ERIA Research Project Report 2021, No. 24

Maritime Highway and Eastern Indonesia Development

Edited by

Fauziah Zen

M. Halley Yudhistira

Joint Study

ERIA

Ministry of Transport, Republic of Indonesia

LPEM, University of Indonesia

Maritime Highway and Eastern Indonesia Development

Economic Research Institute for ASEAN and East Asia (ERIA)
Sentral Senayan II 6th Floor
Jalan Asia Afrika no.8, Gelora Bung Karno
Senayan, Jakarta Pusat 12710
Indonesia

Ministry of Transportation Indonesia
Jl. Medan Merdeka Barat No. 8 Jakarta Pusat
DKI Jakarta 10110, Indonesia

Institute for Economic and Social Research Faculty of Economics and Business University of Indonesia (LPEM UI)
Jl. Salemba Raya 4 Jakarta 10430, Indonesia

ERIA Research Project Report FY2021 No. 24

Published in March 2022

Foreword

As the largest archipelagic economy in the world, Indonesia enjoys both benefits and faces challenges from having more than seventeen thousand islands. Indonesia's large sea provides very rich biodiversity, abundant ocean products, and various sources of blue economy outputs. But there is also a huge challenge in terms of having to provide efficient connectivity across islands and securing optimal transactions for small islands. Indonesia also faces unequal distribution of population, natural resources, natural disaster risks, infrastructure, and productivity factors.

President Joko Widodo has made the maritime sector the priority development agenda. One of his famous policies is establishing a 'maritime highway' (*tol laut* in Bahasa Indonesia), aiming at strengthening shipping lanes focused on eastern Indonesia. The increasing number of shipping lanes to eastern Indonesia is expected to improve logistics distribution to remote, outermost, and disadvantaged areas. This way the government expects to reduce commodity prices and the imbalance in trade between the western and the eastern parts of Indonesia.

This study analyses the impact of maritime highway policy since its implementation in 2015. We use both quantitative and qualitative methods to show its impact on the commodity price and economic activities in eastern Indonesia. We also look at the potential international hubs in eastern Indonesia. The study also provides some suggestions for government intervention by presenting feasible schemes for immediate, mid-term, and long-term planning. It is found that it is essential to take immediate action in terms of reorganising routes, schedules, and commodity types for subsidy. To establish more robust economic development in eastern Indonesia in the future it is of critical importance to build hubs, new economic centres, and expand direct international routes.

The study also comes as a timely response to Indonesia's mega-project plan. President Joko Widodo has just officially announced to relocate the Jakarta capital to a new capital city *Nusantara (Ibukota Nusantara* (IKN)) in East Kalimantan. One of the objectives of the capital's relocation is to boost the economy of eastern Indonesia and reduce the welfare gaps between west and east. As the IKN is located in the middle of Indonesia, the maritime nexus will be vital for connecting the new capital with the rest of Indonesia. Since the completion of the study in 2020, the government has taken some practical actions, especially in lane and port system development. New lanes have been created and revised routes implemented, and major ports have been modernised applying green principles.

I thank the Ministry of Transport for its support for this study, and we expect more cooperation in the future. ERIA is also grateful to LPEM FEB-UI, for providing an excellent intellectual contribution as an academic partner. I hope the implementation of the maritime highway will further contribute to the development of Indonesia's maritime sector and support Indonesia's role in the Indo-Pacific maritime nexus.

Jakarta, 25 January 2022

Professor Hidetoshi Nishimura

President, ERIA

Table of Contents

List of Project Members v

List of Figures vi

List of Tables vii

Executive Summary viii

Chapter 1 Introduction – Background of the Study and Current Policy Context 1

Chapter 2 Maritime Highway Implementation 4

Chapter 3 Impact of the Maritime Highway on Public Welfare and Regional Economic Activities 10

Chapter 4 Policy Development Leading to Logistics Systems in a More Integrated Eastern Indonesia 19

Chapter 5 The Grand Design for Future Maritime Highway Management 38

References 41

Appendix 1 42

Appendix 2 45

Appendix 3 49

Appendix 4 51

Appendix 5 57

List of Project Members

Project Coordinator

Fauziah Zen, Economic Research Institute for ASEAN and East Asia (ERIA)

Team Leaders

- Wihana Kirana Jaya, Ministry of Transport
- Mayjend TNI (Mar) Buyung Lalana, Ministry of Transport
- Wisnu Handoko, Ministry of Transport
- Fauziah Zen, ERIA
- M. Halley Yudhistira, Institute for Economic and Social Research (LPEM FEB UI), University of Indonesia

Study Team

- Hafida Fahmiasari, Royal HaskoningDHV
- Dewi K. Megasari, Statistics Indonesia (BPS)
- Rudhian Chlissma Putra, ERIA
- Yusuf Sofiyandi, LPEM FEBUI, Indonesia
- Devina Anindita, LPEM FEBUI, Indonesia
- Bisuk Abraham Sisungkunon, LPEM FEBUI, Indonesia
- Yusuf Reza Kurniawan, LPEM FEBUI, Indonesia

List of Figures

Figure 1.1. Night-time Light Distribution, Indonesia 2
Figure 2.1. Maritime Highway Designated Lines Serving the Eastern Indonesia Region 7
Figure 3.1. Inflation Rates of Selected Cities in Eastern Indonesia (before and after Maritime Highway Implementation) 10
Figure 3.2. Average Increases in Rice Prices Before and After Implementation of the Maritime Highway Programme 11
Figure 3.3. Average Monthly Prices of Cement Before and After Implementation of the Maritime Highway Programme 12
Figure 3.4. The Maritime Highway Impact on Commodity Price Disparities 13
Figure 3.5. Night-Time Light Intensity, Eastern Indonesia Region 15
Figure 3.6. Evaluation Matrix of Maritime Highway Routes 17
Figure 4.1. Economic Performance, Eastern Indonesia Region 19
Figure 4.2. Current Main Corridors of the Maritime Highway 22
Figure 4.3. First Version of the Main Maritime Highway Corridors 22
Figure 4.4. Market Potential for Eastern Indonesia 23
Figure 4.5. Volume of Containers in Indonesian Ports with International Shipping Demand 24
Figure 4.6. Potential Shipping Routes for Eastern Indonesia from and to the Northern Region 25
Figure 4.7. Six Main Routes with Highest Annual Frequency 25
Figure 4.8. Six Main International Routes with the Highest Annual Volume 26
Figure 4.9. Volume of International Routes Passing Close to Ports in Eastern Indonesia 27
Figure 4.10. Frequency of International Routes Passing Close to Ports in Eastern Indonesia 27
Figure 4.11. Total Road Length by Region and Condition (km) and Percentage of Road Length Increases in Nusa Tenggara, Maluku, and Papua, 2010 and 2017 28
Figure 4.12. Road Length by Region and Surface Type, 2010 and 2017 29
Figure 4.13. Total Seaports by Hierarchy and Region, 2017 31
Figure 4.14 Map of the Number of Indonesian Ports and their Locations, 2017 31
Figure 4.15. Percentage of Households by Area, Type of Region, and Main Sources of Lighting, 2018 32
Figure 4.16. Main Activities in Port Operations 35
Figure 4.17. Comparison of Actual OPEX Composition in Southeast Asia and Europe 35
Figure 5.1. Development Milestones for an Integrated Logistics System 40

List of Tables

Table 1.1. Volume of Goods and Passenger Traffic in Strategic Ports, Eastern Indonesia Region 1

Table 2.1. Private versus Maritime Highway Tariffs (in Rupiah/TEU), Selected Lines 9

Table 3.1. Changes in Night-Time Light Intensity in the areas of participating ports as an Impact of Maritime Highway Programme Operations (2012–2017) 15

Table 4.1. Dominant Agricultural Products from Provinces in Eastern Indonesia 20

Table 4.2. Shipping Capacity at Ports in Eastern Indonesia 21

Table 4.3. Major Indonesian Ports serving International Shipping 23

Table 4.4. Sea Port Hierarchy 30

Table 4.5. Differences in Port Operation Designs 36

Table 4.6. Analysis of the Handling Equipment Required at Selected Eastern Indonesia Ports 37

Executive Summary

Indonesia is the largest archipelagic state in the world. Indonesia's coastline is the second longest in the world; two-thirds of its territory is sea. This geographical condition is like a double-edged sword: on the one hand, water resources are abundantly available, yet the development challenges faced are also more severe, specifically with respect to equity between regions.

There currently remains a large gap between development in the western and eastern halves of Indonesia. Economic development is concentrated in western Indonesia – known as the Western Indonesia Region (Kawasan Barat Indonesia) – especially in Java. In contrast, the Eastern Indonesia Region (Kawasan Timur Indonesia) is left behind compared to the western region. The eastern part of Indonesia does not have a strong industrial base and is constrained by the issue of limited connectivity. Low connectivity, both inter- and intra-regional, leads to high logistics costs in eastern Indonesia relative to those of western Indonesia, thus encouraging significant price disparities between western and eastern Indonesia.

The Maritime Highway programme is one of the government's breakthroughs in the efforts of equitable development in the Eastern Indonesia Region, especially in disadvantaged, remote, outermost, and border areas (3TP). This programme aims to reduce the cost of logistics in eastern Indonesia through increased connectivity with western Indonesia by providing effective and reliable marine transport services as well as marine transport subsidies, revitalising civil shipping, and developing industries based on regional commodities. After operating for 5 years, has the Maritime Highway programme succeeded in achieving its expected goals? What are the lessons learned from the implementation of the Maritime Highway so far? What measures can the government take to improve the effectiveness of the Maritime Highway programme?

This report was prepared to evaluate the impact of the implementation of the Maritime Highway programme on the regional economy in the eastern region. This study seeks to answer the question of whether there has been a positive change in (i) price disparities between the Western Indonesia Region and the Eastern Indonesia Region, (ii) the level of household consumption in the Eastern Indonesia Region, and (iii) the economic activities of the Eastern Indonesia Region after the Maritime Highway programme started operating. In addition, this report also outlines measures that can be taken by the government to improve the effectiveness of the Maritime Highway in order to accelerate development in the Eastern Indonesia Region.

Since the Maritime Highway programme was launched in 2015:

- There has been a downwards trend in the monthly inflation rate in several major cities in the Eastern Indonesia Region.
- There has been varied impact on decreasing price disparities, both between the Western Indonesia Region and Eastern Indonesia Region, coastal areas, and the hinterland, as well as for each commodity.
- The impact on increasing household consumption for selected commodities in the Eastern Indonesia Region has remained limited.
- Economic activity in coastal areas has increased, yet the effect diminishes as the distance from the port increases.

Overall, the impact of the Maritime Highway programme on improving public welfare in the Eastern Indonesia Region is still limited. The programme has only decreased the cost of shipping goods between islands at rates that are 30%–50% cheaper than commercial vessels. Why has the Maritime Highway not had a significant impact on reducing price disparities?

This report identifies several issues that often arise in the process of shipping goods from the point of production to the final consumer. First, the component of logistics costs on land – both from the point of production to the port of origin (door to port) and from the port of destination to the point of consumption (port to door) – remains high. This cost component includes land trucking costs, document fees, escorting fees, and terminal handling charges. Second, the performance of loading and unloading services at ports continues to be suboptimal due to the low productivity and efficiency of dock labourers at both origin and destination ports. Third, in the port-to-port phase, the Maritime Highway designated lines remain long, becoming a disincentive for private shipping to be involved in the programme. The effectiveness of the Maritime Highway has also been hampered by irregular schedules for ship arrivals, lack of transparency regarding quotas and loading priorities, and return loads that are frequently empty. Fourth, a less competitive market structure also encourages high prices in destination areas, especially in the hinterland.

In order to raise the effectiveness of the Maritime Highway programme in the future, there are several measures that the government can take:

- Modernise ports to encourage increased loading and unloading efficiency at ports
- Reorganise routes and designated lines to ensure regular and orderly ship arrivals
- Build capacity on governance and supervising goods to increase the transparency of quotas and loading priorities
- Shift the system of subsidies from being based on commodities to general subsidies
- Develop new region-based economic activity centres in the Eastern Indonesia Region to reduce the problem of empty containers returning
- Develop a more integrated national system for logistics by prioritising the role of the Maritime Highway as a catalyst for the development of the Eastern Indonesia Region

Chapter 1

Introduction – Background of the Study and Current Policy Context

Indonesia is the largest archipelagic country in the world where two-thirds of the entire territory is sea. This geographical condition makes maritime transport one of the economic arteries that the Indonesian government must seriously consider. With the number of islands reaching 16,056, transportation of goods and people using sea lanes has become crucial to improving connectivity between regions in Indonesia, particularly for the outermost and remote areas. In 2017, sea transport played a role in mobilising around 500,000 tonnes of goods and 21 million people, both domestically and internationally.

At present, domestic sea transport continues to be concentrated in western Indonesia or the Western Indonesia Region.[1] Table 1.1 shows the flow of goods and passenger traffic for domestic and international sea transport in 25 strategic Indonesian ports in 2017 as reported by the 2017 Sea Transportation Statistics. The volume of goods loaded and unloaded at strategic ports located in the Eastern Indonesia Region is much lower than that of strategic ports in the Western Indonesia Region.[2]

Table 1.1. Volume of Goods and Passenger Traffic in Strategic Ports, Eastern Indonesia Region

Port	Flow of Goods		Passenger Traffic	
	Loaded ('000 tonnes)	Unloaded ('000 tonnes)	Arrivals (people)	Departures (people)
Tenau (East Nusa Tenggara)	68	288	175,259	168,738
Bitung (North Sulawesi)	2,709	10,201	51,629	38,192
Makassar (South Sulawesi)	4,614	6,842	300,844	316,189
Ambon (Maluku)	532	1,729	236,280	245,902
Sorong (West Papua)	186	655	154,503	137,297
Jayapura (Papua)	393	1,657	112,477	105,680
Biak (Papua)	183	594	65,772	65,799
Total	8,685	21,966	1,096,764	1,077,797
Total at 25 Strategic Ports	199,593	261,990	7,963,793	8,088,144

Source: Data taken and adapted from Statistics Indonesia (2018).

The low volume of goods through strategic ports in the Eastern Indonesia Region indicates that the intensity of economic activity in eastern Indonesia is still not as high in western Indonesia. Economic

[1] Goods in this context include containers and non-containers.

[2] In this report, the Eastern Indonesia Region covers all provinces in Sulawesi, the Maluku Islands, and Nusa Tenggara, in addition to Bali and Papua.

sectors in eastern Indonesia have not been able to produce a final product that is attractive enough to generate trading activities in the region. This phenomenon is commonly known as 'ships follow the trade' in the shipping world, namely that ships and ports would not exist without the prior existence of trade.

The economic disparity between the two halves of Indonesia is also confirmed by data compiled by the National Aeronautics and Space Administration (NASA) on night-time light distribution. Night-time light intensity is generally used as a reference to detect economic activity in certain areas, in which there tends to be better economic development and more expansive urbanisation in areas with higher light intensity. As seen in Figure 1.1, higher night-time light intensiy is found in western Indonesia, especially on the island of Java. Meanwhile, the majority of the Eastern Indonesia Region remains mired in darkness at night. The highest night-time light intensity in the Eastern Indonesia Region is found in parts of South Sulawesi.

Figure 1.1. Night-time Light Distribution, Indonesia

Source: Light distribution data from NASA representing night-time light distribution on 31 December 2016.

In addition to the shipping frequency being low, the inadequate production capacity in eastern Indonesia prompts significant price disparities between western and eastern Indonesia. These disparities are evident when comparing the consumer price index data in port cities in the Western Indonesia Region and the Eastern Indonesia Region.

The development of the maritime sector based on the idea of ships promoting trade may be one option for realising equitable development between western and eastern Indonesia. The concept of ships promoting trade prioritises the procurement of port infrastructure and the opening of shipping lanes to create new trade routes, reduce logistics costs, and accelerate economic growth in the Eastern Indonesia Region. A concrete form of the concept in practice is the opening of the Maritime Highway, which was initiated in 2015. The Maritime Highway concept emphasised by President Jokowi is the strengthening of shipping lanes focused on eastern Indonesia. The increasing number of shipping lanes to eastern Indonesia are expected to improve the distribution of logistics to remote, outermost, and disadvantaged areas. In addition, the Maritime Highway is also expected to enable the facilitation of commercial access from south Pacific countries to countries in East Asia.

This study seeks to investigate the impact of the Maritime Highway on welfare and price levels in areas located in eastern Indonesia, and provide the insights by addressing the following issues:

- Evaluating the connectivity improvements in remote areas to support the acceleration of economic growth in the Eastern Indonesia Region during the implementation of the Maritime Highway programme.
- Estimating the impact of the implementation of the Maritime Highway programme on reducing price level disparities and public welfare in the Eastern Indonesia Region.
- Formulating policy recommendations that may improve the Maritime Highway programme, especially in relation to programme sustainability without government subsidies.

Chapter 2

Maritime Highway Implementation

2.1 Maritime Highway Concept

The Maritime Highway provides effective connectivity over sea waters by facilitating vessels to routinely ship with regular schedules from western Indonesia to eastern Indonesia. The program should operate the vessels consistent with needs to achieve the Maritime Highway's purpose. To that end, the Ministry of Transportation is committed to providing 100 ships throughout Indonesia, consisting of 60 pioneer vessels, 15 container ships (with 100 20-foot equivalent units [TEUs]), 20 *Rede* [3] vessels, and five livestock vessels, including passenger ships. The government hopes to increase inter-island connectivity throughout Indonesia by developing vessels to support the Maritime Highway in this manner.

2.2 Regulation Aspects

Legal Basis and Regulations

In operating Maritime Highway vessels, there are several regulatory references; the major ones are:

1. Republic of Indonesia Presidential Regulation No. 70/2017 on Performing Public Obligations for Shipping, amending Presidential Regulation No. 106/2015 on Performing Public Obligations for Shipping
2. Presidential Regulation No. 71/2015 on the Definition and Storage of Staples and Necessary Goods
3. Transport Ministerial Regulation No. PM. 4/2016 on the Amendment to Transport Ministerial Regulation No. PM 161/2015 on Performing Public Obligations for Shipping
4. Transport Ministerial Regulation No. 17/2017 on Shipping Tariffs in Performing Public Service Obligations

According to Presidential Regulation No. 106/2015, to ensure the availability of goods and reduce price disparities for the public as well as the continuity of transporting goods to disadvantaged, remote, outermost, and border areas in supporting the Maritime Highway, the government has assigned state-owned enterprise PT Pelayaran Nasional Indonesia (PT Pelni) to perform public service obligations (PSO). PT Pelni is tasked with transporting goods to disadvantaged, remote, outermost, and border areas in accordance with the designated lanes that have been established, while considering and maintaining shipping safety and security. The disparities that occur in cargo flows

[3] A Rede ship is a ship that transfers loads between large vessels and the pier. It is used when vessels cannot dock at the pier.

require the support of subsidies as a form of the government's responsibility for conditions in the country, which consists of isolated islands, and the government's desire for the sea to be a means of connecting instead of being a barrier. The presence of the government in isolated regions is also crucial in terms of national defence, specifically economic security as the front line for a robust unitary state of the Republic of Indonesia.

According to Article 1 of Presidential Regulation No. 106/2015 on Performing Public Service Obligations for Shipping Goods, the government will finance this assignment to perform public service obligations for shipping goods to the amount of the difference between production costs and the tariffs established by the central government and/or local governments as public service obligations. For this reason, in a meeting of the government and the budget agency of the People's Representative Council of the Republic of Indonesia discussing central government spending in the 2017 draft state budget, the government proposed giving subsidies to PT Pelni amounting to Rp2.1 trillion under the PSO scheme. The financial support for the PSO indicates the government's seriousness in ensuring the availability of goods and reducing price disparities for the public and the continuity of services transporting goods to disadvantaged, remote, outermost, and border areas.

In 2017, the government amended Presidential Regulation No. 106/2015 to Presidential Regulation No. 70/2017 on Performing Public Service Obligations to Transport Goods from and to Disadvantaged, Remote, Outermost, and Border Areas. One of the changes made in the regulation was increasing the types of goods covered by the Maritime Highway programme, given the needs of the islands in eastern Indonesia. This revision is based on input from relevant ministries and regional heads about necessary goods. Additional goods covered by the Maritime Highway programme shall be detailed further in a Trade Ministerial Regulation.

2.3 Technical Aspects

Competent Institutions

The Maritime Highway programme is implemented based on Presidential Regulation No. 106/2015 on Performing Public Service Obligations for Sea Freight Transport, which refers to three government agencies tasked with implementing the Maritime Highway programme:

1. Ministry of Transportation

The Ministry of Transportation functions as the assignor in accordance with Presidential Regulation No. 106/2015 through Transport Ministerial Regulation PM 4/2016 and Transport Ministerial Regulation No. 161/2015 as well as port infrastructure and loading equipment providers.

2. Ministry of Trade

In the Maritime Highway programme, the Ministry of Trade functions as the executor of marketing and cargo verification. The Ministry of Trade is tasked with determining the types of cargo facilitated by the Maritime Highway, which includes staples and necessary goods. The Ministry of Trade also provides shipping instructions and controls market prices at the destination.

3. PT Pelayaran Nasional Indonesia (PT Pelni)

PT Pelni has the role of operator and is responsible for container yard to container yard (CY to CY) transportation.

These three parties are jointly responsible for:

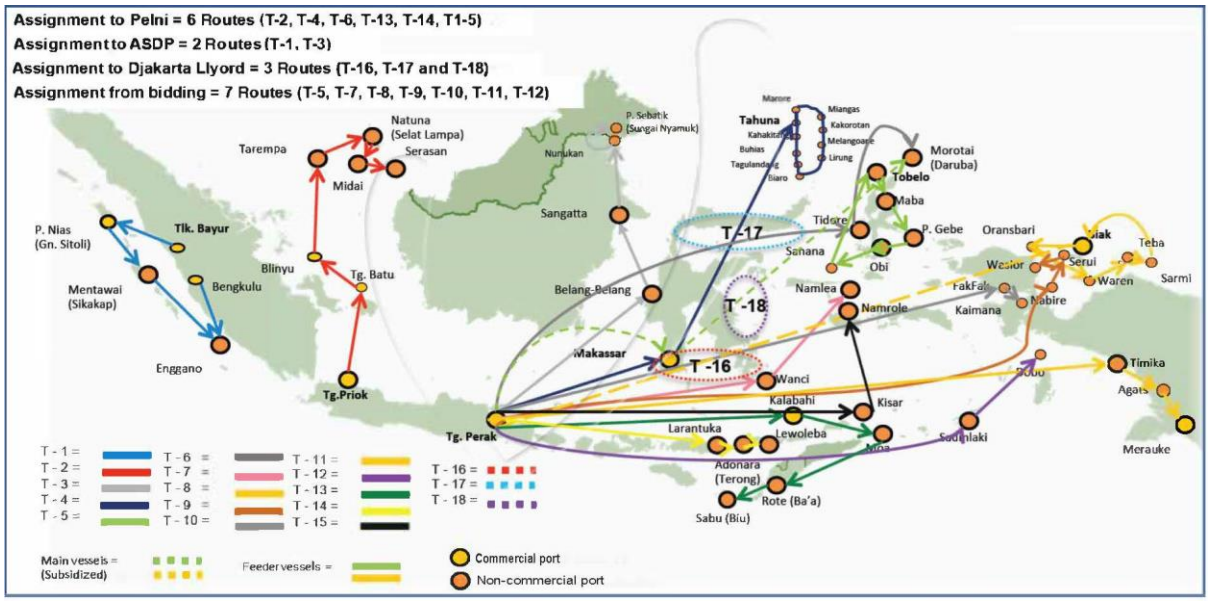
a) Providing transportation for disadvantaged, remote, outermost, and border areas in accordance with the designated lanes that have been established, while considering and maintaining shipping safety and security.
b) Ensuring the availability of goods and reducing price disparities for staples and necessary goods between Java and outside Java.
c) Organising scheduled, permanent, and regular shipping (liners).

Lanes and Operating Period

The shipping route is the direction or distance that must be covered by water transportation from one port to another by considering the navigational aspects of the port, shipping, and security aspects (Hakim, 2016). The determination of these shipping routes is related to one of the current government's main programmes, namely the development of the Maritime Highway in supporting national connectivity and logistics systems. To implement the concept of Maritime Highway optimally, the determination of the best shipping routes from one port to another is crucial for improving shipping safety and effectiveness.

In 2018, the Ministry of Transportation established 18 designated lanes in the Maritime Highway (Figure 2.1). (Appendix 1 provides further details of the lane). Most are feeder routes as a solution to reduce disparities for more uniform prices of goods. These were incorporated in the Director General of Sea Transportation Decision No UM 002/109/2/DJPL-18 dated 14 December 2018. According to this Letter of Decision, there are 7 direct call and 11 feeder routes. The ship operators on 18 Maritime Highway designated lines are determined through the mechanism of assigning them to shipping state-owned enterprises and holding public bids for private shipping companies.

Figure 2.1. Maritime Highway Designated Lines Serving the Eastern Indonesia Region



Source: Ministry of Transportation, 2019: http://hubla.dephub.go.id/berita/Pages/KEMENHUB-RESMI-TETAPKAN-15-TRAYEK-TOL-LAUT-UNTUK-TAHUN-2018.aspx. Accessed 5 June 2019

Of the 18 maritime highway lanes, there are three private companies appointed by the government as operators through a bidding mechanism. The three private companies that won the operator bid for seven maritime highway designated lanes as established on 25 March 2019 are PT Mentari Sejati Perkasa (Mentari Lines), PT Pelayaran Tempuran Emas Tbk. (Temas Line), and PT Pelangi Tunggal Ika. The rules regarding subsidies provided by the government to state-owned operators differ from those for private operators. If the service uses state-built vessels, the subsidy is given in the form of operational subsidies for ships. Conversely, if an operator-owned vessel is used, the subsidy provided is in the form of a container rental subsidy.

Businesses and Types of Ship Operated

Since 2015, the government has undertaken an effort to implement this programme. About 100 ships will replace old ships that have been operated by PT Pelni, Djakarta Lloyd, and several other shipping companies. PT Daya Radar Utama is a manufacturer of eight units of 2000 gross tonnage (GT) pioneer vessels and five units of 100 TEU container vessels.

The size of a ship must be adjusted to the level of connectivity on the Maritime Highway, according to the Director of Sea Traffic. With consideration to the development of the size of the fleet of ships used in international trade lanes, it is necessary to prepare ports and channels to support ships capable of serving larger loads. There are four route segment levels served by different sizes and types of vessel. For level 1, the main vessels have the capacity of 100 TEUs or 200 GT. For level 2, there are feeder ships carrying advanced containers from destination ports to feeder ports. This is to be continued (if necessary) to level 3, where the role of pioneer vessels and non-commercial operated by the government ships bring mini containers to local ports. The last is level 4, in which the operation of

Landing Craft Tank (LCT) ships[4] with a weight of 50 GT and community shipping with a weight of 35 GT continue the transportation using smaller vessels to the surrounding small islands.

Load Handling Procedures

Technically, the procedure for handling maritime highway loads comprises several steps:

1. The shipper fills out shipping instructions in accordance with the format provided by the Ministry of Trade.
2. The shipping instructions from the Ministry of Trade are provided to the public through designated handling agencies.
3. The shipper receives a delivery order (D/O) to retrieve empty containers from the depot
4. The shipper retrieves the empty containers by bringing the D/O that has been obtained to the depot
5. The shipper stuffs goods into containers outside the container yard (CY) area (outside stuffing). The maximum weight that has been set for each container is 15 tonnes. The expedition and warehouse costs of the shipper to the CY are the responsibility of the shipper. The deadline for the CY receiving containers that have been filled is no later than 2 days prior to the vessel's departure (estimated time of departure).

2.4 Financial Aspects

Subsidised Cost Components

The main objective of the Maritime Highway is to reduce the price disparities between eastern and western Indonesia by subsidising shipping costs for full container loads (FCL) and general cargo to certain ports with predetermined schedules and routes. With the Maritime Highway programme, the cost of shipping FCL cargo for eastern Indonesia is expected to be cheaper, ultimately reducing the selling price of goods in destination areas. The Maritime Highway programme has a list of transportable goods or commodities specified in Presidential Regulation No. 106/2015 on Performing Public Obligations for Shipping, which was then revised by Presidential Regulation No. 70/2017 on Performing Public Service Obligations to Transport Goods from and to Disadvantaged, Remote, Outermost, and Border Areas (3TP). Under Presidential Regulation No. 70/2017, the goods transported under the Maritime Highway programme include staples and necessary goods, in accordance with laws and regulations, along with other types of goods in accordance with public needs in 3TP areas. These include livestock and fish as well as returning containers originating from stopovers by sea, land, and air transport.

Goods that are subsidised for shipping are regulated by Presidential Regulation No. 71/2015 on the Determination and Storage of Staples and Necessary Goods and Indonesian Trade Ministerial Regulation No. 57/M-DAG/PER/8/2012:

[4] LCT is a ship to transfer heavy materials suchs as machinery, coal, and other bulk things. It is suitable for small ports because it can approach to the platform and jetty.

Staples consist of:

1) Agricultural products (rice, soy, chillies, shallots)
2) Industrial products (sugar, cooking oil, wheat flour)
3) Animal products (pedigree chicken eggs, pure-bred chicken, beef)
4) Fresh fish (milkfish, mackerel, tuna/tuna/skipjack)

Necessary goods consist of:

1) Seeds (rice, corn, soy beans)
2) Non-subsidised fertiliser
3) 3kg LPG canisters
4) Plywood
5) Cement
6) Construction steel
7) Light steel

In the implementation of the Maritime Highway, there are cost components paid by the government in its operation. These cost components are incorporated under the Transportation Ministerial Regulation No. PM 85/2016 on the Cost Component of Compensation Paid by the Government in Operating Shipping. In this ministerial regulation, it is stated that the cost component of compensation paid by the government in the operation of shipping goods includes direct and indirect operational costs. Direct operational costs include fixed costs such as the depreciation cost of vessels, marine communication systems, vessel charters, and compensation costs paid by the government; indirect operational costs include salaries for non-crew members, general office costs, corporate taxes, as well as licensing and certification.

Maritime Highway Load Tariffs and Business Processes

The Maritime Highway programme has several tariffs, namely FCL dry container, reefer container, and general cargo loads that are calculated per tonne or per cubic metre. The determination of tariff calculations for general cargo based on weight or size is made by calculations that are more advantageous for the company. Table 2.1 shows examples of the costs charged by both private companies and subsidised maritime highway programme.

Table 2.1. Private versus Maritime Highway Tariffs (in Rupiah/TEU), Selected Lines

No.	Designated Line	Private	Maritime Highway
1	Surabaya–Merauke	10–11 million	5.9 million
2	Surabaya–Manokwari	11–13 million	5.3 million
3	Surabaya–Kaimana	11–12 million	5.2 million
4	Surabaya–Timika	10–11 million	5.7 million
5	Surabaya–Fakfak	10–11 million	5.9 million

Source: Directorate General for Sea Transportation, July 2017.

Chapter 3

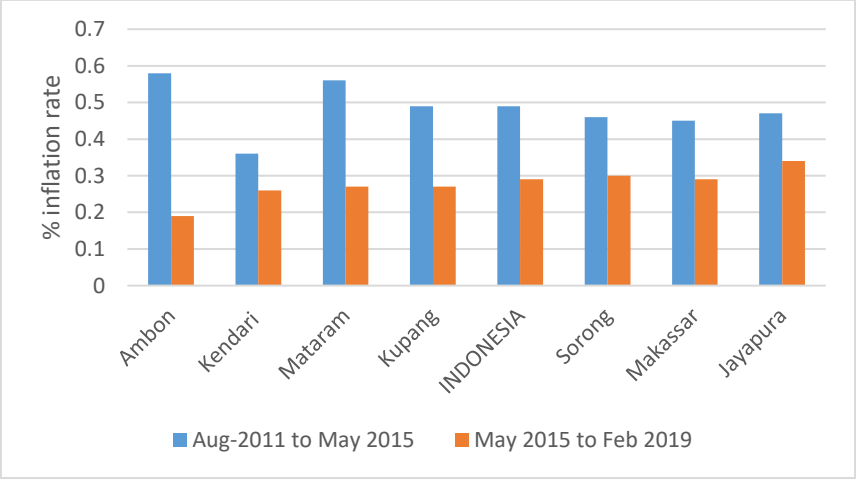
Impact of the Maritime Highway on Public Welfare and Regional Economic Activities

In evaluating the implementation of the Maritime Highway policy, the focus of the analysis in this study covers two main issues. First, identifying the impact of the existence of the Maritime Highway programme on the welfare level of people living in eastern Indonesia by using the indicators of price and household consumption levels. Second, identifying improvements in connectivity between western and eastern Indonesia that will support the acceleration of economic growth in eastern Indonesia after the programme is fully operational. Specifically, this study discusses the issue of price disparities between regions by focusing on the problem of connectivity between areas around ports supporting the Maritime Highway programme and hinterland areas. This will lead to the analysis of regional economic activities influenced by the program.

3.1 Price Disparity Changes

Since the Maritime Highway programme became operational in 2015, developments in the monthly inflation rate in several large cities in eastern Indonesia have shown a declining trend. Average monthly inflation in several cities such as Ambon, Kendari, Kupang, and Mataram is even lower than the national average. Figure 3.1 shows a comparison of the average monthly inflation values in selected cities before and after implementation of the Maritime Highway programme. Nevertheless, the monthly inflation that has declined cannot immediately be concluded as resulting from the existence of the Maritime Highway programme.

Figure 3.1. Inflation Rates of Selected Cities in Eastern Indonesia (before and after Maritime Highway Implementation)

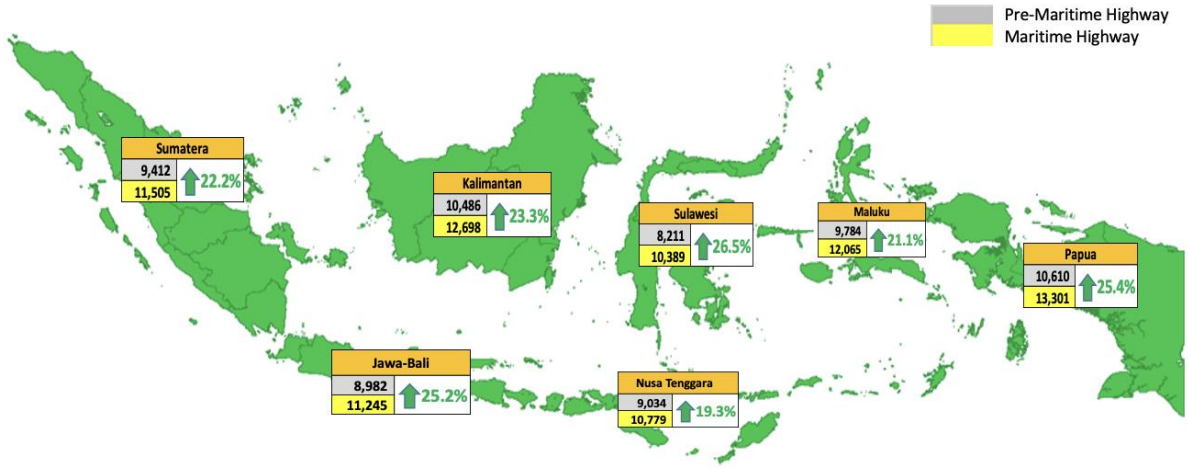


Note: Maritime Highway Program is launched in May 2015.
Source: Adapted from Central Bureau of Statistics (BPS) data (2019).

The study then analyses the development of selected commodity prices (rice and cement) as an alternative approach in obtaining indications of the impact of the Maritime Highway programme on price disparities in eastern Indonesia. Figures 3.2 and 3.3 show the comparison of the average monthly prices of rice and cement between islands before and after the implementation of the programme.

Figure 3.2 shows that when the Maritime Highway programme started operations, there was no decline in the average monthly price of rice, both in western and eastern Indonesia. Conversely, there was an increase in the average monthly price of rice throughout the country. The average monthly price of rice in the Western Indonesia Region rose by 22%, while it only rose by 19.6% in the Eastern Indonesia Region. In other words, there is a possibility that the Maritime Highway programme will contribute to curbing the effect of rising rice prices in the west and improving price disparities in the Eastern Indonesia Region.

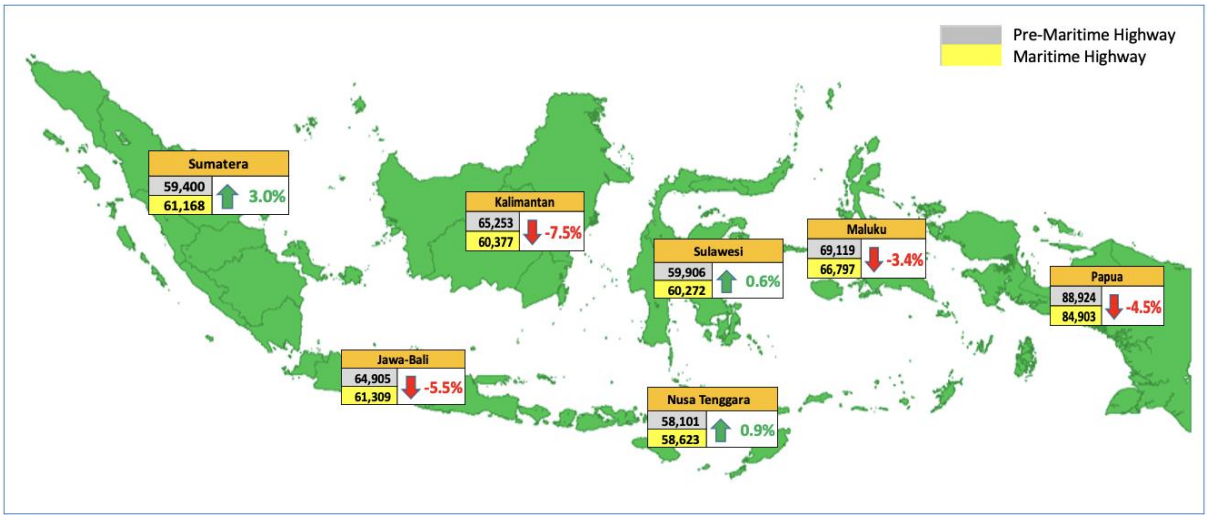
Figure 3.2. Average Increases in Rice Prices Before and After Implementation of the Maritime Highway Programme



Source: Adapted from BPS data (2019).

Figure 3.3 shows that when the Maritime Highway programme became operational, the average monthly price of cement in the Maluku and Papua regions decreased significantly, by 3.4% and 4.5%, respectively. However, it should also be noted that at the same time, the average monthly price of cement in the Java region as the centre of the cement industry in Indonesia also dropped significantly by 5.5%. The Maritime Highway programme might contribute to the decline in commodity price disparities in eastern Indonesia, but the factor of reduced cement prices in the Java region cannot be ignored.

Figure 3.3. Average Monthly Prices of Cement Before and After Implementation of the Maritime Highway Programme



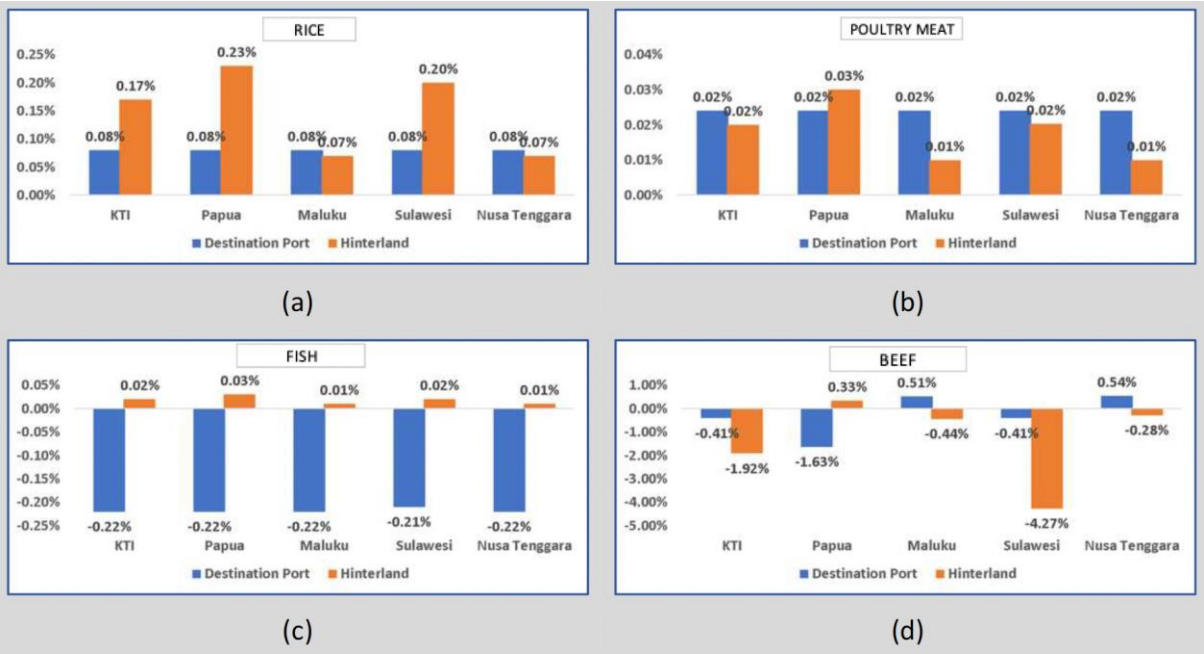
Source: Adapted from BPS data (2019).

3.2 Spillover Effect of the Maritime Highway Programme and Price Disparities in Eastern Indonesia

To obtain the results of a more in-depth analysis of the impact of the existence of the Maritime Highway programme on changes in price disparities in the Eastern Indonesia Region, this study examines and compares the price developments of some staple commodities transported using maritime highway vessels, for distribution in port and hinterland areas. The prices of basic commodities are also compared, for example rice, fresh fish, chicken, and beef.[5] Furthermore, the price data of the four commodities are used as a database in economic modelling, which is compiled to estimate the impact of the existence of the Maritime Highway programme on price disparities by region in eastern Indonesia. A comparison of estimated results between regions according to commodity types is presented in graphical form consisting of four panels (Figure 3.4), which implicitly shows how the Maritime Highway programme has influenced the price disparities between the port areas and the hinterland areas in the Eastern Indonesia Region.

[5] The commodities of rice, fresh fish, chicken, and beef were selected as samples based on the findings of focus group discussions with shipping operators who are maritime highway operators in the Eastern Indonesia Region in Sorong and Makassar.

Figure 3.4. The Maritime Highway Impact on Commodity Price Disparities



KTI = Kawasan Timur Indonesia [Eastern Indonesia Region].
Source: Calculations based on the data from BPS (2019).

There is no significant statistical evidence showing that the level of rice prices in eastern Indonesia is at a relative decline following the implementation of the Maritime Highway. Conversely, the level of rice prices has increased in all regions. Also, the price level in the hinterland areas is almost always relatively higher compared to the price level in the port areas. The highest increase in rice prices for the hinterland areas occurred in the Papua region (0.2%), while the increase for the port areas was relatively the same in all regions at 0.1%.

There is no significant statistical evidence showing that the level of chicken meat prices in eastern Indonesia is at a relative decline after the implementation of the Maritime Highway. However, the price level of chicken meat tends to be constant or experience minuscule changes in all regions, both in the port areas and in the hinterland areas, ranging from 0.01% to 0.03%.

There is significant statistical evidence showing that the level of fresh fish prices in eastern Indonesia is at a relative decline following the implementation of the Maritime Highway. However, the impact was only seen in the port areas, albeit with a slim margin of 0.2%. Meanwhile, the level of fresh fish prices in the hinterland tends to be constant or experience very small changes in all regions, ranging from 0.01% to 0.03%.

There is significant statistical evidence showing that the level of beef prices in eastern Indonesia, both in the port areas as well as the hinterland, is at a relative decline after the implementation of the Maritime Highway. In general, beef price levels fell by 0.41% in the port areas and 1.92% in the hinterland areas. At the regional level, the greatest decrease in beef prices for the port areas was in the Papua region (1.6%), while for the hinterland it was in the Sulawesi region (4.3%). Interestingly, beef prices in the interior hinterland in the Papua region rose slightly by 0.3%. Implicitly, this shows

that Sulawesi currently has relatively better connectivity between the ports and the hinterland than Papua.

Based on Figure 3.4, there are three conclusions that can be drawn. First, the Maritime Highway programme has had the effect of changing price disparities between port areas and the hinterland areas. Second, the change in price disparities in each port area and hinterland area is of a different magnitude for each type of staple commodity. Third, although there is sufficient statistical evidence to state that the Maritime Highway programme has had an impact on reducing price disparities in the Eastern Indonesia Region, the amount remains too small and has not yet had a significant impact in terms of economic value.

3.3 Changes in Household Consumption Levels

To analyse the impact of the existence of the Maritime Highway programme on increasing regional economic activity in eastern Indonesia, this study uses an economic model that utilises information on changes in night-time light intensity based on satellite data imaging published by NASA.[6] In recent years, data on night lights to help complete the analysis of the development of social and economic statistical indicators has been used quite frequently in various countries (Elvidge et al, 2012; Henderson, Storeygard, and Weil, 2012; Stathakis, Tselios, and Faraslis, 2015; Zhou, Hubacek, and Roberts, 2015; Roberts, 2018).

Assuming that all socio-economic activities carried out at night require light, the night-time light intensity in an area correlates to the development of higher economic development in the region. Therefore, when mapping night-time light intensity at the national level, a portrait of the imbalance of the development of economic activities between western and eastern Indonesia is evident.

As shown in Figure 1.1 the night-time imaging data in 2016 portrayed striking differences of intensity between western and eastern Indonesia. It implicitly indicates an imbalance in economic development between the two regions.

If the mapping of night-time light is focused on eastern Indonesia (as shown in Figure 3.5), the difference in economic development disparities within eastern Indonesia itself are evident. Panel (a) and Panel (b) in Figure 3.6 show the conditions of night-time light intensity in 2012 and 2016, respectively. There are indications that night-time economic activity increased after the Maritime Highway programme began operating in 2015. The increase in night-time light intensity was significant in the Sulawesi region. Meanwhile, the regions of Nusa Tenggara, Maluku, and Papua do not appear to exhibit significant differences in night-time light intensity compared to the previous 4 years. This has led to allegations that the Maritime Highway programme has not yet provided a sufficiently large impetus for increasing development activities in the Nusa Tenggara, Maluku, and Papua regions.

[6] Accessible through the following link: https://earthobservatory.nasa.gov/features/NightLights

Figure 3.5. Night-Time Light Intensity, Eastern Indonesia Region

(a) December 2012 (b) December 2016

Source: Adapted from NASA data.

Furthermore, based on night-time light intensity data, this study measures the impact of the implementation of the Maritime Highway programme on the improvement of economic disparity in eastern Indonesia with modelling in which the level of light intensity is a function of the distance of villages or districts *(kelurahan)* to the port area supporting the Maritime Highway. The results of estimates are presented briefly in Table 3.1, while more detailed estimates are provided in Appendix 5.

Table 3.1. Changes in Night-Time Light Intensity in the areas of participating ports as an Impact of Maritime Highway Programme Operations (2012–2017)

Dependent Variables: Night-Time Light Intensity	Average	Zoning for the Radius of Village/District Locations to Participating Ports					
		≤2 km	≤5 km	≤7 km	≤10 km	≤12 km	≤15 km
Maritime Highway Programme:							
Eastern Region	0.43%	0.06%	0.08%	0.08%	0.08%	–0.06%	–0.05%
Nusa Tenggara	0.45%	-	-	-	-	-	-
Sulawesi	0.51%	0.01%	0.08%	0.07%	0.07%	–0.05%	–0.093 %
Maluku	0.36%	-	-	-	-	-	-
Papua	0.37%	1.14%	1.18%	1.20%	1.19%	–0.03%	–0.07%

km = kilometre.
Notes: Number of observations according to radius zoning is insufficient for the regions of Nusa Tenggara and Maluku.
Source:Calculations by authors.

After the Maritime Highway programme started operating in 2015, there was a significant increase in night-time light intensity by an average of 0.43% in the districts/cities that are port areas supporting the Maritime Highway. If the impact of the programme is measured based on a certain distance radius, there is evidence that is statistically significant enough to state that the increase in night-time light intensity in the Eastern Indonesia Region has increased by 0.6% in a radius of less than 2 kilometres (km), by 0.08% within a 7-km radius, and 0.08% within a 10-km radius. After exceeding a 10-km radius from port areas, the night-time light intensity continued to decrease, rendering distance to port areas no longer significant.

There are two conclusions that can be drawn from Table 3.1. First, the decrease in night-time light intensity along with the increase in distance to port areas implicitly shows that the Maritime Highway programme has a relatively limited spatial impact. Second, the existence of the programme has driven more economic activity in port areas supporting the Maritime Highway than in the hinterland areas.

3.4 Connectivity and economic activities

The Maritime Highway moves forwards from the concept of subsidies in the economy that aims to improve public welfare. The beneficiaries in this context are citizens who live in remote island areas that are generally scattered across eastern Indonesia. Subsidies were increased between 2016 and 2018 from Rp219 billion to Rp335 billion, and then Rp448 billion, and then followed by a decrease in 2019 to Rp264 billion. On the other hand, the number of designated lines has grown rapidly, starting with 6 designated lines in 2016, 13 in 2017, 18 in 2018, and 20 in 2019. The development of designated lines and increased loads also has implications on the reduction in average subsidies per designated line from Rp36 billion in 2016 to Rp13 billion in 2019, alongside a decrease in average subsidies per tonne from Rp2.7 million to Rp1.1 million during the same period.

For future improvement, the determination of routes must be based on spatial demand rather than mere sectoral deliberations or regional input. The design for including subsidies inevitably needs to be rethought as well to ensure targeting accuracy to reduce price disparities between regions.

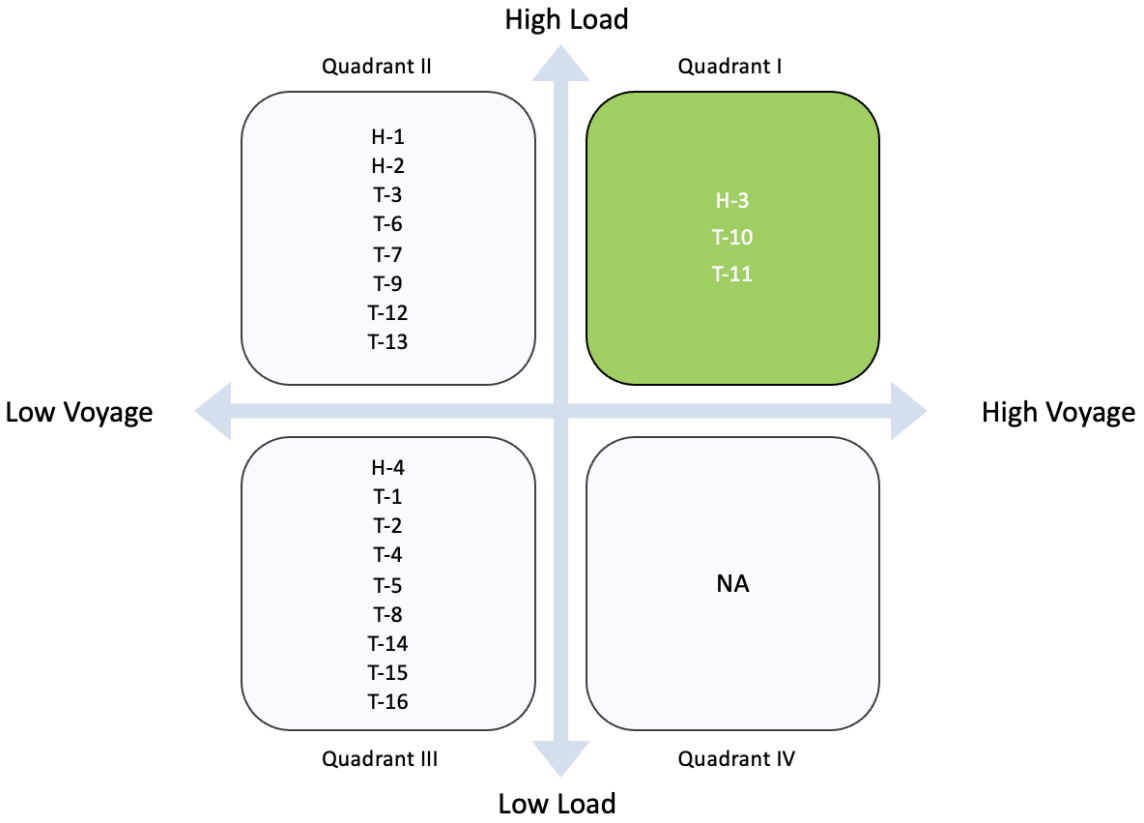
The disaggregation of the figures provides information on the proportion of subsidies per component. Subsidies for shipping activities that cover freight (berth to berth)/port to port are the smallest at 19%. Port activities such as lift on lift off container costs, costs of shipping to port, terminal handling costs, cargo loading and unloading costs (cargo hold to jetty), haulage costs, and lift on lift off container costs absorb 31% of the budget. The largest component is logistical support activities, namely transportation management services and the cost of shipping to the consignee, with a proportion of 50%.

The high logistics cost in hinterland areas shows the importance of multimodal support in the logistics chain. Moreover, based on our calculations (Figure 3.4) price reductions due to the Maritime Highway only occurred at a radius of 10 km from the logistics warehouse, known as *Rumah Kita*. There is an urgency for coordination between maritime transportation and better hinterland connectivity through the integration of the *Rumah Kita* support programme with the Ministry of Trade and regional governments.

A spatial cost analysis of the Maritime Highway provides an illustration of the unit cost of the Maritime Highway subsidies per designated line and Maritime Highway subsidies per designated line per

voyage. First, the Maritime Highway subsidy for each designated line considers load volume. The T-15 designated line serving the Tanjung Perak–Tidore–Morotai–Tanjung Perak route receives the largest subsidy at Rp264 billion or 50%. Second, the Maritime Highway subsidy per designated line per voyage considers the volume of the load and the frequency of services. The H-3 designated line serving Tanjung Perak–Tenau-Saumlaki–Dobo–Tanjung Perak receives the largest subsidy at Rp9.2 billion or 22.6%.

Figure 3.6. Evaluation Matrix of Maritime Highway Routes



Source: Authors' analysis.

A spatial cost analysis of the Maritime Highway becomes the basis for mapping the performance of Maritime Highway routes. There are two criteria for voyages and loads, 'High' with a target realisation of more than 50% and 'Low' with a target realisation of less or equal to 50%. In 2019, only three designated lines were in Quadrant I or performing well: H-3 (Tanjung Perak–Tenau-Saumlaki–Dobo), T-10 (Tidore–Morotai–Buli–Maba–Gebe–Tidore Island), and T-11 (Tanjung Perak–Fakfak–Kaimana–Timika–Agats–Boven Digoel–Tanjung Perak). All three lines have the potential to be developed by commercial shipping outside the subsidy mechanism. The routes in Quadrant II require further evaluation because the high shipping frequency is not followed by adequate loads. Meanwhile, routes in Quadrant III require fundamental justification if they are to be continued or the possibility of route rationalisation.

Mapping can also be conducted at ports that are navigable by the Maritime Highway routes. It is important to determine the strategic ports to be included in the Maritime Highway programme. One

way to define the strategic ports is by calculating the betweenness centrality, which is the frequency of the shortest call voyages between two ports across the questioned port. We found that the most important ports are Tanjung Perak, Makassar, Tenau, Kendari, and Morotai.

Other indicators of centrality are hub and authority centrality. Hub centrality shows the amount of connectivity between ports with high impact through port *i* (forwards linkage). Authority centrality refers to the extent to which port *i* is connected to a port with high impact (backwards linkage). Tanjung Perak and Waren both have high scores as hub and authority centrality.

The use of big data is also relevant in understanding the Maritime Highway discourse. Searching trends through Google's search engine show fluctuations in search interest over the last 5 years. This variation was caused by several events related to the Maritime Highway in the news. Spatial identification was also conducted.

In addition, the text analysis approach in the release of Maritime Highway news on the five most popular pages on the Google search engine site can be modelled with Bigram. Bigram was developed based on the conditional probability logic of two words. In this analysis, searches for the term 'Maritime Highway' in a news text were conducted. Maritime Highway often appeared with the following bigram terminology: Tanjung Perak (hub port), Ministry of Transportation (implementing authority), empty containers, price disparities (target), and sea transportation (connectivity).

Chapter 4

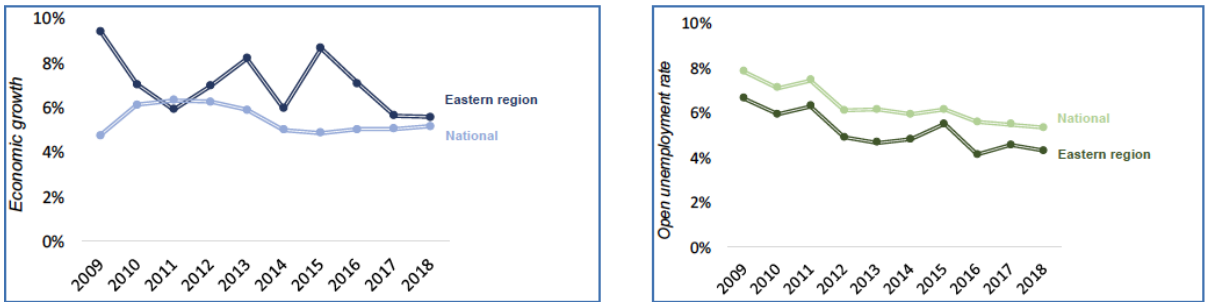
Policy Development Leading to Logistics Systems in a More Integrated Eastern Indonesia

4.1 Development Policy Direction for Eastern Indonesia

Although most of Indonesia's economic activities tend to remain concentrated in the Western Indonesia Region, the prospects for the economic advancement of provinces in eastern Indonesia cannot be neglected. One of these prospects is the macroeconomic resilience of eastern Indonesia, which was quite impressive following the global economic recession in 2008. Since 2009, economic growth in eastern Indonesia has always been higher than the national economic growth rate. Regional gross domestic product (GDP) in eastern Indonesian provinces has risen approximately 7% per year in the last decade, while the national average for economic growth is at 5.4% per year. West Papua emerged as the province with the fastest rate of regional GDP growth (9.1% per year), followed by Central Sulawesi (8.5% per year) and West Sulawesi (7.7% per year) as shown in Figure 4.1a.

The regional GDP growth of provinces in eastern Indonesia may be capable of expanding employment opportunities for local residents, as seen by the reduced open unemployment rate in the region in Figure 4.1b. The percentage of the workforce in eastern Indonesia that is unemployed has gradually decreased from 7.9% in 2009 to 5.3% in 2018. During the same period, the open unemployment rate in eastern Indonesia was consistently below the national rate.

Figure 4.1. Economic Performance, Eastern Indonesia Region



a. Economic Growth b. Open Unemployment

Source: Adapted from BPS data.

Agricultural production remains one of the key sectors in the provinces of eastern Indonesia as described in Table 4.1. Saltwater fish, cocoa, logs, and nickel are leading commodities from eastern Indonesia.

Eastern Indonesia is the main contributor of marine fisheries production in Indonesia. Provinces located in eastern Indonesia generally exceed western Indonesia in terms of saltwater fish production. Maluku was the province with the largest catches of skipjack tuna and tuna in Indonesia in 2017 (the

volume of skipjack tuna production was 76,790 tonnes and 66,065 tonnes for tuna production).[7] On the other hand, the majority of the production of aquacultured freshwater fish, --a type of gourami, catfish, walking catfish, and carp-- comes from western Indonesia.

Cocoa emerged as a plantation commodity that is widely produced in eastern Indonesia, especially in provinces located on the island of Sulawesi. Unlike western Indonesia, there is not much production of national strategic commodities, such as palm oil and rubber, in eastern Indonesia. Meanwhile, eastern Indonesia is also leading in terms of log production from the forestry sector and nickel from the mining sector.

Table 4.1. Dominant Agricultural Products from Provinces in Eastern Indonesia

Province	Commodity
West Nusa Tenggara	Soybean, shallot, chilli, mango, tobacco, seaweed
East Nusa Tenggara	Pork meat, seaweed
North Sulawesi	Potato, cabbage, coconut, clove, pork meat, skipjack, tilapia, carp
Central Sulawesi	Coconut, cocoa, skipjack, nickel
South Sulawesi	Rice, corn, shallot, tomato, cocoa, chicken, duck, prawn, seaweed, nickel
Southeast Sulawesi	Clove, cocoa, cashew, seaweed, nickel, asphalt
West Sulawesi	Cocoa
Gorontalo	Skipjack, tuna
Maluku	Skipjack, tuna, seaweed
North Maluku	Coconut, tuna
Papua	Timber, pork meat, skipjack, mackarel tuna, copper, gold
West Papua	Timber

Source: Adapted from BPS data.

[7] The three provinces in Indonesia that had the largest skipjack tuna catches in 2017 were Maluku, Gorontalo (51,391 tonnes), and Central Sulawesi (50,481 tonnes). Meanwhile, the three provinces in Indonesia that had the largest tuna catches in 2017 were Maluku, Papua (51,709 tonnes), and Jakarta (27,983 tonnes) (BPS Data: https://www.bps.go.id/indicator/56/1515/1/produksi-perikanan-tangkap-di-laut-menurut-komoditas-utama.html [Accessed 4 January 2022])

4.2 Purpose of Developing an Integrated Logistics System in Eastern Indonesia

The development of ports in Eastern Indonesia can be analysed through the shipping capacity at these ports. The port capacity in this study will focus on selected ports in eastern Indonesia. The selection of ports will be based on infrastructure data at major ports in eastern Indonesia.

The major ports in eastern Indonesia are: (i) Tenau/Kupang, (ii) Bitung, (iii) Pantoloan, (iv) Makassar, (v) Ternate, (vi) Ambon, (vii) Sorong, and (viii) Jayapura. Table 4.2 provides information on vessel capacity in TEU from two points of view: current traffic and the latest draft. The shipping capacity cannot be ascertained immediately from the depth of the draft due to several reasons: (i) inadequate quality of dock infrastructure; (ii) low efficiency in equipment handling, and (iii) lack of shipping demand from the market.

Table 4.2. Shipping Capacity at Ports in Eastern Indonesia

Port	Current maximum draft (m)	Maximum vessel size that can be accommodated in the current traffic (TEU)	Maximum vessel size that can be accommodated in the current draft (TEU)
Tenau	13	606	4,900
Bitung	14	3,534	5,250
Pantoloan	9.5	608	1,700
Makassar	12	2,700	4,000
Ternate	10	644	2,200
Ambon	10	1,560	2,200
Sorong	12	3,000	4,000
Jayapura	12	2,524	4,000

M = metre, TEU = twenty-foot equivalent unit.
Sources: IHS Markit (2019), Pelindo 3 (2019), and Pelindo 4 (2019).

Based on draft data, the Ports of Bitung, Tenau, Makassar, Sorong, and Jayapura have a draft of more than 10 metres, enabling them to serve vessels equivalent to or more than 4,000 TEU in size. This section will be the basis for developing ports in eastern Indonesia to be competitive as international hubs for East Asia and the Pacific.

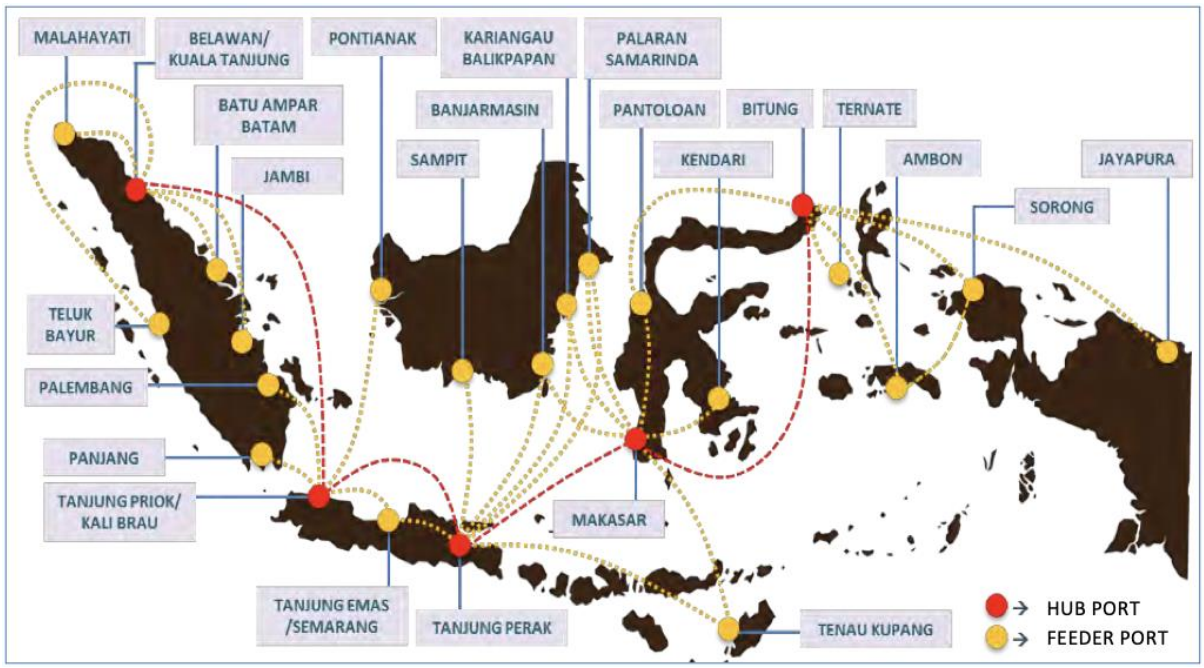
Main Maritime Highway Corridors and Potential Network Expansion

The Maritime Highway definition can be categorised into two different types: main corridors and feeder corridors. This section will focus on the main corridors. The main corridors connect the main ports: Belawan, Batam, Tanjung Priok, Tanjung Perak, Makassar, Balikpapan, Ambon, Bitung, and Sorong. Balikpapan and Ambon have been added to the current networks since the first version was released in 2015 by the National Planning Agency (BAPPENAS) (Figures 4.2 and 4.3).

Figure 4.2. Current Main Corridors of the Maritime Highway

Source: Adapted based on data from Ministry of Transportation, 2017.

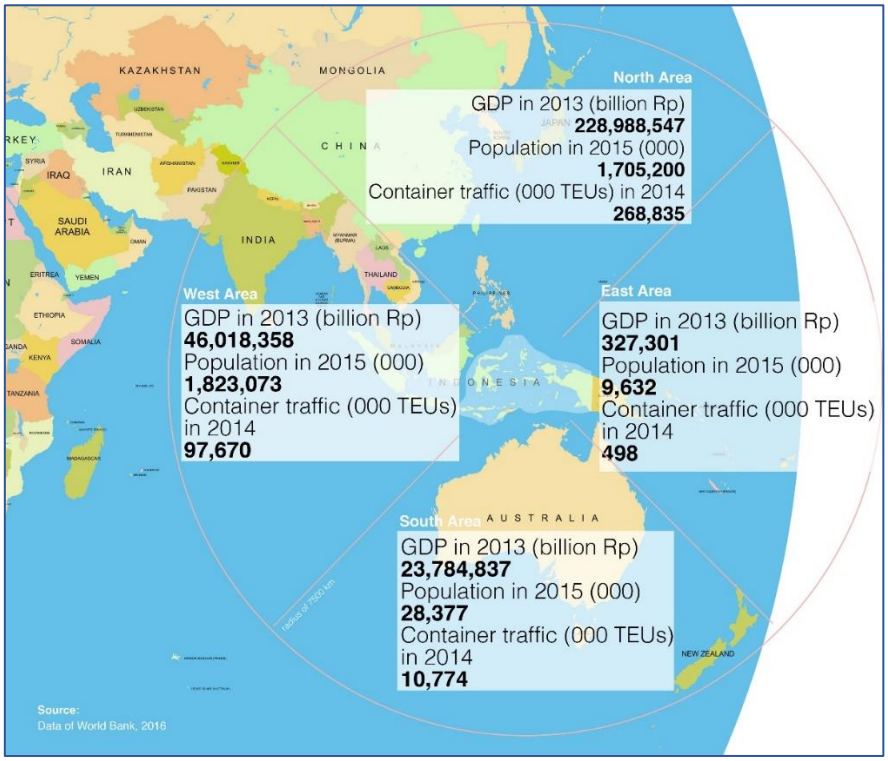
Figure 4.3. First Version of the Main Maritime Highway Corridors



Source: BAPPENAS (2015).

Potential network expansion can be assessed by analysing the closest international routes. In this study, the scope of international routes will be limited to international routes around eastern Indonesia. The largest market for eastern Indonesia is in the northern region (Figure 4.4), mostly dominated by areas with high consumption populations, such as Japan, China, Taiwan, and Hong Kong. This consumption is also represented by the volume of containers, which is three times that of western Indonesia.

Figure 4.4. Market Potential for Eastern Indonesia



GDP = gross domestic product, Rp = rupiah, TEU = twenty-foot equivalent unit.
Source: Analysed from 2015 World Bank data.

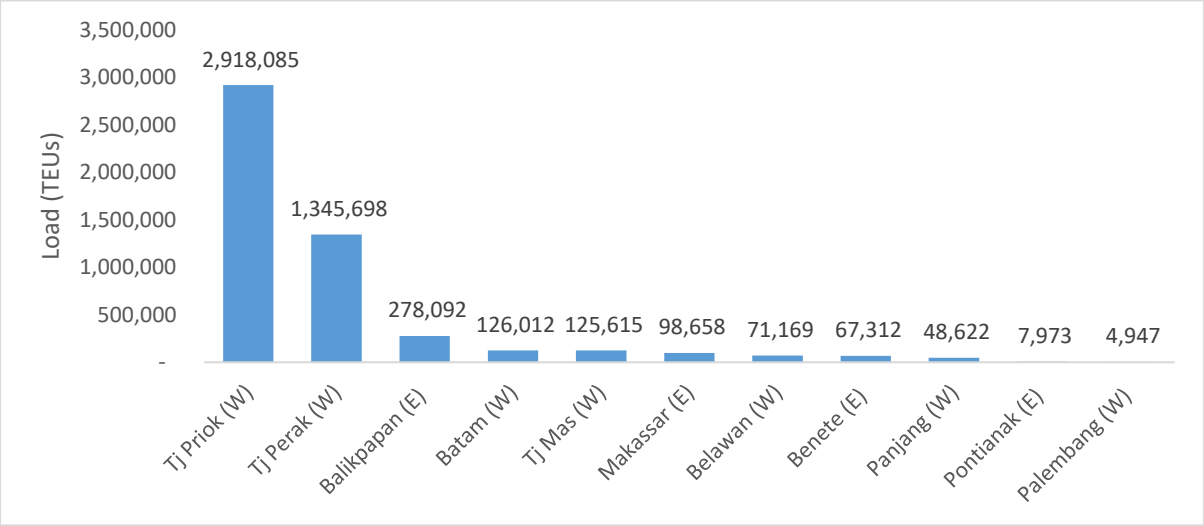
Table 4.3. Major Indonesian Ports serving International Shipping

No.	Origin	Destination
1	Busan (Korea)	Tanjung Priok
2	Shanghai (China)	Tanjung Priok
3	Shekou (China)	Tanjung Priok
4	Kaohsiung (Taiwan, China)	Tanjung Perak
5	Kaohsiung (Taiwan, China)	Tanjung Priok
6	Davao (Philippines)	Tanjung Perak
7	Davao (Philippines)	Balikpapan
8	Davao (Philippines)	Tanjung Priok
9	Cebu (Philippines)	Makassar
10	Taipei (Taiwan, China)	Tanjung Perak
11	Cebu (Philippines)	Makassar
12	Taipei (Taiwan, China)	Tanjung Perak
13	Manila (Philippines)	Tanjung Perak

Source: Alphaliner (2016) database (Accessed 5 August 2019).

In 2016, of the 11 ports in Indonesia serving international shipping from various locations, Tanjung Priok is the busiest port with a total annual container volume of 2.9 million TEU (Table 4.3). The least busy port is Palembang with a volume below 5,000 TEU per year. The total flow of international trade in these 11 ports is shown in Figure 4.5. Amongst the ports of eastern Indonesia, only Makassar has international shipping with minimal volumes. This illustrates the huge gap between eastern and western Indonesia.

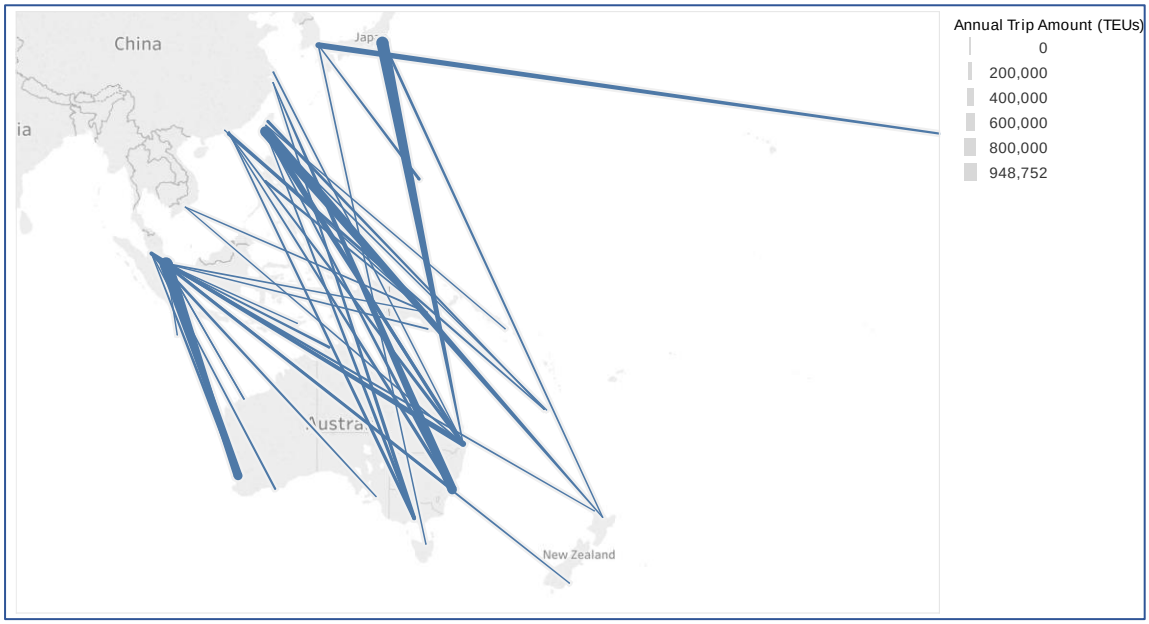
Figure 4.5. Volume of Containers in Indonesian Ports with International Shipping Demand



Note: W indicates Western Indonesia, E indicates Eastern Indonesia.
Source: Alphaliner (2016) database. Accessed 5 August 2019.

Potential network expansion can be started by analysing potential shipping routes passing through ports in eastern Indonesia from the largest market in the northern region. Most routes originate from East Asia into Australia and Oceania, as illustrated in Figure 4.6. Other busy routes are from Southeast Asia to the western part of Australia, but most do not pass through eastern Indonesia, instead passing through the Sunda Strait.

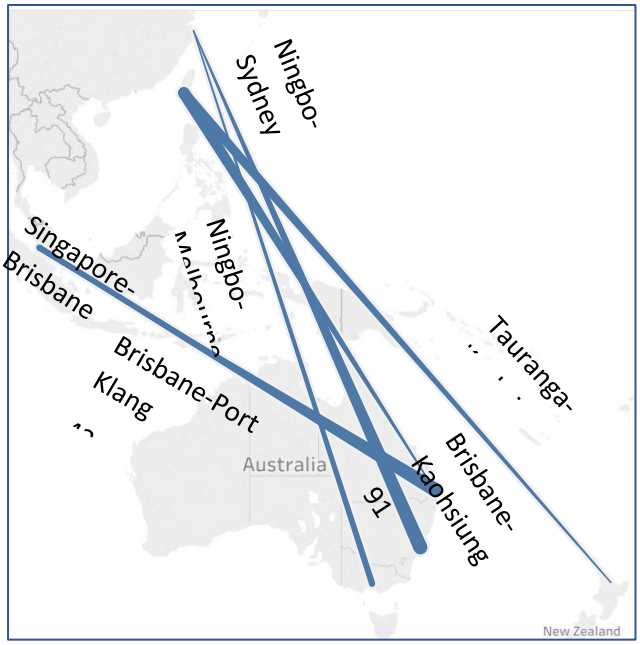
Figure 4.6. Potential Shipping Routes for Eastern Indonesia from and to the Northern Region



TEU = twenty-foot equivalent unit.
Source: Analysed with data from Alphaliner (2016).

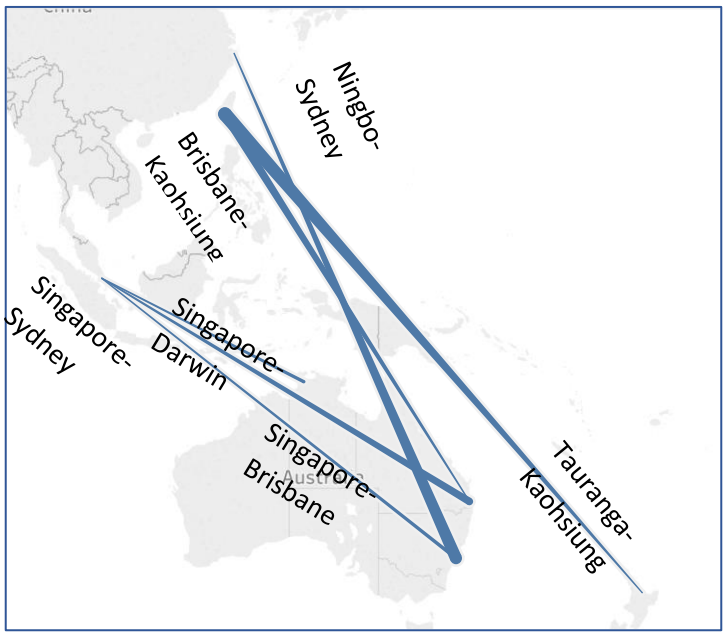
To identify the ports in eastern Indonesia that are most likely to receive shipping demand with adequate cargo, it is assumed that international ships can meet shipping demand if the total distance deviation from the initial route is no more than 10%. Based on this assumption, there are 27 potential routes that can provide shipping demand at ports in eastern Indonesia.

Figure 4.7. Six Main Routes with Highest Annual Frequency



Source: Analysed with data from Alphaliner (2016).

Figure 4.8. Six Main International Routes with the Highest Annual Volume



Source: Analysed with Alphaliner data (2016).

After identifying potential international routes that may be of interest for eastern Indonesia, the next step is to determine which ports have the highest potential for attracting international demand. Traffic and volume analysis is conducted for each Indonesian port, as shown in Figure 4.7 (traffic) and Figure 4.8 (volume). The analysis is conducted by calculating the value and frequency of international routes that might provide demand for eastern Indonesian ports with a total distance deviation of less than 10%.

The results of the analysis are: (i) the volume of international shipping passing through and/or in proximity to eastern Indonesia, and (ii) the frequency of services. Figures 4.9 and 4.10 show the volume for routes passing near ports in eastern Indonesia. The highest volumes pass close to the ports of Bitung (4.3 million TEU), Ambon (4.2 million TEU), Sorong (4.1 million TEU), Merauke (4.1 million TEU), and Kendari (4 million TEU).

Figure 4.9. Volume of International Routes Passing Close to Ports in Eastern Indonesia

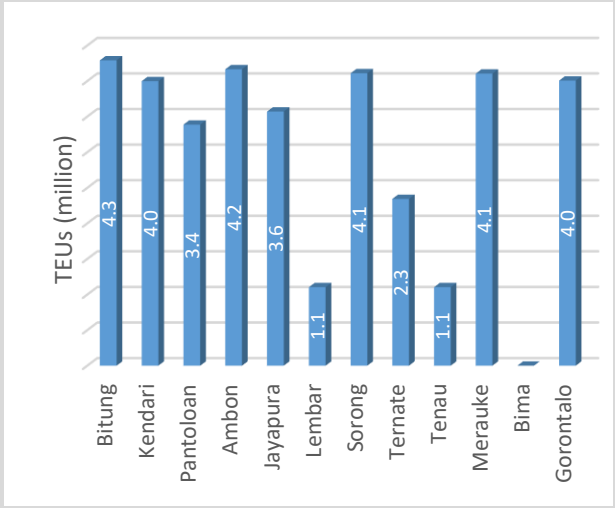
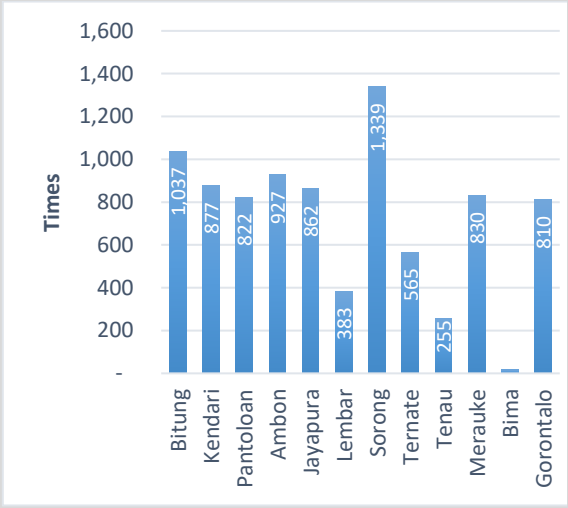


Figure 4.10. Frequency of International Routes Passing Close to Ports in Eastern Indonesia



TEU = twenty-foot equivalent unit.
Source: Analysed with Alphaliner data (2016).

The highest frequencies are from international routes in close proximity to Sorong (1,339), Bitung (1,037), Ambon (927), Kendari (877), and Merauke (830). In both analyses, the port of Bima is described as not being attractive to international shipping routes because the total distance deviation from the original route is greater than 10%.

The ports that appear in terms of both frequency and volume are Bitung, Ambon, Sorong, Kendari, and Merauke. These five ports are the best choice in terms of strategic location as trans-shipment hubs in eastern Indonesia. This may be a vital consideration for the government if it wants to capture the shipping potential of eastern Indonesia.

4.3 Prerequisites and Challenges

Efforts to accelerate development and make it equitable in eastern Indonesia face several issues and challenges, which are affected by both domestic factors and global dynamics. These issues and challenges include: (i) intra-regional, interregional, and regional, and global connectivity problems; (ii) human resource capacity; (iii) institutional and governance issues in local government; and (iv) globalisation and urbanisation.

One of the seven development agendas in the 2020–2024 National Mid-Term Development Plan (RPJMN) is to strengthen infrastructure to support economic development and basic services. The main objective of strengthening infrastructure is to support economic expansion and to encourage equitable national development. The infrastructure development being raised in the development agenda was triggered by the continuing limited availability of and the persistently low quality of infrastructure, which are amongst the main obstacles leading to the stagnation of Indonesia's economic growth. Therefore, the 2020–2024 RPJMN will continue infrastructure development, which

was intensively implemented through the previous RPJMN, particularly with infrastructure related to connectivity and energy to foster economic activity and inclusive growth. Roads, ports, and the availability of electricity may be categorised as primary infrastructure to bring Indonesia towards achieving such objectives.

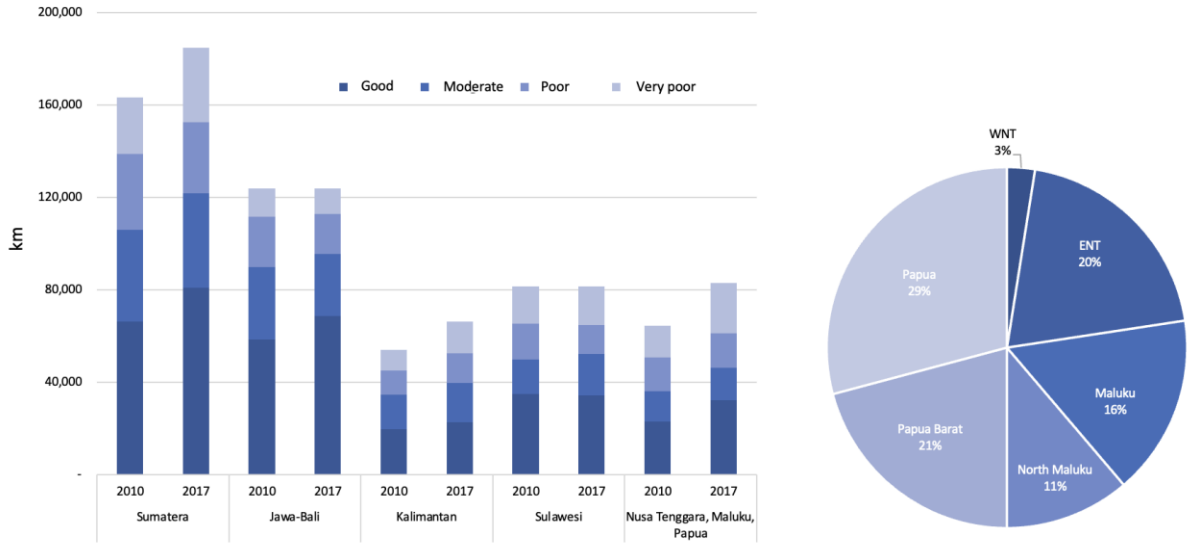
Infrastructure

Roads

Limited infrastructure, including road infrastructure, has been the primary obstacle to taking advantage of opportunities to increase investment and has been the cause of high logistics costs. Therefore, one of the missions of the Public Works and Housing Ministry in 2015–2019 has been to accelerate the development of road infrastructure to support connectivity to improve productivity, efficiency, and national logistics system services to strengthen national competitiveness on a global scale, which focuses on integrated land and maritime connectivity.

Based on data from the Ministry of Public Works, the total road length in 2017 was 539,400 kilometres, an increase of 10.7% compared to the road length in 2010. According to the administrative level authority, district and/or city roads remain the largest proportion at 437,700 kilometres or 81.8% of the total road length in Indonesia, while state roads and provincial roads stand at 47,000 kilometres (8.7%) and 54,600 kilometres (10.1%), respectively.

Figure 4.11. Total Road Length by Region and Condition (km) and Percentage of Road Length Increases in Nusa Tenggara, Maluku, and Papua, 2010 and 2017



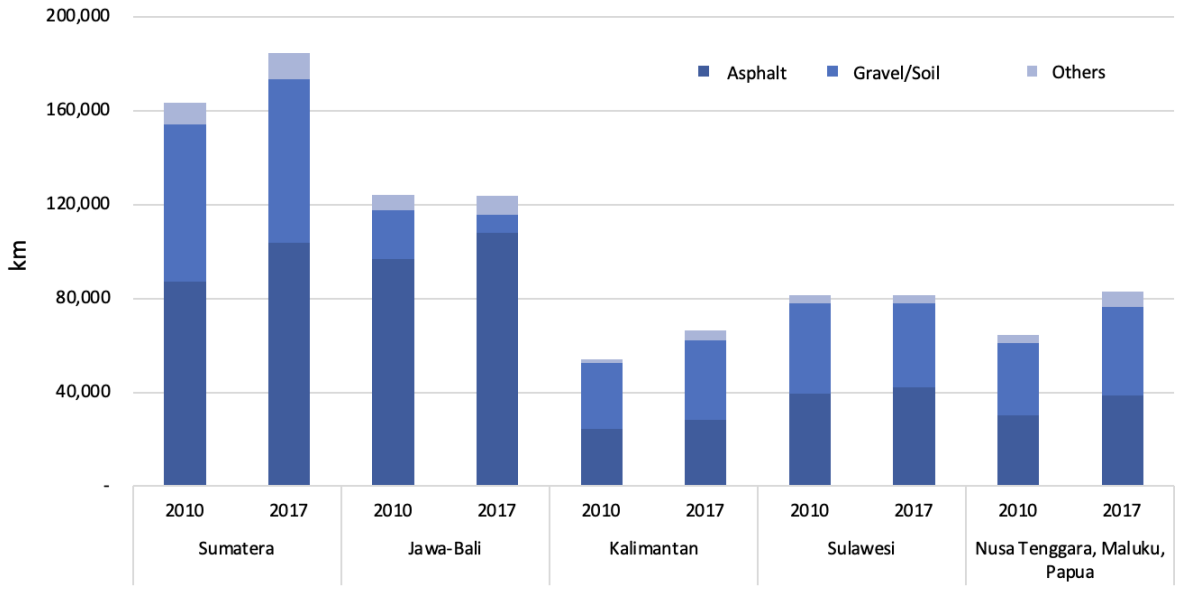
km = kilometre, WNT = West Nusa Tenggara, ENT = East Nusa Tenggara.
Source: BPS from the Ministry of Public Works (2010 and 2017, adapted).

When assessed by region, Nusa Tenggara, Maluku, and Papua experienced the most significant increase in road length during 2010–2017 with 28.8%. The length of roads in Papua and West Papua

has increased significantly with the construction of the Trans Papua Highway that stretches from the city Sorong in West Papua Province to Merauke in Papua Province. Meanwhile, the construction of the Red Belt Road (Jalan Sabuk Merah) near the border of East Nusa Tenggara Province with Timor–Leste significantly adds to road length in the region. The Sumatra region also experienced a substantial increase of 22.9% in road length with the construction of the Trans Sumatra Highway (Figure 4.11). Road infrastructure development is expected to increase accessibility to support regional development along with the better distribution of goods and services.

According to road condition, the Java–Bali region has the most roads that are in good condition with a percentage reaching 55.5% of the total road length in the region in 2017. The roads in other areas that are in good condition are in the range of 40% of the total length of existing roads. Only 22.7% of roads in the Java–Bali region are classified as damaged or heavily damaged roads. Meanwhile, the total number of damaged or heavily damaged roads reached more than 30%, and even 44% for the Nusa Tenggara, Maluku, and Papua regions.

Figure 4.12. Road Length by Region and Surface Type, 2010 and 2017



Source: BPS from the Ministry of Public Works (2010 and 2017, adapted).

According to surface type, more than 40% of the roads in each region are paved. As an economic and government hub, the Java–Bali region has asphalt roads, with the largest percentage reaching 87.2% of the total road length in the region. On the other hand, there remains a large percentage of roads with gravel and/or soil surfaces in other regions (Figure 5.12).

Ports

As an archipelagic country, ports are important infrastructure for fostering connectivity between the economic corridors of islands and between regions to encourage the creation of inclusive economic growth. This may occur as high inter-regional connectivity affects the increase in the value-added of natural resources and regional competitiveness. The importance of the role of sea transportation is reflected in the 2015–2019 and 2020–2024 RPJMN in which sea transportation is positioned as a special priority to further enhance its function and role in making Indonesia a global maritime axis.

Law No. 17/2008 on Shipping classifies seaports into three hierarchies: main ports, hub ports, and feeder ports. The difference in the three types lies in the sea transportation activities that are conducted, the volume of trans-shipment at sea, and the range of passenger and/or goods services (Table 4.4).

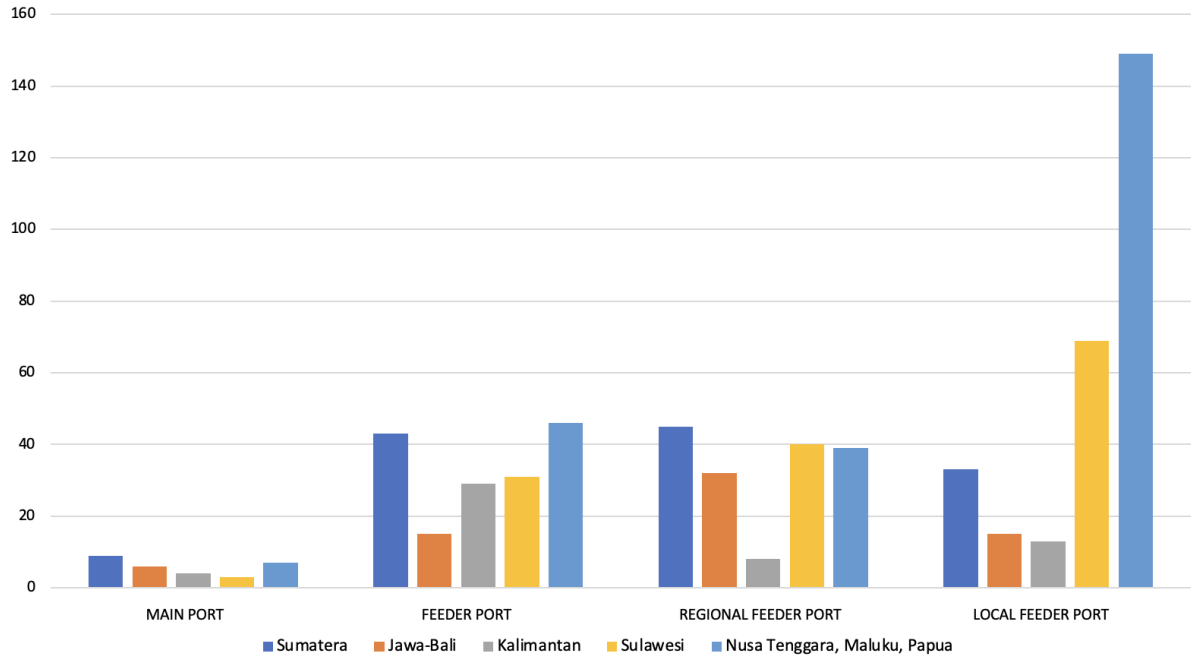
Table 4.4. Sea Port Hierarchy

Category	Sea Port Hierarchy		
	Main Port	Hub Port	Feeder Port
Shipping activities	Domestic and International	Domestic	Domestic
Volume of trans-shipment at sea	Large Volume	Medium Volume	Limited Volume
The range of passenger/goods and crossing services	Interprovincial	Interprovincial	Intra-provincial

Source: Law No. 17/2008 on Shipping.

According to the Transport Ministry's Port Information System (Simpel) data, the total number of ports in Indonesia in 2017 was recorded at 636. Of these, 29 are main ports that are spread throughout almost every province in Indonesia. While there are 164 operating feeder ports, the majority are in Sumatra and the regions of Nusa Tenggara, Maluku, and Papua. Feeder ports are categorised further as regional feeder ports (located around economic growth centres in the province and acting as feeders for hub ports and main ports) and local feeder ports (around the district and/or city economic growth centres and acting as passenger service points in remote, isolated, border, and restricted areas that are only supported by sea transport). Meanwhile, there were 279 hub ports recorded, of which 50% were in Nusa Tenggara, Maluku, and Papua (Figure 4.13). The large number of local feeder ports in eastern Indonesia shows how important the role and function of sea transport is in the region. However, the availability of port infrastructure becomes less meaningful without the availability of regular sea transport. As a consequence, the Indonesian government initiated the Maritime Highway programme to improve inter-island connectivity in Indonesia.

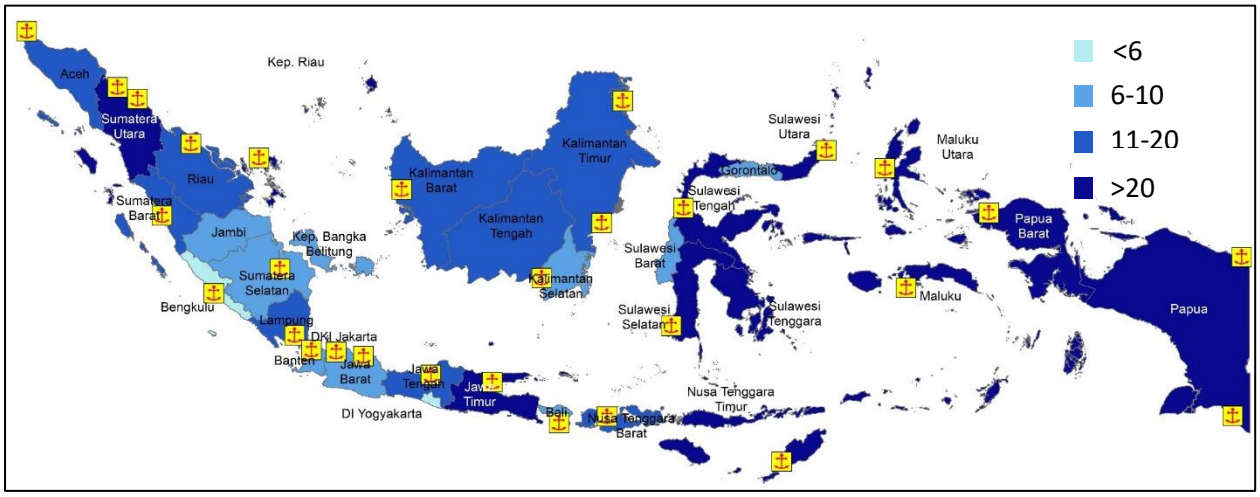
Figure 4.13. Total Seaports by Hierarchy and Region, 2017



Source: Adapted from the Port Information System, Indonesian Department of Transportation (2017).

The importance of maritime transport's main role in eastern Indonesia is clarified in Figure 4.14. Almost every province in eastern Indonesia has more than 20 ports, most of which are local feeder ports.

Figure 4.14 Map of the Number of Indonesian Ports and their Locations, 2017



Note: the legend shows the number of ports in each province.
Source: Adapted from the Port Information System, Indonesian Department of Transportation (2017).

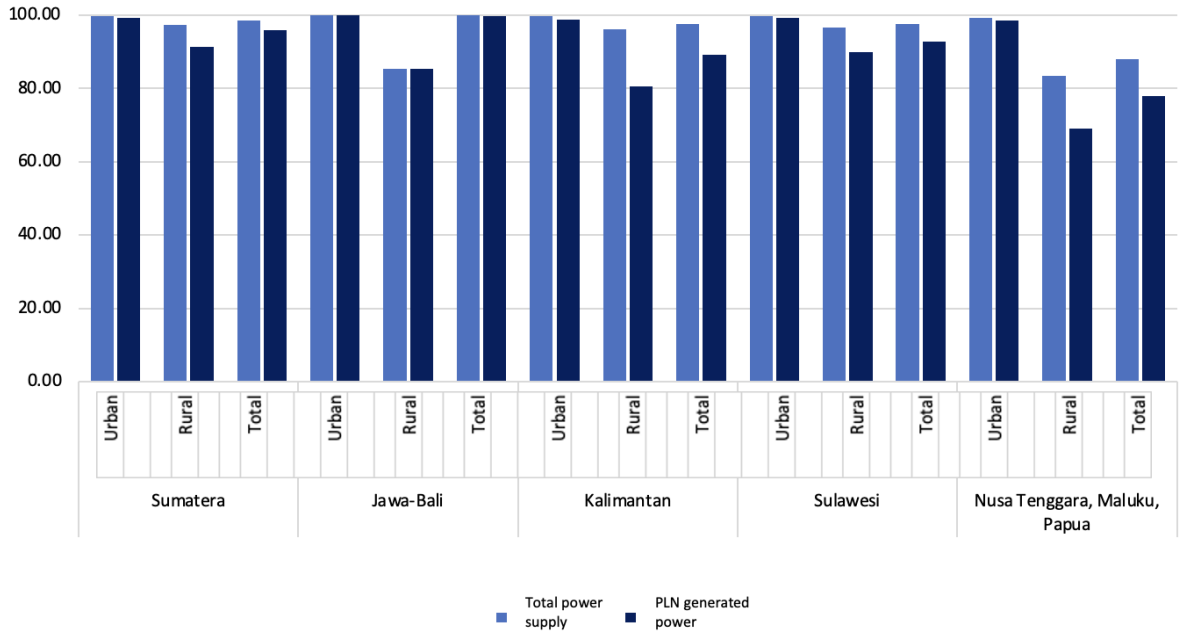
Availability of Electricity

It is undeniable that almost all human activities are currently supported by energy. Of the many types of energy, electrical energy is the most important in sustaining human needs. The inclusion of accelerating minimum service standards compliance for basic public services in disadvantaged areas, including the provision of electricity, shows the importance of the role of electricity in human life, not only in urban areas, but also in rural areas.

According to National Socio-Economic Survey (Susenas) data, the source of lighting for 98.5% of households in Indonesia in 2018 came from electricity. This figure is up from 94.2% in 2010. The state-owned power company, Perusahaan Listrik Negara (PLN), provides electricity to 96.5% of households. Therefore, only 2% of the electricity used by households comes from non-PLN sources, mainly from private generators.

Based on the type of region, the percentage of households in urban areas that had access to electricity in 2018 amounted to 99.8% or 3% higher than rural areas. Almost all electricity used by households in urban areas came from PLN. Meanwhile, 4% of households in rural areas still use non-PLN electricity as their main source of electricity. However, more households in rural areas have begun to enjoy electricity supplied by PLN.

Figure 4.15. Percentage of Households by Area, Type of Region, and Main Sources of Lighting, 2018



Source: Adpated from BPS National Socio-Economic Survey (2009–2018).

Figure 4.15 shows that electricity has become accessible by almost all households in urban areas and PLN supplies more than 98% of it. Rural areas in the regions of Nusa Tenggara, Maluku, and Papua were the areas with the lowest electrification ratio at only 83.3% and PLN only supplied electricity to 69.2% of households in the region. Accessibility difficulties are suspected to be the main cause of households in the region with electricity facilities not being covered. Therefore, one of the development goals in the 2020–2024 RPJMN is to continue infrastructure development, especially connectivity and energy, which aims to increase economic productivity and inclusive growth by prioritising the increase of new and renewable energy to meet those energy needs.

Connectivity

Connectivity remains a major problem in the government's efforts to accelerate the development of eastern Indonesia. Connectivity problems still arise in various contexts, such as inter-regional connectivity within eastern Indonesia, connectivity between areas in the Eastern Indonesia Region

and those in the Western Indonesia Region, and Eastern Indonesia Region connectivity in the Asia Pacific and global contexts.

Connectivity within the Eastern Indonesia Region

Connectivity for regions of eastern Indonesia in general remain behind that of inter-regional connectivity in western Indonesia, even though the proper flow of goods and services is one of the factors driving high economic growth. The Maritime Highway is also actually indirectly attempting to overcome the problem of intra-regional connectivity within the Eastern Indonesia Region. Of the 18 Maritime Highway routes that have been operating up until 2018, only 2 routes have not served ports in eastern Indonesia. The challenge over the next few years is how to optimise the existence of the Maritime Highway programme to accelerate development both in the areas it serves directly as well as the surrounding areas.

Furthermore, the development of eastern Indonesia also needs to consider the aspect of connectivity between coastal areas – especially those directly served by the Maritime Highway – and hinterland areas. Good connectivity between the two regions will ensure that development is equitably distributed.

Connectivity with Java–Sumatra

Indonesia's economic activity is currently concentrated in Java and Sumatra, which is a condition that is expected to persist in the long term. For this reason, the acceleration of development in eastern Indonesia must be directed to improve connectivity with the Java–Sumatra economy.

In relation to the Maritime Highway, connectivity between the Eastern Indonesia Region and the Western Indonesia Region currently relies on two main ports, Tanjung Perak Port (Western) and Makassar Port (Eastern). The challenge in the long term is to ensure that the facilities and infrastructure at the two ports are able to meet the needs of sea transport services for effective development acceleration of the Eastern Indonesia Region.

Connectivity with other regions in Indonesia

In addition to increasing the economic connectivity of the Eastern Indonesia Region with Java–Sumatra, the development of eastern Indonesia also needs to consider the level of connectivity with other Indonesian regions, particularly with Kalimantan. In relation to national development planning, the focus is on the island of Kalimantan as the national energy source capable of supporting industrial development. In addition, the development of eastern Indonesia must also anticipate the impact of the relocation of the new capital to the island of Kalimantan.

Connectivity with countries in the Asia Pacific region

In the long term, the strategy of developing eastern Indonesia needs to be directed towards optimising the existence of the global shipping lanes in the Eastern Indonesia Region that pass through two Indonesian archipelagic sea lanes (ALKI). ALKI II is a global shipping lane that passes through the Sulawesi Sea, Makassar Strait, Flores Sea, and Lombok Strait; ALKI III crosses the Pacific Ocean, Maluku Sea, Seram Sea, Banda Sea, Ombai Strait, Sawu Sea, and the Indian Ocean.

Human Resource Capacity

Efforts towards accelerating development and making it equitable in eastern Indonesia will be more effective if supported by the availability of quality human resources that are competitive. Human

resource capacity can be strengthened by expanding the scope of infrastructure services for education and health, especially in disadvantaged, remote, and outermost (3T) regions.

Local Government Institutions and Governance

Institutional capacity and governance for local governments needs to be strengthened given the important role of these institutions in developing and maintaining a stable industrial climate at the local level. Capacity building for local governments is useful in supporting regional independence and competitiveness in an effort to accelerate regional economic development. In addition, a region with a capable government will guarantee the availability of reliable, quality public services that support the strengthening of the region's human resources.

Urbanisation

Currently, 54% of Indonesia's population live in urban areas (World Bank, 2015). This figure is expected to continue to rise until it reaches approximately 67% in 2050. Urbanisation brings benefits such as the ease of obtaining input for industries and facilitating the faster exchange of information and knowledge. However, urbanisation must also be managed properly to minimise adverse effects such as traffic jams and pollution, along with the declining quality of life and the environment.

The development of eastern Indonesia must consider the management of urbanisation in the coming years, especially for regions with metropolitan areas as major growth centres such as Makassar and Manado. City governments must focus on providing basic infrastructure such as adequate housing, drinking water, sanitation and waste facilities, as well as mass transportation facilities and infrastructure. Infrastructure readiness in anticipating the pressure of urban populations may increase the chances of regions to benefit from agglomeration with minimal negative impacts.

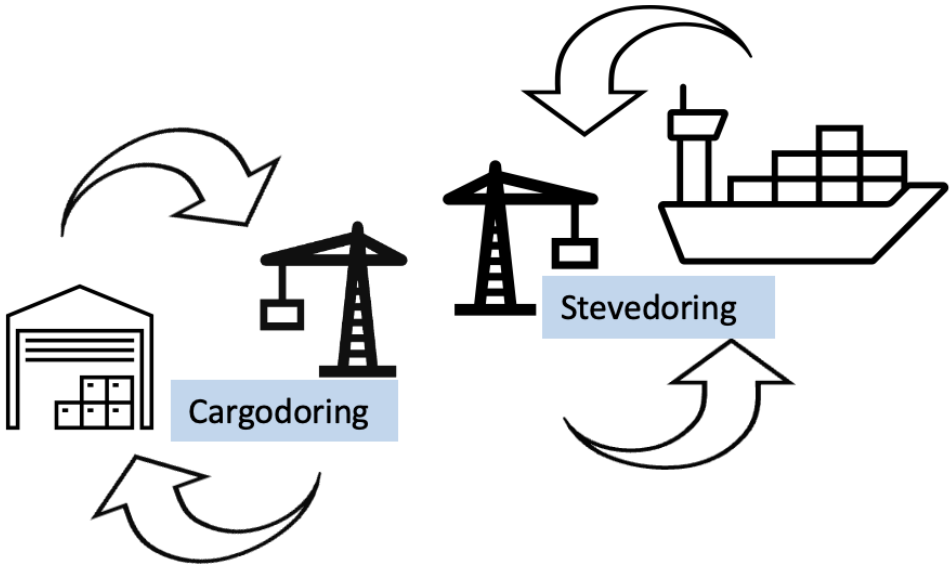
4.4 Future Steps

Port Operations Design

The previous section described the potential in eastern Indonesia from the parameters of dock infrastructure (related to shipping capacity) and strategic locations. However, in order to compete with other ports in the region, how port operators regulate operations at ports must be considered.

Port operations comprise stevedoring and cargodoring activities (Figure 4.16). Stevedoring is the process of loading and unloading cargo to and from terminals to vessels. Cargodoring is loading and unloading from terminals to secondary port areas (warehouses or stockpiles). It is necessary to consider the two activities to ensure efficient cargo flow at ports. Efficient cargo flow at the port depends on well-prepared infrastructure (dock length, dock capacity, adequate stockpile areas) and equipment operating systems (conventional, semi-automated, and fully automated).

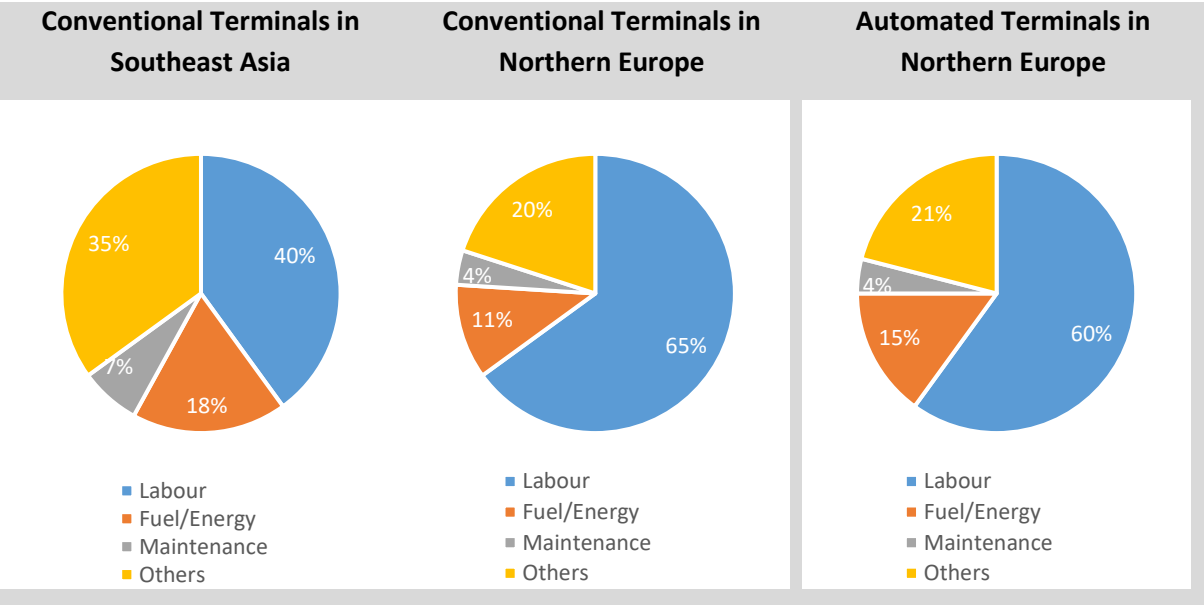
Figure 4.16. Main Activities in Port Operations



Source: Authors.

In the current port industry, operation port designs can be divided into three types: (i) conventional ports, (ii) semi-automated ports, and (iii) fully automated ports. The difference between these designs is the use of equipment and human resources, which leads to a decrease in the value of operational expenditure (OPEX) and capital expenditure (CAPEX).

Figure 4.17. Comparison of Actual OPEX Composition in Southeast Asia and Europe



OPEX = operational expenditure
Source: Royal HaskoningDHV (2018).

In Southeast Asian countries, the cost of labour is the dominant component (40%). The second largest is allocated to 'others,' which represents expenditure for depreciation as well as selling, general, and administration. Fuel/energy is at 18% of OPEX. The smallest proportion is for maintenance (Figure 4.17).

The main advantage of automation is usually a reduction in labour costs. Therefore, most of this type of development is carried out in Western Europe, the United States, and Australia, where labour prices are exceedingly high and even a slight reduction in the number of workers can contribute to investment payback. However, it is also important to mention that the actual OPEX difference shows that the reduction in labour costs is not as significant as originally envisioned at the start of the project because more competent staff usually demand higher wages, even when the number of workers is reduced.

In Southeast Asia, the labour cost at container terminals is smaller, thereby leading to relatively insignificant profits from automated terminals. For some countries where the level of education is not too high, automation will increase operational costs due to the need to bring in experienced expatriates to operate the terminal. In choosing the level of automation, a meticulous cost-benefit analysis needs to be conducted to ensure that a comprehensive decision is made. Table 5.5 shows the difference between operating designs at ports.

Table 4.5. Differences in Port Operation Designs

Category	Item	Fully Automated	Semi-Automated	Conventional
Design type	Gate operation	Automated	Automated	Manual or automated
	Container Stacking cranes	Automated Stacking cranes	Hybrid stacking Cranes	
	Transfer the stockpile to the vessel	Automatic guided vehicles	Not automated (trucks and trailers)	Not automated (trucks and trailers)
	STS operation	Semi-automated	Semi-automated	Manual
	Empty lot	-	Conventional	Conventional
Reduction of labour compared to conventional operations	Gate	~80%	~80%	-
	Stockpile area	~80%	~30%	-
	Dock	~20%	~20%	-
	Mechanic	~20% Increase	Similar to conventional	-
Productivity		30–35 gross moves per hour (GMPH)	30–35 GMPH	25–30 GMPH

STS = ship-to-shore.
Source: Adapted from Notteboom, Pallis, and Rodrigue (2022).

Application of Efficient Port Operations in Indonesia

In the case of eastern Indonesia, finding a semi-automated or fully automated container terminal is difficult. Even in the ports of western Indonesia, only the Teluk Lamong Terminal (Gresik, Pelindo III) has semi-automated equipment. Therefore, the most necessary step for the government to take is improving port operations with respect to the level of standards for container terminal services. The standards consist of infrastructure (dock draft, bearing capacity of the dock,[8] and dock length) and handling equipment (ship-to-shore cranes [STS]/mobile harbour cranes [MHC], Rubber Tyred Gantry Crane [RTG crane], forklifts, trucks, and trailers).

Regarding the draft dock and standards, referring to BAPPENAS, the minimum draft required for an effective trans-shipment hub is 13 metres (m). This draft can accommodate 3,000–4,000 TEU vessels suited to the main corridors of the Maritime Highway. On average, ports in eastern Indonesia have adequate drafts from 10 m to 12 m. However, handling equipment and the bearing capacity of docks must be improved.

Estimation of the total handling equipment based on the number of STS cranes for every 150 m of dock length (a benchmark in the port industry). The analysis of the handling equipment and draft required is shown in Table 4.6. The results of the analysis show that only Pantoloan has a non-standard dock draft. From the perspective of handling equipment, most of the ports in eastern Indonesia combine STS and MHC cranes for cost efficiency and flexibility for the size of ships that may dock. They are more flexible than STS cranes. Tenau, Bitung, Pantoloan, Makassar, and Jayapura have the ideal amount of handling equipment.

Table 4.6. Analysis of the Handling Equipment Required at Selected Eastern Indonesia Ports

Ports	Current maximum draft (m)	Draft required for main corridors of the Maritime Highway	Dock Length (m)	Current handling equipment	Handling equipment according to industry standards
Tenau	13	10–12 m	223	2 STS	2 STS
Bitung	14	10–12 m	830	3 STS, 2 MHC	5 STS
Pantoloan	9.5	10–12 m	250	1 STS, 1 MHC	2 STS
Makassar	12	10–12 m	1,461	9 STS, 2 MHC	10 STS
Ternate	10	10–12 m	413	1 STS, 1 MHC	3 STS
Ambon	10	10–12 m	576	2 STS	4 STS
Sorong	12	10–12 m	340	2 MHC	2 STS
Jayapura	12	10–12 m	310	2 STS	2 STS

m = metre, MHC = mobile harbour cranes, STS = ship-to-shore cranes.
Sources: Pelindo 3 (2019), Pelindo 4 (2019), Google Earth (2019).

[8] Dock strength to bear the load on it. Further analysis on bearing capacity will not be addressed in this study.

Chapter 5

The Grand Design for Future Maritime Highway Management

The eastern part of Indonesia is largely an archipelago separated by straits and seas; there are only two large islands, Sulawesi, and Papua. With these geographical conditions, the movement pattern of goods and people will always rely on sea-based transportation. For this reason, an efficient maritime transportation system is one of the key prerequisites for the economic development of provinces in eastern Indonesia.

The Maritime Highway programme is one of the government's efforts to accelerate economic development in eastern Indonesia by increasing the effectiveness of the maritime transportation system in eastern Indonesia with the provision of regular and affordable shipping services to key ports in various regions of eastern Indonesia. With the existence of this programme, connectivity between western and eastern Indonesia as well as between regions within eastern Indonesia itself will increase. This will ultimately boost the welfare of the people in eastern Indonesia through economic development and will act as one of the triggers for the growth of new industries in eastern Indonesia.

During the 5 years that the Maritime Highway programme has been operating, its impact on improving the welfare and economic activities of the people in the Eastern Indonesia Region remains limited. However, the role of sea-based transportation is undeniable given the geographical condition of the Eastern Indonesia Region, which comprises mostly sea waters. The government must continue to pay attention to the optimisation of the sea-based transportation system, including increasing the effectiveness of the Maritime Highway programme as the backbone of connectivity in eastern Indonesia.

In addition to increasing the effectiveness of the Maritime Highway, efforts to improve sea-based transportation also need to be directed towards the creation of a more integrated logistics system. In other words, all programmes and policies in the maritime transport sector – including the Maritime Highway – need to have an integrated design with an integrated logistics system in the long run. To create a more integrated logistics system, a logistics system grand design is required.

5.1 Grand Design for an Integrated Logistics System

A policy grand design needs to establish clear and measurable objectives to be achieved. The main objective of an integrated logistics system is creating ease in the transportation of goods and people between regions. In order to achieve the main objective, several intermediate objectives can be established according to timeframes for their achievement. The grand design document will later act as a reference in developing short- and medium-term policies.

Short Term (until 2021)

In the next year or two, the development of an integrated logistics system is directed at efforts to increase the effectiveness of the Maritime Highway programme that is in operation and to overcome

unresolved obstacles such as low connectivity between coastal areas and hinterland areas, low productivity of loading and unloading at ports, limited port facilities and infrastructure, as well as the low quality of roads and bridges.

In terms of connectivity, the priority for improvement is directed at increasing connectivity between coastal areas and the hinterland areas on each island. In addition, connectivity between regions in eastern Indonesia also needs to be a priority. Therefore, the existing centres of economic activity in the Eastern Indonesia Region can be better connected to each other.

Good connectivity within the Eastern Indonesia Region will be the starting point for the development of new industries that are the main motors for accelerating economic development in the region. For this reason, there needs to be an effort in the short term to identify leading commodities to be the basis of new industrial development in the Eastern Indonesia Region.

Medium Term (2021 to 2024)

In the next 5 years, policies in maritime transport will be directed towards efforts to create new regional-based industrial centres. Current regional-based industrial policies are encouraged by the central government through the development of special economic zones and industrial estates. In eastern Indonesia itself, several regions have been designated as special economic zones or industrial estates to support the acceleration of regional economic development in accordance with the leading resources possessed by each region.

In terms of connectivity, the priority for improvement is directed at increasing connectivity between the regions in eastern Indonesia and those in western Indonesia. Economic integration between provinces in eastern and western Indonesia needs to be a priority in the medium term.

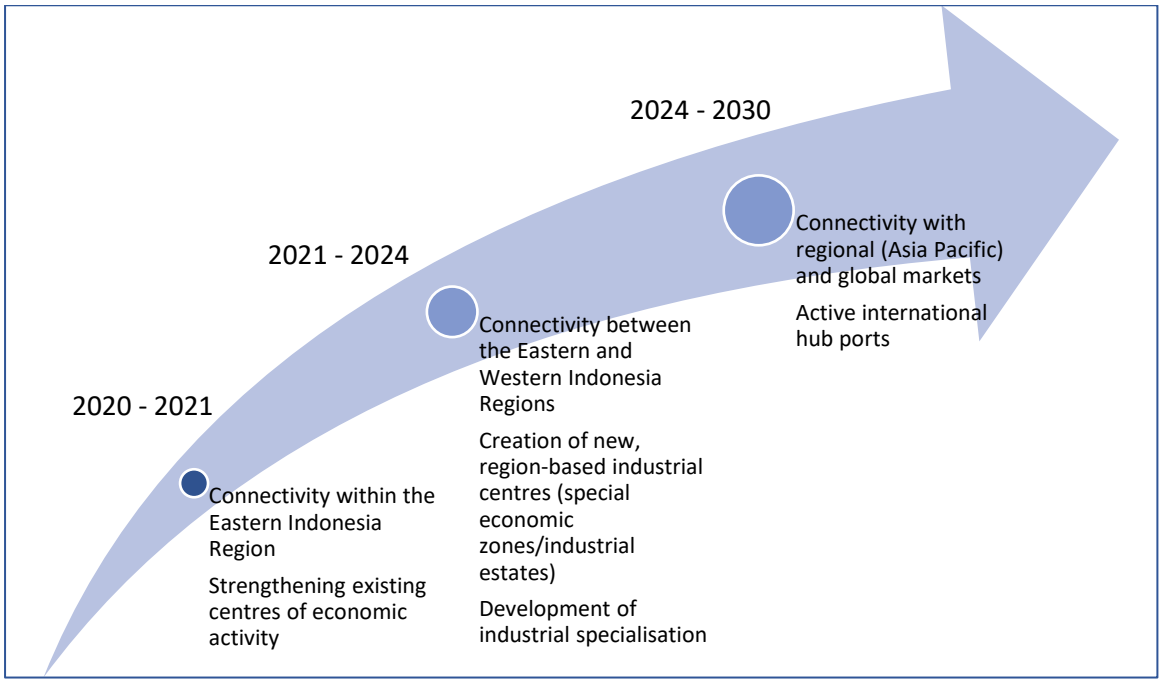
Connectivity between the Eastern Indonesia Region and the Western Indonesia Region will later be a catalyst for the development of new industries in eastern Indonesia that is able to encourage regional economic development and play a role in improving public welfare in the Eastern Indonesia Region.

Long Term (2024 to 2030)

The long-term goal is directed at the integration of the eastern Indonesia economy with the regional economy of the Asia Pacific region. In this case, new industrial centres have been established in the Eastern Indonesia Region that are specialised and capable of being part of international trade. To this end, improvements in the long term need to be directed at efforts to increase international connectivity by improving the quality of key ports in the Eastern Indonesia Region.

In the long run, the provinces in eastern Indonesia are expected to have sufficient capacity to play an active role in the national, regional, and global economy. To support this, in the long run an international hub port will be developed that actively serves shipping to global destinations.

Figure 5.1. Development Milestones for an Integrated Logistics System



Source: Authors.

References

Bank Mandiri (2018), *Tol Laut untuk Pemerataan Pertumbuhan Ekonomi Indonesia Timur* [Maritime Highway for Equitable Economic Growth in Eastern Indonesia]. Daily Economic and Market Review.

Elvidge, C.D., K.E. Baugh, S. J. Anderson, P.C. Sutton, and T. Ghosh (2012), 'The Night Light Development Index (NLDI): A Spatially Explicit Measure of Human Development from Satellite Data'. *Social Geography,* 7(1), pp.23–35.

Hakim, L. (2016), '*Penentuan Rute Pelayaran Terbaik untuk Mendukung Program Tol Laut NKRI*' [Determination of the Best Shipping Routes to Support the Maritime Highway Program of the Unitary State of the Republic of Indonesia]. *Jurnal Pendidikan Geografi*, 16(2).

Henderson, J.V., A. Storeygard, and D.N. Weil (2012), 'Measuring Economic Growth from Outer Space'. *American Economic Review*, 102(2), pp.994–1028.

Pelindo III (2019), 'Pelabuhan Di Bawah Pelindo III'. Unpublished.

Pelindo IV (2019), 'Pelabuhan Di Bawah Pelindo IV'. Unpublished.

Roberts, M. (2018), 'Urban Growth in South Asia: A View from Outer Space', in *Alternative Approaches in Macroeconomics.* Palgrave Macmillan, Cham, pp.269–302.

Stathakis, D., V. Tselios, and I. Faraslis (2015), 'Urbanization in European Regions Based on Night Lights'. *Remote Sensing Applications: Society and Environment*, 2, pp.26–34.

Zhou, N., K. Hubacek, and M. Roberts (2015), 'Analysis of Spatial Patterns of Urban Growth Across South Asia using DMSP-OLS Nighttime Lights Data'. *Applied Geography*, 63, pp.292–303.

Department Perhubungan [Ministry of Transportaion Indonesia], 2018. *Kemenhub Tetapkan 15 Trayek Tol Laut untuk Tahun 2018.* http://hubla.dephub.go.id/berita/Pages/KEMENHUB-RESMI-TETAPKAN-15-TRAYEK-TOL-LAUT-UNTUK-TAHUN-2018.aspx (accessed 10 August 2019).

http://hubla.dephub.go.id/berita/Pages/KEMENHUB-TARGETKAN-15-TRAYEK--TOL-LAUT-BEROPERASI-PENUH-APRIL-2018.aspx (accessed 10 August 2019).

Appendix 1

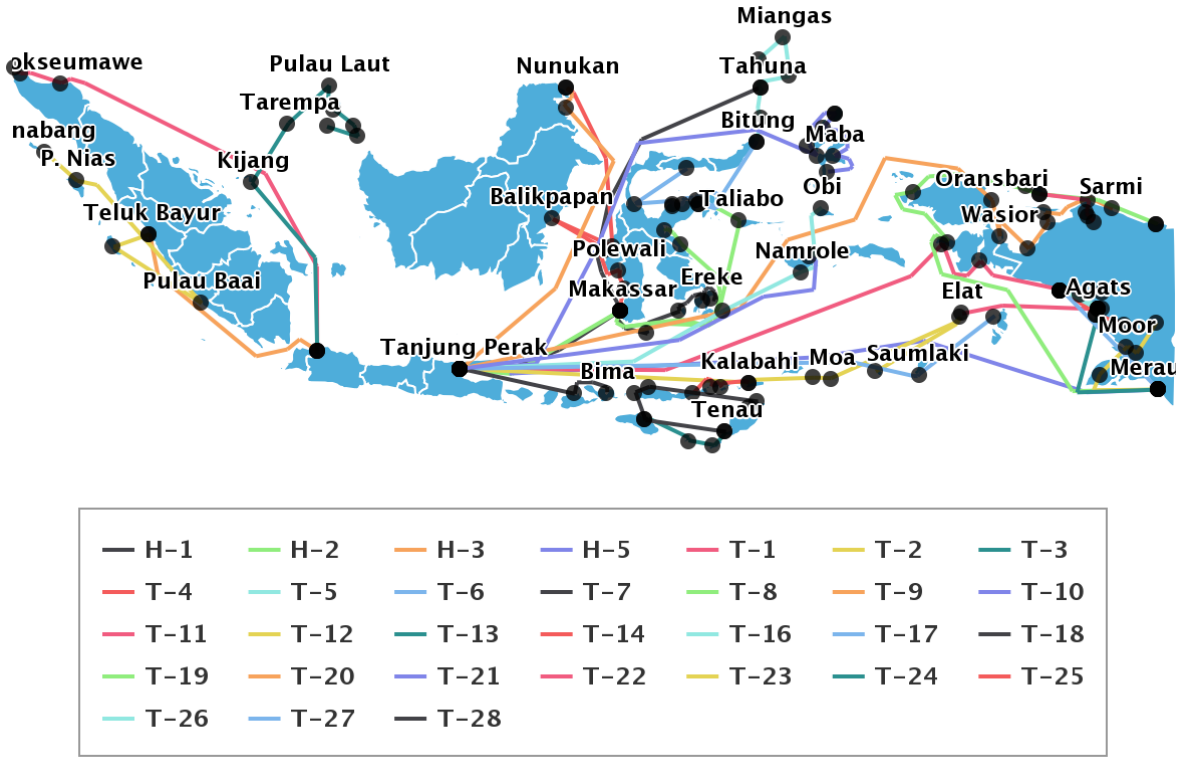
The Designated Lanes of the Maritime Highway in Operation (2022)

Route	Network	Operator	Distance (km)
H-1	Tg Perak - Makassar - Tahuna - Tg Perak	PT PELNI (PERSERO)	2,275
H-2	Tanjung Perak- Makassar (Soekarno Hatta) - Bobong (Taliabu) - Luwuk - Tanjung Perak	PT DJAKARTA LLOYD	2,149
H-3	Tanjung Priok - Teluk Bayur - Tanjung Priok	PT MERATUS LINE	1,124
H-5	Tanjung Perak - Merauke - Agats - Timika (Pomako) - Tanjung Perak	PT TEMPURAN MAS LINE	3,784
T-1	Tanjung Priok - Lhokseumawe - Malahayati - Sabang - Tanjung Priok	PI TEMPURAN MAS LINE	2,242
T-2	Teluk Bayur - Mentawai (Sikakap) - Pulau Baai - Gn. Sitoli - Sinabang- Teluk bayur - Sinabang - Gn. Sitoli - Pulau Baai - Mentawai (Sikakap) - Teluk Bayur	PT ASDP	2,456
T-3	Tg.Priok - Patimban - Kijang - Tarempa - Pulau Laut - Selat Lampa - Subi - Serasan - Midai - Tg.Priok	PT PELNI (PERSERO)	1,766
T-4	Makassar (Soekarno Hatta) - Barru (Garongkong)- Polewali (Tanjung Silopo) - Mamuju - Balikpapan - Belang-Belang - Nunukan/Sebatik- Makassar (Soekarno Hatta)	PT ASDP	1,783
T-5	Bitung - Ulu Siau/Tagulandang - Tahuna - Lirung/Melangoane - Miangas - Marore - Tahuna - Ulu Siau/Tagulandang - Bitung	PT PELNI (PERSERO)	670
T-6	Bitung - Luwuk - Pagimana - Bunta - Mantangisi- Ampana - Parigi/Tinombo - Tilamuta - Bitung	PT DJAKARTA LLOYD	889
T-7	Makassar (Soekarno Hatta) - Ereke - Raha - Sikeli- Selayar - Makassar (Soekarno Hatta)	PT DJAKARTA LLOYD	780
TÆ	Makassar (Soekarnc Hatta) - Bungku - Kolonodale- Makassar (Soekarno Hatta)	PT PELNI (PERSERO)	1,125

T-9	Tanjung Perak - Oransbari - Wasior - Nabire-Serui - Waren - Sarmi - Tanjung Perak	PT LUAS LINE	4,072
T-10	Tanjung Perak - Tidore (Soasio) - Morotai - Galela - Maba/Buli- Weda - Tanjung Perak	PT PELNI (PERSERO)	2,940
T-11	Tanjung Perak - Fak Fak - Kaimana- Elat - Tanjung Perak	PT TEMPURAN MAS LINE	2,954
T-12	Tanjung Perak - Kalabahi - Kisar - Moa - Larat - Tepa - Tanjung Perak	PT PELAYARAN PELANITI	2,452
T-13	Tanjung Perak - Rote (Ndao) - Sabu (Biu) - Tanjung Perak	PT PELNI (PERSERO)	2,452
T-14	Tanjung Perak - Lembata (Lewoleba) - Tabilota/ Larantuka - Tanjung Perak	PT PELNI (PERSERO)	1,332
T-15	Tanjung Perak - Makassar (Soekarno Hatta) - Jailolo- Morotai (Daruba) - Tanjung Perak	PT PELNI (PERSERO)	2,507
T-16	Tanjung Perak - Wanci - Namrole (Leksula) - P. Obi - Tanjung Perak	PT DJAKARTA LLOYD	2,152
T-17	Tanjung Perak - Saumlaki - Dobo - Tanjung Perak	PT TEMPURAN MAS LINE	
T-18	Tanjung Perak - Badas - Bima - Tanjung Perak	PT PELNI (PERSERO)	867
T-19	Merauke - Kokas - Sorong - Biak/Korido - Depapre/Jayapura - Sorong - Merauke	PT PELNI (PERSERO)	3,047
T-20	Tanjung Perak- Tarakan - Nunukan - Tanjung Perak	-	1,840
T-21	Tanjung Perak - Namiea - Tanjung Perak	PT TEMPURAN MAS LINE	2,076
T-22	Biak - Teba - Bagusa - Trimuris - Kasonaweja - Teba - Biak - Brumsi - Biak	PT ASDP	524
T-23	Merauke (Kelapa Lima) - Kimnam - Moor - Bade (Mapi) - Gatentiri (bovendigoel) - Merauke (Kelapa Lima)	PT ASDP	714
T-24	Merauke (Kelapa Lima) - Atsy - Agats - Atsy - Senggo - Atsy - Merauke (Kelapa Lima)	PT ASDP	1,084
T-25	Timika (Pomako) - Atsy - Eci - Atsy - Pomako	PT ASDP	644
T-26	Timika (Pomako) - Agats - Sawaerma - Mamugu - Agats - Timika (Pomako)	PT ASDP	1,252

T-27	Merauke - Timika (Pomako)	-	394
T-28	Kupang - Waingapu - Labuan Bajo - Reo - Merauke - Atapupu/Wini - Kupang	PT PELNI (PERSERO)	2,725

The Maritime Highway Routes: 2022



Source: Ministry of Trade website: http://geraimaritim.kemendag.go.id/trayek (accessed 2 January 2022).

Appendix 2

Dependent Variables: Consumer Price Index (CPI)	Eastern Indonesia Region				Sulawesi				Papua				Maluku and Nusa Tenggara			
	General CPI	Ingredients CPI	Food CPI	Materials CPI	General CPI	Ingredients CPI	Food CPI	Materials CPI	General CPI	Ingredients CPI	Food CPI	Materials CPI	General CPI	Ingredients CPI	Food CPI	Materials CPI
		Processed	Food	Construction		Processed	Food	Construction		Processed	Food	Construction		Processed	Food	Construction
3 months	0.290	–0.032	–0.682	–0.676	0.865	3.328	–0.880	–0.667	0.525	–7.226***	0.388	6.810***	0.510	–4.270***	–0.583	8.297***
	(0.712)	(3.601)	(1.137)	(3.382)	(0.947)	(2.302)	(1.205)	(3.886)	(0.426)	(1.668)	(0.552)	(1.988)	(0.450)	(1.223)	(1.222)	(1.389)
6 months	0.927***	3.596***	0.031	1.823	1.125***	3.440***	–0.481	–0.479	0.710***	2.933*	1.430**		0.806***	3.090***	1.256***	
	(0.161)	(0.323)	(0.616)	(2.998)	(0.263)	(0.547)	(0.477)	(1.789)	(0.163)	(1.060)	(0.308)		(0.115)	(0.856)	(0.231)	
9 months	0.118	0.068	–1.179***	5.333*	–0.003	0.185	–1.409*	–1.742	2.172**	2.455	–0.077	–1.047	1.080	–0.280	–0.445	–2.817
	(0.465)	(1.313)	(0.490)	(2.641)	(0.525)	(2.044)	(0.669)	(1.781)	(0.529)	(1.731)	(1.864)	(1.643)	(0.641)	(1.134)	(0.449)	(1.840)

12 months	–0.086	–0.977	0.302	–0.107	–0.150	–1.578	0.420		0.004	–1.603*	0.361	–0.287	0.070	–1.127**	0.271	0.016
	(0.249)	(0.715)	(0.342)	(0.323)	(0.360)	(1.053)	(0.529)		(0.129)	(0.668)	(0.191)	(0.509)	(0.091)	(0.475)	(0.174)	(0.518)
15 months	–1.692*	–3.536	0.400	–8.555**	–0.685**	–1.580	0.880		–3.747***	–8.154***	–0.284	–11.462***	–3.671***	–7.743***	–0.392*	–12.390***
	(0.839)	(2.214)	(0.576)	(3.543)	(0.249)	(2.099)	(0.763)		(0.133)	(0.743)	(0.206)	(0.456)	(0.097)	(0.543)	(0.183)	(0.717)
18 months	0.080	0.958	0.011	0.414	0.278*	1.688***	0.233	3.457*	–0.514**	–1.142	–0.464*		–0.437***	–0.627	–0.544***	
	(0.227)	(0.744)	(0.506)	(2.188)	(0.142)	(0.280)	(0.836)	(1.714)	(0.134)	(0.625)	(0.186)		(0.098)	(0.438)	(0.169)	
21 months	0.906***	2.096	–0.054	2.886	0.626**	0.656	0.014	3.032	0.609	3.601	–0.549	8.462**	1.464**	5.259***	–0.477	7.370***
	(0.221)	(1.438)	(0.495)	(4.484)	(0.236)	(0.703)	(0.761)	(3.877)	(0.954)	(2.698)	(1.612)	(2.103)	(0.469)	(1.411)	(0.605)	(1.543)
24 months	0.759	0.451	0.265	–3.685	–0.136	–1.826***	–0.366		2.502***	3.743***	1.724***	–9.005***	2.584***	4.494***	1.706***	–8.467***
	(0.780)	(1.577)	(0.710)	(3.446)	(0.076)	(0.542)	(0.357)		(0.139)	(0.428)	(0.215)	(0.574)	(0.101)	(0.343)	(0.155)	(0.453)
27 months	–0.183	–0.737	–0.138	0.641	0.402***	2.059***	-0.015	–2.813	–1.424***	–5.981***	–0.210	2.060***	–1.346***	–5.336***	–0.256	2.175***

	(0.476)	(2.067)	(0.153)	(1.797)	(0.080)	(0.526)	(0.239)	(4.081)	(0.136)	(0.499)	(0.189)	(0.232)	(0.099)	(0.351)	(0.158)	(0.252)
30 months	–0.294*	–0.036	–0.690**	7.655**	–0.378	–0.788**	–0.785***	4.889	–0.405*	–0.206	–0.196		–0.343***	0.354	–0.265	
	(0.142)	(0.254)	(0.272)	(2.794)	(0.226)	(0.344)	(0.193)	(3.210)	(0.129)	(0.579)	(0.183)		(0.088)	(0.401)	(0.164)	
33 months	–0.065	4.241	–1.605	1.356**	–0.389	0.739	–0.119	1.737								
	(0.461)	(3.303)	(1.106)	(0.609)	(0.384)	(1.681)	(0.344)	(1.008)								
36 months	0.622***	1.097	–0.574	–6.466*	0.641**	0.521	–0.418	–6.706*								
	(0.204)	(0.837)	(0.414)	(3.410)	(0.220)	(0.869)	(0.452)	(3.289)								
39 months	–0.585***	–2.059***	–0.505	–3.342	–0.567***	–2.131***	–0.367	–3.434								
	(0.063)	(0.310)	(0.341)	(2.765)	(0.057)	(0.213)	(0.374)	(2.896)								
42 months	–0.418	-2.147***	–1.239***		-0.398	–2.639***	–1.109***									
	(0.325)	(0.207)	(0.106)		(0.343)	(0.154)	(0.156)									
Total Observations	2022	1281	1281	638	928	610	610	312	385	244	244	116	1094	671	671	326
r2_o	0.891	0.077	0.320	0.008	0.898	0.116	0.003	0.000	0.697	0.479	0.195	0.090	0.868	0.176	0.420	0.096

r2_w	0.976	0.776	0.894	0.037	0.986	0.884	0.904	0.050	0.985	0.856	0.967	0.277	0.971	0.690	0.905	0.066

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.
Source: Calculation by authors.

Appendix 3

Dependent Variables: Household Per Capita Expenditure	Regional Category				
	Eastern Indonesia Region	Nusa Tenggara	Sulawesi	Maluku	Papua
Maritime Highway Programme	–0.114*	–0.0188	0.675***	–0.0755	0.00201
	(0.0680)	(0.146)	(0.248)	(0.0997)	(0.227)
Ln (Total ART)	0.580***	0.618***	0.606***	0.610***	0.470***
	(0.00370)	(0.00774)	(0.00615)	(0.00720)	(0.00807)
Ln (Age)	2.039***	2.562***	2.373***	1.705***	0.986***
	(0.127)	(0.277)	(0.200)	(0.259)	(0.296)
Ln (Age^2)	–0.265***	–0.338***	–0.308***	–0.218***	–0.122***
	(0.0169)	(0.0366)	(0.0266)	(0.0344)	(0.0400)
Sex	0.0973***	0.0836***	0.105***	0.0687***	0.0997***
	(0.00542)	(0.0108)	(0.00853)	(0.0113)	(0.0129)
Work Status	0.00872	–0.0116	0.0174*	0.00705	0.00649
	(0.00602)	(0.0131)	(0.00910)	(0.0124)	(0.0148)
Total Children	0.0137***	0.0214**	0.00178	0.0235***	0.0110
	(0.00380)	(0.00880)	(0.00609)	(0.00704)	(0.00869)
2014 Dummy	0.0920***	0.108***	0.0758***	0.114***	0.0722***
	(0.0100)	(0.0213)	(0.0156)	(0.0207)	(0.0232)

2016 Dummy	0.256***	0.237***	0.244***	0.284***	0.173***
	(0.00960)	(0.0191)	(0.0149)	(0.0193)	(0.0258)
2017 Dummy	–0.511***	–0.0693***	–0.610***	–0.306***	–0.919***
	(0.00956)	(0.0191)	(0.0148)	(0.0192)	(0.0257)
2018 Dummy	0.401***	0.367***	0.380***	0.443***	0.326***
	(0.00959)	(0.0189)	(0.0150)	(0.0191)	(0.0257)
Constants	9.701***	8.547***	9.032***	10.31***	11.95***
	(0.234)	(0.516)	(0.370)	(0.482)	(0.541)
Total Observations	114,531	16,611	50,025	25,097	22,798
Coefficient of Determination	0.539	0.555	0.522	0.507	0.603

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.
Source*:* Calculation by authors.

Appendix 4

Dependent Variables: Quantity of Commodities (in kilogrammes)	Eastern Indonesia Region				Nusa Tenggara			
	Rice	Fresh Fish	Chicken Meat	Beef	Rice	Fresh Fish	Chicken Meat	Beef
Ln (Total ART)	5.035***	0.182***	0.0224***	0.0167***	5.694***	0.0739***	0.0127***	0.00692***
	(0.0210)	(0.00533)	(0.00148)	(0.00134)	(0.0669)	(0.00735)	(0.00253)	(0.00233)
Ln (Age)	3.583***	0.593***	0.132***	0.0947**	9.651***	0.720***	–0.00672	0.185**
	(0.721)	(0.183)	(0.0507)	(0.0460)	(2.393)	(0.263)	(0.0903)	(0.0833)
Sex	–0.131***	–0.00251	–0.000621	0.00122	–0.322***	0.0135	0.000305	0.00104
	(0.0308)	(0.00781)	(0.00217)	(0.00197)	(0.0937)	(0.0103)	(0.00354)	(0.00326)
Work Status	0.119***	0.0159*	0.00537**	0.00567***	0.326***	–0.00462	0.0123***	0.00271
	(0.0342)	(0.00867)	(0.00241)	(0.00218)	(0.113)	(0.0125)	(0.00428)	(0.00395)
Total Children	–0.319***	–0.00852	–0.000964	0.000482	–0.483***	0.00987	–0.00375	0.00112
	(0.0216)	(0.00547)	(0.00152)	(0.00138)	(0.0760)	(0.00835)	(0.00287)	(0.00265)
Maritime Highway Programme	–0.359	0.234**	0.00635	–0.00575	1.974	–0.0175	0.0739	0.0535
	(0.387)	(0.0980)	(0.0272)	(0.0247)	(1.258)	(0.138)	(0.0475)	(0.0438)
2014 Dummy	0.0242	-0.00155	–0.000236	–0.0391***	–0.581***	0.0207	–0.000681	–0.0231***
	(0.0570)	(0.0144)	(0.00401)	(0.00364)	(0.184)	(0.0203)	(0.00696)	(0.00642)
2016 Dummy	0.832***	–0.00964	0.0258***	–0.0300***	1.621***	0.0574***	0.0214***	0.0244***
	(0.0546)	(0.0138)	(0.00384)	(0.00349)	(0.165)	(0.0181)	(0.00622)	(0.00573)
2017 Dummy	-0.0367	–0.0391***	–0.0118***	-0.0658***	–0.0643	0.0133	–0.00701	–0.0287***
	(0.0544)	(0.0138)	(0.00383)	(0.00347)	(0.165)	(0.0181)	(0.00623)	(0.00575)
2018 Dummy	–0.136**	0.725***	0.128***	–0.0543***	-0.0415	0.234***	0.0512***	–0.0224***

	(0.0546)	(0.0138)	(0.00384)	(0.00348)	(0.163)	(0.0179)	(0.00616)	(0.00568)
Constants	–8.381***	–1.336***	–0.305***	–0.164*	–19.88***	–1.411***	–0.0174	–0.337**
	(1.332)	(0.337)	(0.0937)	(0.0850)	(4.458)	(0.490)	(0.168)	(0.155)
Total Observations	114.531	114.531	114.531	114.531	16.611	16.611	16.611	16.611
Coefficient of Determination	0.551	0.296	0.162	0.257	0.535	0.191	0.115	0.256

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Appendix 4 — Continued

Dependent Variables: Quantity of Commodities (in kilogrammes)	Sulawesi				Maluku			
	Rice	Fresh Fish	Chicken Meat	Beef	Rice	Fresh Fish	Chicken Meat	Beef
Ln (Total ART)	5.255***	0.178***	0.0239***	0.0158***	4.658***	0.227***	0.0111***	0.00792***
	(0.0323)	(0.00758)	(0.00236)	(0.00188)	(0.0404)	(0.0142)	(0.00243)	(0.00212)
Ln (Age)	4.500***	0.730***	0.191**	0.135**	1.932	0.189	0.0790	0.0367
	(1.051)	(0.247)	(0.0767)	(0.0610)	(1.458)	(0.512)	(0.0876)	(0.0766)
Sex	–0.0885**	0.00401	–0.00362	0.000695	–0.153**	–0.000611	0.000567	0.00164
	(0.0448)	(0.0105)	(0.00327)	(0.00260)	(0.0633)	(0.0222)	(0.00380)	(0.00333)
Work Status	0.108**	0.0153	0.00463	0.00740***	0.138**	0.0510**	0.0107**	0.00318
	(0.0478)	(0.0112)	(0.00349)	(0.00278)	(0.0700)	(0.0246)	(0.00420)	(0.00368)
Total Children	–0.310***	–0.00778	–0.00223	–0.000136	–0.291***	–0.0325**	–0.00181	–0.000337
	(0.0320)	(0.00751)	(0.00234)	(0.00186)	(0.0396)	(0.0139)	(0.00238)	(0.00208)
Maritime Highway Programme	–1.665	–0.110	0.0334	–0.0480	–0.0318	0.187	–0.00736	–0.0320
	(1.301)	(0.306)	(0.0950)	(0.0755)	(0.560)	(0.197)	(0.0336)	(0.0294)
2014 Dummy	0.0567	–0.0160	0.00290	–0.0366***	–0.00494	0.0190	0.00171	–0.0179***
	(0.0819)	(0.0193)	(0.00598)	(0.00476)	(0.116)	(0.0408)	(0.00698)	(0.00610)
2016 Dummy	0.752***	0.0498***	0.0461***	–0.0259***	0.578***	–0.234***	0.0191***	–0.0295***
	(0.0781)	(0.0183)	(0.00570)	(0.00454)	(0.108)	(0.0380)	(0.00650)	(0.00569)
2017 Dummy	–0.269***	0.00719	0.00890	–0.0640***	0.0894	–0.0660*	–0.0138**	–0.0425***
	(0.0780)	(0.0183)	(0.00569)	(0.00453)	(0.108)	(0.0378)	(0.00647)	(0.00566)
2018 Dummy	–0.507***	0.926***	0.137***	–0.0550***	0.106	0.808***	0.0558***	–0.0330***

	(0.0786)	(0.0185)	(0.00574)	(0.00456)	(0.108)	(0.0378)	(0.00646)	(0.00565)
Constants	–9.897***	–1.672***	–0.428***	–0.260**	–5.612**	-0.679	–0.186	–0.0495
	(1.941)	(0.456)	(0.142)	(0.113)	(2.708)	(0.951)	(0.163)	(0.142)
Total Observations	50,025	50,025	50,025	50,025	25,097	25,097	25,097	25,097
Coefficient of Determination	0.554	0.336	0.142	0.213	0.540	0.301	0.101	0.238

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Appendix 4 – Continued

Dependent Variables: Quantity of Commodities (in kilogrammes)	Papua			
	Rice	Fresh Fish	Chicken Meat	Beef
Ln (Total ART)	5.035***	0.182***	4.453***	0.230***
	(0.0210)	(0.00533)	(0.0408)	(0.0130)
Ln (Age)	3.583***	0.593***	–4.366***	0.444
	(0.721)	(0.183)	(1.498)	(0.476)
Sex	–0.131***	–0.00251	–0.216***	–0.0207
	(0.0308)	(0.00781)	(0.0654)	(0.0208)
Work Status	0.119***	0.0159*	–0.0557	–0.0125
	(0.0342)	(0.00867)	(0.0747)	(0.0237)
Total Children	–0.319***	–0.00852	–0.309***	0.00515
	(0.0216)	(0.00547)	(0.0439)	(0.0140)
Maritime Highway Programme	0.0242	–0.00155	0.430***	–0.00549
	(0.0570)	(0.0144)	(0.117)	(0.0373)
2014 Dummy	0.832***	–0.00964	0.690***	0.0387
	(0.0546)	(0.0138)	(0.131)	(0.0415)
2016 Dummy	–0.0367	–0.0391***	0.284**	–0.163***
	(0.0544)	(0.0138)	(0.130)	(0.0412)
2017 Dummy	–0.136**	0.725***	0.275**	0.546***
	(0.0546)	(0.0138)	(0.130)	(0.0413)
2018 Dummy	–8.381***	–1.336***	6.179**	–0.931

	(1.332)	(0.337)	(2.733)	(0.868)
Constants	5.035***	0.182***	4.453***	0.230***
	(0.0210)	(0.00533)	(0.0408)	(0.0130)
Total Observations	114.531	114.531	22.798	22.798
Coefficient of Determination	0.551	0.296	0.555	0.260

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.
Source: Calculation by authors.

Appendix 5

Changes in Night-Time Light Intensity in eastern region and islands as an Impact of Operating the Maritime Highway Programme, 2012–2017

Dependent Variables: Night-Time Light Intensity	Eastern Indonesia Region	Nusa Tenggara	Sulawesi	Maluku	Papua
Maritime Highway Programme	0.425***	0.452***	0.506***	0.364***	0.373***
	(0.0411)	(0.144)	(0.0657)	(0.0341)	(0.0981)
Constants	–1.746***	–1.699***	–1.462***	–1.995***	–2.258***
	(3.94e-05)	(6.24e-05)	(4.66e-05)	(8.56e-05)	(0.000115)
Total Observations	467,438	90,224	220,002	50,942	106,270
Total Villages	22,516	4,397	10,380	2,352	5,387

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01
Source: Calculation by authors.

Changes in Night-Time Light Intensity in the areas of the participating ports as an Impact of Operating the Maritime Highway Programme, 2012–2017

Dependent Variables: Night-Time Light Intensity	Zoning for the Radius of Village/District Locations to Participating Ports					
	≤ 2 km	≤ 5 km	≤ 7 km	≤ 10 km	≤ 12 km	≤ 15 km
Maritime Highway Programme	0.0583***	0.0796***	0.0797***	0.0822***	–0.0610	–0.0515
	(0.0172)	(0.0119)	(0.00975)	(0.00883)	(0.0732)	(0.0739)
Constants	–1.626***	–1.588***	–1.611***	–1.651***	–1.714***	–1.704***
	(0.0214)	(0.0156)	(0.0134)	(0.0120)	(0.0116)	(0.0107)
Total Observations	8,947	15,280	19,968	24,647	30,278	35,229
Total Villages	429	733	965	1.191	1.463	1.703

Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.
Source: Calculation by authors.