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An Assessment Impact of Poor Linkage of Indonesian Ports with International Container Shipping Lines

By

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Abstract

Based on the periodic Worldbank report, Indonesia's Logistic Performance Index (LPI) is not quite good; especially compared to its neighbor countries. Furthermore, by the study of Worldbank, the low LPI cause high logistics cost for Indonesia. It is about 25 percent of its Gross Domestic Product (GDP), while it is just about 8 percent for Singapore, and 14 percent for Malaysia. Besides the custom performance, the other two main issues which cause low Indonesia logistic performance are the connectivity with international shipment and the port infrastructure. These two main issues are related to the maritime sector. As shipping lines tend to deploy a big ship to serve long-haul trade service, the inadequate port infrastructure causes big container ship can-not make a direct call to an Indonesian port. As a consequence, trans-shipment should be carried out to bridge the flow of Indonesia container related. The trans-shipment activity raises the transport cost of Indonesia-related containers. Thus, this thesis aims to assess the cost impact on the transport cost of Indonesia-related containers due to poor Indonesian port connectivity with international shipping line.

High transportation cost constitutes higher non-tariff measures (NTM) for Indonesia. It puts Indonesia in a non-favorable position in the trade international trade. Realizing the condition, Indonesian government plans to improve its logistics performance through major projects in the maritime sector such as "Sea-Toll" program. The Indonesian government project brings better port infrastructure and management, thus bigger container ship from all other regions can make a direct call to an Indonesian port.

To assess the cost impact of the better port infrastructure and management, thus we calculate the transport cost of Indonesia-related containers from/ to other regions. The transport cost is calculated in two conditions, poor connectivity and better connectivity. Poor connectivity is the current condition where Indonesian government project is not implemented yet, and direct call to Indonesian port is not available from all other regions. Meanwhile, the better connectivity is the condition after the Indonesian government projects in maritime sector are realized, where Indonesian port infrastructure and management is much better, and direct call to Indonesian port is available from all other regions. The cost impact of poor linkage of Indonesian port with International shipping network is obtained by subtracting the transport cost of better connectivity to the transport cost of the poor connectivity.

We use Generalized Cost (GC) model in calculating the transport cost. We find a significantly reduced transportation cost of Indonesia-related containers from/ to some particular regions. The significant reduced transport cost is experienced in the trade route where previously direct call is not available. However, the reduced transport cost to the regions where a direct call has been available in the current condition is not as significant as to the region where a direct call is not available.

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List of Abbreviations

GDP	Gross Domestic Product
NTM	Non-Tariff Measures
LPI	Logistics Performance Index
GC	Generalized Cost
FTAs	Free Trade Agreements
Teu	Twenty-Foot Equivalent Unit
IPC	Indonesia Port Corporation
PSA	Port of Singapore Authority
UNCTAD	United Nation Conference on Trade and Development
JICT	Jakarta International Container Terminal
NPCT1	New Priok Container Terminal 1
TPS	Terminal Petikemas Surabaya
NYK	Nippon Yusen Kabushiki Kaisha
MOL	Mitsui O.S.K. Lines
DPW	Dubai Port World
BICT	Belawan International Container Terminal
CY	Container Yard
TPKS	Terminal Petikemas Semarang
SEA	South East Asia
M. East	Middle East
N. America	North America
S. America	South America
H&S	Hub and Spoke
VoT	Value of Time

Chapter 1 Introduction

Indonesia faces two main issues which create significant disadvantages in the international trade environment: the poor performance of its logistics service and the rare involvement in bilateral and regional trade agreements. Poor logistics performance causes higher non-tariff measures (NTM) and limited participation in free trade agreements (FTAs) creates higher tariff measures for Indonesia. Meanwhile, Singapore, a neighbouring country, is favoured by further reductions in NTM and tariff measures. Better logistic performance and more involvement in the FTA have granted them a favoured position in international trade compared to Indonesia.

1.1 Joint Research Thesis Project

To analyze the logistics performance particularly in maritime sector and the involvement of Indonesia in FTAs comprehensively, thus we make a joint research project namely *"Indonesian Trade, Shipping Network, and Maritime Investment Analysis."* The joint research project aims to provide a picture of potential benefit for Indonesia in the domestic and international trade. The benefit is triggered by the better logistics performance of the maritime sector and the decrease of the tariff measures. The joint research project consists of five studies as follow:

1. The economic and maritime trade impact of Indonesia's and global trade policy
2. Impact assessment of the poor linkage of Indonesian ports to international container shipping network
3. Comparative analysis of domestic shipping network for container trade in Indonesia between current condition and the implementation of "Sea-Toll' project: a cost perspective.
4. The impact of investments in Indonesian maritime sector on countries' domestic economy.
5. The combined economic and maritime trade impact for Indonesia of local and global trade policies as well as improvements in Indonesia infrastructure and logistics performance.

This thesis is the second study that discussing the implications of the better linkage of international shipping network with Indonesian port on the maritime transport cost. The better condition of Indonesian port connectivity (international and domestic shipment) is expected as the result of Indonesian government's project, namely "Sea-Toll" program. Meanwhile, Triantoro[1] does the study number three which focus on the domestic shipping network. The result of this study and Triantoro's part constitute a new reduction in the Indonesia NTM. Together with the study of Serena[2] and Kalinichenko[3] which is about the possible change in the tariff measures and the impact of investment in the maritime sector, Wiragi[4] analyzes the potential impact for Indonesia due to the change in the NTM and tariff measures in the international trade.

[1] The student does the study of number three.
[2] The student does the study of number one.
[3] The student does the study of number four.
[4] The student does the study of number five.

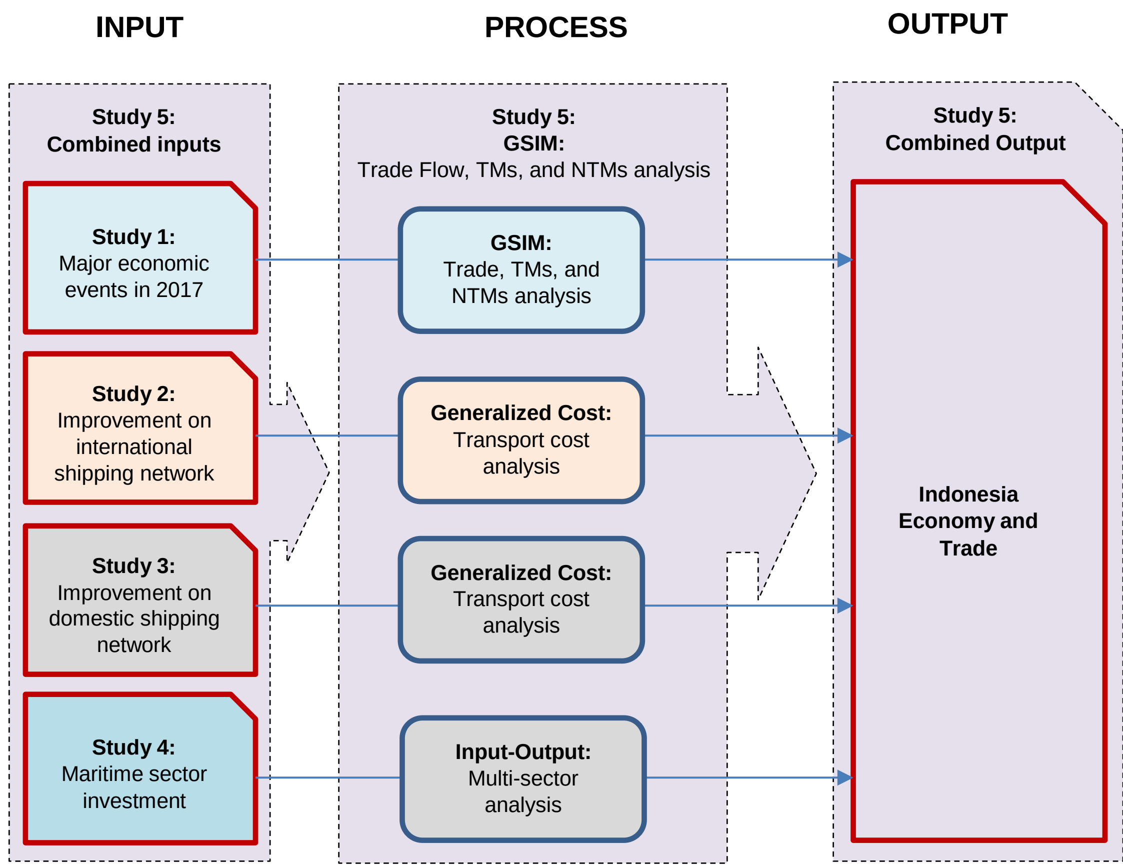

Figure 1 Joint Research Project "Indonesian Trade, Shipping Network, and Maritime Investment Analysis"

Source: Authors of Indonesia-Focused Joint Thesis Project

1.2 Background and Relevance

Logistics performance in Indonesia is not good, especially when it is compared to its neighbouring countries. According to Worldbank, there are six indicators by which to measure Logistics Performance Indicator (LPI): infrastructure to the ports and airports, customs, the availability of international shipments, logistics quality and competence, tracking and tracing, and timelines. Based on the periodic Worldbank Logistic Performance Index (LPI) Report, Indonesia's LPI overall score has been behind Singapore, Malaysia, Thailand and Vietnam for the last six years.

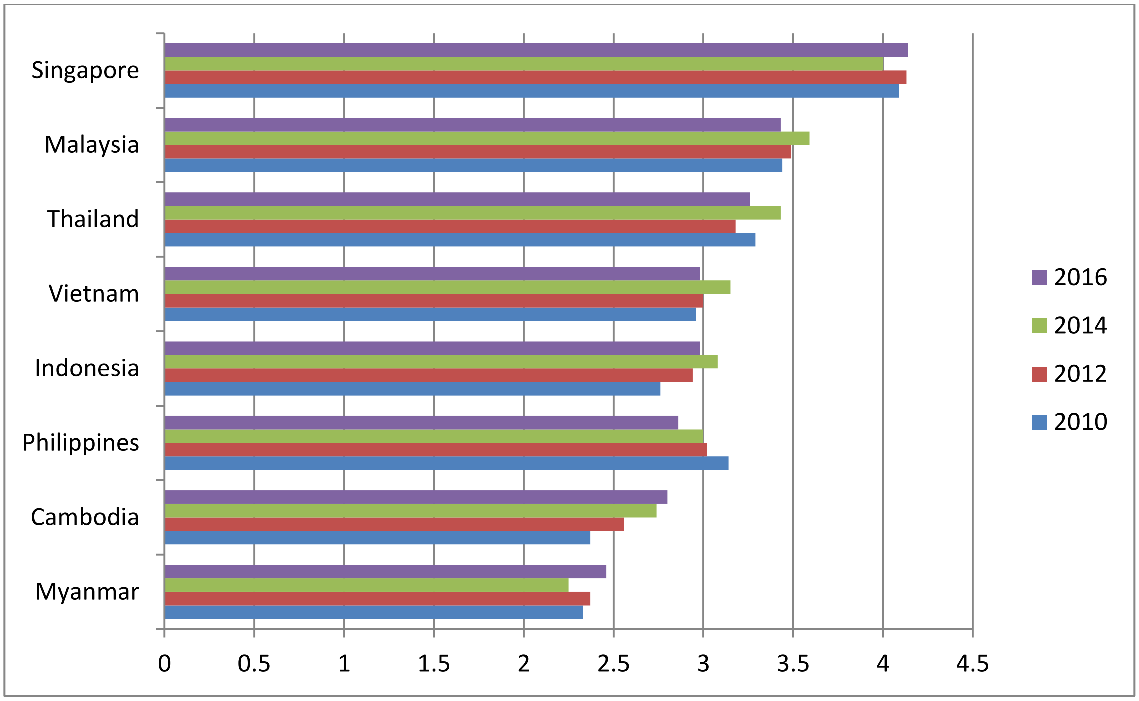

Figure 2 LPI Scores of South East Asian Countries
Source: Worldbank LPI Report 2010, 2012, 2014, and 2016

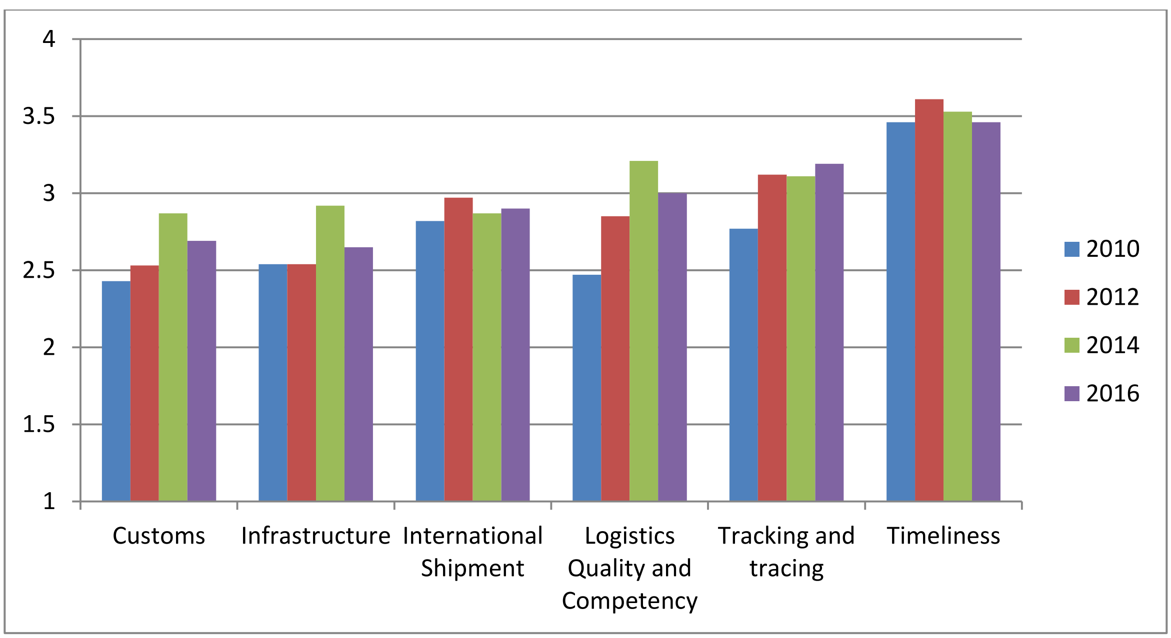

Figure 3 Indonesia's LPI scores by logistic indicators
Source: Worldbank LPI Report 2010, 2012, 2014, and 2016

According to the figure above, beside the Customs issue, the other two main issues of Indonesia's logistics performance are connectivity with the international shipping network and the infrastructure of Indonesian seaports and airports. These two issues contribute to Indonesia's high logistic costs which are about 25 percent of Indonesia's GDP in 2015 (Worldbank, 2016) compared to its neighbouring countries such as Thailand and Malaysia, which are about 15 and 13 percent.

According to the LPI 2016, the index score of the international shipment was just 2.9 out of 5.0, and just 2.65 out of 5.0 for infrastructure. The score of 5.0 is the best condition. In the maritime sector, these two indicators are closely related. As the operational cost per TEU of the bigger ship is lower than the smaller one (Notteboom, Strategic Challenges to Container Ports in a Changing Market Environment, 2007), shipping lines tend to deploy larger ships in serving international shipments to facilitate international trade for various regions around the world. The use of larger vessels is also likely to be continued in the future (Veldman, 2011). Moreover, a bigger ship requires better port infrastructure, such as deeper channels and basins.

Even though Indonesia has hundreds of seaports, 94 percent of international container business of Indonesia is concentrated in just four major ports: Port of Tanjung Priok, Port of Tanjung Perak, Port of Belawan, and Port of Tanjung Emas (OECD, 2012). Due to the port's infrastructure limitations, such as the depth of only 14 meters and the outreach of the available quay cranes with a maximum of 16 rows, until 2016, the 5,000 TEU-container ship calling in the Port of Tanjung Priok was the biggest one to come to an Indonesian port. The ship serves an intra-Asia trade service route (IPC, 2012). On the other hand, other ports in the neighbouring countries such as Singapore and Malaysia provide better infrastructure and superstructure. Container Terminal Pasir Panjang Terminal 5 in Singapore has a maximum depth of up to 18 meters and quay cranes with 52 m height and a 24-row outreach (PSA, 2016). Similar to the port in Singapore, the Port of Tanjung Pelepas in Malaysia also has a maximum depth of up to 18 meters and quay cranes with a 22-row outreach (PTP, 2016).

As mentioned before, shipping lines tend to deploy a bigger ship to serve trade routes between regions, particularly on long-haul voyages. For instance, Samsung uses a 12,000 TEU vessel in the Europe–Far East service route (Notteboom, 2004). A New Panamax container ship requires 15.2 meters draught and quay cranes with a 20-row outreach (Maritime-Connector, 2015). Better infrastructure, superstructure facilities, and port operational performance have granted Singapore and Malaysian ports a competitive advantage over Indonesian ports in their ability to serve bigger container ships.

The deployment of a bigger ship provides an economy of scale for a shipping line. Due to inadequate infrastructure and superstructure facilities, bigger container ships could not make a direct call to Indonesian ports, even with sufficient cargo. There is no direct call from/ to Indonesian ports to/ from some regions around the world such as Europe, North America, South America, and the Middle East (Drewry, 2016). The unavailability of a direct call to some other regions indicates the weak linkage of Indonesian ports with the international shipment network. This forces a shipping line to use either a

Singapore port or a Malaysian port as a trans-shipment point for Indonesia-related containers.

Moreover, the unavailability of a direct call raises additional costs for trans-shipment activity. There are two kinds of costs: financial cost and time cost. Financial costs comprise the marine service costs delivered to the ship (port due, pilot fee, tugging fee) and the terminal handling charge on the container. The time cost lies in the time needed for loading and unloading containers and waiting for the next/ feeder ship service. This trans-shipment cost becomes an additional cost on the freight cost of a direct call to Indonesian ports. All these costs constitute a higher Generalized Cost (GC) on the transport cost of Indonesia-related containers.

The costs associated with port services is a part of Non-Tariff Measures (NTM) among the international trade barrier. Such costs are included as a part of NTM as they might change the price or the quantity of goods traded (MAST, 2008). The higher the transport cost, the higher the NTM applied within the international trade of Indonesian products and consumption. A high NTM puts Indonesia in an unfavourable position in international trade.

Being aware of this condition, the Indonesian government has striven to improve its logistics performance. One of the main priorities is logistic performance in the maritime sector. Through a national program, called the '*Master Plan Acceleration and Expansion of Indonesia Economic Development 2011 – 2025*, the Indonesian government highlights some maritime projects, including improving the domestic shipping network efficiency through the '*Sea Toll*' program, the appointment of an Indonesian international hub port, the revitalisation of port infrastructure, and encouraging better coordination between relevant parties in the port area. Through these projects, the Indonesian government expects better connectivity between Indonesian ports and shipping lines, both domestically and internationally.

1.3 Research Objective and Question

As mentioned before, this study aims to analyse the impact of the current connectivity of Indonesian ports with international container shipping networks. According to the Worldbank LPI Report, its current connectivity is not reliable. Such poor linkage can cause Indonesia-related containers from and to some particular regions around the world to be trans-shipped via either Singapore or Malaysian ports beforehand. Such trans-shipment brings additional costs.

The revitalisation of the Indonesian port infrastructure, other supporting activities, and the designation of an Indonesian international hub port have had an impact on the connectivity of Indonesian ports with global container shipping networks. The direct call of a bigger container ship from some regions to Indonesian ports and vice versa can be carried out. Trans-shipments can be avoided, and the costs associated with trans-shipments can be eliminated. The ship size in the direct call service tends to be bigger than the previous condition. Both changes contribute to the change of the total transport cost. The improvement due to better connections of Indonesian ports with the international container shipping network is measured by subtracting the GC of having better linkage of Indonesian ports with international shipping network (future condition) with the current GC. The result is considered as a reduction of Indonesia's NTM in international trade.

Thus, the research question (RQ) that this study aims to answer is: *What is the decrease in generalized cost of Indonesia-related containers from/ to other regions if the Indonesian government successfully implements its maritime program?*

To answer the research question sufficiently, several sub-research questions (SQ) need to be addressed:

How is the current connectivity of Indonesian ports with the other regions around the world?

What is the current amount of Indonesia's export and import containers which are transported directly and trans-shipped via trans-shipment port?

What is the current transport cost for Indonesia-related containers from/ to other regions around the world?

What is the possible transport cost reduction by having better linkage of Indonesian ports with international container shipping networks?

1.4 Scope and Limitation of the Research

In international trade, there are five types of cargo: liquid bulk, dry bulk, breaks bulk, Ro-ro, and container cargo. Most of those cargoes are transported from their origin to a destination via ocean transportation. Ocean transportation is carried out by a shipping line in a way that always tries to increase cost efficiency. The transportation of container cargo from/ to Indonesia to/ from other regions around the world is the cargo type discussed in this thesis.

Currently, most of the international shipping lines which transport Indonesia-related containers designate Singapore and Malaysian ports as a trans-shipment point. To simplify the calculation, we use a Singapore port as the basis for our transportation cost calculation, since more shipping lines use Singapore port than a Malaysian port. We also use a similar reason in defining the Port of Tanjung Priok as the port which serves as the direct call from and to other regions. The proportion of import and export containers in Indonesia is higher through the Port of Tanjung Priok than the other three major container ports (Port of Tanjung Perak, Port of Belawan, and Port of Tanjung Emas).

To be able to serve bigger container ships, Indonesian ports need two essential things. First, they need capital investment to revitalise the port infrastructure and superstructure. Second, they need improvement in port operational performance. As our primary focus is to calculate the reduction of generalised cost of Indonesia-related containers resulting from the better connectivity between Indonesian ports and international container shipping lines, we do not calculate the required capital investment and do not discuss the operational port performance.

1.5 Research Design and Thesis Structure

This thesis uses both a qualitative and quantitative methodology to answer the research question and the sub-research questions. We use a qualitative methodology to explain the current connectivity quality of Indonesian ports within an international container shipping network. We look into the existing service routes of global container shipping lines and analyse how Indonesian ports are connected with other regions (distinguished in direct and indirect calls). We also identify the ship size deployed on the service route.

Thus, we engage with a qualitative methodology. An econometric model, namely the GC model, is used to calculate the transport cost of Indonesia-related containers to and from other regions. This model combines the monetary and non-monetary costs in the calculation. The non-monetary cost refers to the total maritime transport transit time. First, we calculate the transport cost of the condition wherein the Indonesian port considered has a poor connectivity with an international container shipping network. This condition is also called the current state. The poor connectivity is based on real Indonesian port connectivity in 2016. We find that, for several regions, a trans-shipment activity is still required during the maritime transport process. Then we calculate the transport cost of the condition whereby the linkage of the Indonesian port within an international shipping network is improved considerably. The better connectivity is also named the future state, after the realisation of the government's maritime project. It is also assumed as a condition wherein the Indonesian port has a direct call service with all other regions, and the improvement in the Indonesian port performance has been realised. The improvement of the port performance is an essential thing as it saves days in total transit time and comes from the decrease in the dwelling time in the Indonesian port.

To get the cost impact of the poor linkage of the Indonesian port within an international shipping network, we then compare the transport cost in both situations. By subtracting the transport cost of the better connectivity with the poor connectivity condition, we get the final result of the cost impact due to a different level of connectivity. The final result is in the form of the unit cost per Teu and a percentage of transport cost change.

This thesis consists of six chapters. Chapter 2 describes the present condition of the connectivity of Indonesian ports within an international container shipping network. In chapter 3, we introduce the literature review of the transport cost and the determinant factors, economics of ship size and shipping network optimisation. Chapter 4 details the approach in the research methodology used to complete this thesis. Chapter 5 consists of the results and data analysis. Finally, in the last chapter, we conclude by summarising the main findings and the implications. Furthermore, a suggestion for further research is presented.

Chapter 2 Current Connectivity of Indonesian Port with Other Regions

To provide its citizens with the necessities of life, the Indonesian government is actively involved in international trade. The total value of Indonesia's import and export in the last ten years can be seen below.

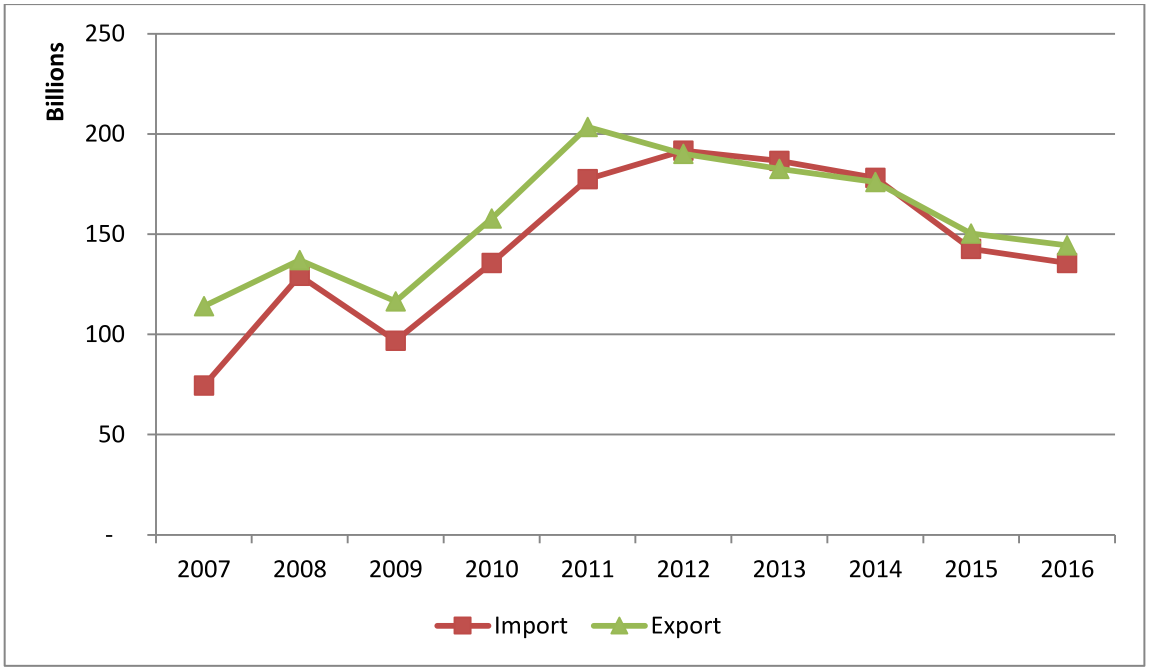

Figure 4 Indonesia export and import value for the last ten years (US$)
Source: UN Comtrade

The transportation of goods via international trade is carried out by seaborne, airborne, piping, and inland transportation. Seaborne plays an important role as it accounts for more than 80 percent of international trade volume and around 70 percent in term of value (UNCTAD, 2015). Commodities in international seaborne trade are classified into four types of cargo: oil and gas, containers, dry cargo, and main bulk commodities. Containerised cargo has seen a steady increase in share in terms of volume compared to other types of cargo. It has about 14 percent of total worldwide seaborne trade by volume in 2009, and rose to be 17 percent in 2015 (UNCTAD, 2016).

The growth of containerisation has also happened in Indonesia. The number of exported and imported Indonesia-related containers has increased steadily from 2010 to 2014. The export and import of Indonesia-related containers go through several international container terminals in Indonesia. The maritime transportation of these containers is carried out by companies with offices in Indonesia.

2.1. International Port Container in Indonesia

Indonesia has around 2,400 ports spread out from the western part until the eastern part of Indonesia. Among this number, 294 ports are classified as commercial ports. These commercial ports are administered by four state-owned port companies: Pelindo 1, Pelindo 2 (or Indonesia Port Company [IPC]), Pelindo 3, and Pelindo 4 (Indonesia Ministry of Transportation, 2015). The management of each company is entirely separated and independent.

Each of the Indonesia port companies has its territory. Pelindo 1 deals with the western part of Indonesia, Pelindo 4 deals with the eastern side, while Pelindo 2 and Pelindo 3 manage the middle of Indonesia. Each Pelindo has a domestic and international container terminal, except Pelindo 4: it just has a domestic container terminal.

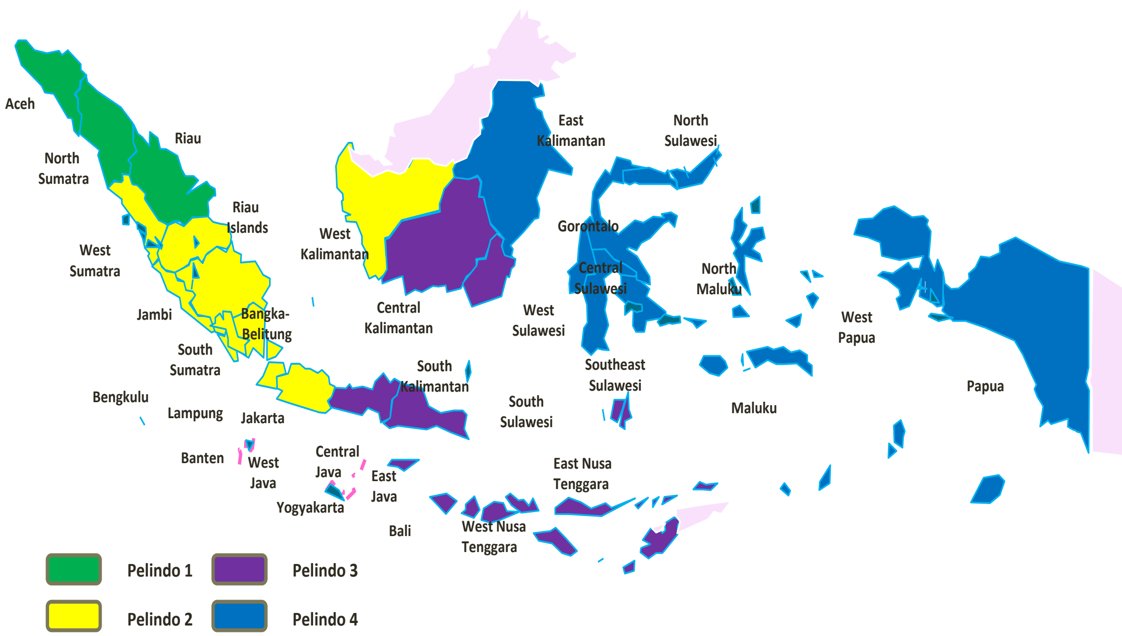

Figure 5 Territorial of each Indonesia port companies

Source: Author elaboration

The international container terminal in Indonesia serves the international container business. Some of the terminals are still entirely operated by Pelindo itself while some others have been privatised. The container terminals such as Jakarta International Container Terminal (JICT), Koja Terminal, New Priok Container Terminal 1 (NPCT1), and Terminal Petikemas Semarang (TPS) are jointly operated by Pelindo and foreign companies. JICT and Koja Terminal are operated by the joint venture of IPC and Hutchinson Port Hong Kong (JICT, 2016), NPCT1 is managed by a consortium of IPC, PSA, NYK, and MOI, while TPS is managed by the joint venture of Pelindo 3 and Dubai Port World (DP World, 2016).

Table 1 Throughput of major international container terminals in Indonesia

Port Company	Container Terminal	Throughput (TEUs)		
		2014	2015	2016
Pelindo 1	BICT	554,260	582,819	463,464
Pelindo 2	PT Port of Tanjung Priok	666,946	492,133	822,395
	JICT	2,355,904	2,222,182	2,144,394
	KOJA Terminal	872,508	975,438	826,189
	NPCT1	-	-	65,150
Pelindo 3	Terminal Petikemas Surabaya	1,192,032	1,198,483	1,225,953
	Terminal Petikemas Semarang	551,655	589,379	597,580
Total		6,193,305	6,060,434	6,145,125

Source: Compiled from various sources

Based on the table above, we can see that JICT and TPS are the busiest container terminals in Indonesia. Based on the container terminal location, the Port of Tanjung Priok has the biggest share as it accounts for more than 60 percent of total Indonesia international container movement. The throughput of the terminals in the table above includes the trans-shipment containers which are destined or originated to/ from the other container terminals in Indonesia. The average trans-shipment container is about 10 percent[5] of total international container terminal throughput.

2.1.1 PT Port of Tanjung Priok (PTP)

PT Port of Tanjung Priok is a subsidiary of IPC which is located in Jakarta province. It provides services not only for containerized cargo, but also for non-containerized cargo such as general cargo, liquid bulk, dry bulk, and break bulk. It operates four terminals, namely terminal 1 to terminal 4. The container handling service is held in terminal 2 and terminal 3. Terminal 2, which is dealing with the domestic container, is not dedicated just for container service but also mixed with services for break bulk, and passenger. Terminal 3 is dedicated for containerized cargo, for both domestic and international container.

The Container Yard (CY) in PTP is about 80 Ha with holding capacity is about 30,476 TEUs. The draught is varying from 5.5 to 12 meters. The annual throughput of its international container in average is about a half of its domestic container (PT Port of Tanjung Priok, 2016).

2.1.2 Jakarta International Container Terminal (JICT)

As we can see from the table 1 above, JICT is the biggest container terminal in Indonesia in term of annual throughput. Until the end of 2016, the biggest ship ever made a call to JICT is a 5,000 TEU container ship which is also the largest ship able to come to an Indonesian port. JICT is jointly operated by IPC and Hutchinson Port Hong Kong (HPH) and is located in the area of Port of Tanjung Priok, Jakarta. Even though

[5] Based on estimation of several officers from several container terminals

JICT is located in Port of Tanjung Priok, but the management is fully separated from the PT Port of Tanjung Priok.

JICT has a total area of about 100 Ha, with about 45.5 Ha used as Container Yard (CY). Its total berth length is 2,150 meters; with the draught vary between 11-14 meters. It manages two terminals, namely JICT Terminal 1 and JICT Terminal 2 with full capacity about 3 million TEU. JICT serves more than 20 container shipping lines and provides direct services up to 25 countries around the world (JICT, 2015).

2.1.3 KOJA Container Terminal

KOJA container terminal is also located in Port of Tanjung Priok. It is jointly operated by IPC and HPH. It provides services for export and import of Indonesia-related containers from/ to other countries, and also trans-shipment container. The trans-shipment is for the other ports in Indonesia which do not have sufficient port infrastructure to serve international container ship.

To support its operational activity, KOJA terminal is equipped with CY area of 21.8 Ha. The total berth length is 650 meters, and maximum wharf draught is about 13 meters. It's shipping lines customer consists of international shipping lines such as Hapag-Lloyd, MSC, OOCL, UASC, and domestic shipping lines such as SPIL and Temas Line. In 2015, KOJA throughput was about 975,400 TEU, which is the highest in its history (KOJA Terminal, 2016).

2.1.4 New Priok Container Terminal One (NPCT1)

NPCT 1 is a newly operated container terminal that comes into operation in August 2016. It is a part of the first phase of the development of Port of Kalibaru, the expansion of Tanjung Priok port. The development of Kalibaru port consists of two phase. The first phase is planned to be carried out from 2012 to 2017. It encompasses the development of three container terminals which each annual capacity is 1.5 million TEU. The second phase is planned to be completed in 2020, which focuses on the development of liquid bulk terminal and multi-purpose terminal. The development of Kalibaru port is intended to double the capacity of Tanjung Priok port (IPC, 2014).

NPCT1 is operated by the consortium of IPC with Mitsui, NYK, and PSA. The terminal is equipped with sufficient infrastructure and superstructure to welcome large container ship. It has berth length of 850 meters; draught of 16 meters, super post Panamax cranes, and the annual capacity is 1.5 million TEUs (NPCT1, 2017).

2.1.5 Terminal Petikemas Surabaya (TPS)

TPS is located in the area of Port of Tanjung Perak, Surabaya, in East Java. It is jointly operated by Pelindo 3 and Dubai Port World (DPW). TPS provides services for both international and domestic container. The International terminal has a bigger size than its domestic terminal. TPS is the second largest container terminal in Indonesia after

JICT by annual throughput, and at the same time is the largest one outside Port of Tanjung Priok.

To serve the international container related, TPS has berth length of 1,000 meters; with maximum draught is about 13 meters. It is also equipped with CY area of 35 Ha, with the total ground slot is about 32,223 TEUs. To have the maximum draught, the berth is designed advanced to the sea; causing a quite far distance between the berth and the CY. A 2 Kilometers trestle connects the wharf and the CY. The international shipping lines which become its customer are such as Maersk Line, American President Line (APL), CMA CGM, MSC, and Evergreen. (TPS, 2017).

2.1.6 Terminal Petikemas Semarang (TPKS)

TPKS is fully owned and operated by Pelindo 3. It is located in the Port of Tanjung Emas, Semarang city, Central Java. TPKS serves both domestic and international container business. The domestic container just accounts a relatively small compared to its international container where it is about 10 percent of its total throughput.

The international container terminal in TPKS has a total berth length of 382 meters; with a maximum draught of 10 meters. The CY area is about 19 Ha. The highest TPKS international container throughput was 597,580 TEUs in 2016. Its primary international shipping line customers are Evergreen, Wan Hai Lines, K-Line, and MCC Transport Singapore (TPKS, 2017).

2.1.7 Belawan International Container Terminal (BICT)

BICT is fully owned and operated by Pelindo 1. It is the only international container terminal under the administration of Pelindo 1. BICT is located in Belawan, North Sumatera, which is nearby to Malacca Strait. The ships that come to BICT are feeder vessels which serve the bigger container ship in Singapore, Malaysia, and Thailand Port.

BICT has a total berth length of 550 meters; with draught, depth varies from 8 to 10 meters. It's CY is about 16 Ha with ground slot capacity is 15,726 TEUs. The biggest ship visiting BICT is a 2,000 TEU container ship, while the highest annual throughput was about 582,819 TEUs in 2015 (BICT, 2017).

2.2. Indonesia in the International Trade and Present Connectivity of Indonesian Ports with Other Regions

Indonesia’s trading partners include countries around the world. As shown in Figure 4 above, the trade value of Indonesia in international trade has fluctuated within the last ten years. The cargo type in international trade has varied, but one of them is containerized cargo.

To serve the flow of Indonesia-related containers to/ from other countries in other regions, several container shipping lines provide a service to Indonesian ports. Some of those shipping lines provide a direct call service from Indonesian ports to some particular regions while some others do not have the similar service. The availability of direct call helps to create a faster and more efficient transport cost from/ to Indonesian port to/ from other countries. Nonetheless, until the end of 2016, the availability of the direct call to Indonesian ports is very limited: just within the similar region and in areas located nearby.

2.2.1 Present Indonesian International Trade

Currently, Indonesia manages trade with many countries around the world. To increase its export to other countries, Indonesia has engaged in several multilateral and bilateral free trade agreements (FTAs). Indonesia was firstly involved in a multilateral FTA in 2002 when Indonesia ratified the FTA between South East Asian countries which are called ASEAN FTA. Thereafter, the FTA has expanded with other countries such as China, Japan and Australia (Indonesian Ministry of Finance, 2013).

Indonesia also has some major partners in international trade. Regarding trade value, China, Japan, Singapore and the USA are the biggest Indonesian trade partners. The commodities traded by Indonesia vary, including textiles, electronic devices, rubber, palm oil, automotive goods, wood, cocoa, coffee, and shrimp (Indonesian Trade Ministry, 2017). We will further show the value of trade with other countries based on region.

Table 2 Indonesia trade value with the regions around the world (in million)

Regions	Trade Value (US$)								
	2007	2008	2009	2010	2011	2012	2013	2014	2015
S.E. Asia	43,754	65,205	51,218	70,988	91,400	94,195	92,740	88,548	70,914
East Asia	61,307	89,998	70,627	103,517	137,385	135,543	126,636	115,459	95,737
Middle East	9,906	13,636	9,635	12,499	15,996	18,011	17,679	19,042	12,776
Oceania	7,300	9,406	7,658	9,495	11,891	11,375	10,718	11,962	9,621
Europe & Med.	27,556	34,854	28,011	35,011	42,210	41,825	41,681	38,888	34,376
N. & S. America	21,147	27,894	23,337	31,754	37,888	36,582	35,299	34,816	32,891

Source: Adapted from UN Comtrade

2.2.2 Present Connectivity of Indonesian Ports with Other Regions

As mentioned in the first chapter, based on the Worldbank LPI report 2016, Indonesian port connectivity within an international shipping network is not good (2.9 out of 5). One of the main reasons is the inadequate Indonesian port infrastructure and superstructure in serving bigger ships which are deployed in long-haul service routes.

The shipment of Indonesia-related containers from/ to other countries is carried out by foreign and domestic shipping lines. Domestic shipping lines have service to Singapore or Malaysian ports, located in South East Asia (SEA). Meanwhile, foreign shipping lines cover all the trade routes across the world.

Table 3 Foreign and Domestic Shipping Line and Its Service Route Range

Foreign Shipping Line		Domestic Shipping Line	
Shipping Line	Service Route	Shipping Line	Service Route
Maersk Line	Indo - All Regions	Meratus	Indonesia - SEA
MSC	Indo - All Regions	Samudera Shipping Line	Indonesia - SEA
CMA CGM	Indo - All Regions	CTP Line	Indonesia - SEA
Hapag Lloyd	Indo - All Regions		
COSCO	Indo - All Regions		
APL	Indo - All Regions		
Evergreen	Indo - All Regions		
OOCL	Indo - All Regions		
UASC	Indo - All Regions		
Mitsui O.S.K Lines	Indo - All Regions		
NYK Line	Indo - All Regions		
K-Line	Indo - All Regions		
KMTC	Indo - Intra Asia		
Sinokor	Indo - Intra Asia		
Heung-A Shipping	Indo – Intra Asia		
Wan Hai Lines	Indo - All Regions (Excl. Africa)		
SITC	Indo – Intra Asia		
Yang Ming	Indo - All Regions (Excl. Africa)		

Source: Compiled from several shipping line web sites

As we can see from the table above, Indonesia domestic shipping lines offer service within the SEA regions, to Singapore and Malaysian ports. Foreign container shipping lines connect Indonesian ports with countries in other regions. The connectivity of Indonesian ports with other regions by those lines is performed by a direct call[6] to an Indonesian port or through a trans-shipment[7] point.

Until the end of 2016, the direct call service to an Indonesian port from other regions was few in number, available to/ from the region of East Asia and Oceania. The maritime transportation to the other regions is by a trans-shipment mode. The number of international container shipping lines that has a direct call to/ from East Asia is quite numerous, but it is just a few for the region of Oceania.

Table 4 Current shipping network connectivity of Indonesian ports with other regions

Region	Shipping Line	Shipping Network Connectivity
South East Asia	All foreign shipping line	Direct call
East Asia	Maersk Line, CMA CGM, OOCL, Hapag Lloyd, Evergreen, NYK Line, K Line, COSCO, KMTC, Sinokor, Wan Hai Lines	Direct call
	MSC, MOL, UASC	Trans-shipment
Middle East & South Asia	Most of the foreign shipping line	Trans-shipment
Europe and Mediterranean	Most of the foreign shipping line	Trans-shipment
North and South America	Most of the foreign shipping line	Trans-shipment
Oceania	OOCL, K Line, COSCO	Direct call
	Other foreign shipping lines	Trans-shipment

Source: Compiled from several shipping line web sites

From the table above, the description of Indonesian port connectivity with other regions, especially the Port of Tanjung Priok can be described as below.

[6] A direct call by a ship in a port to load and unload the container between origin and destination port pairs (Imai, et al., 2009).
[7] Two calls of ports, one in the region of a trade lane, and the other one between the origin and the destination of a trade lane (Imai, et al., 2009).

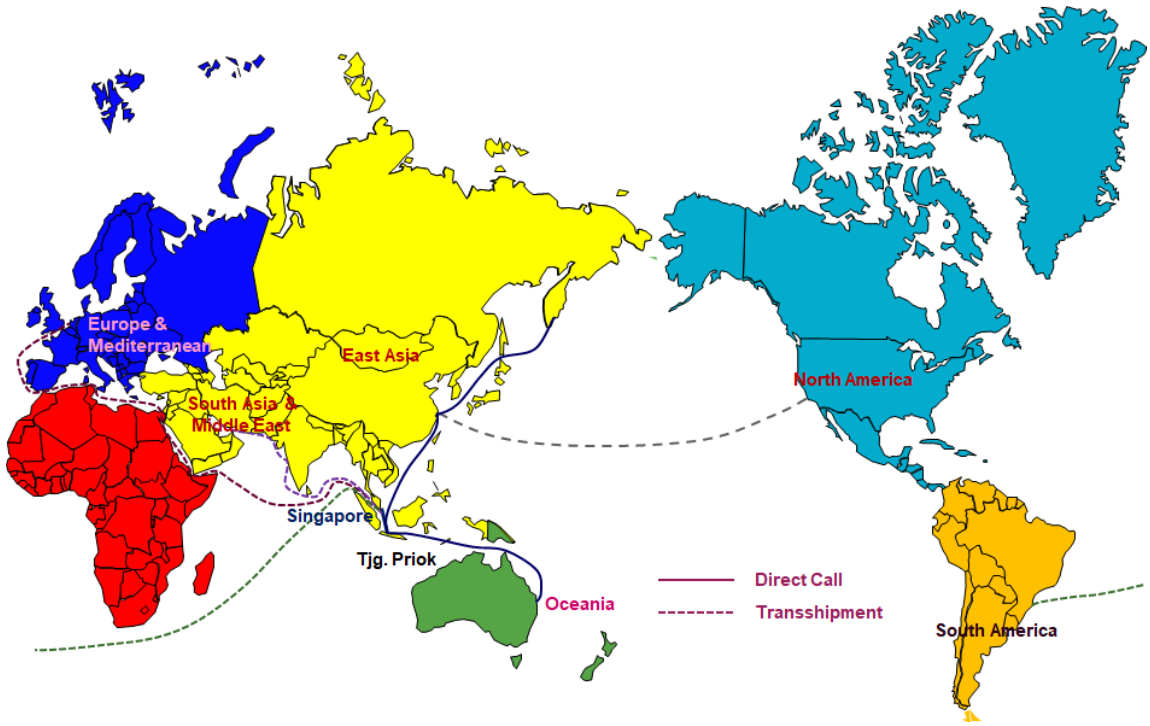

Figure 6 Current connectivity of Indonesian port (Tanjung Priok) with other regions
Source: Own elaboration

Several ports are used as trans-shipment point for Indonesia-related containers. Two main ports that commonly used are Port of Singapore and Port of Tanjung Pelepas in Malaysia.

Table 5 Shipping line's trans-shipment port for Indonesia-related containers

Trade Route	Port of		
	Origin (Indonesia)	Trans-shipment	Destination
Indonesia – Middle East	Tanjung Priok		Salalah/ Sohar
Maersk Line		Singapore	
MSC		Singapore	
CMA CGM		Singapore	
Evergreen		Singapore	
COSCO		Singapore	
NYK		Singapore	
Indonesia – South East	Tanjung Priok		Jawaharlal Nehru/ Nhava Sheva
Maersk Line		Tjg. Pelepas (Malaysia)	
MSC		Singapore	
CMA CGM		Singapore	
Evergreen		Singapore	

Trade Route	Port of		
	Origin (Indonesia)	Trans-shipment	Destination
COSCO		Singapore	
NYK		Singapore	
Indonesia – Europe & Mediterranean	Tanjung Priok		Rotterdam
Maersk Line		Tjg. Pelepas (Malaysia)	
MSC		Tjg. Pelepas (Malaysia)	
CMA CGM		Singapore	
Evergreen		Singapore	
COSCO		Singapore	
NYK		Singapore	
Indonesia – America	Tanjung Priok		Los Angeles/ N. York
Maersk Line		Yantian (China)	
MSC		Tjg. Pelepas (Malaysia)	
CMA CGM		Singapore	
Evergreen		Shanghai	
COSCO		Singapore	
NYK		Singapore	

Source: Compiled from several shipping line web sites

Based on the table above, we can see that most of the shipping lines choose Singapore port as their trans-shipment port for Indonesia-related containers. The Maersk Line has several trans-shipment points, such as Singapore ports for containers going to the Middle East, the Port of Tanjung Pelepas for containers going to/ from South Asia, Europe, and Mediterranean, and Yantian port in China for containers to/ from America. Some shipping lines such as CMA CGM, COSCO, and NYK just have a Singapore port as their connecting point to serve all trade to other regions. MSC has both the Port of Singapore and the Port of Tanjung Pelepas as its trans-shipment ports. While the options of trans-shipment ports are, in general, between Singapore and Tanjung Pelepas port, a different choice has been opted for by Evergreen to serve trade to America, picking Shanghai port as its trans-shipment point.

As has been described above, Indonesia-related containers to/ from other regions is transported by a direct call or trans-shipment shipment. The direct call shipment is available to the regions of East Asia, and Oceania, while the container transport of Indonesia-related containers is still by trans-shipment to the regions of Europe, Middle East, North and South America. Taking into consideration that 10 percent of total Indonesia container terminals' throughput (Table 1) is domestic throughput and the proportion of Indonesia international trade value with the other regions, below is the estimate of a number of Indonesia's export and import containers from/ to other regions and domestic container terminals' throughput. While the international throughput is already an estimation of Indonesia's export and import containers, the domestic throughput is still a mix between Indonesia's fully generated containers with international containers trans-shipped via domestic ports.

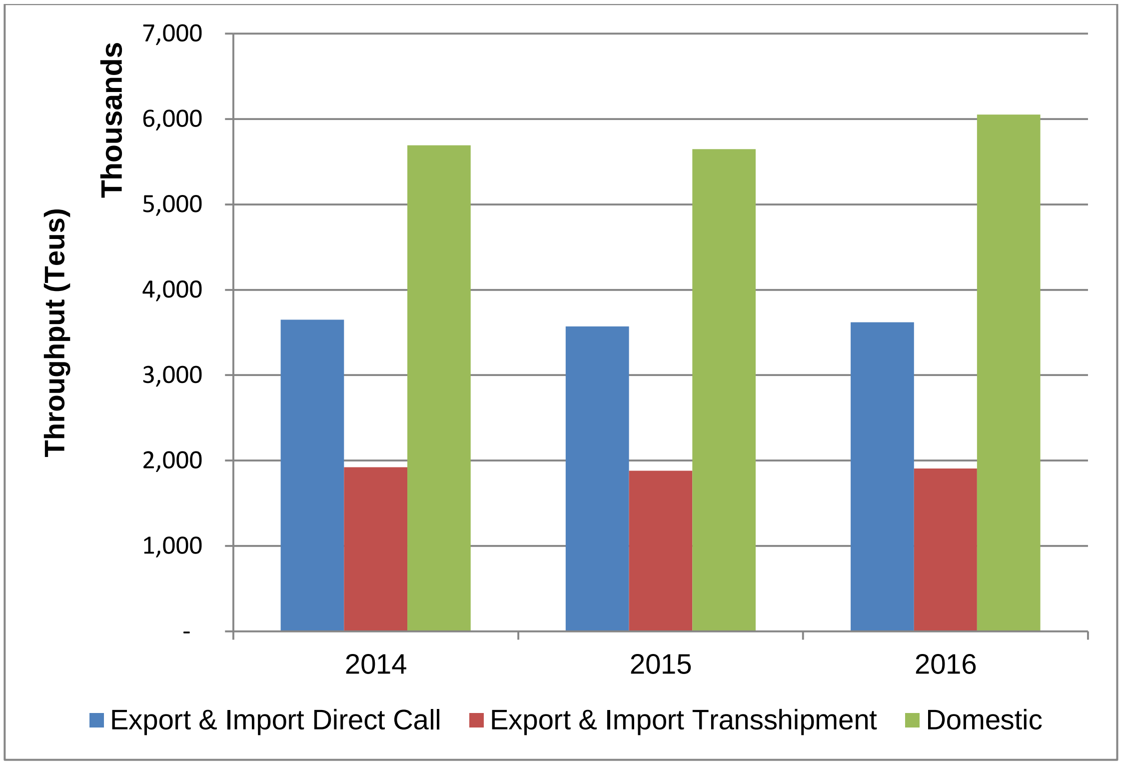

Figure 7 Indonesia's international and domestic container terminal throughput
Source: Own estimation and Triantoro (2017)

Chapter 3 Theoretical Background of Transport Cost and International Trade

This thesis aims to analyze the transport cost of containerized cargo. The transport cost consists of two divisions, namely maritime leg cost and port leg cost. Many studies have discussed the factors that influence transport cost, as well as the impact of the transport cost in general on international trade. Those studies provide insight into maritime transportation cost structure and its relation to international trade.

3.1 Determinant Factors of Transport Cost

Several variables influence the transport cost. The factors come from both maritime leg and port leg. According to several types of research, efficiency is one of the important keys when dealing with transport cost.

3.1.1 Economies of Ship Size

During the last decade, container ship size has increased. The increased ship size is intended to achieve economies of scale. According to Cullinane & Khanna (2000), the economies of scale may provide the reasonable short-term cost leadership for the shipping operators. The reasonable cost will allow the liners to have reasonable transport cost. To achieve such reasonable cost, ship size should be balanced with the cargo volume transported. Another study by Imai et al. (2006) also shows the close relationship between freight rate and the selection of ship size. A mega container ship is feasible on the Asia-North America service route only if the feeder costs and freight rate are less, while the container mega-ship is always viable for the Asia-Europe trade route.

The importance of the economies of ship size is also emphasized by Koi Yu Ng & K.Y.Kee (2008) in their research about the optimal size of a container feeder in Southeast Asia. Through optimal ship size, the ship operator will ensure the adequate utilisation with the proper cost. Thus, the determination of ship size on each route becomes crucial. Also, through economic modelling and a questionnaire survey, the research also provides insight into the market of feeder liner services in Southeast Asia wherein an optimal ship size tends to increase within the next decade. The economies of ship size will remain relevant in the future due to maritime transport. According to Veldman (2011), the growth of the shipping size will continue in the future, with economies of ship size as the reason behind it.

3.1.2 Fuel Cost

Fuel cost is one of the biggest expenses in the operation of a ship. For a ten-year-old ship, it accounts for about 60 percent of ship voyage cost, whereas voyage cost is estimated at 40 percent of total ship cost (Stopford, 2009). The significance of the bunker price is also perceived in a large ship. Even in a Post-Panamax container ship, the bunker price affects the costs per TEU enormously in the North Europe-East Asia loop. To comply with the schedule due to the delay of two days from Port of Antwerp to Port of Singapore, there is an additional cost of about US$38 per TEU according to

Notteboom, et al. (2009). The increase of the bunker price causes an advantage for the liner, as the increase of the bunker price is just partially accommodated in the freight cost as a surcharge.

A more comprehensive effect of the bunker price on the container ship business was proposed by Ronen (2011). Due to the high bunker price, a liner tends to decrease sailing speed to save more fuel, which causes longer transit time. To maintain the service frequency, more vessels are needed.

3.1.3 Shipping Network

Shipping Network is considered one of the determinant factors of freight rates. Wilmsmeier and Hoffman (2008), through their research of the Caribbean regions, found that more expensive transport costs are experienced in area with many routes and low trade volume within a dispersed market. On the other hand, fewer freight rates can be achieved in an area with a less-concentrated shipping market. Meanwhile, according to Fuguzza, et al. (2017), shipping connectivity's effect goes further into the international trade. A lower export value is associated with the poor direct shipping connectivity, and trans-shipments cause bilateral trade volume to decrease by up to 40 percent. Thus, shipping network is very important in determining trasnport cost.

There are two standard approaches in a container shipping network system: trans-shipment or hub and spoke (H&S) network and direct port to port services or multiple port calls (Imai et al. , 2009).

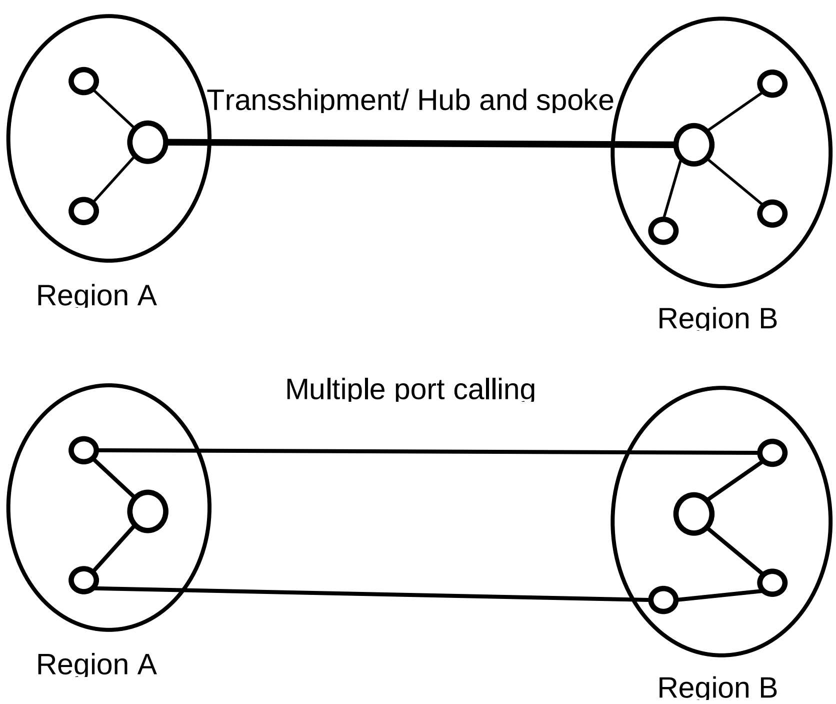

Figure 8 Container shipping network

Source: Imai et al. (2009)

The H&S network design, introduced by (A.J.Goldman, 1969), was intended to locate the transportation center to minimize the total transport cost. Since then, the utilization of H&S network, particularly in container transportation, has grown significantly. About 30 percent of world container movement was trans-shipment container as the result of H&S shipping network in 2003 (Agarwal & Ergun, 2008). The economies of scale by deploying larger ship is the rational reason of the enormous portion of trans-shipment. Nowadays, the concept of trans-shipment has been extended. In practice, interliner or relay trans-shipment is carried out by shipping lines. Interliner or relay trans-shipment network is used to serve the container transport between main lines (Drewry, 2016).

3.1.4 Port Efficiency and Characteristic

According to (Clark, Dollar, & Micco, 2004), seaport efficiency is an important determinant factor of maritime transport cost other than distance, the degree of containerization, and variables that cannot be changed by the government. A reduction of shipping cost for about 12 percent could be gained by improving port efficiency from 25^{th} to 75^{th} percentiles. The seaport efficiency is not just the physical infrastructure issue, but also non-physical such as regulation. The sufficient regulation increases the efficiency while excessive regulation may be damaging. This result is based on the observation on more than 300,000 shipments of various products toward United States (US). The study also shows that terminal handling charge is increased due to inefficient port.

The other study which relates the maritime transport cost with the port aspect is as brought by Wilmsmeier et al. (2006). The decrease in the maritime transport cost can be achieved by the improvement of port infrastructure and participation of the private sector. As due to the higher competition between carriers, the inter-port connectivity also may contribute to lowering the transport cost. This study incorporates 75,928 observations among 16 Latin-American countries, on the containerized cargo in the year of 2002. The research also shows that port efficiency as the other significant factor in the international maritime transport cost as mentioned by Clark et al. (2004).

3.1.5 Distance and Time

The other factor that considered as a determinant of the transport cost is distance. Based on the study of (Zarzoso & Lehmann, 2007), distance is not a good proxy for transport cost for both maritime and road transport. Further, they found that efficiency and service quality are the most essential in maritime transport cost, while geographical distance is for road transport. The study was based on the Spanish exports to Turkey and Poland, where maritime and road transport modes are competing. The other research by Rietveld & Vickerman (2004) mentioned that distance is related to the transaction cost. Even though the transport performance getting better regarding money and time, nonetheless the economic activities still have relation with the distance. Transit time matters to transport cost and trade. An additional day of transit time reduces the trade by 1 percent (Djankov et al., 2006). “Time-sensitive” goods that are more affected due to the delays.

3.2 International Trade

International trade is the exchange of goods or services between parties in a country with a party of another country by agreement. Buying something that is required and selling something which is not needed in a country is the fundamental reason for the international trade. International trade is motivated by the development of specialization regarding needs and production activities. International trade has been a feature of economic growth since the Neolithic Revolution. Over time, the trade routes expanded as Roman Empire extended its trade network into Asia, and Africa (Helpman, 2012).

International trade expansion is affected by several things such as the technological development. This improvement influences many activities, including information, industry, and transportation. In general, technological changes are intended to increase efficiency, particularly in terms of cost. Developments in the technological aspect bring changes in transport cost and, consequently, affect international trade (Hummels, 2007).

3.2.1 International Trade Growth

International trade grew and expanded in terms of value and regions involved. The annual average of international trade's growth was about 5.9 percent in the period of 1950-2004 (WTO, 2005). Meanwhile, the international trade growth since 2005-2015 has been lower due to major global economic events, with an annual average of about 1 percent as can be seen in the picture below.

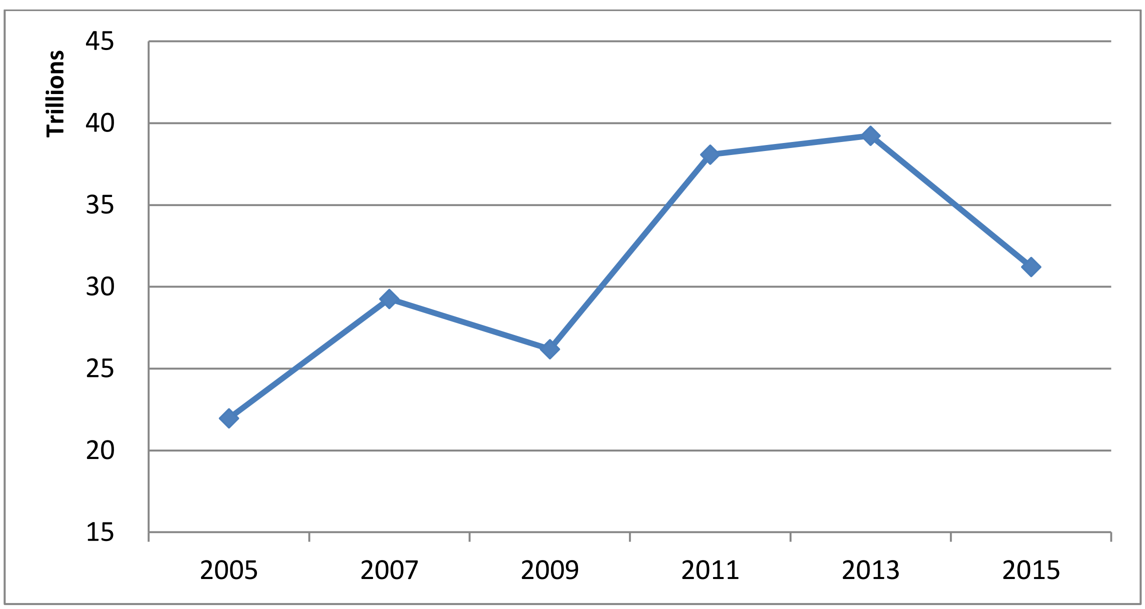

Figure 9 World Trade Value (US$)
Source: UN Comtrade

According to Krugman (1995), the economists and journalists have different opinions on the reasons for global trade growth. Economists believe that the liberation of bilateral trade and policy-led multi-lateral agreements are the drivers of trade growth. Meanwhile, journalists consider changes in technology and the decline of transport costs to be the reason. There are four possible reasons for trade growth (Feenstra, 1998). The first two reasons are reduced transport cost and trade liberalization. The third motive is that economies have merged in monetary size as suggested by David & James (1995). The fourth reason is increased outsourcing, whereby the production process has been spread out internationally due to specialisation, causing intermediate goods to be transported multiple times before the final process stage. The relation between international growth and the decline in transport cost via econometric evidence is also mentioned by Estevadeoral, et al. (2003). A different view regarding the reason for trade growth, by Helpman (1987), concluded that the change of a country's size by time may contribute to the country's income. The other important reason, as mentioned by Baier and Bergstrand (2007), is free trade agreements. The econometrical method (gravity equation) is used to estimate the effects of the FTA on international trade growth. The results show that an FTA's effect on trade growth is quintupled.

3.2.2 International Trade Barriers

The international trade brings a concern to the governments regarding their domestic industries. To protect the domestic producers due to the presence of the similar product as the result of the international trade, some countries apply two kinds of policies, namely Tariff Measures and Non-Tariff Measures (NTM)[8]. There are many things classified as NTM. Based on the UNCTAD classification, there are sixteen main heading of the NTM where technical measures are on of it. The technical measures comprise pre-shipment inspection, special custom regulation and other measures (Heydon & Woolcock, 2012).

The application of the trade barriers raises a disadvantage on the side of exporters as it made the trade more complicated and got interfered with normal supply and demand (Cekrezi, 2012). The difficulty on the exporters due to the technical barrier to trade is also emphasized by the study of (Averbeck & Skorobogatova, 2010). The result came based on the survey in 30 countries which aimed to understand the impact of non-tariff measures and technical regulations.

3.2.3 Transport Cost Effect on International Trade

As found by Feenstra (1998), international trade is also affected by the transport cost. Maritime transport cost is estimated at 6 percent of total goods value (Korinek & Sourdin, 2009). Meanwhile, since technological advances have brought changes to the shipping industry, such as containerization and degree of automatization, transport costs have varied between hub and feeder transport (OECD, 2008).

According to Korinek & Sourdin (2009), maritime transport costs have a big effect on international trade. With other things being equal, the change of 10 percent in maritime

[8] Non-Tariff Measures are defined as policy measures other than customs tariffs that can potentially have an economic effect on the change of quantities, price, or both within the international trade (UNCTAD).

transport cost causes changes of about 6 percent in trade value. Likewise, Hummels (2007) highlighted that the rapid growth in trade is explained by the decline in transport cost. Technological changes led to essential reform in shipping costs. Meanwhile, by using an empirical method, Baier et al. (2007) suggested that income growth is 8 percent due to the transport cost decline.

Chapter 4 Research Methodology

To addresss the research question in this thesis, it is necessary to understand the current conditions of international container shipping networks in Indonesia. Thus, it is also important to know how Indonesia-related containers are transported from/to other regions around the world, thus, creating a design of the connectivity of Indonesian ports with other regions with better linkage/ future condition. Furthermore, by using the GC model, we can calculate the transport costs for both networks' qualities.

4.1. Generalized Cost (GC) Model

The GC model is an econometric model used to calculate transport costs. This model fits into this study as it includes not only monetary costs, but also non-monetary costs into the calculation. Such non-monetary costs include the required transit time from the port of origin to the port of destination.

4.1.1 GC Model Introduction

The GC model is an econometric model which is capable of calculating the whole of transport cost, from the point of origin to the final destination. It covers the cost of all supply chain sections, namely the hinterland transport cost at the original point and the destination point, port-related cost, and ocean transportation cost (maritime leg). It concerns all the costs of all the actors involved in the chain. The GC is the sum of the freight cost and the opportunity cost. The opportunity cost is based on the transportation time and the value of time (E. Van Hassel, 2016).

GC model has been used in some research which related to the transportation activity. The parameters used in each research are based on the study's objectives and purpose. Kronbak and Cullinane (2011), in a study of the visual representation of different port hinterlands, took a part of the maritime leg and the port process into account. However, the study still simplified the chain elements. The cost difference between ports was not (yet) taken into consideration, and just applied the road haulage cost to the hinterland leg. Other research which used the GC model includes the assessment of the transportation cost of three inland transportation modes (Grosso, 2011). The study analysed the transportation costs of the port hinterland in the Antwerp-Genoa corridor. Within this study, all modes of inland transportation—road, rail, and inland waterway transport—and the intermodal cost were taken into account. The out-of-pocket costs for each inland transport were determined. Another reference was made by Blauwens et al. (2012), wherein the cost related to the distance and the transport time were calculated regarding the hinterland transport cost for each mode.

4.1.2 GC Formula

As mentioned before, the GC model takes into account the monetary cost and the non-monetary cost such as the value of time. In general, the GC model is described by the equation below (Grey, 1978):

$$GC = \sum_{1}^{m} m_i M_i + \sum_{1}^{t} t_i T_i \quad (1)$$

M_i = various components actual money costs of the voyage such as freight costs and fuel costs
T_i = various components of time

Each monetary and non-monetary cost consists of two group cost, namely maritime leg cost and port leg cost. Maritime leg cost is the cost incurred due to the operation of the ship and the service delivered to the ship. Meanwhile, the port leg cost is the cost due to the service provided directly into the container.

GC model used in the section of maritime leg is by the concept constructed by Van Hassel et al. (2016). The formula is as follow:

$$GC_m = \frac{OC_j + VC_j + CapC_j}{N_{TEU}} + \sum_{o}^{i} VoT.T_m \quad (2)$$

$$GC_m = \frac{\left[CC_j + IC_j + RM_j + AdmC\right] + \left[(FC_j + LUB_j).\frac{Dist_k}{V_j} + CD_j + PD_{ij}\right] + \left[CapC_j.\frac{T_k}{365}\right]}{N_{TEU}} + \sum_{1}^{m} VoT.T_m \quad (3)$$

Where:

GC_m	: GC of maritime leg	FC_j	: Fuel cost
OC_j	: Operational cost ship j	LUB_j	: Lubricant cost
VC_j	: Coyage cost ship j	$Dist_k$	: Total sailing distance (nm)
$CapC_j$	: Capital cost	V_j	: Speed of ship
VoT	: Value of Time	CD_j	: Canal Dues
T_m	: Total maritime time of O-D (Origin to Destination)	PD_{ij}	: Port Dues (Port of Origin, transhipment, and Destination)
CC_j	: Crew cost ship j	$CapC_j$	: Capital cost
RM_j	: Repair and Maintenance cost	T_k	: Total time in route k (days)
N_{TEU}	: Number of transported containers	$AdmC$	: Administration Cost

Meanwhile, GC formula for the port section is derived from the approach of Fahmiasari (2016). GC formula in the port section consists of three kinds of cost namely pilotage service charge, towing service charge, and container handling charge. The GC formula is as follow:

$$GC_p = \frac{PIL_{ij} + TOW_{ij} + CH_{ij}}{N_{TEU}} + \sum_{1}^{p} VoT.T_p \qquad (4)$$

Where:

GC_p	: GC of port leg	TOW_{ij}	: Towing service charge ship j
PIL_{ij}	: Pilot service charge (Port of Origin, Transhipment, and Destination)	CH_{ij}	: Container handling cost in port (Port of Origin, Transhipment, and Destination)
VoT	: Value of Time	T_p	: Total spent time in port (Port of Origin, Transhipment, and Destination)
N_{TEU}	: Number of transported containers		

4.2. Economies of Ship Size Model

Different ship size causes different total ship operating costs. For instance, the bigger ship needs bigger engine capacity, and bigger engine capacity consumes more fuel than the smaller engine. Likewise, the ship size, in term of the length, affects the loading and unloading activity in the terminal. The right ship size selection brings the economies of ship size as it provides efficiency (Veldman, 2011). The possibility to deploy more cranes on the longer vessel is higher than the shorter vessel, even though another factor such as the stowage plan contributes as well. The more the cranes deployed, the faster the loading and unloading activities carried out.

The calculation of the price, design speed, engine capacity, and the container handling speed uses regression analysis method. The regression analysis is based on the container ship data WSE (2008). Since the ship size in the model is varying from 3,000 Teu until 21,000 Teu, thus we classify the ship into two groups namely up to Panamax and Post Panamax. Up to Panamax range from 3,000 Teu up to 5,000 Teu, and post Panamax range from 6,000 Teu up to 21,000 Teu. The different ship size classification uses different elasticity in the regression analysis.

4.2.1 Price of container ship

As adopted from Veldman (2011), the relation of ship size with the production cost and operational performance can be seen below.

$$P = \alpha_0 S^{\alpha_1} V^{\alpha_2} \qquad (5)$$

Where P is the price of the ship; S is the ship size in Teu; V is the design speed in knots/hour. The notation of α_1 and α_2 is the elasticity of the ship size and the design speed. For the ship size of the “up to panamax”, α_1 is 0.677; α_2 is 0.249. Meanwhile for the ship size of the “post panamax”, α_1 is 0.733.

Table 6 Statistical test result of container ship price as a function of ship size and speed

Dependent Variable	Ln (dwt)		Ln (speed)		Sample Description	Degree of Freedom	r-square
	α_1	t-value	α_2	t-value			
Ln (Price)	0.726	42.0	0.235	2.6	All ships	1364	0.895
Ln (Price)	0.677	29.8	0.249	2.3	Up to Panamax	1014	0.811
Ln (Price)	0.745	26.3	-0.290	-1.4	Post Panamax	349	0.910
Ln (Price)	0.766	92.4	Not Included		All ships	1364	0.895
Ln (Price)	0.721	59.1	Not Included		Up to Panamax	1014	0.810
Ln (Price)	0.733	27.2	Not Included		Post Panamax	349	0.909

Source: Veldman (2011).

4.2.2 *Design speed of container ship*

In general, there is a relation between the ship speed and ship size. To reduce the voyage time, the bigger ship needs to travel faster. By reducing the voyage time, the ship is way more productive as it may have more service frequency. The relationship between ship size and ship speed is as below

$$V = \beta_0 S^{\beta_1} \quad (6)$$

The notation of β_1 is the elasticity of the ship size. For the ship size of the “up to panamax”, β_1 is 0.174. Meanwhile for the ship size of the “post panamax”, β_1 is 0.029.

Table 7 Statistical test result of design speed as a function of ship size

Dependent Variable	Ln (dwt)		Sample Description	Degree of Freedom	r-square
	β_1	t-value			
Ln (Price)	0.167	67.2	All ships	1,364	0.768
Ln (Price)	0.174	45.4	Up to Panamax	1,014	0.670
Ln (Price)	0.029	4.9	Post Panamax	349	0.061

Source: Veldman (2011).

4.2.3 *Engine capacity*

Fuel consumption is related to the engine size. To get a certain design speed, a ship with a certain size needs to install an engine with sufficient capacity. Thus, we can see that the engine capacity as the function of ship size and speed design. The relationship between engine capacity with the ship size and ship speed is as below:

$$kW = \gamma_0 S^{\gamma_1} V^{y_2} \quad (7)$$

The notation of kW is the engine capacity of kW. Meanwhile, the notation of γ_1 is the elasticity of the ship size and γ_2 is the elasticity of the ship speed. For the ship size of the "up to panamax", γ_1 is 2.008; γ_2 is 0.586. Meanwhile for the ship size of the "post panamax", γ_1 is 2.963.

Main engine fuel consumption is 170 gram/kW/ hour while the main engine power is 80 percent. The fuel price is based on the price of IFO 380 in 2016, which is $ 232.76/ ton. Auxiliary engine consumption and lubricant costs are 5 percent and 2 percent respectively of the main engine consumption.

Table 8 Statistical test result of engine capacity as a function of ship size and speed

Dependent Variable	Ln (dwt)		Ln (speed)		Sample Description	Degree of Freedom	r-square
	γ_1	t-value	γ_2	t-value			
Ln (Price)	0.607	42.6	2.215	29.7	All ships	1,330	0.941
Ln (Price)	0.586	33.4	2.008	24.3	Up to Panamax	994	0.902
Ln (Price)	0.417	16.3	2.963	12.8	Post Panamax	335	0.624

Source: Veldman (2011).

4.2.4 *Container handling speed*

The total transit time of a container ship is the sum up of transit time in the maritime leg and the time spent in port. As design speed is one of the determinant factors of transit time in the maritime leg, the container handling speed is one of the determinant factors of time spent in port. The container handling speed depends on the number of cranes deployed and crane productivity. The container handling speed is expressed as below:

$$H = \varepsilon_0 S^{\varepsilon_1} \quad (8)$$

The notation of H is the number of cranes deployed. The notation of ε_1 is the elasticity of the ship size. Based on Veldman et al. (2016), the length of the ship is proportional to a power of one-third of its size. It implies that ε_1 is 0.333.

4.3. *Value of Time (VoT)*

One of the factors influencing the total transportation cost in the GC model is VoT. The value of time is interpreted as the relevant resources such as employment, capital, and storage involved in transportation time as well as the impact of a longer transport time that results in lost opportunities (Verhaeghe et al., 2016). VoT is a non-monetary cost which is converted into monetary value.

In the beginning, we have three different alternatives by which to calculate the VoT. The first is using the approach as created by Shuaian et al. (2015), where the VoT is calculated based on the cost of the ship sailing time of nine trans-Pacific services by OOCL, and five services by Maersk Line. We did not use this approach as it just considers the costs experienced by the ship. The second is the approach by Van Diepen (2011) which is based on the aggregate value of various commodities. As we could not find the exact commodity and the proportion of each commodity within Indonesia's international trade, we did not use this approach. The third approach is by considering the willingness of the cargo owners to pay a certain amount of money in relation to freight cost and transit time. This method is based on a study of Feo et al. (2011). Concerning time constraints, we did not proceed with this methodology.

Thus, we use a straightforward way to calculate the VoT, which is based on the value per Teu container. We assume that the value per Teu container traded between Indonesia and other countries is about $100,000[9], with an interest rate of 10 percent. Thus, by dividing proportionally for the whole of the year, we get the VoT is $ 27.4/ Teu/ day.

4.4. *Methodology Approach*

As this thesis aims to assess the cost impact due to the poor linkage of Indonesian port to international shipping networks, we thus establish two different loop service models that connect an Indonesian port with other regions. The regions in the calculation are East Asia (EA), Middle East (MA), Oceania, Europe, North America (NA), and South America (SA). The difference in the transport costs for Indonesia-related containers from/ to other regions in these two shipping networks is the cost impact due to the poor linkage of Indonesian ports with international shipping networks. The year serving as the basis for this thesis is 2016.

4.4.1 *The model of loop service*

The loop service models used is a model with a poor connectivity and a model with better connectivity. The poor linkage represents the current condition, whereby the transportation of Indonesian containers related to some particular regions is carried out via trans-shipment before arriving in the port of destination. Meanwhile, the better connectivity is perceived as a condition whereby the Indonesian port has a direct call to all other regions. It means that the Indonesian port is included in the loop service. We

[9] Based on discussion with Prof. Veldman

also name this as a future condition: when all the maritime projects planned by the Indonesian government are realised.

As in the current condition, a direct call service has been available in the service route of Indonesia with the regions of East Asia and Oceania. Thus, we apply the loop service model 2 to calculate the transport costs for both current conditions and future conditions. The difference between the current and the future conditions for both service routes is the efficiency in the Indonesian port. In the future condition, the container-handling speed and dwelling time in the Indonesian port is assumed to be similar to another international container terminal.

In the first model, the ship in the trade route to Asia that has a call in Singapore port (ship A) with other regions is different than the ship deployed to serve the transport from Singapore to Indonesia (ship B). However, in the second model, the ship in the trade route of other regions with Asia that has a call in Singapore port is also the ship that goes to an Indonesian port.

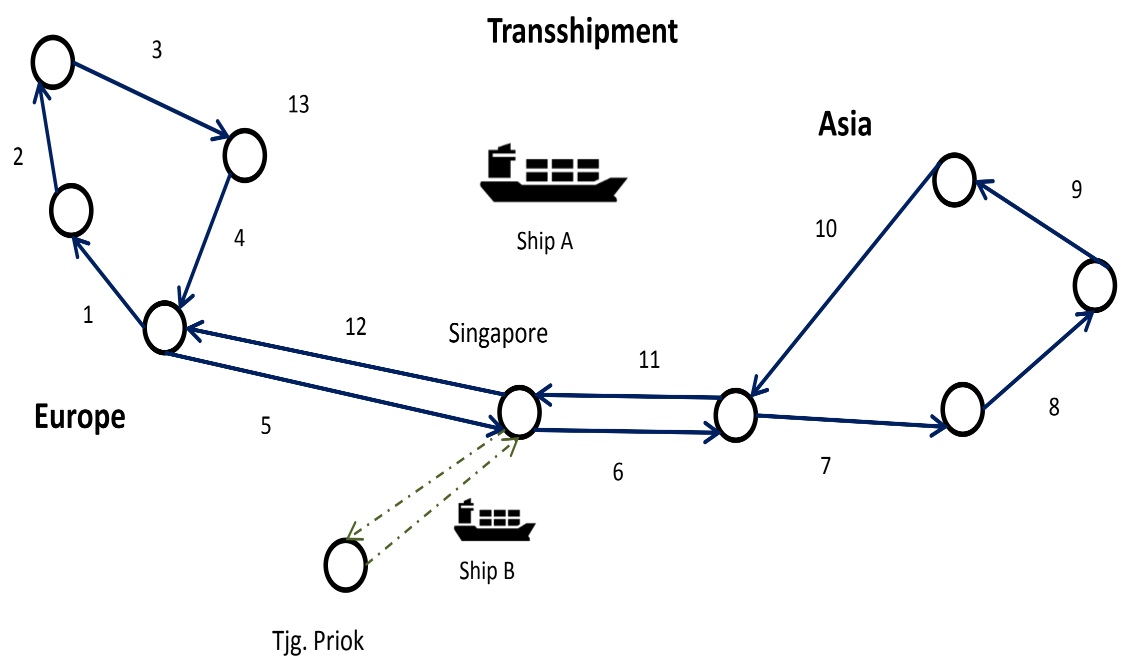

Figure 10 Loop service Model 1 (poor linkage of Indonesian port with other regions)
Source: Own elaboration

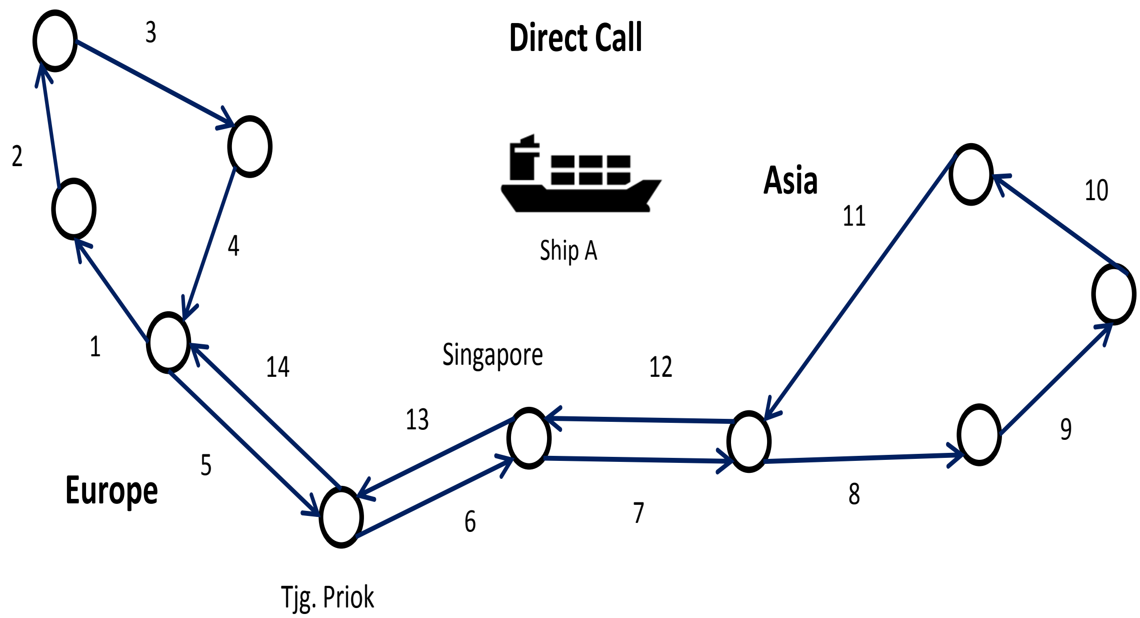

Figure 11 Loop service Model 2 (better linkage of Indonesian port with other regions)
Source: Author elaboration

4.4.2 Indonesian port in the loop service and the trans-shipment port

In this model, we chose the Port of Tanjung Priok as the port that represents the Indonesian port. The high share of the Port of Tanjung Priok in the total Indonesian ports throughput, which is about more than 60 percent (as we can see in chapter 2), and the designation as an Indonesia international hub port by the Indonesian government are our main reasons behind it. Meanwhile, we choose the Singapore port as the trans-shipment point as most container shipping lines designate the Singapore port as their trans-shipment point (Table 5).

4.4.3 Maritime Leg Time

Total maritime leg time is based on the total ship round-trip time. It comprises the time at sea and time in port. Time at sea is calculated based on the assumption of the average sailing speed of 80 percent of the ship design speed. Time in port consists of two items: fix time and variable time. Fix time is about six hours and is similar for each port. Variable time is the time needed for unloading and loading activities. The variable time depends on the container-handling speed per crane and the average number of cranes per ship.

In the first model, we assume that the container-handling speed between all other ports with the Port of Tanjung Priok is different. While all the other ports have a container-handling speed at 30 moves per hour per crane, it is just 25 moves per hour per crane for the Port of Tanjung Priok. However, in model 2, we apply a similar handling speed for the Port of Tanjung Priok (30m/hr/crane). The increasing in handling speed is due to the investment in the port sector by the Indonesian government. The spare time is the available time for the ship to adjust its service frequency on the basis of weekly service.

In the first model, the one-way transit time from other regions to the Singapore port is assumed take half of its total round-trip time of the service route. A similar approach is also used in the second model to calculate one-way transit time from other regions to the Port of Tanjung Priok.

4.4.4 Port Leg Time

The port leg time is calculated based on the time that a container stays in the port. In the first model, port leg time consists of three parts namely the time in the port of origin, trans-shipment, and destination. Meanwhile in the second model, as the Port of Tanjung Priok is included in the loop service, the port leg time in the trans-shipment port is eliminated. In the first model, we assume that each port in the loop service has similar port leg time which is two days, except for Port of Tanjung Priok. Port leg time in Port of Tanjung Priok is 3.5 days which based on the average dwelling time in JICT on 2016. Then in the second model, the port leg time in Port of Tanjung Priok is similar with other ports in the loop service, becomes two days, as the result of investment in the port sector by the Indonesian government. The port leg time in the trans-shipment port (Singapore port), is about 2.5 days. It is based on the trans-shipment service by a shipping line, Maersk Line.

4.4.5 Service charge delivered on the ship and the terminal handling charge

There are several services delivered to container ships, such as pilot service, towage services, mooring, and berthing services. Together with the port due, we apply a similar base charge on all of these services for all ports in the loop service. Due to the availability of the data, we use the service charge in the Port of Rotterdam as our base. However, since there is a quite significant difference in terminal handling rates in some terminals, such as in the Port of Rotterdam which is about $230 per Teu and is about $170 per Teu in Port of Singapore; thus, we considered taking the average of this handling charge in our model. Then, we applied a handling rate as $200 per Teu in the calculation.

4.4.6 Ship Size, number of port call, call size, and round trip distance

In the beginning, for the model 1, we used a single ship size that serves the container transport from other regions to Asia where Singapore port is included in the service route, and the ship size of 4,000 Teu to serve the container transport from Singapore port to Port of Tanjung Priok. The ship size that serves the transport from other regions to Indonesia was based on the average ship size in the trade route that we got from Drewry report.

Then we revised our approach to the determination of ship size. We calculated the transport cost for all ship sizes available in the market. For instance, in the trade route from Europe to Asia (Singapore port), the ship size ranges from 6,000 Teu up to 21,000 Teu. As the result of the calculation of the cost impact due to poor linkage of Indonesian ports with other regions, we take the result of the average ship size deployed in each trade route. Meanwhile, the ship size used in the trade route of Singapore and Indonesia is 3,000 Teu, matching the Indonesian domestic side.

In the first loop service model, the number of port call for each trade route is based on the average port calls that have Singapore port in the route services of the shipping line. Then, in the second model, we added another one-port call to accommodate Indonesian ports in the service.

The call size is calculated based on some assumptions. Load degree is assumed as 80 percent for head-haul and back-haul services, call size is equal in every port call, the laden ratio is 80 percent of the total container, and Teu ratio is 1.6.

The round-trip distance in the first model is based on the distance between the two main ports in each region within the service route. In the second model, where the Port of Tanjung Priok is in the loop service, we added another 1,000 nm to the round-trip distance in the first model. It is based on the distance of one-way travel from Singapore to Jakarta which is about 500 nm. The distance from port to port is generated from searates.com. Meanwhile, on the service route between Indonesia with the region of East Asia and Oceania, where the direct call is available in the current state, the round-trip distance is similar for the first and the second model.

4.4.7 Interest rate and term, repair & maintenance, and other costs

In the model, we assume that the container transport is served by new building container ship. The capital investment is 30 percent equity and 70 percent debt of the total new shipbuilding price. Even though the 30 percent comes from the equity, but we still include it together with the debt as a part of the capital cost. The interest rate is 10 percent per year similar to Cullinane & Khanna (2000), with ten years term.

The crew cost which consists of labor cost and crew supply is based on Moore Stephens (2013). It accounts for 33% of daily operation cost (which was about $ 2,480/day in 2013), we adjust by considering inflation to calculate the mentioned cost in 2016. Repair and maintenance cost is estimated at 3 percent per year; insurance cost takes 2 percent per year of the new ship building price. The management fee is 30 percent of the yearly operational cost.

4.4.8 Calculation of transport cost

Transportation cost of Indonesia-related containers from/ to the region of Middle East, Europe, North America, and South America is based on the service loop model 1 and model 2 as described in section 4.4.1. Transport cost of current condition (model 1/ trans-shipment) and future condition (model 2/ direct call) is the summation of the monetary cost (freight cost) and non-monetary cost (transit time times value of time). Freight cost and value of time are coming from both maritime leg and port leg. The

Maritime leg is whenever the container on the ship and port leg is whenever the container in the port.

The freight cost of the maritime leg is derived from the ship's round-trip cost. The ship's round-trip cost is the summation of ship cost while sailing at sea with the ship cost while berthing in port, and with the marine service costs (pilot fee, towage fee, canal due). The cost at sea consists of ship's operational cost (crew, maintenance, administration, and insurance) and the main engine fuel cost, while the cost in port comprises the ship's operational cost and the auxiliary engine fuel cost.

To get a container round-trip freight cost, the ship's round-trip cost is divided by the number of whole containers transported by taking into account the laden container ratio (80 percent). Container round-trip freight cost is divided by two to get a one-way freight cost. In model 1, this method is applied for both the service route of another region to Asia (Singapore port) and the service route of the Singapore port to an Indonesian port. The summation of a one-way freight cost of these two service routes is the total one-way freight cost of the maritime leg. Meanwhile, in model 2, it is directly from other regions (East Asia and Oceania) to Indonesian port.

One-way freight cost in the port leg is the summation of a terminal handling charge in the port of origin, port of trans-shipment (for model 1), and port of destination. The summation of the one-way freight cost of a maritime leg and one-way freight cost of the port leg is total one-way freight cost.

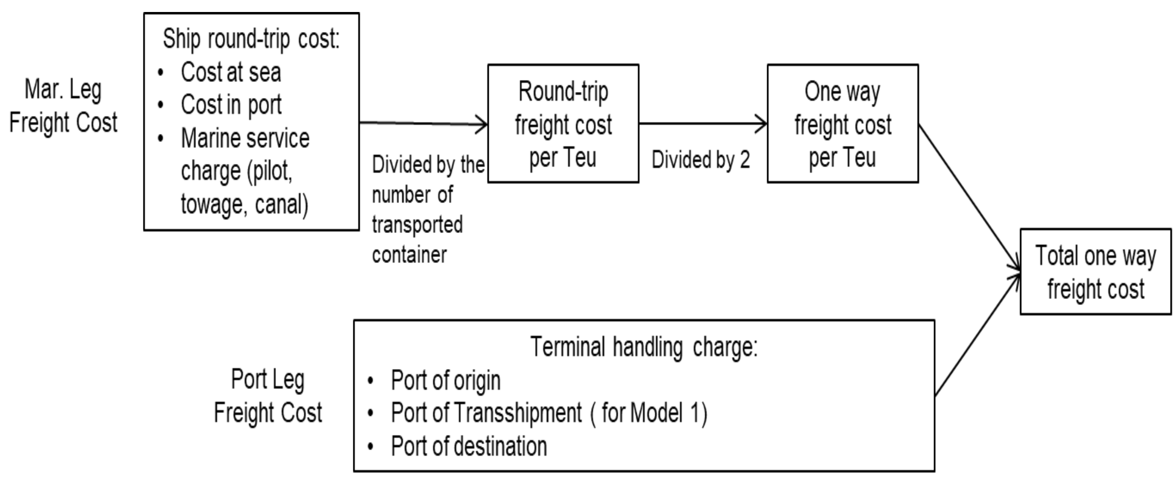

Figure 12 Freight cost chart
Source: Author elaboration

A quite similar approach is used in calculating transit time. The transit time of a maritime leg is derived from a ship's round-trip transit time. The ship's round-trip transit time is the summation of the time spent at sea with the time spent in port. The time spent at sea is obtained by dividing the round-trip distance with the average sailing speed (80 percent of design speed). The time spent in port is the accumulation of time for all port calls in the service route. Port call time consists of fix time (six hours per port call) and variable time which based on the time spent for container unloading and loading activity. Then, the ship's round-trip transit time is divided by two to get a one-way transit time. In model 1, this method is applied for both the service route of another region to Asia (Singapore port) and the service route of the Singapore port to an Indonesian port. The summation of one-way transit time of these two service routes is the total one-way transit time of the maritime leg.

The one-way transit time in the port leg is the summation of time that a container stays in the port of origin, port of trans-shipment (for model 1), and port of destination. The summation of one-way transit time of a maritime leg and one-way transit time of a port leg is the total one-way transit time.

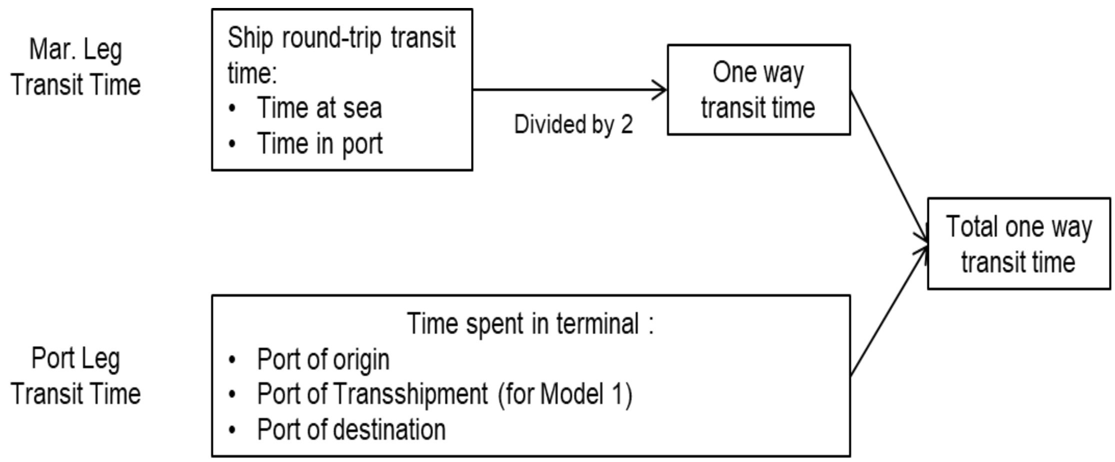

Figure 13 Transit time chart
Source: Author elaboration

One way transport cost is the summation of one-way freight cost with one way transit time being multiplied by the value of time.

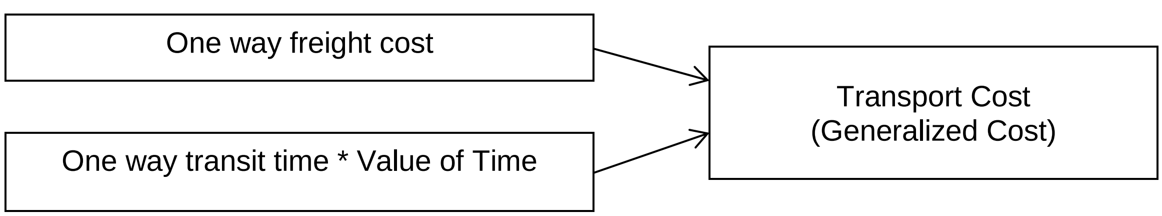

Figure 14 Transport cost chart

Source: Own elaboration

The change in transport cost is calculated by subtracting the generalized cost of model 1/ trans-shipment with the generalized cost of model 2/ trans-shipment.
We apply the model 2/ direct call in calculating the transport cost for Indonesia-related containers from/ to the region of East Asia and Oceania. The different between current conditions with the future condition is the port leg transit time. The time of a container stay in an Indonesian port becomes similar to the others' international container

terminal as the result of the port improvement. Th time of a container stays in port is about 3.5 days in the current condition and is assumed to be similar to others international port in the future state (2 days).

Chapter 5 Result and Data Analysis

Following the methodology and approach as explained in chapter 4, we carry out a regression analysis to calculate design speed, ship price, cost for running a container ship, engine power, and the number of cranes deployed per ship. We do this first since the output of the regression is used to calculate the transport cost of Indonesia-related containers from/ to other regions.

5.1 Result and data analysis of the regression calculation

In this thesis, we deal with two ship size classifications: 'panamax' and 'post-panamax'. Panamax size has a range of 2,000 Teu up to 5,000 Teu, and post-panamax size has a range of 6,000 up to 21,000 Teu. The price of ship, design speed, engine power, and the cranes per ship of all ships are calculated by using regression calculation.

There are two differences in the regression calculations for the two ship size classifications. Firstly, the different classifications of ship size use the different elasticity of ship size, design speed, and engine capacity. Secondly, both ship sizes with their elasticity and design speed with its elasticity is taken into the calculation of the ship price and engine capacity, while the regression calculation just takes the ship size and its elasticity for post panamax ship size. The figure of elasticity for each calculation is as described in chapter 4.2.1 until 4.2.4.

As there are two ship size classifications, we use two ships' data as references in the regression calculation. To represent the panamax ship size, a new building ship of 4,000 Teu, price at $ 35 million (Clarkson, 2017), design speed at 21 knots/hour, and engine capacity of 24,500 kW is used (Hapag-Lloyd, 2017). Meanwhile, for post panamax ship size, we use a newly built ship of 10,000 Teu, price at $ 95.5 million (Clarkson, 2017), design speed at 25 knots/ hour, engine capacity of 41,480 kW, and an average number of ship cranes is 4.9 cranes. The ship is operated for 350 days per year.

Table 9 Result of regression calculation

Size		Design Speed (knots/hr)	Price ($ mill)	Engine Power (kW)	Cranes per ship
dwt	Teu				
24,000	2,000	18.6	21.2	12.811	2.8
36,000	3,000	20.0	28.4	18.720	3.2
48,000	4,000	21.0	35.0	24.500	3.5
60,000	5,000	21.8	41.1	30.187	3.8
72,000	6,000	24.6	65.7	32.082	4.1
84,000	7,000	24.7	73.5	34.668	4.4
96,000	8,000	24.8	81.1	37,077	4.5
108,000	9,000	24.9	88.4	39,339	4.7
120,000	10,000	25.0	95.5	41,480	4.9

Size		Design Speed (knots/hr)	Price ($ mill)	Engine Power (kW)	Cranes per ship
dwt	Teu				
132,000	11,000	25.1	102.4	43,517	5.1
144,000	12,000	25.1	109.2	45,463	5.2
156,000	13,000	25.2	115.8	47,331	5.3
168,000	14,000	25.2	122.2	49,128	5.5
180,000	15,000	25.3	128.6	50,863	5.6
192,000	16,000	25.3	134.8	52,541	5.7
204,000	17,000	25.4	140.9	54,167	5.8
216,000	18,000	25.4	146.9	55,747	6.0
228,000	19,000	25.5	152.9	57,284	6.1
240,000	20,000	25.5	158.7	58,781	6.2
252,000	21,000	25.5	164.5	60,241	6.3

Source: Own calculation, adopted from Veldman (2011)

From the table above, we can see that the escalation of the ship's design speed of panamax ship size is higher than post panamax ship size. The increase of ship size by 1,000 Teu is followed by the escalation of ship design speed by around 1 knot/ hour in the panamax ship size, while it is just around 0.1 knot/ hour in the post panamax ship size.

A bigger ship needs bigger engine capacity. Thus, the fuel consumption of a bigger ship is higher than that of a smaller ship. From the table above, a 3,000 Teu ship needs a main engine with a capacity of 18,720 kW. On average, a ship of this size needs 6.24 kW/ Teu. Meanwhile, a 15,000 Teu ship needs a main engine with a capacity of 50,836 kW. On average, a ship on this size needs 3.39 kW/ Teu. The difference in the engine capacity required to transport per Teu container provides an advantage to the bigger ship in the field of fuel consumption. Lastly, the difference of the engine capacity per Teu contributes to the lower total transport cost per Teu for the bigger ship compared to the smaller ship.

More cranes can be deployed in the bigger ship compared to the smaller ship. Assuming the handling speed rate of all the cranes is similar, the container handling speed in terms of total moves per hour of a bigger ship is higher than a smaller container ship. Thus, within the same amount of call size, the time spent during container handling activity for a bigger ship is less than compared to a smaller ship. It provides an advantage as it causes shorter variable time in port for the larger ship.

The daily operating cost is derived from the price of the ship, crew ship, insurance, administration, repair & maintenance, and fuel costs. The table below shows the average of daily ship cost.

Table 10 Ship daily operational cost

Ship Size (Teu)	Cost ($ million)						Fuel cost per day
	Capital	Crew	Insurance	R&M	Adm.	Total/ day	
2,000	3.46	0.35	0.42	0.64	2.09	19,884	10,220
3,000	4.63	0.35	0.57	0.85	1.92	23,789	14,933
4,000	5.70	0.35	0.70	1.05	2.34	28,965	19,544
5,000	6.69	0.35	0.82	1.23	2.73	33,788	24,081
6,000	10.69	0.35	1.31	1.97	4.30	53,203	25,593
7,000	11.97	0.35	1.47	2.21	4.80	59,411	27,656
8,000	13.20	0.35	1.62	2.43	5.28	65,385	29,577
9,000	14.39	0.35	1.77	2.65	5.75	71,163	31,382
10,000	15.54	0.35	1.91	2.87	6.20	76,772	33,090
11,000	16.67	0.35	2.05	3.07	6.64	82,233	34,715
12,000	17.76	0.35	2.18	3.27	7.07	87,562	36,267
13,000	18.84	0.35	2.32	3.47	7.49	92,774	37,757
14,000	19.89	0.35	2.44	3.67	7.91	97,880	39,191
15,000	20.92	0.35	2.57	3.86	8.31	102,650	40,575
16,000	21.93	0.35	2.70	4.04	8.71	107,810	41,913
17,000	22.93	0.35	2.82	4.23	9.10	112,650	43,211
18,000	23.91	0.35	2.94	4.41	9.48	117,414	44,471
19,000	24.88	0.35	3.06	4.59	9.86	122,108	45,697
20,000	25.83	0.35	3.17	4.76	10.24	126,736	46,891
21,000	26.77	0.35	3.29	4.94	10.61	131,303	48,056

Source: Own calculation

5.2 Result and data analysis of transport cost from Indonesia to other regions

Following to the result of the regression, we calculated the transport cost of Indonesia-related containers from/ to other regions. The transport cost calculation uses the GC model, which is able to quantify time cost into monetary cost. As explained in chapter 4, two model of service loop are used in the calculation.

5.2.1 Transport cost of Indonesia-related containers from/ to the East Asia

In the current condition, the direct call of a service route from East Asia to an Indonesian port is available. The average ship size serving this service route is 4,000 Teu ship (Drewry, 2016). The dwelling time in the port of East Asia is 2 days, while it is 3.5 days in the Port of Tanjung Priok. Total port leg transit time is 5.5 days.

As described in chapter 4.4.4, the realisation of the Indonesian government's program in maritime sector can bring better management to the port sector. The dwelling time in the Port of Tanjung Priok decreased from 3.5 days to two days. Thus, the total port leg time of the service route from the regions of East Asia to Indonesia becomes four days. The handling speed in the Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of the Indonesian ports is assumed to cause shipping lines to deploy bigger ships to serve the service route; on average of 4,000 Teu becomes 5,000 Teu (increase by around 25 percent).

In the model, the round-trip distance is 6,400 nm, which is based on the distance from Port of Tokyo to the Port of Singapore. The number of the port call is 12 calls.

Table 11 Transport cost on the trade route of Indonesia with the region of East Asia

Ship Size (Teu)	Cost ($/Teu)		Freight Cost ($/ Teu)	Trans. Time (days)		Generalized Cost ($/ Teu)			
	Mar. leg	Port leg		Before Imp.	After Imp.	Before Imp.	After Imp.	Reduction	
								$/Teu	%
4,000	57	400	457	16.51	15.01	909	868	41	4.50
5,000	53	400	453	16.46	14.96	904	863	41	4.63
From 4,000 Teu to 5,000 Teu						909	863	46	5.05

Source: Own calculation

As we can see from the table above, before the improvement in the transport cost (generalised cost) of Indonesia-related containers from/ to the region of East Asia by a 4,000 Teu ship was $ 909/ Teu. After the improvement, the transport cost (generalised cost) of Indonesia-related containers from/ to the region of East Asia by a 5,000 Teu ship was $ 863/ Teu. The reduction of the transport cost was $ 46/ Teu which is equal to 5.05 percent.

The reduced transport cost comes from the decrease in freight cost and value of time/ transit time. The reduced freight cost is $ 4/ Teu or equal to 8.70 percent and the decrease of the value of time is $ 42/ Teu or equal to 91.30 percent. The decrease of freight cost is the impact of the deployment of a bigger ship to serve the service route, and the reduced of the value of time is gained from the decrease in dwelling time.

5.2.2 Transport cost of Indonesia-related containers from/ to the Oceania

In the current condition, the direct call of a service route from Oceania to an Indonesian port is available. The average ship size serving this service route is 4,000 Teu ship (Drewry, 2016). The dwelling time in the port of Oceania is 2 days, while it is 3.5 days in the Port of Tanjung Priok. Total port leg transit time is 5.5 days.

As described in chapter 4.4.4, the realization of Indonesian government program in maritime sector can bring better management to the port sector. The dwelling time in the Port of Tanjung Priok decreased from 3.5 days to 2 days. Thus, the total port leg time of the service route from the regions of Oceania to Indonesia becomes 4 days. The handling speed in Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of the Indonesian port is assumed to cause shipping lines to deploy a bigger ship to serve the service route; on average of 4,000 Teu becomes 5,000 Teu.

In the model, the round-trip distance is 8,800 nm, which is based on the distance from Port of Sydney in Australia to Port of Kelang in Malaysia. The number of the port call is eight calls.

Table 12 Transport cost on the trade route of Indonesia with the region of Oceania

Ship Size (Teu)	Cost ($/Teu)		Freight Cost ($/ Teu)	Trans. Time (days)		Generalized Cost ($/ Teu)			
	Mar. leg	Port leg		Before Imp.	After Imp.	Before Imp.	After Imp.	Reduction	
								$/Teu	%
4,000	66	400	466	18.99	17.49	986	945	41	4.16
5,000	62	400	462	18.82	17.32	978	937	41	4.19
From 4,000 Teu to 5,000 Teu						986	937	49	4.97

Source: Own calculation

As we can see from the table above, before the improvement in the transport cost (generalized cost) of Indonesia-related containers from/ to the region of Oceania by a 4,000 Teu ship is $ 986/ Teu. After the improvement, the transport cost (generalized cost) of Indonesia-related containers from/ to the region of Oceania by a 5,000 Teu ship is $ 937/ Teu. The reduction of the transport cost was $ 49/ Teu which is equal to 4.97 percent.

The reduced transport cost comes from the decrease in freight cost and value of time/ transit time. The reduced freight cost is $ 4/ Teu or equal to 8.16 percent and the decrease of the value of time is $ 45/ Teu or equal to 91.84 percent. The decrease of freight cost is the impact of the deployment of a bigger ship to serve the service route, and the reduced of the value of time is the result of the decrease in dwelling time.

5.2.3 Transport cost of Indonesia-related containers from/ to the Middle East

In the current condition (model 1), a direct call of a voyage service connecting an Indonesian port with the Middle East is not available yet. Thus, trans-shipment is needed. The dwelling time in a Middle East port is two days, wait time in a trans-shipment port (Port of Singapore) for next service is 2.5 days (based on the service of Maersk Line), and dwelling time in the Port of Tanjung Priok is 3.5 days. Total port leg time is eight days. The average ship size serving this service route (Middle East – Asia) is a 9,000 Teu ship (Drewry, 2016).

After the realization of Indonesian government program in maritime sector (model 2), better management and better port infrastructure results in better connectivity for Indonesian ports as described in chapter 4.4.4. Dwelling time in Port of Tanjung Priok goes down from 3.5 days to two days. A direct call which connects the Indonesian port with the region of Middle East is going to be available. Thus, trans-shipment is eliminated. As waiting time in trans-shipment port is eliminated, the port leg time is just the dwelling time in a Middle East port and Port of Tanjung Priok which is 2 days respectively. Total dwelling time thus becomes 4 days. The handling speed in Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of Indonesian port is assumed to trigger shipping lines deploy a bigger ship to serve the service route; from an average of 9,000 Teu becomes 11,000 Teu (increase by 20 percent).

In the first model, the round-trip distance is 12,000 nm, which is based on the distance between the Port of Jebel Ali in United Arab Emirate (UAE) and the Port of Pusan in South Korea. The number of the port call is ten. Meanwhile, in the second model, as the Port of Tanjung Priok is included in the loop service, the round-trip distance becomes 13,000 nm, with 11 port calls.

Table 13 Container transport cost; Indonesia - Middle East

Ship Size (Teu)	Trans-shipment		Direct Call		Value of Time ($/Teu/ day)	Generalized Cost ($/Teu)			
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Transs	Direct Call	Reduction	
								$/Teu	%
9,000	27.40	687	21.60	479	27.40	1,438	1,071	367	25.53
11,000	27.71	683	21.90	474	27.40	1,442	1,074	368	25.50
From 9,000 Teu to 11,000 Teu						1,438	1,074	364	25.3

Source: Own calculation

As we can see from the table above, the transport cost of Indonesia-related container from/ to the region of Middle East by a 9,000 Teu ship is $ 1,438/ Teu. After the improvement, the transport cost of 11,000 Teu ship for this service route becomes $ 1,074/ Teu. The reduction of the transport cost is $ 364/ Teu which is equal to 25.3 percent.

The reduction of transport cost is obtained from the decrease in both monetary cost (freight cost) and non-monetary cost (value of time/ transit time). The reduction in freight cost and transit time/ value of time comes from both maritime leg and port leg. In the maritime leg, less transit time cause less ship operational costs. In the port leg, the elimination of trans-shipment in the direct call causes the loss of terminal handling charge as well as the waiting time for the feeder service in the trans-shipment port.

Taking into consideration that the value of time is $ 27.4/ Teu/ day, freight cost contributes more than the value of time in the reduction of the transport cost, which is about 58.55 percent compared to 41.45 percent. Meanwhile, based on the location of the reduced transport cost, port leg contributes much more than the maritime leg, which is about 85.12 percent compared to 14.88 percent. Overall, the decrease in the freight cost of the port leg is the highest (54.99 percent). Then, the second is the reduced of the value of time/ transit time in the port leg (30.13 percent), followed by the value of time in the maritime leg (11.32 percent), and lastly the freight cost in maritime leg (3.56 percent) of the total reduced transport cost.

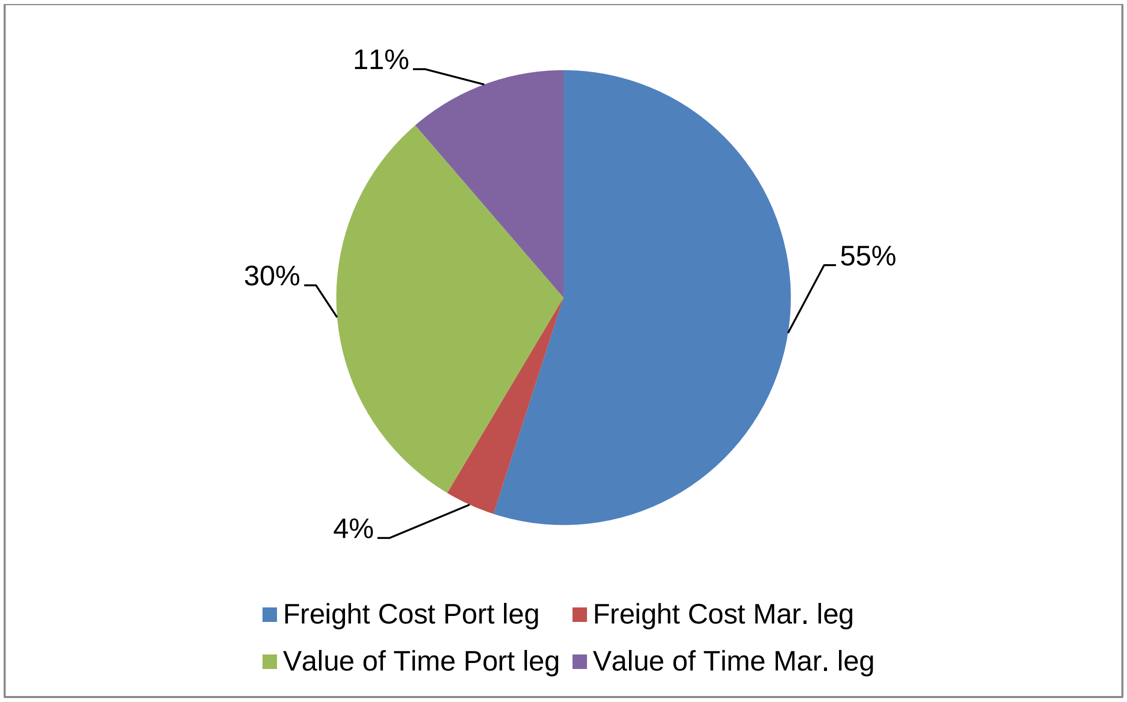

Figure 15 Breakdown of Indonesia - Middle East's reduced transport cost
Source: Own calculation

5.2.4 Transport cost of Indonesia-related containers from/ to the Europe

In the current condition (model 1), a direct call of a voyage service connecting an Indonesian port with the region of Europe is not available yet. Thus, trans-shipment is needed. The dwelling time in a Europe port is 2 days, waiting time in a trans-shipment port (Port of Singapore) for next service is 2.5 days (based on service of Maersk Line), and dwelling time in Port of Tanjung Priok is 3.5 days. Total port leg time is 8 days. The average ship size serving this service route (Europe – Asia) is a 15,000 Teu ship (Drewry, 2016).

After the realization of Indonesian government program in the maritime sector (model 2), better management and better port infrastructure results in better connectivity for Indonesian port as described in chapter 4.4.4. Dwelling time in the Port of Tanjung Priok goes down from 3.5 days to 2 days. A direct call which connects the Indonesian port with the region of Europe is going to be available. Thus, trans-shipment is eliminated. As waiting time in trans-shipment port is eliminated, the port leg time is just the dwelling time in a European port and the Port of Tanjung Priok which is 2 days respectively. Total dwelling time thus becomes 4 days. The handling speed in the Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of Indonesian port is assumed to trigger shipping lines to deploy a bigger ship to serve the service route; an average of 15,000 Teu becomes 18,000 Teu (increase by 20 percent).

In the first model, the round-trip distance is 22,000 nm, which is based on the distance between the Port of Rotterdam in The Netherlands and the Port of Pusan in South Korea. The number of the port call is 14. Meanwhile, in the second model, as the Port of Tanjung Priok is included in the loop service, the round-trip distance becomes 23,000 nm, with 15 port calls.

Table 14 Container transport cost; Indonesia - Europe

Ship Size (Teu)	Trans-shipment		Direct Call		Value of Time ($/Teu/ day)	Generalized Cost ($/Teu)			
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Transs	Direct Call	Reduction	
								$/Teu	%
15,000	39.09	719	33.27	510	27.40	1,790	1,421	369	20.59
18,000	39.45	714	33.62	504	27.40	1,794	1,425	369	20.57
From 15,000 Teu to 18,000 Teu						1,790	1,425	365	20.38

Source: Own calculation

As we can see from the table above, the transport cost of Indonesia-related containers from/ to the region of Europe by a 15,000 Teu ship is $ 1,790/ Teu. After the improvement, the transport cost of 18,000 Teu ship for this service route becomes $ 1,425/ Teu. The reduction of the transport cost is $ 365/ Teu which is equal to 20.38 percent.

The reduction of transport cost is obtained from the decrease in both monetary cost (freight cost) and non-monetary cost (value of time/ transit time). The reduction in freight cost and transit time/ value of time comes from both maritime leg and port leg. In the maritime leg, less transit time causes less ship operational costs. In the port leg, the elimination of trans-shipment in the direct call causes the loss of terminal handling charges as well as the waiting time for the feeder service in trans-shipment port.

Taking into consideration that the value of time is $ 27.4/ Teu/ day, freight cost contributes more than the value of time in the reduction of the transport cost, which is about 58.97 percent compared to 41.03 percent. Meanwhile, based on the location of the reduced transport cost, port leg contributes much more than the maritime leg: about 84.90 percent compared to 15.10 percent. Overall, the decrease in the freight cost of the port leg is the highest (54.85 percent). Then the second is the reduced value of time/ transit time in the port leg (30.05 percent), followed by the value of time in the maritime leg (10.98 percent), and lastly the freight cost in maritime leg (4.12 percent) of the total reduced transport cost.

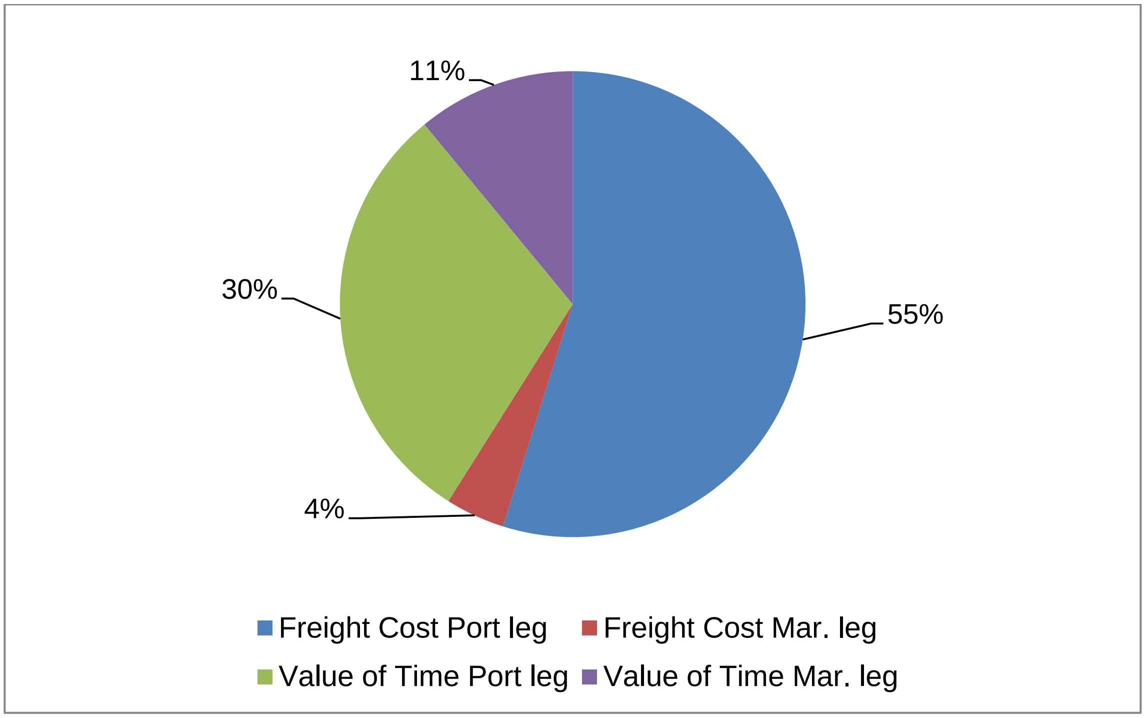

Figure 16 Breakdown of Indonesia - Europe's reduced transport cost
Source: Own calculation

5.2.5 Transport cost of Indonesia-related containers from/ to the North America

In the current condition (model 1), direct call of a voyage service connecting an Indonesian port with the region of North America is not available yet. Thus trans-shipment is needed. The dwelling time in a North America port is 2 days, waiting time in a trans-shipment port (Port of Singapore) for next service is 2.5 days (based on service of Maersk Line), and dwelling time in the Port of Tanjung Priok is 3.5 days. Total port leg time is 8 days. The average ship size serving this service route (North America – Asia) is 8,000 Teu ship (Drewry, 2016).

After the realization of the Indonesian government program in the maritime sector (model 2), better management and better port infrastructure results in better connectivity for Indonesian ports as described in chapter 4.4.4. Dwelling time in the Port of Tanjung Priok goes down from 3.5 days to 2 days. A direct call which connects Indonesian port with the region of North America is going to be available. Thus, trans-shipment is eliminated. As waiting time in trans-shipment port is eliminated, the port leg time is just the dwelling time in North America port and Port of Tanjung Priok which is 2 days respectively. Total dwelling time thus becomes 4 days. The handling speed in Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of Indonesian port is assumed to trigger shipping lines to deploy a bigger ship to serve the service route; an average of 8,000 Teu becomes 10,000 Teu (increase by around 20 percent).

In the first model, the round-trip distance is 15,000 nm, which is based on the distance between the Port of Los Angeles in the United States and the Port of Singapore. The number of the port call is 12. Meanwhile, in the second model, as the Port of Tanjung Priok is included in the loop service, the round-trip distance becomes 16,000 nm, with 13 port calls.

Table 15 Container transport cost; Indonesia - North America

Ship Size (Teu)	Trans-shipment		Direct Call		Value of Time ($/Teu/ day)	Generalized Cost ($/Teu)			
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Transs	Direct Call	Reduction	
								$/Teu	%
8,000	30.64	707	24.84	499	27.40	1,546	1,179	367	23.72
10,000	30.93	700	25.13	492	27.40	1,548	1,180	367	23.75
From 8,000 Teu to 10,000 Teu						1,546	1,180	366	23.67

Source: Author calculation

As we can see from the table above, the transport cost of Indonesia-related containers from/ to the region of North America by an 8,000 Teu ship is $ 1,546/ Teu. After the improvement, the transport cost of 10,000 Teu ship for this service route becomes $ 1,180/ Teu. The reduction of the transport cost is $ 366/ Teu which is equal to 23.67 percent.

The reduction of transport cost is obtained from the decrease in both monetary cost (freight cost) and non-monetary cost (value of time/ transit time). The reduction in freight cost and transit time/ value of time comes from both maritime leg and port leg. In the maritime leg, less transit time causes less ship operational costs. In the port leg, the elimination of trans-shipment in the direct call causes the loss of terminal handling charges as well as the waiting time for the feeder service in the trans-shipment port.

Taking into consideration that the value of time is $ 27.4/ Teu/ day, freight cost contributes more than the value of time in the reduction of the transport cost, which is about 58.73 percent compared to 41.27 percent. Meanwhile, based on the location of the reduced transport cost, port leg contributes much more than the maritime leg: about 84.58 percent compared to 15.42 percent. Overall, the decrease in the freight cost of the port leg is the highest (54.64 percent). Then the second is the reduced value of time/ transit time in the port leg (29.94 percent), followed by the value of time in the maritime leg (11.34 percent), and lastly the freight cost in maritime leg (4.09 percent) of the total reduced transport cost.

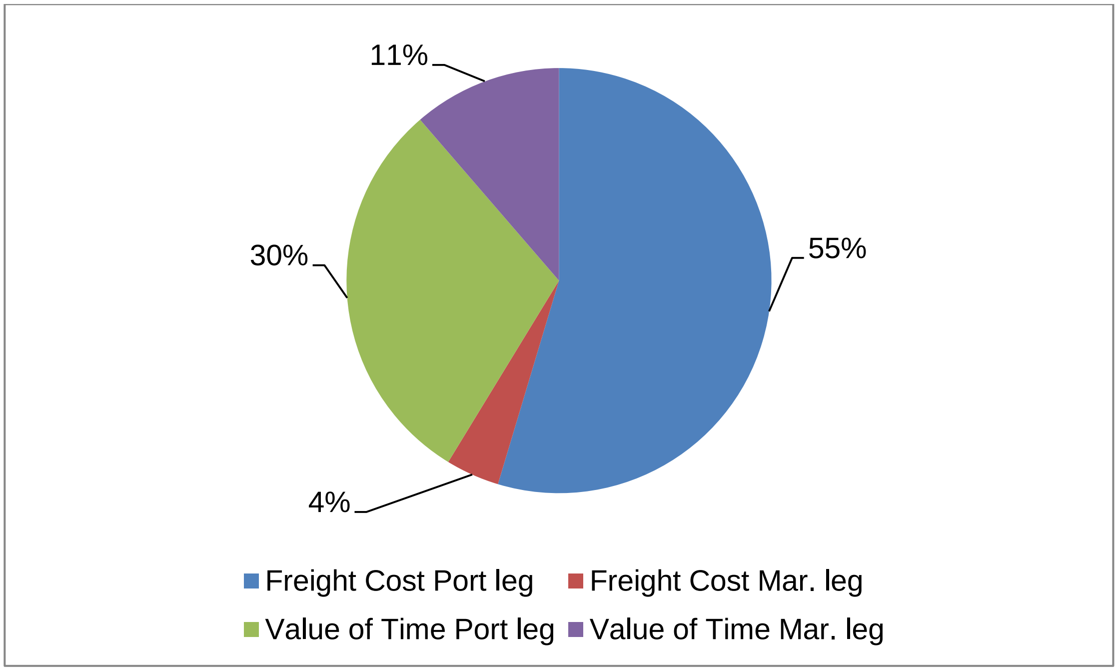

Figure 17 Breakdown of Indonesia - North America's reduced transport cost
Source: Own calculation

5.2.6 *Transport cost of Indonesia-related containers from/ to the South America*

In the current condition (model 1), a direct call of a voyage service connecting an Indonesian port with the region of South America is not available yet. Thus trans-shipment is needed. The dwelling time in a South America port is 2 days, waiting time in a trans-shipment port (Port of Singapore) for next service is 2.5 days (based on service of Maersk Line), and dwelling time in Port of Tanjung Priok is 3.5 days. Total port leg time is 8 days. The average ship size serving this service route (South America - Asia) is 7,000 Teu ship (Drewry, 2016).

After the realization of Indonesian government program in the maritime sector (model 2), better management and better port infrastructure results in better connectivity for Indonesian ports as described in chapter 4.4.4. Dwelling time in Port of Tanjung Priok goes down from 3.5 days to 2 days. A direct call which connects Indonesian port with the region of South America is going to be available. Thus, trans-shipment is eliminated. As waiting time in trans-shipment port is eliminated, the port leg time is just the dwelling time in South America port and Port of Tanjung Priok which is 2 days respectively. Total dwelling time becomes 4 days. The handling speed in Port of Tanjung Priok increases from 25 moves/ crane/ hour to 30 moves/ crane/ hour. The better management and infrastructure of Indonesian port is assumed to trigger shipping lines to deploy a bigger ship to serve the service route; from an average of 7,000 Teu becomes 9,000 Teu (increase by around 20 percent).

In the first model, the round-trip distance is 25,000 nm, which is based on the distance between the Port of Santos in Brazil and the Port of Tokyo in Japan. The number of the port call is sixteen. Meanwhile, in the second model, as the Port of Tanjung Priok is included in the loop service, the round-trip distance becomes 26,000 nm, with 17 port calls.

Table 16 Container transport cost; Indonesia - South America

Ship Size (Teu)	Trans-shipment		Direct Call		Value of Time ($/Teu/ day)	Generalized Cost ($/Teu)			
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Transs	Direct Call	Reduction	
								$/Teu	%
7,000	41.52	766	35.72	559	27.40	1,904	1,537	366	19.25
9,000	41.74	754	35.93	545	27.40	1,897	1,530	367	19.36
From 7,000 Teu to 9,000 Teu						1,904	1,530	374	19.64

Source: Own calculation

As we can see from the table above, the transport cost of Indonesia-related containers from/ to the region of North America by a 7,000 Teu ship is $ 1,537/ Teu. After the improvement, the transport cost of a 9,000 Teu ship for this service route becomes $ 1,530/ Teu. The reduction of the transport cost is $ 374/ Teu which is equal to 19.64 percent.

The reduction of transport cost is obtained from the decrease in both monetary cost (freight cost) and non-monetary cost (value of time/ transit time). The reduction in freight cost and transit time/ value of time comes from both maritime leg and port leg. In the maritime leg, less transit time causes less ship operational costs. In the port leg, the elimination of trans-shipment in the direct call causes the loss of terminal handling charges as well as the waiting time for the feeder service in the trans-shipment port.

Taking into consideration that the value of time is $ 27.4/ Teu/ day, freight cost contributes more than the value of time in the reduction of the transport cost, which is about 59.08 percent compared to 40.92 percent. Meanwhile, based on the location of the reduced transport cost, port leg contributes much more than the maritime leg: about 82.79 percent compared to 17.21 percent. Overall, the decrease in the freight cost of the port leg is the highest (59.08 percent). Then the second is the reduced value of time/ transit time in the port leg (29.31 percent), followed by the value of time in the maritime leg (11.61 percent), and lastly the freight cost in maritime leg (5.59 percent) of the total reduced transport cost.

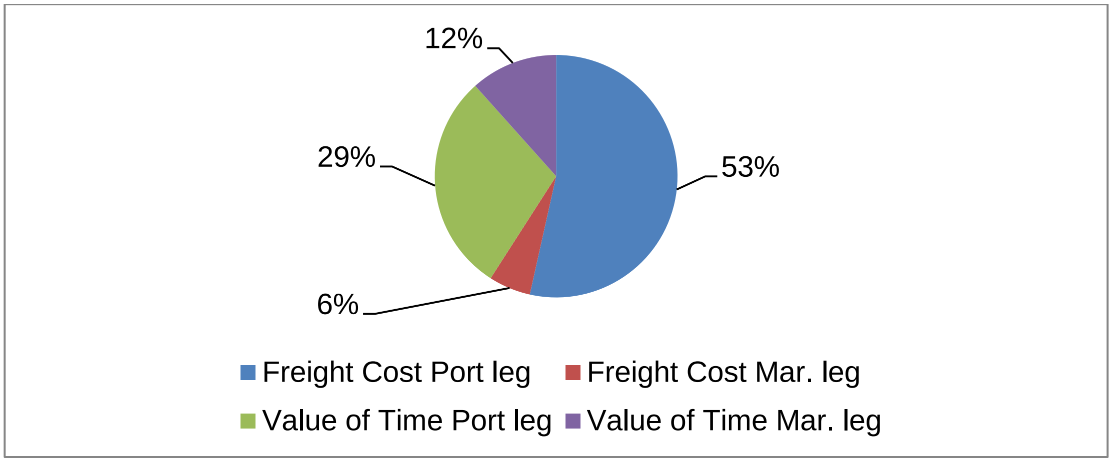

Figure 18 Breakdown of Indonesia - South America's reduced transport cost
Source: Own calculation

5.2.7 *Output for Joint Thesis Project*

As part of the joint thesis project, the output of this thesis is used as the reduced of the NTM in Indonesian trade. The figure that is going to be used by Wiragi in his research is the percentage of the reduced transport cost

Table 17 Summary of the reduction of transport cost; Indonesia with other regions

Regions	Trans-shipment		Direct Call		Value of Time ($/Teu/ days)	Generalized Cost ($/Teu)		Reduction	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Transs	Direct Call	$/Teu	%
M. East	27.40	687	21.90	474	27.40	1,438	1,074	364	25.29
Europe	39.09	719	33.62	504	27.40	1,790	1,425	365	20.37
N. America	30.64	707	25.13	492	27.40	1,546	1,180	366	23.67
S. America	41.52	766	35.93	545	27.40	1,904	1,530	374	19.64
Regions	Direct Call Before Improv.		Direct Call After Improv.		Value of Time ($/Teu/ days)	Generalized Cost ($/Teu)		Reduction	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)	Freight Cost ($/Teu)		Before Improv.	After Improv.	$/Teu	%
East Asia	16.51	457	14.96	453	27.40	909	863	46	5.04
Oceania	18.99	466	17.32	462	27.40	986	937	49	4.97

Source: Author calculation

Chapter 6 Conclusion

This chapter serves to summarize the conclusion based on the findings of the reduced transport cost the Indonesia-related containers' transport cost from/ to other regions. In addition, we also add the shortcoming of the approach used in the model. It can be considered as a suggestion for further research

6.1 Summary

The connectivity of Indonesian port with other regions is not quite good in the current condition. Direct call of container shipping line to Indonesian port is just available from the regions of East Asia and Oceania. Meanwhile, trans-shipment should be carried out when it deals with the regions of Middle East, Europe, North America, and South America. The inadequate port infrastructure, superstructure, and port performance are the reasons of the unavailability of a direct call to those regions. As the deepest port's draught in Indonesia is just 14 meters, thus the biggest ship may have a direct call to Indonesian port is a 5,000 Teu. It is suitable for the ship size in the trade route of Intra Asia and South East Asia – Oceania, where shipping lines deploy an average 4,000 Teu ship. Meanwhile, for further trade routes such as Asia - Middle East, Asia – Europe, Asia – North America, and Asia – South America, where shipping lines tend to deploy bigger container ship (8,000 Teu to 21,000 Teu), the current Indonesian port's infrastructure is not capable of serving those ships. Thus, trans-shipment is carried out for Indonesia-related containers from/ to these regions. The trans-shipment is mostly done in Singapore port. The Smaller ship is deployed to serve the container transport from Singapore port to Indonesian port. The trans-shipment activity causes a higher transport cost for Indonesia-related containers and constitutes a higher NTM for Indonesia in the international trade.

In the future, Indonesian port is perceived has a better infrastructure, superstructure, port performance, and a decreased of dwelling time. It is as the result of the realization of some major projects of the Indonesian government in the maritime sector. This condition allows big ship makes a direct call to an Indonesian port. Thus, a direct call can be made from all other regions to an Indonesian port.

Better port sector management and the availability of direct call to Indonesian port will bring the decreased of transport cost from Indonesia to other regions. The transport cost consists of monetary (freight cost) and non-monetary cost. Both monetary cost (freight cost) and non-monetary cost (value of time) contribute to the transport cost reduction. The disappearance of terminal handling charge and the transit time while waiting for the next ship in the trans-shipment port are the biggest contributors.

The reduced transport cost varies between the trade routes (regions) in term of percentage, while it is almost similar in term of the amount of money. In the trade route where direct call in not available yet, the highest reduced transport cost in term of percentage is the transport cost from/ to Middle East (25.29 percent), N. America (23.67 percent), Europe (20.37 percent), and South America (19.64 percent). In terms of the amount of money, the reduction of transport cost is $ 364/ Teu to the region of Middle

East, is $ 365/ Teu to the region of Europe, is $366/ Teu to the region of North America, and is $ 374/ Teu to the region of South America. The closer the trade route, the higher the percentage reduction of the transport cost.

Meanwhile, for the region of East Asia and Oceania where the direct call to Indonesian port is available in the current condition, the reduced transport cost is less than the reduced transport cost for other regions. It is just 5.04 percent and 4.97 percent for these two regions respectively. It is not as significant as the other regions, as the trans-shipment cost is not available in the current condition.

The reduced transport cost provides benefit for both Indonesia and its trading partners. Combined with the reduced transport cost in Indonesia domestically, as the result of the study from Triantoro (2017), the result provides the new NTM for Indonesia in international trade. As a part of Indonesia joint research project, the result of this study is used by Serena (2017) and Wiragi (2017) to analyze its impact on Indonesia's international trade.

6.2 Suggestions for Further Research

Due to some restrictions, such as time and data limitation, we use a straightforward approach in determining the value of time of the containerized goods transported. As the value of time of the cargoes transported via container affects the generalized transport cost directly, the other approach to determine the value of time can be considered in the other study. One of the alternatives is by considering the willingness of the cargo owners to pay in the relation of the freight cost and the transit time can be considered.

The better Indonesian port infrastructure and management bring lower transport cost of Indonesia-related containers. As the impact of the reduced transport cost for Indonesia-related containers is already as a part of this joint research project, it is necessary to have another study which is about the required investment for Indonesia maritime sector. This study will complete the Indonesia joint research project, as it will provide the required cost and the advantage produced.

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Appendixes

I. Table calculation of Indonesia – East Asia's transport cost

Port Leg; One way									Total; One Way			Value of Time ($/ day/ Teu)	Generalized Cost			
Transit Time (days)						Freight Cost ($/Teu)			Transit Time (days)		Freight Cost ($/Teu)					
Before Improvement			After Improvement			Before and After Improvement			Before Improv.	After Improv.	Before & After Improv.		Before Improv.	After Improv.	Reduction	
Origin	Dest.	Total	Origin	Dest.	Total	Origin	Dest.	Total							$/Teu	%
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.64	15.14	462	27.4	919	877	41	4.47
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.51	15.01	457	27.4	909	868	41	4.52
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.46	14.96	453	27.4	904	863	41	4.54
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	15.78	14.28	455	27.4	888	847	41	4.63
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	15.97	14.47	453	27.4	890	849	41	4.62
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.15	14.65	451	27.4	893	852	41	4.60
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.33	14.83	449	27.4	897	855	41	4.58
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.50	15.00	448	27.4	900	859	41	4.57
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.67	15.17	447	27.4	903	862	41	4.55
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.83	15.33	446	27.4	907	866	41	4.53
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	16.99	15.49	445	27.4	910	869	41	4.51
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	17.15	15.65	444	27.4	914	873	41	4.50
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	17.30	15.80	444	27.4	918	877	41	4.48

Ship Size (teu)	No. of Cont. handled		Maritime Leg												
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost ($/teu)
				Fix	Variable										
3,000	9,600	6,000	16.69	3.00	2.60	5.71	28	651,168	137,389	171,048	959,605	79,967	125	11.14	62
4,000	12,800	8,000	15.87	3.00	3.15	5.98	28	776,196	184,131	201,030	1,161,356	96,780	113	11.01	57
5,000	16,000	10,000	15.27	3.00	3.65	6.08	28	890,921	232,869	241,328	1,365,118	113,760	107	10.96	53
6,000	19,200	12,000	13.53	3.00	4.03	7.44	28	1,073,219	383,125	248,011	1,704,355	142,030	111	10.28	55
7,000	22,400	14,000	13.47	3.00	4.47	7.06	28	1,180,413	454,049	254,506	1,888,968	157,414	105	10.47	53
8,000	25,600	16,000	13.42	3.00	4.88	6.70	28	1,282,326	527,223	272,509	2,082,058	173,505	102	10.65	51
9,000	28,800	18,000	13.37	3.00	5.28	6.34	28	1,379,851	602,532	282,772	2,265,154	188,763	98	10.83	49
10,000	32,000	20,000	13.33	3.00	5.67	6.00	28	1,473,648	679,874	289,455	2,442,977	203,581	95	11.00	48
11,000	35,200	22,000	13.30	3.00	6.04	5.66	28	1,564,224	759,159	299,994	2,623,377	218,615	93	11.17	47
12,000	38,400	24,000	13.26	3.00	6.40	5.33	28	1,651,974	840,307	315,137	2,807,418	233,951	91	11.33	46
13,000	41,600	26,000	13.23	3.00	6.75	5.01	28	1,737,218	923,245	325,336	2,985,798	248,817	90	11.49	45
14,000	44,800	28,000	13.20	3.00	7.10	4.70	28	1,820,217	1,007,907	340,838	3,168,963	264,080	88	11.65	44
15,000	48,000	30,000	13.18	3.00	7.43	4.39	28	1,901,189	1,094,234	351,097	3,346,521	278,877	87	11.80	44

II. *Table calculation of Indonesia – Oceania's transport cost*

Ship Size (teu)	No. of Cont. handled		Maritime Leg													
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost ($/teu)
				Fix	Variable										
3,000	9,600	6,000	22.95	2.00	2.60	0.45	28	895,356	112,853	114,032	1,122,242	140,280	146	13.77	73
4,000	12,800	8,000	21.83	2.00	3.15	1.03	28	1,067,269	154,188	134,020	1,355,477	169,435	132	13.49	66
5,000	16,000	10,000	20.99	2.00	3.65	1.35	28	1,225,016	197,877	160,886	1,583,779	197,972	124	13.32	62
6,000	19,200	12,000	18.61	2.00	4.03	3.36	28	1,475,675	328,643	165,341	1,969,659	246,207	128	12.32	64
7,000	22,400	14,000	18.52	2.00	4.47	3.01	28	1,623,068	393,256	169,671	2,185,994	273,249	122	12.50	61
8,000	25,600	16,000	18.45	2.00	4.88	2.66	28	1,763,198	460,359	181,673	2,405,229	300,654	117	12.67	59
9,000	28,800	18,000	18.39	2.00	5.28	2.33	28	1,897,295	529,799	188,515	2,615,609	326,951	114	12.84	57
10,000	32,000	20,000	18.33	2.00	5.67	2.00	28	2,026,267	601,447	192,970	2,820,684	352,585	110	13.00	55
11,000	35,200	22,000	18.28	2.00	6.04	1.68	28	2,150,808	675,191	199,996	3,025,994	378,249	107	13.16	54
12,000	38,400	24,000	18.24	2.00	6.40	1.36	28	2,271,464	750,932	210,091	3,232,487	404,061	105	13.32	53
13,000	41,600	26,000	18.19	2.00	6.75	1.05	28	2,388,674	828,583	216,890	3,434,148	429,268	103	13.47	52
14,000	44,800	28,000	18.16	2.00	7.10	0.75	28	2,502,798	908,068	227,226	3,638,091	454,761	102	13.63	51
15,000	48,000	30,000	18.12	2.00	7.43	0.45	28	2,614,135	989,316	234,065	3,837,516	479,689	100	13.77	50

Port Leg; One way									Total; One Way			Value of Time ($/ day/ Teu)	Generalized Cost			
Transit Time (days)						Freight Cost ($/Teu)			Transit Time (days)		Freight Cost ($/Teu)					
Before Improvement			After Improvement			Before and After Improvement			Before	After	Before & After		Before	After	Reduction	
Origin	Dest.	Total	Origin	Dest.	Total	Origin	Dest.	Total	Improv.	Improv.	Improv.		Improv.	Improv.	$/Teu	%
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	19.27	17.77	473	27.4	1,001	960	41	4.11
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.99	17.49	466	27.4	986	945	41	4.17
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.82	17.32	462	27.4	978	937	41	4.20
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	17.82	16.32	464	27.4	952	911	41	4.32
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.00	16.50	461	27.4	954	913	41	4.31
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.17	16.67	459	27.4	957	915	41	4.30
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.34	16.84	457	27.4	959	918	41	4.28
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.50	17.00	455	27.4	962	921	41	4.27
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.66	17.16	454	27.4	965	924	41	4.26
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.82	17.32	453	27.4	968	927	41	4.24
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	18.97	17.47	452	27.4	971	930	41	4.23
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	19.13	17.63	451	27.4	975	934	41	4.22
2.0	3.5	5.50	2.00	2.00	4.00	200	200	400	19.27	17.77	450	27.4	978	937	41	4.20

III. *Table calculation of Indonesia – Middle East's transport cost*

Middle East - Asia (Sing)															
Ship Size (teu)	No. of Cont. handled		Maritime Leg												
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable										
6,000	19,200	12,000	25.37	2.50	4.03	3.09	35.00	2,012,285	355,884	206,676	2,574,845	257,484	168	15.95	84
7,000	22,400	14,000	25.26	2.50	4.47	2.77	35.00	2,213,274	423,652	212,089	2,849,015	284,901	159	16.11	79
8,000	25,600	16,000	25.16	2.50	4.88	2.45	35.00	2,404,361	493,791	227,091	3,125,242	312,524	153	16.27	76
9,000	28,800	18,000	25.08	2.50	5.28	2.14	35.00	2,587,220	566,165	235,644	3,389,029	338,903	147	16.43	74
10,000	32,000	20,000	25.00	2.50	5.67	1.83	35.00	2,763,091	640,661	241,213	3,644,964	364,496	142	16.58	71
11,000	35,200	22,000	24.93	2.50	6.04	1.53	35.00	2,932,919	717,175	249,995	3,900,089	390,009	138	16.74	69
12,000	38,400	24,000	24.87	2.50	6.40	1.23	35.00	3,097,451	795,619	262,614	4,155,684	415,568	135	16.89	68
13,000	41,600	26,000	24.81	2.50	6.75	0.94	35.00	3,257,283	875,914	271,113	4,404,310	440,431	132	17.03	66
14,000	44,800	28,000	24.76	2.50	7.10	0.65	35.00	3,412,907	957,987	284,032	4,654,926	465,493	130	17.18	65
15,000	48,000	30,000	24.71	2.50	7.43	0.36	35.00	3,564,729	1,041,775	292,581	4,899,085	489,909	128	17.32	64
16,000	51,200	32,000	24.66	2.50	7.76	0.08	35.00	3,713,094	1,127,219	304,300	5,144,613	514,461	126	17.46	63
17,000	54,400	34,000	24.62	2.50	8.08	6.81	42.00	3,858,295	1,214,266	309,869	5,382,429	538,243	124	17.60	62
18,000	57,600	36,000	24.58	2.50	8.39	6.53	42.00	4,000,583	1,302,866	318,408	5,621,857	562,186	122	17.73	61
19,000	60,800	38,000	24.54	2.50	8.70	6.26	42.00	4,140,179	1,392,974	323,664	5,856,817	585,682	120	17.87	60
20,000	64,000	40,000	24.50	2.50	9.00	6.00	42.00	4,277,275	1,484,549	328,920	6,090,744	609,074	119	18.00	59
21,000	67,200	42,000	24.47	2.50	9.30	5.73	42.00	4,412,040	1,577,551	334,176	6,323,767	632,377	118	18.13	59

Sing - Jkt															
Ship Size (teu)	No. of Cont. handled		**Maritime Leg**												
			Round Trip Time (days)					Round Trip Cost ($)						One Way	
	Teu	Moved	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost/ teu ($/teu)
				Fix	Variable										
3,000	9,600	6,000	2.61	0.50	2.84	1.06	7.00	101,745	81,849	28,508	212,102	106,051	28	2.97	14

Middle East - Jakarta (Combining Europe - Asia (Singapore) with Singapore - Jakarta); One Way												
Ship Size (Teu)	Maritime Leg		Port Leg								Total	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)				Freight Cost ($/Teu)				Transit Time (days)	Freight Cost ($/teu)
			Origin	Transs.	Dest.	Total	Origin	Transs.	Dest.	Total		
6,000	18.92	98	2.00	2.50	3.50	8.00	200	200	200	600	26.92	698
7,000	19.09	93	2.00	2.50	3.50	8.00	200	200	200	600	27.09	693
8,000	19.25	90	2.00	2.50	3.50	8.00	200	200	200	600	27.25	690
9,000	19.40	87	2.00	2.50	3.50	8.00	200	200	200	600	27.40	687
10,000	19.56	85	2.00	2.50	3.50	8.00	200	200	200	600	27.56	685
11,000	19.71	83	2.00	2.50	3.50	8.00	200	200	200	600	27.71	683
12,000	19.86	81	2.00	2.50	3.50	8.00	200	200	200	600	27.86	681
13,000	20.00	80	2.00	2.50	3.50	8.00	200	200	200	600	28.00	680
14,000	20.15	79	2.00	2.50	3.50	8.00	200	200	200	600	28.15	679
15,000	20.29	78	2.00	2.50	3.50	8.00	200	200	200	600	28.29	678
16,000	20.43	77	2.00	2.50	3.50	8.00	200	200	200	600	28.43	677
17,000	20.57	76	2.00	2.50	3.50	8.00	200	200	200	600	28.57	676
18,000	20.71	75	2.00	2.50	3.50	8.00	200	200	200	600	28.71	675
19,000	20.84	74	2.00	2.50	3.50	8.00	200	200	200	600	28.84	674
20,000	20.97	73	2.00	2.50	3.50	8.00	200	200	200	600	28.97	673
21,000	21.10	73	2.00	2.50	3.50	8.00	200	200	200	600	29.10	673

Ship Size (teu)	No. of Cont. handled		Maritime Leg													Port Leg (One Way)						Total (One Way)	
			Round Trip Transit Time (days)					Round Trip Cost ($)						One Way									
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)			Freight Cost ($/Teu)			Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable											Origin	Dest.	Total	Origin	Transs.	Total		
6,000	19,200	12,000	27.49	2.75	4.03	0.73	35.00	2,179,975	369,505	227,344	2,776,823	252,438	181	17.13	90	2.00	2.00	4.00	200	200	400	21.13	490
7,000	22,400	14,000	27.36	2.75	4.47	0.42	35.00	2,397,714	438,851	233,297	3,069,862	279,078	171	17.29	86	2.00	2.00	4.00	200	200	400	21.29	486
8,000	25,600	16,000	27.26	2.75	4.88	7.11	42.00	2,604,724	510,507	249,800	3,365,031	305,912	164	17.45	82	2.00	2.00	4.00	200	200	400	21.45	482
9,000	28,800	18,000	27.17	2.75	5.28	6.80	42.00	2,802,822	584,348	259,208	3,646,378	331,489	158	17.60	79	2.00	2.00	4.00	200	200	400	21.60	479
10,000	32,000	20,000	27.08	2.75	5.67	6.50	42.00	2,993,348	660,267	265,334	3,918,949	356,268	153	17.75	77	2.00	2.00	4.00	200	200	400	21.75	477
11,000	35,200	22,000	27.01	2.75	6.04	6.20	42.00	3,177,329	738,167	274,995	4,190,491	380,954	149	17.90	74	2.00	2.00	4.00	200	200	400	21.90	474
12,000	38,400	24,000	26.94	2.75	6.40	5.91	42.00	3,355,572	817,963	288,875	4,462,410	405,674	145	18.05	73	2.00	2.00	4.00	200	200	400	22.05	473
13,000	41,600	26,000	26.88	2.75	6.75	5.62	42.00	3,528,723	899,579	298,224	4,726,527	429,684	142	18.19	71	2.00	2.00	4.00	200	200	400	22.19	471
14,000	44,800	28,000	26.82	2.75	7.10	5.33	42.00	3,697,316	982,947	312,435	4,992,698	453,882	139	18.33	70	2.00	2.00	4.00	200	200	400	22.33	470
15,000	48,000	30,000	26.77	2.75	7.43	5.05	42.00	3,861,790	1,068,005	321,839	5,251,634	477,421	137	18.47	68	2.00	2.00	4.00	200	200	400	22.47	468
16,000	51,200	32,000	26.72	2.75	7.76	4.78	42.00	4,022,519	1,154,696	334,730	5,511,944	501,086	135	18.61	67	2.00	2.00	4.00	200	200	400	22.61	467
17,000	54,400	34,000	26.67	2.75	8.08	4.50	42.00	4,179,819	1,242,968	340,856	5,763,643	523,968	132	18.75	66	2.00	2.00	4.00	200	200	400	22.75	466
18,000	57,600	36,000	26.63	2.75	8.39	4.23	42.00	4,333,965	1,332,775	350,249	6,016,989	546,999	131	18.88	65	2.00	2.00	4.00	200	200	400	22.88	465
19,000	60,800	38,000	26.58	2.75	8.70	3.97	42.00	4,485,194	1,424,072	356,030	6,265,297	569,572	129	19.02	64	2.00	2.00	4.00	200	200	400	23.02	464
20,000	64,000	40,000	26.54	2.75	9.00	3.70	42.00	4,633,715	1,516,819	361,812	6,512,345	592,031	127	19.15	64	2.00	2.00	4.00	200	200	400	23.15	464
21,000	67,200	42,000	26.51	2.75	9.30	3.44	42.00	4,779,710	1,610,977	367,594	6,758,281	614,389	126	19.28	63	2.00	2.00	4.00	200	200	400	23.28	463

Ship Size (teu)	Result								
	Transshipment		Direct Call		Value of Time ($/teu/day)	Generalized Cost ($/teu)			
	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)	Freight Cost ($/teu)		Transs.	Direct Call	Reduction	
								$/teu	%
6,000	26.92	698	21.13	490	27.40	1,435	1,069	366	25.49
7,000	27.09	693	21.29	486	27.40	1,435	1,069	366	25.53
8,000	27.25	690	21.45	482	27.40	1,437	1,070	367	25.53
9,000	27.40	687	21.60	479	27.40	1,438	1,071	367	25.53
10,000	27.56	685	21.75	477	27.40	1,440	1,072	367	25.52
11,000	27.71	683	21.90	474	27.40	1,442	1,074	368	25.50
12,000	27.86	681	22.05	473	27.40	1,445	1,077	368	25.47
13,000	28.00	680	22.19	471	27.40	1,447	1,079	368	25.44
14,000	28.15	679	22.33	470	27.40	1,450	1,082	368	25.41
15,000	28.29	678	22.47	468	27.40	1,453	1,084	369	25.37
16,000	28.43	677	22.61	467	27.40	1,456	1,087	369	25.33
17,000	28.57	676	22.75	466	27.40	1,458	1,089	369	25.30
18,000	28.71	675	22.88	465	27.40	1,461	1,092	369	25.26
19,000	28.84	674	23.02	464	27.40	1,464	1,095	369	25.21
20,000	28.97	673	23.15	464	27.40	1,467	1,098	369	25.17
21,000	29.10	673	23.28	463	27.40	1,470	1,101	369	25.13

IV. Table calculation of Indonesia – Europe's transport cost

Europe - Asia (Sing)															
Ship Size (teu)	No. of Cont. handled		Maritime Leg												
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable										
6,000	19,200	12,000	46.52	3.50	4.03	1.95	56.00	3,689,189	410,367	289,346	4,388,902	313,493	286	27.02	143
7,000	22,400	14,000	46.31	3.50	4.47	1.72	56.00	4,057,669	484,446	296,924	4,839,039	345,646	270	27.14	135
8,000	25,600	16,000	46.13	3.50	4.88	1.48	56.00	4,407,994	560,655	317,927	5,286,577	377,613	258	27.26	129
9,000	28,800	18,000	45.97	3.50	5.28	1.24	56.00	4,743,237	638,898	329,901	5,712,035	408,003	248	27.38	124
10,000	32,000	20,000	45.83	3.50	5.67	1.00	56.00	5,065,666	719,087	337,698	6,122,451	437,318	239	27.50	120
11,000	35,200	22,000	45.71	3.50	6.04	0.75	56.00	5,377,019	801,143	349,993	6,528,155	466,297	232	27.62	116
12,000	38,400	24,000	45.59	3.50	6.40	0.51	56.00	5,678,660	884,995	367,660	6,931,314	495,094	226	27.75	113
13,000	41,600	26,000	45.49	3.50	6.75	0.26	56.00	5,971,686	970,576	379,558	7,321,820	522,987	220	27.87	110
14,000	44,800	28,000	45.39	3.50	7.10	0.02	56.00	6,256,996	1,057,827	397,645	7,712,467	550,891	215	27.99	108
15,000	48,000	30,000	45.30	3.50	7.43	6.77	63.00	6,535,337	1,146,694	409,613	8,091,644	577,975	211	28.11	105
16,000	51,200	32,000	45.21	3.50	7.76	6.53	63.00	6,807,339	1,237,125	426,020	8,470,484	605,035	207	28.23	103
17,000	54,400	34,000	45.13	3.50	8.08	6.29	63.00	7,073,540	1,329,076	433,817	8,836,433	631,174	203	28.35	102
18,000	57,600	36,000	45.06	3.50	8.39	6.05	63.00	7,334,402	1,422,503	445,771	9,202,677	657,334	200	28.47	100
19,000	60,800	38,000	44.99	3.50	8.70	5.81	63.00	7,590,329	1,517,366	453,130	9,560,824	682,916	197	28.59	98
20,000	64,000	40,000	44.92	3.50	9.00	5.58	63.00	7,841,671	1,613,629	460,488	9,915,788	708,271	194	28.71	97
21,000	67,200	42,000	44.86	3.50	9.30	5.34	63.00	8,088,740	1,711,256	467,846	10,267,843	733,417	191	28.83	95
Sing - Jkt															
Ship Size (teu)	No. of Cont. handled		**Maritime Leg**												
			Round Trip Time (days)					Round Trip Cost ($)						One Way	
	Teu	Moved	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost/ teu ($/teu)
				Fix	Variable										
3,000	9,600	6,000	2.61	0.50	2.84	1.06	7.00	101,745	81,849	28,508	212,102	106,051	28	2.97	14

Europe - Jakarta (Combining Europe - Asia (Singapore) with Singapore - Jakarta); One Way													
Ship Size (teu)	Maritime Leg		Port Leg								Total	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)				Freight Cost ($/Teu)				Transit Time (days)	Freight Cost ($/teu)
			Origin	Transs.	Dest.	Total	Origin	Transs.	Dest.	Total		
6,000	30.00	157	2.00	2.50	3.50	8.00	200	200	200	600	38.00	757
7,000	30.11	149	2.00	2.50	3.50	8.00	200	200	200	600	38.11	749
8,000	30.23	143	2.00	2.50	3.50	8.00	200	200	200	600	38.23	743
9,000	30.35	138	2.00	2.50	3.50	8.00	200	200	200	600	38.35	738
10,000	30.47	133	2.00	2.50	3.50	8.00	200	200	200	600	38.47	733
11,000	30.60	130	2.00	2.50	3.50	8.00	200	200	200	600	38.60	730
12,000	30.72	127	2.00	2.50	3.50	8.00	200	200	200	600	38.72	727
13,000	30.84	124	2.00	2.50	3.50	8.00	200	200	200	600	38.84	724
14,000	30.96	121	2.00	2.50	3.50	8.00	200	200	200	600	38.96	721
15,000	31.09	119	2.00	2.50	3.50	8.00	200	200	200	600	39.09	719
16,000	31.21	117	2.00	2.50	3.50	8.00	200	200	200	600	39.21	717
17,000	31.33	115	2.00	2.50	3.50	8.00	200	200	200	600	39.33	715
18,000	31.45	114	2.00	2.50	3.50	8.00	200	200	200	600	39.45	714
19,000	31.56	112	2.00	2.50	3.50	8.00	200	200	200	600	39.56	712
20,000	31.68	111	2.00	2.50	3.50	8.00	200	200	200	600	39.68	711
21,000	31.80	109	2.00	2.50	3.50	8.00	200	200	200	600	39.80	709

Ship Size (teu)	No. of Cont. handled		Maritime Leg													Port Leg (One Way)						Total (One Way)	
			Round Trip Transit Time (days)					Round Trip Cost ($)						One Way									
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)			Freight Cost ($/Teu)			Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable											Origin	Dest.	Total	Origin	Transs.	Total		
6,000	19,200	12,000	48.63	3.75	4.03	6.59	63.00	3,856,879	423,987	310,014	4,590,880	306,059	299	28.21	149	2.00	2.00	4.00	200	200	400	32.21	549
7,000	22,400	14,000	48.41	3.75	4.47	6.37	63.00	4,242,109	499,644	318,133	5,059,886	337,326	282	28.32	141	2.00	2.00	4.00	200	200	400	32.32	541
8,000	25,600	16,000	48.23	3.75	4.88	6.14	63.00	4,608,358	577,371	340,637	5,526,365	368,424	270	28.43	135	2.00	2.00	4.00	200	200	400	32.43	535
9,000	28,800	18,000	48.06	3.75	5.28	5.90	63.00	4,958,838	657,081	353,465	5,969,385	397,959	259	28.55	130	2.00	2.00	4.00	200	200	400	32.55	530
10,000	32,000	20,000	47.92	3.75	5.67	5.66	63.00	5,295,924	738,694	361,819	6,396,436	426,429	250	28.67	125	2.00	2.00	4.00	200	200	400	32.67	525
11,000	35,200	22,000	47.78	3.75	6.04	5.42	63.00	5,621,429	822,135	374,993	6,818,557	454,570	242	28.79	121	2.00	2.00	4.00	200	200	400	32.79	521
12,000	38,400	24,000	47.66	3.75	6.40	5.18	63.00	5,936,781	907,339	393,921	7,238,040	482,536	236	28.91	118	2.00	2.00	4.00	200	200	400	32.91	518
13,000	41,600	26,000	47.55	3.75	6.75	4.94	63.00	6,243,126	994,241	406,670	7,644,037	509,602	230	29.03	115	2.00	2.00	4.00	200	200	400	33.03	515
14,000	44,800	28,000	47.45	3.75	7.10	4.70	63.00	6,541,405	1,082,787	426,048	8,050,239	536,683	225	29.15	112	2.00	2.00	4.00	200	200	400	33.15	512
15,000	48,000	30,000	47.36	3.75	7.43	4.46	63.00	6,832,397	1,172,923	438,872	8,444,192	562,946	220	29.27	110	2.00	2.00	4.00	200	200	400	33.27	510
16,000	51,200	32,000	47.27	3.75	7.76	4.23	63.00	7,116,764	1,264,602	456,450	8,837,815	589,188	216	29.39	108	2.00	2.00	4.00	200	200	400	33.39	508
17,000	54,400	34,000	47.18	3.75	8.08	3.99	63.00	7,395,064	1,357,779	464,804	9,217,647	614,510	212	29.51	106	2.00	2.00	4.00	200	200	400	33.51	506
18,000	57,600	36,000	47.11	3.75	8.39	3.75	63.00	7,667,784	1,452,412	477,612	9,597,809	639,854	208	29.62	104	2.00	2.00	4.00	200	200	400	33.62	504
19,000	60,800	38,000	47.03	3.75	8.70	3.52	63.00	7,935,343	1,548,464	485,496	9,969,304	664,620	205	29.74	102	2.00	2.00	4.00	200	200	400	33.74	502
20,000	64,000	40,000	46.96	3.75	9.00	3.29	63.00	8,198,110	1,645,899	493,380	10,337,390	689,159	202	29.86	101	2.00	2.00	4.00	200	200	400	33.86	501
21,000	67,200	42,000	46.90	3.75	9.30	3.05	63.00	8,456,410	1,744,683	501,264	10,702,357	713,490	199	29.97	100	2.00	2.00	4.00	200	200	400	33.97	500

Ship Size (teu)	Result								
	Transshipment		Direct Call		Value of Time ($/teu/day)	Generalized Cost ($/teu)			
	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)	Freight Cost ($/teu)		Transs.	Direct Call	Reduction	
								$/teu	%
6,000	38.00	757	32.21	549	27.40	1,798	1,432	366	20.35
7,000	38.11	749	32.32	541	27.40	1,793	1,427	366	20.44
8,000	38.23	743	32.43	535	27.40	1,790	1,423	367	20.49
9,000	38.35	738	32.55	530	27.40	1,788	1,421	367	20.53
10,000	38.47	733	32.67	525	27.40	1,787	1,420	367	20.56
11,000	38.60	730	32.79	521	27.40	1,787	1,419	368	20.58
12,000	38.72	727	32.91	518	27.40	1,787	1,419	368	20.59
13,000	38.84	724	33.03	515	27.40	1,788	1,420	368	20.59
14,000	38.96	721	33.15	512	27.40	1,789	1,420	368	20.59
15,000	39.09	719	33.27	510	27.40	1,790	1,421	369	20.59
16,000	39.21	717	33.39	508	27.40	1,791	1,423	369	20.59
17,000	39.33	715	33.51	506	27.40	1,793	1,424	369	20.58
18,000	39.45	714	33.62	504	27.40	1,794	1,425	369	20.57
19,000	39.56	712	33.74	502	27.40	1,796	1,427	369	20.55
20,000	39.68	711	33.86	501	27.40	1,798	1,429	369	20.54
21,000	39.80	709	33.97	500	27.40	1,800	1,430	369	20.53

V. *Table calculation of Indonesia – North America's transport cost*

North America - Asia (Sing)															
Ship Size (teu)	No. of Cont. handled		Maritime Leg												
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable										
6,000	19,200	12,000	31.72	3.00	4.03	3.25	42.00	2,515,356	383,125	248,011	3,146,492	262,208	205	19.37	102
7,000	22,400	14,000	31.57	3.00	4.47	2.96	42.00	2,766,593	454,049	254,506	3,475,148	289,596	194	19.52	97
8,000	25,600	16,000	31.45	3.00	4.88	2.66	42.00	3,005,451	527,223	272,509	3,805,183	317,099	186	19.67	93
9,000	28,800	18,000	31.35	3.00	5.28	2.37	42.00	3,234,025	602,532	282,772	4,119,329	343,277	179	19.81	89
10,000	32,000	20,000	31.25	3.00	5.67	2.08	42.00	3,453,863	679,874	289,455	4,423,192	368,599	173	19.96	86
11,000	35,200	22,000	31.16	3.00	6.04	1.80	42.00	3,666,149	759,159	299,994	4,725,302	393,775	168	20.10	84
12,000	38,400	24,000	31.09	3.00	6.40	1.51	42.00	3,871,814	840,307	315,137	5,027,257	418,938	164	20.24	82
13,000	41,600	26,000	31.01	3.00	6.75	1.23	42.00	4,071,604	923,245	325,336	5,320,184	443,349	160	20.38	80
14,000	44,800	28,000	30.95	3.00	7.10	0.96	42.00	4,266,133	1,007,907	340,838	5,614,879	467,907	157	20.52	78
15,000	48,000	30,000	30.88	3.00	7.43	0.69	42.00	4,455,911	1,094,234	351,097	5,901,243	491,770	154	20.66	77
16,000	51,200	32,000	30.83	3.00	7.76	0.42	42.00	4,641,368	1,182,172	365,160	6,188,700	515,725	151	20.79	76
17,000	54,400	34,000	30.77	3.00	8.08	0.15	42.00	4,822,868	1,271,671	371,843	6,466,382	538,865	149	20.92	74
18,000	57,600	36,000	30.72	3.00	8.39	6.89	49.00	5,000,729	1,362,684	382,090	6,745,503	562,125	146	21.06	73
19,000	60,800	38,000	30.67	3.00	8.70	6.63	49.00	5,175,224	1,455,170	388,397	7,018,791	584,899	144	21.19	72
20,000	64,000	40,000	30.63	3.00	9.00	6.37	49.00	5,346,594	1,549,089	394,704	7,290,387	607,532	142	21.31	71
21,000	67,200	42,000	30.58	3.00	9.30	6.12	49.00	5,515,050	1,644,404	401,011	7,560,465	630,039	141	21.44	70
Sing - Jkt															
Ship Size (teu)	No. of Cont. handled		**Maritime Leg**												
			Round Trip Time (days)					Round Trip Cost ($)						One Way	
	Teu	Moved	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost/ teu ($/teu)
				Fix	Variable										
3,000	9,600	6,000	2.61	0.50	2.84	1.06	7.00	101,745	81,849	28,508	212,102	106,051	28	2.97	14

North America - Jakarta (Combining Europe - Asia (Singapore) with Singapore - Jakarta); One Way												
Ship Size (teu)	Maritime Leg		Port Leg								Total	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)				Freight Cost ($/Teu)				Transit Time (days)	Freight Cost ($/teu)
			Origin	Transs.	Dest.	Total	Origin	Transs.	Dest.	Total		
6,000	22.35	116	2.00	2.50	3.50	8.00	200	200	200	600	30.35	716
7,000	22.49	111	2.00	2.50	3.50	8.00	200	200	200	600	30.49	711
8,000	22.64	107	2.00	2.50	3.50	8.00	200	200	200	600	30.64	707
9,000	22.79	103	2.00	2.50	3.50	8.00	200	200	200	600	30.79	703
10,000	22.93	100	2.00	2.50	3.50	8.00	200	200	200	600	30.93	700
11,000	23.07	98	2.00	2.50	3.50	8.00	200	200	200	600	31.07	698
12,000	23.22	96	2.00	2.50	3.50	8.00	200	200	200	600	31.22	696
13,000	23.35	94	2.00	2.50	3.50	8.00	200	200	200	600	31.35	694
14,000	23.49	92	2.00	2.50	3.50	8.00	200	200	200	600	31.49	692
15,000	23.63	91	2.00	2.50	3.50	8.00	200	200	200	600	31.63	691
16,000	23.76	89	2.00	2.50	3.50	8.00	200	200	200	600	31.76	689
17,000	23.90	88	2.00	2.50	3.50	8.00	200	200	200	600	31.90	688
18,000	24.03	87	2.00	2.50	3.50	8.00	200	200	200	600	32.03	687
19,000	24.16	86	2.00	2.50	3.50	8.00	200	200	200	600	32.16	686
20,000	24.29	85	2.00	2.50	3.50	8.00	200	200	200	600	32.29	685
21,000	24.41	84	2.00	2.50	3.50	8.00	200	200	200	600	32.41	684

Ship Size (teu)	No. of Cont. handled		Maritime Leg														Port Leg (One Way)						Total (One Way)	
			Round Trip Transit Time (days)					Round Trip Cost ($)						One Way								
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)			Freight Cost ($/Teu)			Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable											Origin	Dest.	Total	Origin	Transs.	Total		
6,000	19,200	12,000	33.83	3.25	4.03	0.89	42.00	2,683,046	396,746	268,679	3,348,471	257,575	218	20.56	109	2.00	2.00	4.00	200	200	400	24.56	509
7,000	22,400	14,000	33.68	3.25	4.47	0.60	42.00	2,951,032	469,248	275,715	3,695,995	284,307	206	20.70	103	2.00	2.00	4.00	200	200	400	24.70	503
8,000	25,600	16,000	33.55	3.25	4.88	0.32	42.00	3,205,814	543,939	295,218	4,044,971	311,152	198	20.84	99	2.00	2.00	4.00	200	200	400	24.84	499
9,000	28,800	18,000	33.44	3.25	5.28	0.03	42.00	3,449,627	620,715	306,337	4,376,678	336,668	190	20.98	95	2.00	2.00	4.00	200	200	400	24.98	495
10,000	32,000	20,000	33.33	3.25	5.67	6.75	49.00	3,684,121	699,480	313,576	4,697,178	361,321	183	21.13	92	2.00	2.00	4.00	200	200	400	25.13	492
11,000	35,200	22,000	33.24	3.25	6.04	6.47	49.00	3,910,559	780,151	324,994	5,015,704	385,823	178	21.27	89	2.00	2.00	4.00	200	200	400	25.27	489
12,000	38,400	24,000	33.16	3.25	6.40	6.19	49.00	4,129,934	862,651	341,398	5,333,983	410,306	174	21.40	87	2.00	2.00	4.00	200	200	400	25.40	487
13,000	41,600	26,000	33.08	3.25	6.75	5.92	49.00	4,343,044	946,910	352,447	5,642,402	434,031	170	21.54	85	2.00	2.00	4.00	200	200	400	25.54	485
14,000	44,800	28,000	33.01	3.25	7.10	5.65	49.00	4,550,542	1,032,867	369,242	5,952,651	457,896	166	21.68	83	2.00	2.00	4.00	200	200	400	25.68	483
15,000	48,000	30,000	32.94	3.25	7.43	5.38	49.00	4,752,972	1,120,464	380,355	6,253,791	481,061	163	21.81	81	2.00	2.00	4.00	200	200	400	25.81	481
16,000	51,200	32,000	32.88	3.25	7.76	5.11	49.00	4,950,792	1,209,649	395,590	6,556,031	504,310	160	21.94	80	2.00	2.00	4.00	200	200	400	25.94	480
17,000	54,400	34,000	32.82	3.25	8.08	4.85	49.00	5,144,393	1,300,374	402,830	6,847,596	526,738	157	22.08	79	2.00	2.00	4.00	200	200	400	26.08	479
18,000	57,600	36,000	32.77	3.25	8.39	4.59	49.00	5,334,111	1,392,594	413,930	7,140,635	549,280	155	22.21	77	2.00	2.00	4.00	200	200	400	26.21	477
19,000	60,800	38,000	32.72	3.25	8.70	4.33	49.00	5,520,239	1,486,268	420,763	7,427,270	571,328	153	22.33	76	2.00	2.00	4.00	200	200	400	26.33	476
20,000	64,000	40,000	32.67	3.25	9.00	4.08	49.00	5,703,033	1,581,359	427,596	7,711,988	593,230	151	22.46	75	2.00	2.00	4.00	200	200	400	26.46	475
21,000	67,200	42,000	32.62	3.25	9.30	3.83	49.00	5,882,720	1,677,830	434,429	7,994,979	614,998	149	22.59	74	2.00	2.00	4.00	200	200	400	26.59	474

Ship Size (teu)	Result								
	Transshipment		Direct Call		Value of Time ($/teu/day)	Generalized Cost ($/teu)			
	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)	Freight Cost ($/teu)		Transs.	Direct Call	Reduction	
								$/teu	%
6,000	30.35	716	24.56	509	27.40	1,548	1,182	366	23.64
7,000	30.49	711	24.70	503	27.40	1,546	1,180	366	23.70
8,000	30.64	707	24.84	499	27.40	1,546	1,179	367	23.72
9,000	30.79	703	24.98	495	27.40	1,547	1,179	367	23.74
10,000	30.93	700	25.13	492	27.40	1,548	1,180	367	23.75
11,000	31.07	698	25.27	489	27.40	1,549	1,181	368	23.74
12,000	31.22	696	25.40	487	27.40	1,551	1,183	368	23.73
13,000	31.35	694	25.54	485	27.40	1,553	1,185	368	23.71
14,000	31.49	692	25.68	483	27.40	1,555	1,187	368	23.69
15,000	31.63	691	25.81	481	27.40	1,557	1,189	369	23.67
16,000	31.76	689	25.94	480	27.40	1,560	1,191	369	23.64
17,000	31.90	688	26.08	479	27.40	1,562	1,193	369	23.62
18,000	32.03	687	26.21	477	27.40	1,564	1,195	369	23.59
19,000	32.16	686	26.33	476	27.40	1,567	1,198	369	23.56
20,000	32.29	685	26.46	475	27.40	1,570	1,200	369	23.53
21,000	32.41	684	26.59	474	27.40	1,572	1,203	369	23.50

VI. Table calculation of Indonesia – South America's transport port;

South America - Asia (Sing)															
Ship Size (teu)	No. of Cont. handled		Maritime Leg												
			Round Trip Transit Time (days)					Round Trip Freight Cost ($)						One Way	
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable										
6,000	19,200	12,000	52.86	4.00	4.03	2.11	63.00	4,192,260	437,608	330,682	4,960,549	310,034	323	30.45	161
7,000	22,400	14,000	52.62	4.00	4.47	1.91	63.00	4,610,988	514,843	339,342	5,465,172	341,573	305	30.55	152
8,000	25,600	16,000	52.42	4.00	4.88	1.69	63.00	5,009,084	594,087	363,346	5,966,517	372,907	291	30.65	146
9,000	28,800	18,000	52.24	4.00	5.28	1.47	63.00	5,390,042	675,264	377,030	6,442,335	402,646	280	30.76	140
10,000	32,000	20,000	52.08	4.00	5.67	1.25	63.00	5,756,439	758,300	385,940	6,900,679	431,292	270	30.88	135
11,000	35,200	22,000	51.94	4.00	6.04	1.02	63.00	6,110,249	843,127	399,992	7,353,368	459,586	261	30.99	131
12,000	38,400	24,000	51.81	4.00	6.40	0.79	63.00	6,453,023	929,682	420,182	7,802,887	487,680	254	31.11	127
13,000	41,600	26,000	51.69	4.00	6.75	0.56	63.00	6,786,007	1,017,907	433,781	8,237,694	514,856	248	31.22	124
14,000	44,800	28,000	51.58	4.00	7.10	0.33	63.00	7,110,222	1,107,747	454,451	8,672,420	542,026	242	31.34	121
15,000	48,000	30,000	51.47	4.00	7.43	0.10	63.00	7,426,519	1,199,153	468,130	9,093,801	568,363	237	31.45	118
16,000	51,200	32,000	51.38	4.00	7.76	6.87	70.00	7,735,613	1,292,078	486,880	9,514,571	594,661	232	31.57	116
17,000	54,400	34,000	51.29	4.00	8.08	6.64	70.00	8,038,114	1,386,481	495,790	9,920,385	620,024	228	31.68	114
18,000	57,600	36,000	51.20	4.00	8.39	6.41	70.00	8,334,548	1,482,322	509,453	10,326,323	645,395	224	31.80	112
19,000	60,800	38,000	51.12	4.00	8.70	6.18	70.00	8,625,373	1,579,563	517,862	10,722,798	670,175	220	31.91	110
20,000	64,000	40,000	51.05	4.00	9.00	5.95	70.00	8,910,990	1,678,169	526,272	11,115,431	694,714	217	32.02	109
21,000	67,200	42,000	50.97	4.00	9.30	5.73	70.00	9,191,750	1,778,109	534,682	11,504,541	719,034	214	32.14	107

Sing - Jkt															
Ship Size (teu)	No. of Cont. handled		**Maritime Leg**												
			Round Trip Time (days)					Round Trip Cost ($)						One Way	
	Teu	Moved	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Time (days)	Cost/ teu ($/teu)
				Fix	Variable										
3,000	9,600	6,000	2.61	0.50	2.84	1.06	7.00	101,745	81,849	28,508	212,102	106,051	28	2.97	14

South America - Jakarta (Combining Europe - Asia (Singapore) with Singapore - Jakarta); One Way												
Ship Size (teu)	Maritime Leg		Port Leg								Total	
	Transit Time (days)	Freight Cost ($/Teu)	Transit Time (days)				Freight Cost ($/Teu)				Transit Time (days)	Freight Cost ($/teu)
			Origin	Transs.	Dest.	Total	Origin	Transs.	Dest.	Total		
6,000	33.42	175	2.00	2.50	3.50	8.00	200	200	200	600	41.42	775
7,000	33.52	166	2.00	2.50	3.50	8.00	200	200	200	600	41.52	766
8,000	33.62	159	2.00	2.50	3.50	8.00	200	200	200	600	41.62	759
9,000	33.74	154	2.00	2.50	3.50	8.00	200	200	200	600	41.74	754
10,000	33.85	149	2.00	2.50	3.50	8.00	200	200	200	600	41.85	749
11,000	33.96	144	2.00	2.50	3.50	8.00	200	200	200	600	41.96	744
12,000	34.08	141	2.00	2.50	3.50	8.00	200	200	200	600	42.08	741
13,000	34.19	138	2.00	2.50	3.50	8.00	200	200	200	600	42.19	738
14,000	34.31	135	2.00	2.50	3.50	8.00	200	200	200	600	42.31	735
15,000	34.42	132	2.00	2.50	3.50	8.00	200	200	200	600	42.42	732
16,000	34.54	130	2.00	2.50	3.50	8.00	200	200	200	600	42.54	730
17,000	34.65	128	2.00	2.50	3.50	8.00	200	200	200	600	42.65	728
18,000	34.77	126	2.00	2.50	3.50	8.00	200	200	200	600	42.77	726
19,000	34.88	124	2.00	2.50	3.50	8.00	200	200	200	600	42.88	724
20,000	35.00	122	2.00	2.50	3.50	8.00	200	200	200	600	43.00	722
21,000	35.11	121	2.00	2.50	3.50	8.00	200	200	200	600	43.11	721

Ship Size (teu)	No. of Cont. handled		Maritime Leg													Port Leg (One Way)						Total (One Way)	
			Round Trip Transit Time (days)					Round Trip Cost ($)						One Way									
	Teu	Moves	At Sea	Time in Port		Spare	Total	At Sea	In Port	Other Cost (Tug, Pilot, Berth etc)	Total	Per Port	Per Teu	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)			Freight Cost ($/Teu)			Transit Time (days)	Freight Cost ($/teu)
				Fix	Variable											Origin	Dest.	Total	Origin	Transs.	Total		
6,000	19,200	12,000	54.98	4.25	4.03	6.74	70.00	4,359,950	451,229	351,349	5,162,528	303,678	336	31.63	168	2.00	2.00	4.00	200	200	400	35.63	568
7,000	22,400	14,000	54.73	4.25	4.47	6.55	70.00	4,795,427	530,041	360,550	5,686,019	334,472	317	31.72	159	2.00	2.00	4.00	200	200	400	35.72	559
8,000	25,600	16,000	54.52	4.25	4.88	6.35	70.00	5,209,448	610,803	386,055	6,206,306	365,077	303	31.83	152	2.00	2.00	4.00	200	200	400	35.83	552
9,000	28,800	18,000	54.33	4.25	5.28	6.13	70.00	5,605,643	693,447	400,594	6,699,684	394,099	291	31.93	145	2.00	2.00	4.00	200	200	400	35.93	545
10,000	32,000	20,000	54.17	4.25	5.67	5.91	70.00	5,986,697	777,907	410,061	7,174,665	422,039	280	32.04	140	2.00	2.00	4.00	200	200	400	36.04	540
11,000	35,200	22,000	54.02	4.25	6.04	5.69	70.00	6,354,659	864,119	424,992	7,643,770	449,634	271	32.15	136	2.00	2.00	4.00	200	200	400	36.15	536
12,000	38,400	24,000	53.88	4.25	6.40	5.47	70.00	6,711,143	952,026	446,444	8,109,614	477,036	264	32.27	132	2.00	2.00	4.00	200	200	400	36.27	532
13,000	41,600	26,000	53.76	4.25	6.75	5.24	70.00	7,057,447	1,041,572	460,892	8,559,911	503,524	257	32.38	129	2.00	2.00	4.00	200	200	400	36.38	529
14,000	44,800	28,000	53.64	4.25	7.10	5.01	70.00	7,394,631	1,132,707	482,854	9,010,192	530,011	251	32.49	126	2.00	2.00	4.00	200	200	400	36.49	526
15,000	48,000	30,000	53.53	4.25	7.43	4.79	70.00	7,723,580	1,225,382	497,388	9,446,350	555,668	246	32.61	123	2.00	2.00	4.00	200	200	400	36.61	523
16,000	51,200	32,000	53.43	4.25	7.76	4.56	70.00	8,045,037	1,319,555	517,310	9,881,902	581,288	241	32.72	121	2.00	2.00	4.00	200	200	400	36.72	521
17,000	54,400	34,000	53.34	4.25	8.08	4.33	70.00	8,359,638	1,415,184	526,777	10,301,599	605,976	237	32.83	118	2.00	2.00	4.00	200	200	400	36.83	518
18,000	57,600	36,000	53.25	4.25	8.39	4.11	70.00	8,667,930	1,512,231	541,294	10,721,455	630,674	233	32.95	116	2.00	2.00	4.00	200	200	400	36.95	516
19,000	60,800	38,000	53.17	4.25	8.70	3.88	70.00	8,970,388	1,610,661	550,229	11,131,278	654,781	229	33.06	114	2.00	2.00	4.00	200	200	400	37.06	514
20,000	64,000	40,000	53.09	4.25	9.00	3.66	70.00	9,267,429	1,710,439	559,164	11,537,033	678,649	225	33.17	113	2.00	2.00	4.00	200	200	400	37.17	513
21,000	67,200	42,000	53.01	4.25	9.30	3.44	70.00	9,559,420	1,811,536	568,099	11,939,055	702,297	222	33.28	111	2.00	2.00	4.00	200	200	400	37.28	511

Ship Size (teu)	Result								
	Transshipment		Direct Call		Value of Time ($/teu/day)	Generalized Cost ($/teu)			
	Transit Time (days)	Freight Cost ($/teu)	Transit Time (days)	Freight Cost ($/teu)		Transs.	Direct Call	Reduction	
								$/teu	%
6,000	41.42	775	35.63	568	27.40	1,910	1,544	366	19.15
7,000	41.52	766	35.72	559	27.40	1,904	1,537	366	19.25
8,000	41.62	759	35.83	552	27.40	1,900	1,533	367	19.31
9,000	41.74	754	35.93	545	27.40	1,897	1,530	367	19.36
10,000	41.85	749	36.04	540	27.40	1,895	1,528	367	19.39
11,000	41.96	744	36.15	536	27.40	1,894	1,526	368	19.42
12,000	42.08	741	36.27	532	27.40	1,894	1,526	368	19.43
13,000	42.19	738	36.38	529	27.40	1,894	1,525	368	19.45
14,000	42.31	735	36.49	526	27.40	1,894	1,526	368	19.45
15,000	42.42	732	36.61	523	27.40	1,895	1,526	369	19.46
16,000	42.54	730	36.72	521	27.40	1,895	1,527	369	19.46
17,000	42.65	728	36.83	518	27.40	1,896	1,527	369	19.45
18,000	42.77	726	36.95	516	27.40	1,898	1,529	369	19.45
19,000	42.88	724	37.06	514	27.40	1,899	1,530	369	19.44
20,000	43.00	722	37.17	513	27.40	1,900	1,531	369	19.43
21,000	43.11	721	37.28	511	27.40	1,902	1,532	369	19.42