipping

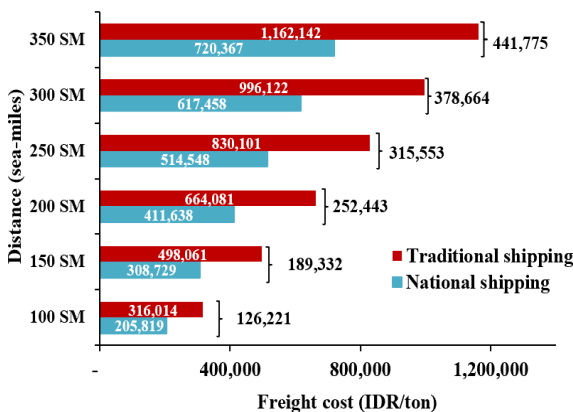


Figure 6. Freight costs difference in distance and traditional shipping according to modern

4. CONCLUSIONS

In this research, the competitiveness of traditional shipping in sea transportation systems based on transport costs was thoroughly studied. The integration of the national shipping transportation network is expected to form a network pattern and increase the demand for traditional shipping cargo. However, traditional shipping is not able to compete with national shipping carriers on the same route.

The cost of transportation per sea mile is quite high. The cost of general cargo transportation of traditional shipping

vessels on several routes shows that there is a difference in costs with a tendency toward the eastern part of Indonesia, the higher the transportation costs.

If it is averaged based on the central port, the route at Sunda Kelapa Port has the lowest transportation cost with an average cost of IDR. 1,354/ton/sea mile, while the highest route is the Angrem Manokwari port at IDR. 4,667/ton/sea mile. The average transportation cost of all central ports is IDR. 3,320/ton/sea mile. The shipping distance also influences the cost difference. The farther the distance, the higher the cost difference that will occur. Based on these conditions, it is necessary to re-route traditional shipping vessels to serve the UROaB area so that the routes do not intersect with nationwide shipping. As a stimulant, it is necessary to provide subsidies to traditional shipping vessels serving the UROaB area. In addition, the re-route of traditional shipping vessels is expected to support national sea transportation connectivity as a feeder in the national shipping network.

This research is limited to a comparison of transport costs and did not analyze competitiveness in terms of capacity and serviceable areas. There will be opportunities in the future to examine the types and amounts of subsidies, as well as the appropriate network integration model. Therefore, traditional shipping can be synergized with national shipping accordingly.

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