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The impact of investments in Indonesian maritime sector on country's domestic economy

by

Anna Kalinichenko

Part of Indonesia-Focused Joint Research Project:
“Indonesian Trade, Shipping Network, and Maritime Investment Analysis”

Acknowledgments

It was a difficult year full of ups and downs, challenging assignments and exams. However, it come to an end and I am happy to finish it with my last contribution to this academic year which is represented in my thesis.

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Abstract

Throughout the years Indonesia was introducing various strategies and policies aiming to develop the national economy, and use wisely its competitive advantage in human, natural resources and favorable geographical location. However, the economy was facing considerable challenges. Starting from 2011 the GDP growth rate decreased from 6.5% to 5.1%, the number of working population continue to increase demanding jobs and higher incomes. In 2014, new president Joko Widodo announced to transform Indonesia into a new maritime power on the global arena of shipping to improve domestic economy and welfare of the nation. The government is convinced that maritime focused strategy will significantly spur economic growth. New economic development plans such as “Medium Term National Development Plan 2015 – 2019”, “Master Plan of National Industry Development 2015 – 2035” and Global Maritime Fulcrum doctrine include multiple number of projects for improvement of port infrastructure, shipbuilding industry, qualified human resources and better inter-island connectivity. However, such an ambitious plan requires considerable amount of investments.

According to Dijk et al. (2015) and Oxford Business Group (2015), Indonesian government has an investment priority for some of maritime sub-sectors such as shipping services, ports, cold storage, ICT for maritime and shipbuilding. According to data extracted from Indonesian investment institution Badan Koordinasi Penanaman Modal (BKPM) the amount of investments for those industries reached $ 4,238,210.59 during the period of Joko Widodo’s governance (2014 – 2017). Nevertheless, it is not clear how those investments will impact Indonesian economy. We employ Input/Output analysis that allow us to analyse how $1 of investments in each prioritized maritime sub-sector will influence output generated by other industries, income of citizens across the country and Gross Domestic Product (GDP).

The analysis of defined industries shows that $1 of investment will benefit the most shipbuilding industry in terms of production. The output of the industry will increase by US$1.31. This finding is highly significant and shows how important it is for shipbuilding to receive funds for higher production outputs. The highest indirect contribution to other industries in terms of production, income and GDP brings US$1 of investment to “ports, bridges and roads”. Investment in ports benefit the most the production of all industries across Indonesia, GDP and household income. Ports should be the priority sector for investments. Additionally, the employees of “transportation support services” will enjoy the highest benefit from investments. Each additional US$1 of investment will increase wages of people involved in cargo handling, cold storage or other infrastructure services by US$0.23. In total, contribution of investments in maritime industry is considered to be significant and might steer Indonesian economy on the way of sustainable growth and constant development.

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List of Abbreviations

ASEAN	Association of Southeast Asian Nations
BKPM	Badan Koordinasi Penanaman Modal
DDI	Direct Debt Investments
DWT	Deadweight
EU	European Union
FDI	Foreign Direct Investments
GDP	Gross Domestic Product
GMF	Global Maritime Fulcrum
GVA	Gross Value Added
ICT	Information and Communication technologies
IDR	Indonesian Rupiah
I/O	Input/Output
MP3EI	Masterplan for Acceleration and Expansion of Indonesia
TEU	Twenty-foot equivalent unit

1. Introduction

1.1 Research Background and Relevance

Since early 1990s, globalization sparked inevitable trend of economic development and growth all over the world. Worldwide trade then enlarged its importance, and goods became available to each individual with enormous choices and varieties. While globalization presented itself as a valuable trend to trigger economic growth, transportation was merely seen as a tool to fulfill global demand. Maritime transportation has long been the most effective mean of transportation for large batches of goods on long distance journeys. However, maritime industry started to be seen not only as a tool for delivery, but also as an important player in economic development of cities, regions and countries' economies (Hall and Jacobs, 2012). Maritime sector, as any other industries, generate output to satisfy their final demands and at the same time produces intermediate goods and services, which are used as an input for other industries. Therefore, efficiency of one industry might directly or indirectly influence efficiency of another industry. Consequently, the investments made in one industry influence the output of other sectors and have an impact on the whole economy.

In recent years, Indonesian government with a chosen president Joko Widodo started to move towards strategical economic revival by making a great emphasis on investments with particular focus on maritime industry. The main idea of shipping and economic development in Indonesia is presented in Global Maritime Fulcrum doctrine, Medium Term National Development Plan 2015 – 2019 and Master Plan of National Industry Development 2015 – 2035, which have a detailed description in the report of Ministry of Industry Republic of Indonesia (2015).The concept created under Joko Widodo's governance would increase efficiency in infrastructure and maritime connectivity as a result of better transport communication within archipelago, reconstruction of deep seaports, improvement of logistics network, maritime security, shipping and fishing industries (Gindarsah and Priamarizki, 2015).However, such great plans require a considerable amount of investments.

According to Coen van Dijk *et. al.* (2015), Indonesia has a great potential of investments in maritime industry due to strategic geographical location, high governmental interest in maritime infrastructure, represented in Global Maritime Fulcrum, and acceleration in trade. Indonesia Investment Coordinating Board (BKPM) announced, that estimated amount of investments nationally in first quarter of 2017 reached US$12.3 billion, which is by 13.2% higher, than in the first quarter of 2016, US$10.9 billion. The chairman of BKPM stated, that interest in investing in Indonesia remains reasonably high and government seems optimistic to achieve its target of investments in 2017, which was set up at the amount of US$50.7 billion (Indonesia Investment Coordinating Board, 2017). Such a rapid boost in investments can lead to spillover effect. This study provides an important opportunity to advance the understanding of relationship among investments and national economy. Improvement of maritime industry can increase its output and be used as an intermediate input to other sectors. As a result, investments may have an impact on the outputs of intra-industry flow, change in higher wages, employment

and GDP in Indonesia. In current study we will investigate how $1 dollar of investments in maritime sectors will impact Indonesian economy.

1.2 *Indonesia-Focused Joint Theses Project*

This theses is the fourth part of *Indonesia-Focused Joint Theses Project: "Indonesian Trade, Shipping Network, and Maritime Investment Analysis"*.

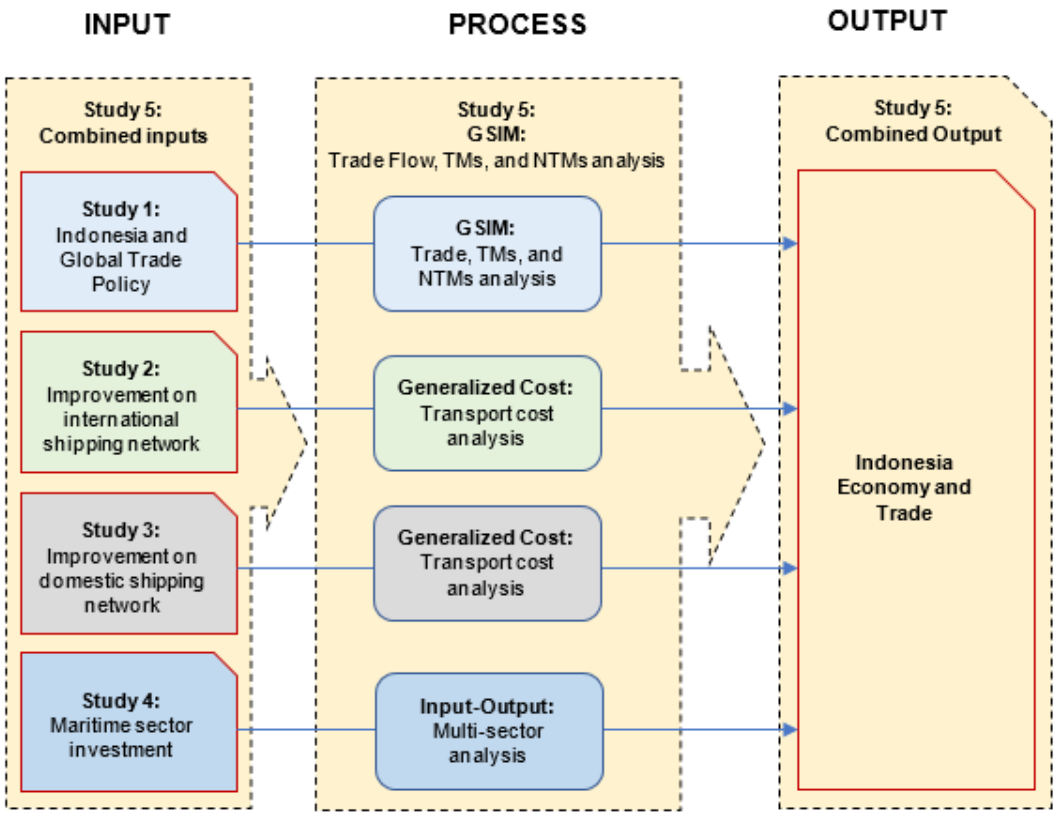


Figure 1.1 Indonesia-Focused Joint Theses Project: *"Indonesian Trade, Shipping Network, and Maritime Investment Analysis"*

Source: Authors of Indonesia-Focused Joint Theses Project

This joint project captures a comprehensive images of the main internal and external factors that affect Indonesia maritime-based economy in shipping sector. There are five research (theses) in this joint project, each focuses on:

1. The impact of Indonesian and global trade policies on the Indonesian economy and maritime trade;
2. Impact assessment of the poor linkage of Indonesia ports with the international shipping network;
3. Comparative analysis of domestic shipping network for container trade in Indonesia between current condition and the implementation of sea-tollway project: a cost perspective;

4. The impact of investments in Indonesian maritime sector on country's 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.

The connection between studies is illustrated in Figure 1.1.

As a forth part of the research project, this study will provide an analysis on impact of $1 investment in maritime industry on Indonesian economy in terms of industrial output, income, employment and GDP. The output of this study will contribute to the second and third research. The input to the third and second study will be provided qualitatively and will help to build necessary assumptions on improvement of port performance as a result of investment planning. The second study will assume that due to investments in shipping and shipbuilding industry the size of the vessels will be at least twice bigger. At the same time, study number three will assume that the operational performance of Indonesian ports will reach the same level as in other international ports due to successful realization of planned investments. The handling speed in all ports will increase significantly and the port leg time decrease up to 2 days in all ports across the country.

The whole research project gives a unique opportunity to assess the efficiency of development policies in Indonesia.

1.3 Research question and sub-questions

Considering the above-mentioned events in sub-chapter 1, the aim of this study is to investigate whether investments in maritime sector will have an impact on other industries, salaries, employment and GDP in Indonesia. Therefore, the central research question of this study is: "**What is the impact of the investments in Indonesian maritime sectors on production output of local industries, wages and GDP?**"

To be able to answer the main research question the next sub-research questions will be investigated:

1. What kind of industries are included to the maritime sector in Indonesia?
2. What kind of industries located and function in Indonesian economy?
3. What are the national development plans introduced by Joko Widodo?
4. What is the potential for investments in maritime industry?
5. Which one of the maritime industries are needed mostly to be invested in?
6. How other industries benefit from maritime activities?
7. What was the state of the economy before Joko Widodo's governance?

1.4. Methodological Approach

The key research question addressed in thesis is aiming to analyze the relationship between investments in maritime industry in Indonesia and impact on its economy.

The most suitable methodology for the research question mentioned in previous sub-section is an Input/Output model. This methodology was found by economist Wassily Leontief in 1936 for which he was awarded with a Nobel Prize for this invention. It has been commonly used for the policy evaluation and forecasting (Haralambides, 1996).

The I/O analysis is a linear model, which will help to analyze the relationship between the industries as an aftereffect of investing in maritime sector and household. I/O method deals with inter-industry trading. Thus, this case study approach will allow to investigate to what extent each dollar of investments in maritime industry will have an impact on output of other industries, wages and GDP in Indonesia. The basic I/O analysis is an integrity of simultaneous linear equations, which aim to calculate distribution of industry's production throughout in Indonesian economy. The data for I/O table can be extracted from the publications of Badan Pusat Statistik.

The power of the mentioned model is the ability to analyze the multiplicative effect of investments on its primary inputs (labor, salaries, household income, taxes) and outputs of the local industries(Haralambides, 1996). The results generated from the formulas by using data from the I/O table, will provide an overview on so known multipliers, which are being calculated with the help of Leontief Inverse. Multipliers can be divided into total and simple ones, which capture indirect and direct effects. In case, when assumptions are based on economy, which include labor and spending, the induced effect, as well, come as a result of total multiplier. Induced effects, also known as income effects, represent new workplaces and value-added generated as a result of spending by those employees, who receive salaries from maritime related activities in Indonesia. Direct effects created by investments in maritime industry include the added value of sector's activity. Second-order growth effects cover labor and import/export effects. Indirect effects cover employment and value added depend on the relations between supply industries and maritime sector.

1.5. Thesis Outline

The overall structure of the study takes the form of 5 chapters, including introduction, literature review, methodological approach, results and analysis, findings, and conclusion. Chapter 1 will give an overview on relevance and background of the study, which touches upon questions such as, why it is important to analyze impact of maritime investments on Indonesian economy and why this study is relevant particularly in present time. Moreover, the chapter will also mention the description of chosen methodology. The second chapter is concerned with description of Indonesian economic potential, state of economy before Jokowi was elected, economic development plans of new government, overview of maritime industry and necessary investment funding. Chapter 3 provides us with explanation on chosen methodology. It will describe the structure of Input/Output model, data collection, and an overview on multipliers and effects. In Chapter 4 we will analyze the results and outcomes of calculated outputs from the model, which consists of direct and indirect effects. We will finalize with Chapter 5, which represents conclusions of the research.

2. Literature review

2.1. Indonesian Potential

2.1.1 Population

According to Ministry of Economic Affairs (2011) Indonesia has a great industrial potential, which is supported by beneficial geographical location and abundant human resources. In 2010 Indonesia was rated as 4th most populous country in the world with its population about 263 million people, which continue to raise throughout the years. Moreover, forecast conducted by Ministry of Economic Affairs (2011) indicates, that the amount of working age people (15-64 y.o.) will continue to grow and will reach its peak in 2025, while dependency ratio will be on its lowest – 40% (Figure 2).

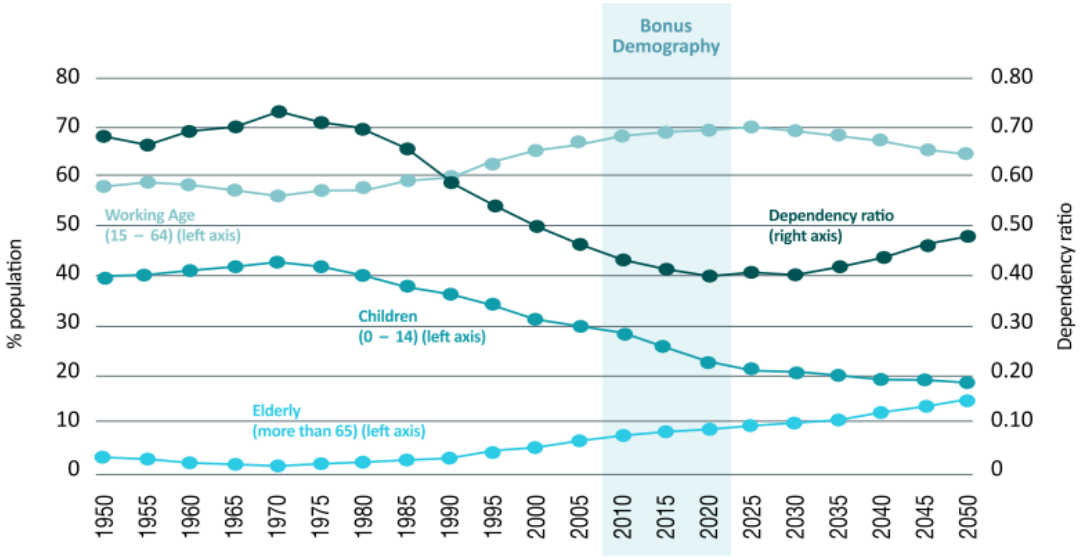
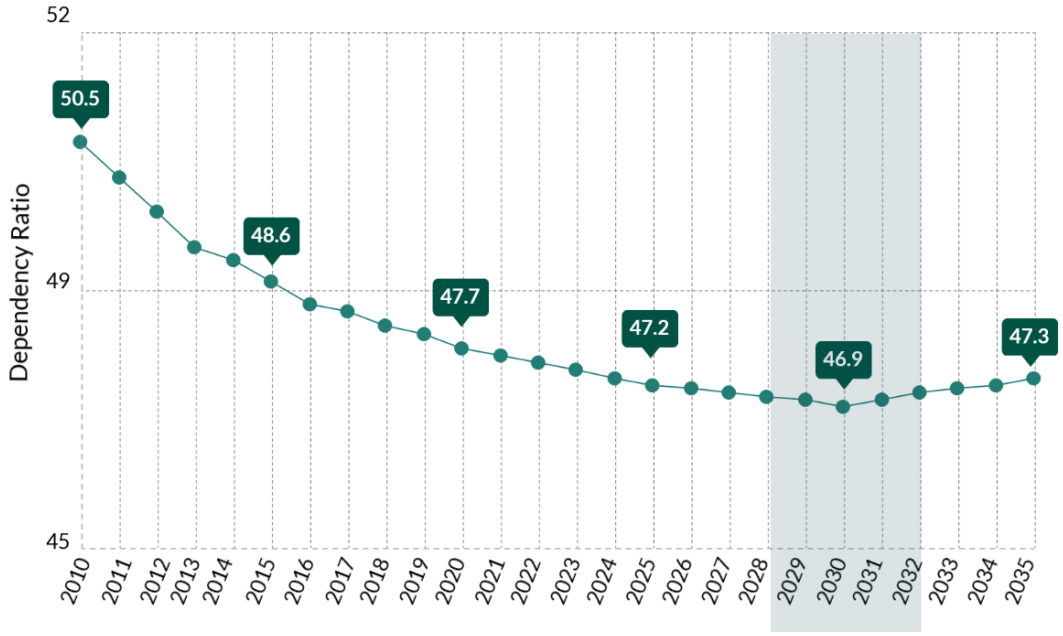


Figure 2. Demographic forecast 1950 – 2050

Source: Ministry of Economic Affairs (2011)

However, the latest report conducted by Ministry of National Development Planning (2014) include population forecast 2010 – 2035, which shows that the lowest point of the dependency ratio is expected to be in the period of 2028 – 2031 (46.9%) (Figure 3). From the above-mentioned literature, it is visible that population in Indonesia continues to grow at a fast pace. Such a change in demographic situation rises the level of productive workforce, creates large consumer class, increases demand for skilled labour, needs for job creation and altogether seen as driver for GDP growth.



**The dependency ratio is calculated from the number of population aged 0-14 years and the 65+ years population divided by the productive age population (15-64 years old)*

Figure 3. Demographic forecast 2010 – 2035

Source: Ministry of National Development Planning (2014)

2.1.2 Geographical Location

Geographically, Indonesia is considered to be largest archipelago in the world with a width of 1,870 km, length 5,200 km and total area of 1,905 million km². The country consists of 5 major islands such as Papua, Java, Sulawesi, Kalimantan and Sumatra. Furthermore, Indonesia has one of the longest coastlines in the world, which accounts for 54,716 km (Dijk *et al*, 2015). The area placed within the sea is two times bigger than the area placed within the land.

Additionally, the country is positioned in the center of shipping activity, partially along the busiest container shipping route, which goes through the Strait of Malacca. Figure 4 represents the main container shipping route between Asia, America and Europe, with ranking of sea ports worldwide. Despite having such a beneficial location, one of Indonesia's deep-sea ports, Tanjung Priok, is taking place number 26 among other ports worldwide.

According to Ministry of Economic Affairs (2011), Indonesia has also direct access to the growing economies such as India and China. Furthermore, Indonesia serves as a bridge between two continents (Asia and Oceania) and two oceans (Pacific and Indian). From the maritime point of view, such strategical geographic location

considered to be beneficial and allows to gain advantage from the maritime activities.

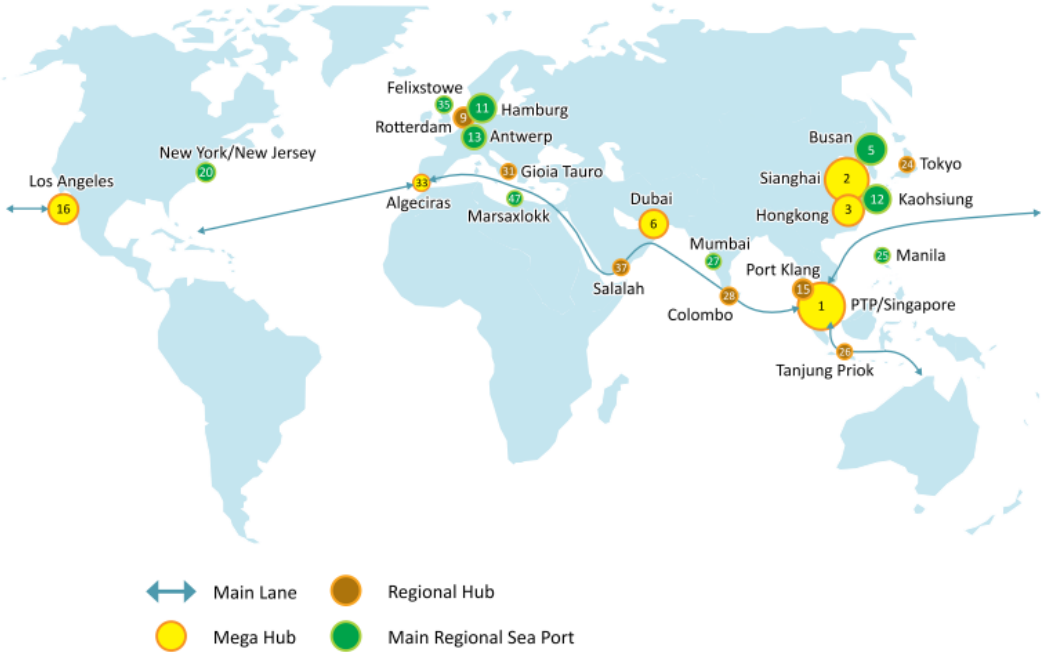


Figure 4. Port ranking in the main container shipping lane

Source: Ministry of Economic Affairs (2011)

2.1.3 Natural resources

Indonesia has abundance of natural resources. In 2015 it was a leading exporter of coal, palm and crude oil, petroleum gas, and rubber. As noted by Dutu (2015) and Ministry of Economic Affairs (2011), the country reserves 40% of geothermal energy in the world, which in addition to water and coal, supplies textile, transportation, shipyard and food industries. In total, according to Ministry of Economic Affairs (2011), Indonesia has 22 main economic activities, which among all industries also include transportation equipment and shipping (Figure 5).

In a report by Ministry of Economic Affairs (2011), it is stated that one of the main industries which contributes the most to Indonesian GDP growth are mining and manufacturing. Mining includes the extraction of coal, gold and oil, while main manufacturing sub-sectors are automotives and electronic products. Additionally, the study conducted by Dutu (2015), shows that Indonesian climate and soil create favourable conditions for agriculture activities in regions such as Java and Bali. The land dedicated for growing crops covers 536,000 $km^{2,}$, which accounts for 29% of total land. Agriculture is mainly focused on growing rice, meadows, permanent crops, palm oil, rubber and maize.

Figure 5. Main economic activities

Source: Ministry of Economic Affairs (2011)

The contribution of natural resources to GDP is considered to be high. East Kalimantan considered to contribute the most to the domestic economy, mainly, by coal mining activities. Java comes in second place by providing Indonesia with its services and manufacturing sectors. Both East Kalimantan and Java considered to have the highest level of life expectancy in the country (Dutu, 2015).

However, the study conducted by Nurkholis et al. (2016), demonstrates that maritime industry contributes essentially to Indonesian economy in terms of citizens' income and GDP. The study estimates the Gross Value Added (GVA) of maritime industry to national economy at IDR 0.43×10^{15} , which accounts for 6.64%. Based on Input/Output analysis, the sub-sector ports; bridges and roads, considered to be the key sectors in Indonesian economy, illustrated by its GVA of 2.56%. Additionally, maritime industry significantly contributes to the national economy by supplying inputs to the fish processing industry. Increase in quality of cold storage services, as an input from maritime industry, helps to boost production of fish, as an output from fishery industry.

2.2. State of economy before 2014

In recent years Indonesian economy raised high interest among the public due to strategic views of the elected president Joko Widodo on industrial and economic development in Indonesia. However, before analysing Jokowi's presidency and investigating how maritime focused policies and investments will shape Indonesian economy, it is necessary that we first track the development of economy throughout the past years and assess economic achievements of the previous cabinet. This will help us to understand better the state of economy in the past and assess the upcoming changes.

According to the report carried out by the Ministry of National Development Planning (2014), various reforms and policies taken towards economic revival after Asian crisis in 1997-1998 influenced and strengthen Indonesian economy. During the governance of previous president Susilo Bambang Yudhoyono (2004-2014), Indonesian economy was facing pressure from the global recession after Lehman Brothers Financial crisis and other economic events. However, it stayed resilient to any global economic shifts and even performed 4.6 percent GDP growth in 2009 and 5.8 percent GDP growth in 2013. During the period of 2010 – 2014 national economy grew by 6 percent on average.

In terms of production, Indonesian economy is mainly driven by tertiary industries, e.g. service focused industries, which is in the period of 2010 – 2014 grew by 7.4 percent on average with the highest growth in telecommunications and transportation sectors – 10.2 percent. The growth in secondary sectors, e.g. manufacturing, increased by 5.6 percent on average with main development in machinery, equipment and transportation sectors. In primary sector, visible changes were mainly seen in agriculture – 3.5 percent growth, and fishery. Throughout the years economic development was supported by investments and sufficient exports with a growth of 6.9 percent and 5.3 percent respectively (Ministry of National Development Planning, 2014)

In 2011 Ministry of Economic Affairs published The Masterplan for Acceleration and Expansion of Indonesia Economic Development (MP3EI), where Indonesian government introduced its strategies and principles on successful implementation of MP3EI, development of six economic regions (Sumatra, Java, Kalimantan, Sulawesi, Bali – Nusa Tenggara and Papua – Kepulauan Maluku), strengthening national connectivity, human resources, national science and technology capabilities. Among the above mentioned strategies government also emphasized on the actions to be taken towards reduction of poverty and increase in employment, which included social insurance for poor, subsidies, cash transfers, availability for education, protection for workers, improvement of industrial and employment relationships, encouraging businesses for corporate social responsibility, and support fairness between workers and employers (Ministry of Economic Affairs, 2011). Visible improvements on industrial side together with the new poverty reduction strategies described in MP3EI, created new opportunities in job market. From 2010 to 2014 the open unemployment rate was reduced by 1.5 percent and level of poverty decreased by 2.37 percent.

Figure 6. Unemployment and Poverty rate

Source: Ministry of National Development Planning (2014)

Despite strong economic growth that lasted until 2011, the slowing down in GDP growth to 6.3 percent in 2012 and to 5.1 percent in 2014 reflects upon economic crisis of 2012 (Figure 7).

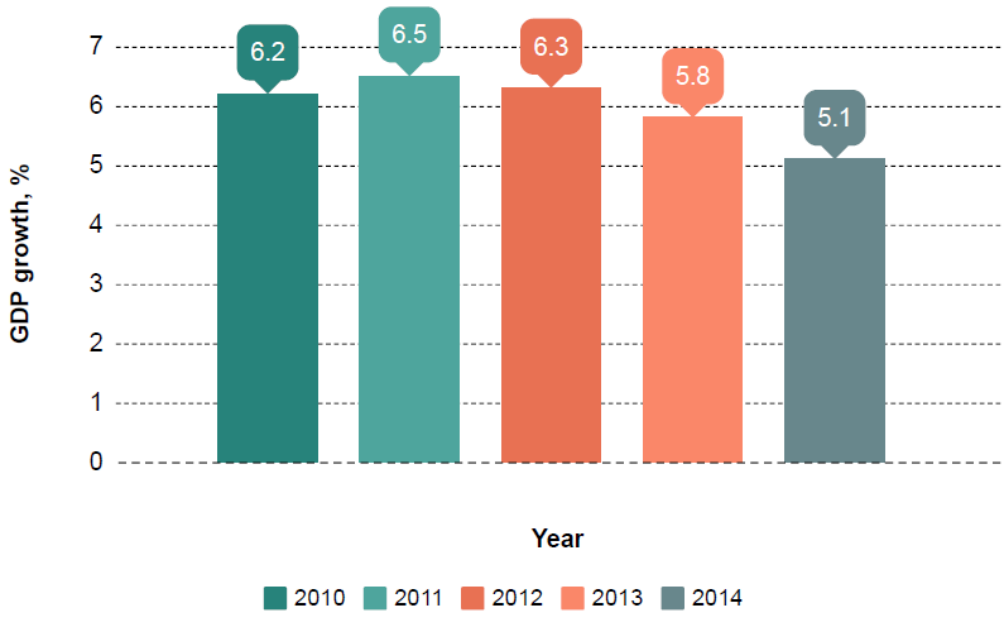


Figure 7. GDP growth 2010 – 2014

Source: Ministry of National Development Planning (2014)

Ministry of National Development Planning (2014) specifies that stability of economic growth in Indonesia, apart of GDP and employment growth, is dependent on trade balance, capital account balance, foreign investments, inflation rate and purchasing power. Table 1 represents the state of Indonesian economy throughout the period of 2010 – 2014, including indicators which represents balance of payments, financial state, poverty rate, inflation rate and nominal exchange rates. Although the period of 2010 – 2014 showed good results and improvements in national economy, there is still a room for improvement to maintain the GDP growth and support national economy.

Table 1. Macroeconomic Figures

Indicators	Realization				Estimation
	2010	2011	2012	2013	2014
GDP growth (%)	6,2	6,5	6,3	5,8	5,1
GDP per capita (thousand Rp)	27.029	30.659	33.531	36.508	43.403
Inflation rate, consumer price index (%)	5,1	5,4	4,3	8,4	8,4
Nominal exchange rates (Rp/US$)	8.991	9.068	9.670	12.189	11.900
Balance of payments					
Current account / GDP (%)	0,7	0,2	-2,8	-3,8	-3,0
Growth of non-oil and gas exports (%)	30,7	25,7	-6,0	-2,1	-1,0
Growth of non-oil and gas imports (%)	38,9	24,8	9,3	-3,6	-1,0
Foreign exchange reserves (US$ billion)	96,2	110,1	112,8	99,4	112,4
State finance					
Primary balance of state budget/GDP (%)	0,6	0,1	-0,6	-1,1	-0,7
Surplus/Deficit state budget/GDP (%)	-0,7	-1,1	-1,9	-2,3	-2,0
Tax revenue/GDP (%)	11,3	11,8	11,9	11,9	11,5
Government debt/GDP (%)	26,2	24,4	24,0	26,1	23,9
Foreign debt	9,6	8,4	7,5	7,8	6,2
Domestic debt	16,6	16,0	16,5	18,3	17,7
Unemployment and Poverty					
Unemployment rate	7,4	6,8	6,2	5,8	5,9
Poverty rate	13,33	12,49	11,46	11,37	10,96*

*Poverty rate in September 2014, before the policy of reducing fuel subsidy in November 2014

Source: Ministry of National Development Planning (2014)

2.3. National Maritime Development Plan

In 2014 the newly chosen president of Indonesia, Joko Widodo, announced an ambitious plan for the national development by introducing mission, vision and main strategies in “Medium Term National Development Plan 2015 – 2019” and “Master Plan of National Industry Development 2015 – 2035”. According to Ministry of Industry Republic of Indonesia (2015), plan of industrial development was issued in 2014 and aligned with “Medium Term National Development Plan 2015 – 2019”, while medium term plan was introduced by new government in 2015 as a part of ‘’Long Term Development Plan 2005 – 2025’’. Furthermore, the government under the leadership of Joko Widodo drafted the Global Maritime Fulcrum doctrine, which is the official program to support Indonesia’s maritime identity. Both development plans and GMF doctrine has a precise view on rising and funding maritime industry for the sake of national economic growth.

The Ministry of Industry Republic of Indonesia (2015) in the national industry development plan 2015 – 2035 identifies three phases of industrial improvement.

- First Phase (2015 – 2020) – prepare competent human resources, improve technological abilities and increase the added value of natural resources extracted from such industries as mineral, oil processing and agriculture.
- Second Phase (2020 – 2024) – gain competitive advantage from accomplished developments described in first phase.
- Third Phase (2025 – 2035) – realize Indonesia as highly innovated, competitive and industrial country.

At the same time, the “Master Plan of National Industry Development 2015 – 2035” describe and prioritize domestic industries, which have to be improved. The plan divides sectors in the mainstay, supporting and upstream groups. Mainstay

Table 2. Industrial priority division

No	Industry	Remark
1	Food Industry	Mainstay
2	Pharmacy, Cosmetics and Health Equipment Industry	
3	Textile, Leather, Footwear and Various Industry	
4	Transportation Industry	
5	Information and Communication Technology Industry	
6	Power Plant Industry	
7	Capital Goods Industry, Components Industry, Auxiliary Material Industry, and Industrial Services	Supporting
8	Agro-Based Upstream Industry	Upstream
9	Basic Metal and Non-Metal Mineral Industry	
10	Oil, Gas and Coal based Chemical Industry	

Source: Ministry of Industry Republic of Indonesia (2015)

industries are considered to be the top priority sectors, which will drive the growth of national economy. Meanwhile, supporting and upstream industries are responsible for sustainable industrial development and supply of raw materials respectively. Using quantitative and qualitative criteria the Ministry of Industry Republic of Indonesia (2015) defines transportation industry together with food, pharmacy, cosmetics, health equipment, textile, leather, footwear, ICT and power plant sectors as a priority industry for long-term development (Table 2). Transportation sector include shipyard industry together with motor-vehicle, train and aerospace sectors.

The “Medium Term National Development Plan 2015 – 2019” as well as “Master Plan of National Industry Development 2015 – 2035” works towards improvement of domestic industries. The plan identifies vision as the aim to realize sovereign, self-sufficient and integrated country built on mutual collaboration. The vision is strengthen by seven development missions, four strategies and nine priority agendas (Figure 8). One of the development aspects mentioned in strategies is focused on improvement of domestic prime sectors to support the independence of national economy. Referring to Ministry of National Development Planning (2014), the main industries for driving economy were identified as food, energy, maritime and tourism industries. The particular attention is given to the maritime and marine industry, since one of the main aims of Joko Widodo’s development policy is not only to convert Indonesia to a maritime driven country, but also introduce maritime industry as a part of country’s identity.

According to Ministry of National Development Planning (2014), development of maritime industry 2015 – 2019 sets up following targets:

- Develop maritime tourism and small islands tours
- Increase the production of fishing industry by 40-50 million tons by 2019
- Improve 24 fishery ports
- Integrate data and information to support management of coastal and maritime resources
- Improve sea transport services by introducing 104 ships and 50 ferry carriers to create better connectivity between the islands
- Develop and introduce 24 deep-sea ports, including Bitung and Kuala Tanjung as new international cargo hubs to support 19 feeder ports and 5 hub ports
- Develop 60 ferry docks
- Increase the infrastructure capability to fulfil domestic imports and exports
- Increase the level of qualified maritime human resources up to 200,000 people by 2019

Additionally, to support the targets government also identifies policies and strategies to accelerate the development of maritime economy (Figure 9). The acceleration plan is focused on potential evaluation of marine resources, development of maritime industry and improvement of logistic systems. The potential evaluation of marine resources require improvement of information and communication technologies. This will allow to support the process of collecting data, advance the process of analysing data results, and facilitate communication between industries and institutions to control/plan exploitation of marine resources. Development of

maritime industry addresses the need to improve sector through the economic interaction with other domestic industries, create investment-friendly environment and support shipbuilding capacity to fulfil domestic demand for sea transportation. Improvement of logistic systems include development of small domestic ports located afar from most important hubs, increase port and warehouse capacity, develop national transportation systems, improve quality of seagoing transportation services and develop deep sea routes for better connectivity with regional economic centres. In such a way improvement of maritime industry can be accelerated and optimally used for nation's livelihood and welfare.

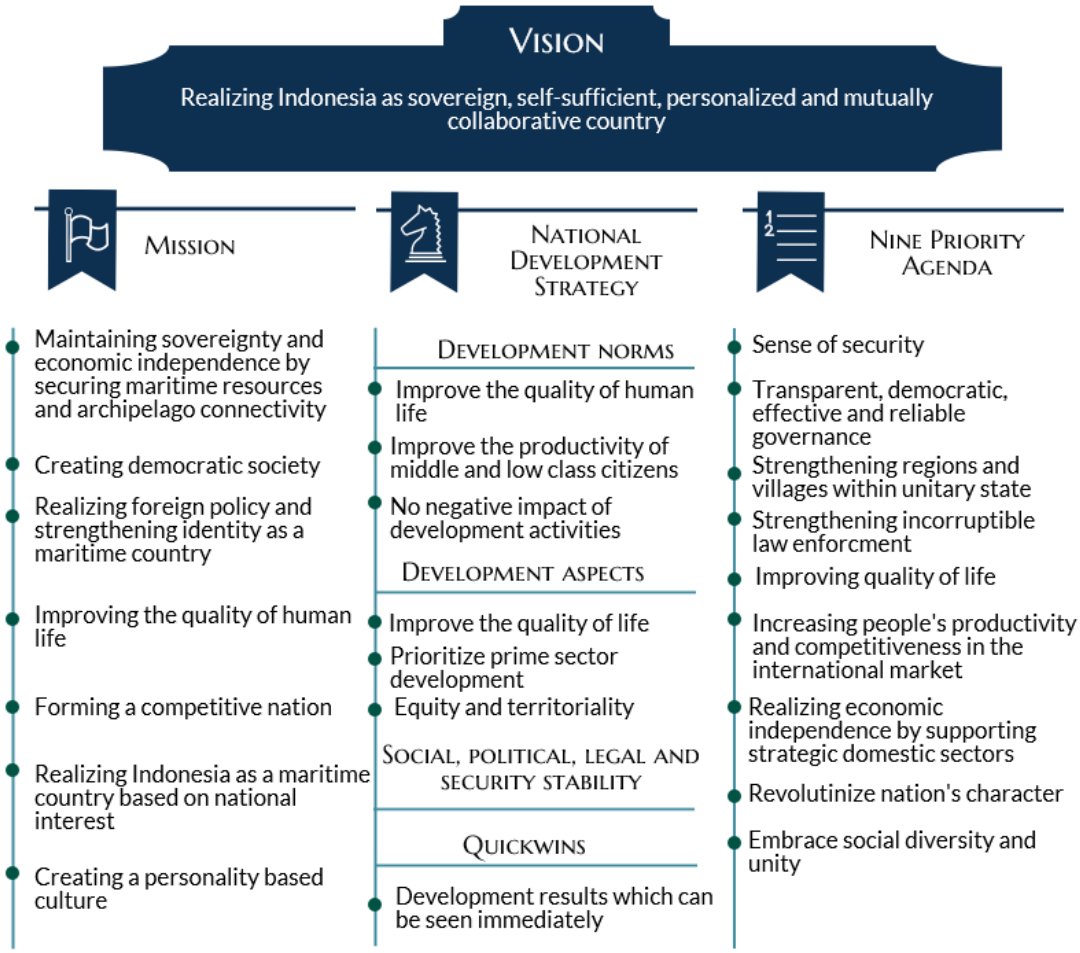


Figure 8.Overview of development planning 2015 – 2019

Source: Ministry of National Development Planning (2014)

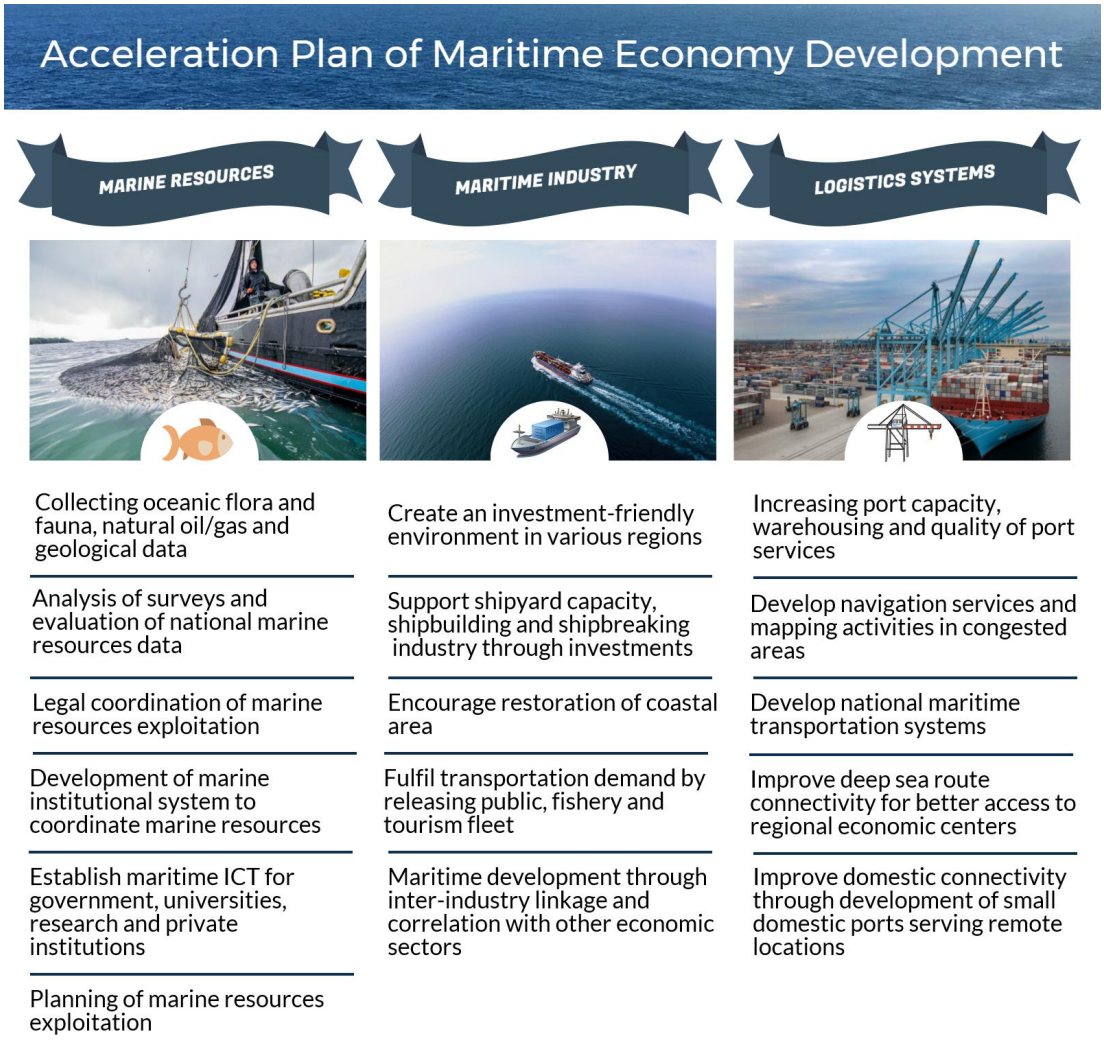


Figure 9. Acceleration Plan of Maritime Economy Development 2015 – 2019

Source: Ministry of National Development Planning (2014)

Furthermore, the Ministry of Industry Republic of Indonesia (2015), in accordance with "Medium Term National Development Plan 2015 – 2019", introduce infrastructure development as one of the main agendas towards sustainable economic growth. The main objectives for maritime development, apart from the targets described above, are as follow:

- Improvement and construction of 163 non-commercial ports to support Indonesian Sea-Tollway Program
- Build 50 new vessels and make 193 sea routes available for maritime services
- Connection of South, North and Central maritime corridors
- Improvement of 50 ferryboats

- Increase the importance of lake and river domestic transportation through building 120 docks
- Boost national market share of maritime fleet up to 20% for export/import activities
- Increase the number of commercial vessels aged less than 25 years up to 50% and increase importance of ferries

  Integrate shipping services with other modes of transport such as road and railway in Sumatra and Java regions
- Increase involvement of private sector to the improvement plans of transportation through attracting direct investments and increasing role of partnerships between government and private sector

Figure 10. Five main pillars of Global Maritime Fulcrum doctrine

Source: Dijk et al.,(2015)

On top of that, Joko Widodo introduced Global Maritime Fulcrum doctrine (GMF) during the East Asia Summit in 2014. The GMF is a program, which focusses entirely on development of Indonesian maritime industry. The president identifies surrounding waters as a great benefit for Indonesian economic growth, instead of looking at it as on natural disadvantage of country (Gindarsah and Priamarizki,

2015).The aim of the doctrine is to transform the country into a main hub and economic influencer of the maritime world.

According to Dijk et al. (2015), the GMF is based on five main pillars, which aims to revive maritime culture, improve management of maritime resources, develop archipelago connectivity, strengthen maritime security and diplomacy (Figure 10). Referring to Gindarsah and Priamarizki (2015), the doctrine was created to support domestic economy through mainly development of islands connectivity and infrastructure. The infrastructure improvement is going to be realized by constructing 'sea highways', building deep sea ports, organizing logistics networks, developing shipping services and fishery industry.

To conclude upon above mentioned development plans and GMF doctrine we should note, that improvement targets within maritime industry, which require capital is mainly focused on development of ICT for fishery sub-sector, port infrastructure, shipbuilding and increase of shipping services quality. The improvement of this sub-sectors is highly capital intensive and requires certain amount of investments to realize all objectives and targets. In next sub-chapter we will analyse closely investment environment and investment needs in Indonesia for maritime industry.

2.4. Indonesian Maritime Industry & Investments

With such beneficial geographical location and abundant natural resources, there are definitely plenty of opportunities for Indonesian maritime industry. There is a high presence of maritime activities, which together with governmental support, might be seen as a good investment option for third parties. In "Medium Term National Development Plan 2015 – 2019", "Master Plan of National Industry Development 2015 – 2035" and Global Maritime Fulcrum doctrine, Jokowi precisely addresses the needs for funding in order to promote maritime industry and boost economic growth. In 2015, EU – Indonesia Business Network reported that development of Indonesian maritime industry will create advantages for other domestic industries, since it will generate more jobs and accelerate economic growth.

Indonesia is open for abundant investment opportunities to each sub-sector of maritime industry, mainly due to its enormous maritime potential, high governmental financing through GMF program and the most potential for trade growth among the Association of Southeast Asian Nations (ASEAN) Economic Community (Dijk et al., 2015). The national investment environment in Indonesia demonstrates favourable conditions and reliable performance, which lead to stable ratings and positive reviews (Ministry of Industry Republic of Indonesia, 2015). Referring back to the previously-reviewed policies in Sub-chapter 2.3, Indonesian government aims to raise funds through both direct/indirect foreign and domestic investments, as well as through wise allocation of government budget.

Preliminary review on Indonesian maritime investment policies was undertaken by Dijk, Mheen and Bloem (2015), where one of the main sub-sectors were identified as ports and terminals, shipping, offshore, shipbuilding, fishery, delta technology and maritime education. However, according to Dijk et al., (2015) and Oxford Business Group (2015), Indonesian government specifies the priority industries and sub-sectors precisely for investments purposes (Figure 11). Further, this study will focus

on priority investment sub-sectors for maritime industry, which were identified as shipping, shipbuilding, sea ports, cold storage and ICT for maritime.

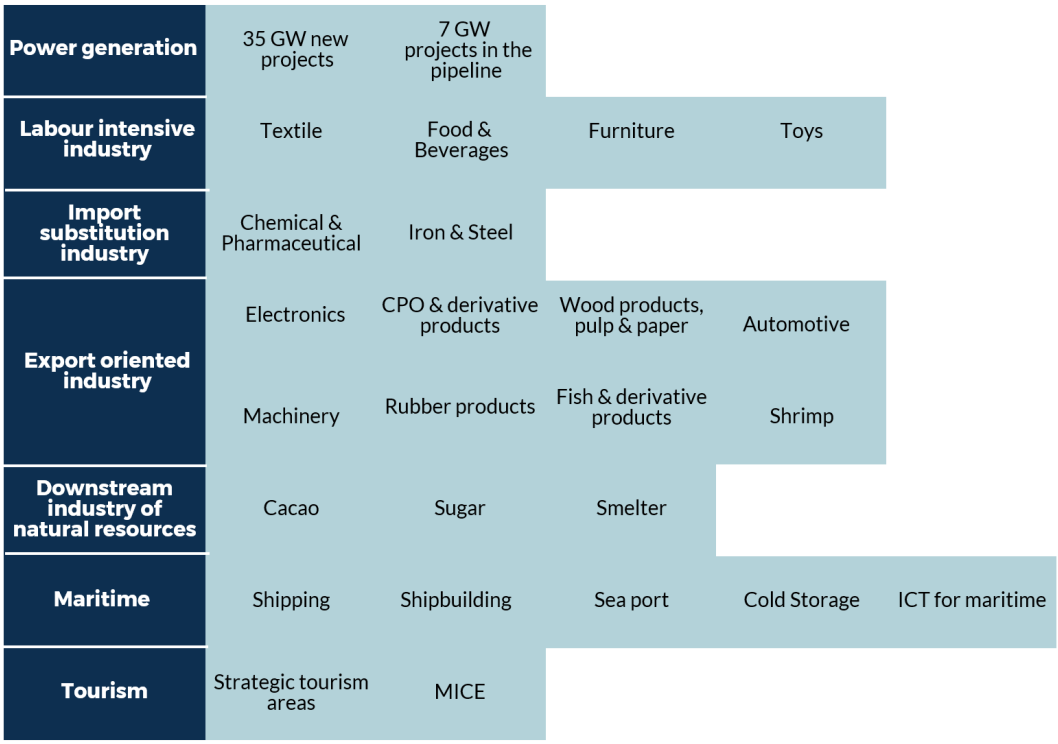


Figure 11. Investment priority sectors
Source: Dijk et al.,(2015)

2.4.1. Ports and terminals

Indonesia has endless list of ports, which are currently reached the number of over 2000 ports across the country (Ministry of Transportation, 2013). Mainly, ports can be divided into commercial, special, non-commercial ports and fishery harbours. There are approximately 111 commercial ports, which include cargo, ro-ro, multi-purpose and container terminals (Dijk et al., 2015). Currently, 25 ports bridges domestic and international sea transportation (Figure 12). Additionally, 24 of them are accounted as the main international cargo hubs in Indonesia and prioritized by the President Joko Widodo for strategical national development (Sheng, 2015). According to Dijk et al. (2015) the largest ports are:

- Tanjung Perak
- Tanjung Priok
- Belawan
- Makassar.

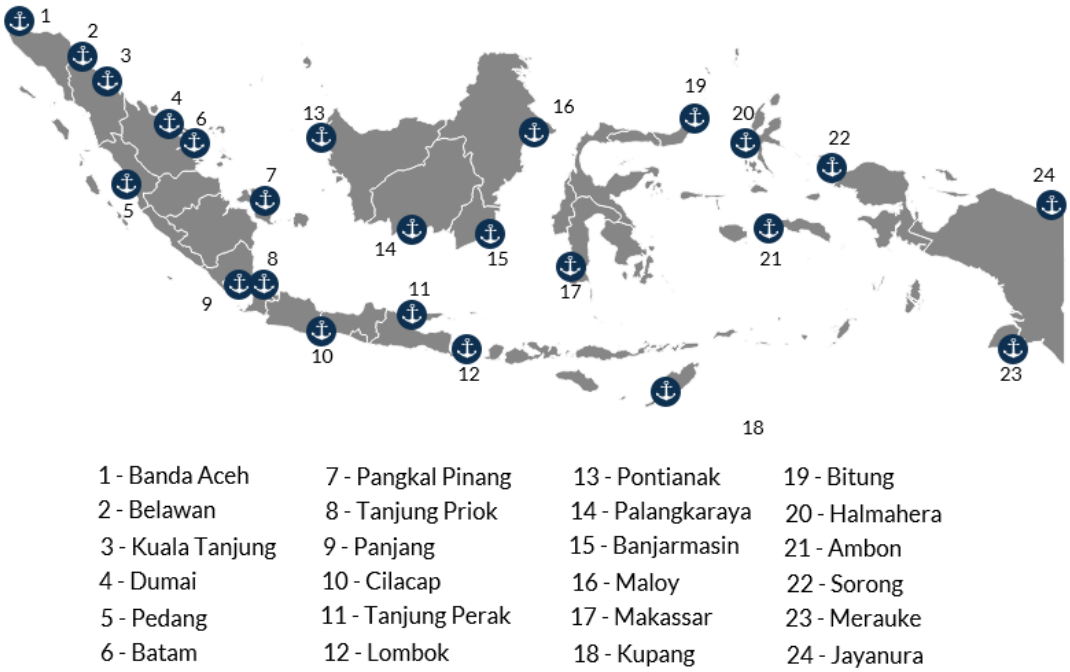


Figure 12. Main 24 strategic commercial ports

Source: Sheng (2015)

Commercial ports were geographically divided and appointed to manage by the state-owned company PT Pelabuhan Indonesia I, II, III and IV. Each of the corporations is responsible for managing certain ports in certain regions (Table 3). However, the central government is still responsible for the setting up port fees at the domestic level. As a result, the 90% of all transportation infrastructure turned out to be in public possession, while only 10% is being managed by private sector (EU - Indonesia Business Network, 2015).

There are also present around 1,129 relatively small and poorly developed non-commercial ports in Indonesia. They are partially owned by port operators, government or private sector and not developed for the high pace trading activities (Dijk et al., 2015). Additionally, there are around 800 special purpose terminals and private ports dedicated for handling oil, gas, coal, timber, fishery and cement.

Throughout the years, port infrastructure had been poorly funded, which explains Indonesia's low logistics performance index. This resulted in high cost for moving goods domestically, which triggered high prices for the end consumers. Moreover, taking into account geographical fragmentation of Indonesia and its enormous population, underperformance of port infrastructure resulted in poor archipelago connectivity and challenged movement of people across the country. Furthermore, such an isolation of islands slows down economic development, since all domestic distribution and production processes are not properly linked with each other. The insufficient flow of goods across Indonesia resulting into unequal utilisation rates in commercial ports.

Table 3. Division of ports and regions between Pelindo I, II, III and IV

Port corporation	Coverage (Provinces)	Ports
Pelindo I	Aceh, North Sumatra, Riau	Belawan, Pekanbaru, Bumai, Tanjung Pinang, Lhokseumawe
Pelindo II	West Sumatra, Jambi , South Sumatra, Bengkulu, Lampung, Jakarta	Tanjung Priok, Panjang, Palembang, Teluk Bayur, Pontianak, Cirebon, Jambi, Bengkulu, Banten, Pangkal Balam, Tanjung Pandan
Pelindo III	Central Kalimantan, South Kalimantan, West Nusa Tenggara, East Nusa Tenggara	Tanjung Perak, Tanjung Emas, Benjarmasin, Benoa, Tenau/Kupang
Pelindo IV	Sulawesi, Maluku, Irian Jaya	Makassar, Balikpapan, Samarinda, Bitung, Ambon, Sorong, Biak, Jayapura

Source: EU - Indonesia Business Network (2015)

Table 4. Indonesian Logistics cost among advanced and ASEAN countries

Country	Logistics Cost (% of GDP)
USA	9.9
Japan	10.6
South Korea	16.3
Singapore	8
Malaysia	13
Thailand	20
Vitnam	25
Indonesia	27

Source: World Bank, Institut Teknologi Bandung, Asosiasi Logistik Indonesia, STC-Group (2013)

Only a few ports in the country are being utilised above 80%. Some of the ports do not even reach a benchmark of 40% of utilisation (Dijk et al, 2015). Moreover, the latest trends in increase in cargo volumes and vessel size worldwide showed the need for more developed port and terminal capacity to remain competitive on international market. More national ports are still not capable of receiving big size vessel and cope with a high flow of goods. According to World Bank et al., (2013), the cost of logistics in Indonesia reached 27% of GDP, which placed Indonesia far behind developed and ASEAN countries (Table 4).

However, the development plans and GMF doctrine opened an enormous opportunity for investments in port infrastructure across the country, which will lead to necessary improvements. Ministry of Industry Republic of Indonesia (2015), estimated its investment needs to support infrastructure of sea ports in amount of US$ 1.3billion. The main strategic port projects identified by Ministry of Industry Republic of Indonesia (2015) are Halmahera, Pontianak, Bitung, Kuala Tanjung, Makassar, Tanjung Perak and Banjarmasin. Refering to EU - Indonesia Business Network (2015), one of the most expected projects to be realized is a new port facility positioned 7km from Tanjung Priok, container facilities Tanjung Sauh Port and Kuala Tanjung Port. This will increase the capability for container storage up to 4 mln TEUs and 1 mln TEUs respectively. All of Pelindo port corporations received detailed projects on port development and amount of investments needed for infrastructure improvements. EU - Indonesia Business Network (2015) presented the name of the projects and amount of investments allocated for them (Table 5). As we can see from Table 5, port development is highly capital intensive and require certain funding.

Table 5. Investments for port development

Port corporation	Project	Investments
Pelindo I	North Sumatra's Kuala Tanjung Port	US$ 1.2 billion
Pelindo II	Kalibaru Port	US$ 2.47 billion
	First two phases for new container facilities in Kalibaru Port	US$ 4 billion
	Tanjung Sauh Port	US$ 515 million
	New Muara Hati Port	US$ 132 million
Pelindo III	Automated container carrier	US$ 200 million
Pelindo IV	Construction works of Makassar New Port	US$ 23.2 million

Source: World Bank, Institut Teknologi Bandung, Asosiasi Logistik Indonesia, STC-Group (2013)

In general, therefore, such capital intensive port development projects are being supported by governmental budget. According to Bappenas (2015), the government estimates total investment needs for all 24 strategic ports around US$5.1 billion. The rest is widely open for foreign investments to divide the financial burden and accelerate national economic growth.

2.4.2. Shipping

In its review of shipping industry, Global Business Guide Indonesia (2014), mentions that Indonesia is mostly an exporting country and 90% of all commodities are being moved internationally via sea transportation. Since Indonesia is divided into multiple

islands, shipping services are playing key role in transportation of goods within the country. According to Clarkson database, the biggest fraction of fleet present in Indonesia is tugboats, which accounted for 50% of all Indonesian flagged fleet. Dry cargo vessels are followed by 21% and container shipping only represents 2% (Figure 13).

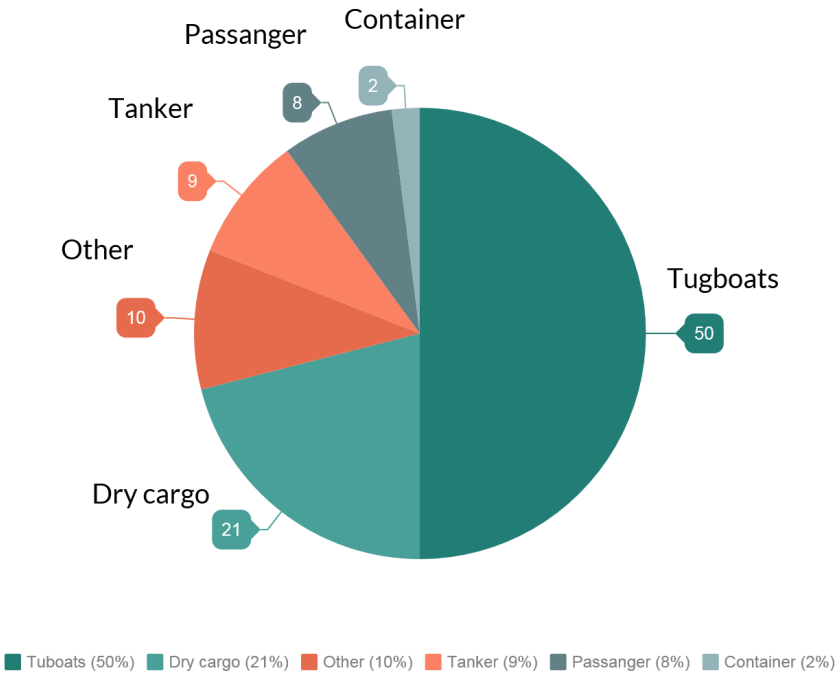


Figure 13. Indonesian flagged vessels

Source: Clarkson Research Services Limited, 2015

As it is visible from Figure 13, there is not enough national fleet capacity to transport commodities, both domestically and internationally. For the sake of lower costs, considerable number of companies prefer to charter foreign ships instead of operating with Indonesian flagged vessel. Currently, there are six main domestic players in the shipping market who control around 80% of Indonesian fleet capacity (Table 6). According to Dijk et al (2015), the capacity of the greater part of Indonesian container ships varies from 350 TEUs to 800 TEUs, while in other countries the smallest vessels reached 1,000 TEUs. Due to the small carrying capacities of goods, domestic shipping companies facing high operational costs, which lead to the high prices of final products for consumers. Using vessels with larger capabilities can decrease cost for shipping companies significantly. Therefore, government will support development of Indonesian fleet for investments in order to increase fleet capacity and overcome inefficiency on national level (Dijk *et al*., 2015). Additionally, according to Ministry of National Development Planning (2014), government is planning to buy 600 vessels to decrease delays and encourage

trading activities. According to Bappenas (2015), the government estimates investment needs for domestic shipping development to be around US$ 7.8 billion.

Table 6. Main domestic players of Indonesian shipping market

Shipping Line	Capacity of domestic container shipping lines, %
Pelayaran Meratus	19%
Tanti Intim Line	17%
Temas	14%
SPIL	13%
Samudera Indonesia	11%
Alken	7%
Others	19%

Source: Dijk et. al., (2015)

2.4.3. Shipbuilding

According to EU - Indonesia Business Network (2015), Indonesian shipyards had, for a long time, been managed mainly by foreign enterprises. There are Dutch owned shipyards such as Damen and Royal IHC. Other foreign players, for example, V-Step, Olivera, CSI Systems and HMSA, provide maritime services and collaborate with shipyards. One of the domestic key players in shipbuilding market are PT Dok & Perkapalan Kodja Bahari (DKB) and PT PAL Indonesia ("PAL Indonesia"). The PT Dok & Perkapalan Kodja Bahari (DKB) is repairing and building ships with maximum capacity of up to 30,000 DWT. Meanwhile, PT PAL Indonesia ("PAL Indonesia") can build vessels up to 50,000 DWT. PT PAL Indonesia shipyard specialises on container ships, tankers, LPG, naval ships and passenger vessels. For the repair purposes the shipyard can serve up to 600,000 DWT of vessels annually (Dijk *et al*., 2015).

The trade in ASEAN Economic Community is growing fast and creating demand for new capacity in sea transportation. However, most of the Indonesian shipyards are not able to build large vessels. Therefore, Indonesia is highly dependent on buying foreign built vessels or order from the shipyards abroad (EU - Indonesia Business Network, 2015). Additionally, there is significant gap between supply and demand for repair services (Figure 14).

The national development plans introduce governmental support for domestic shipyards in terms of incentives, and projects realised in cooperation with foreign professionals of shipbuilding industry. This requires additional funding in amount of US$ 830 million (Bappenas, 2015).

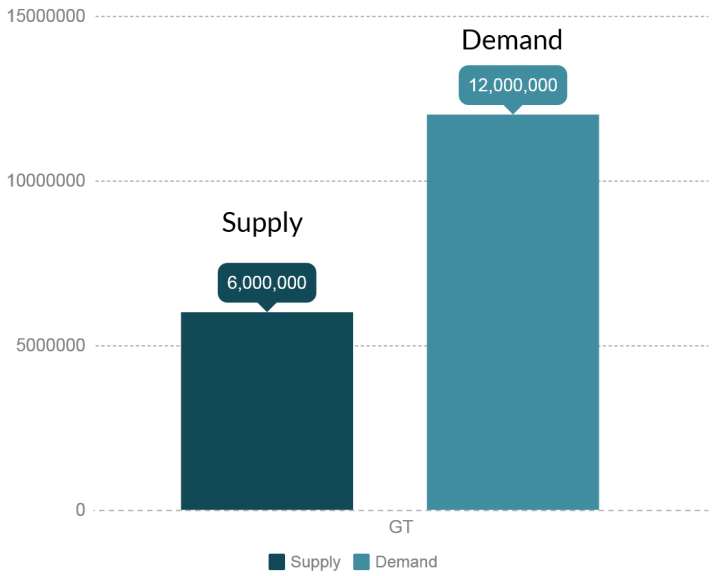


Figure 14. Supply and Demand for ship repair services

Source: EU - Indonesia Business Network, (2015)

As we can see, the shipbuilding industry require considerable amount of investments. To help attract investments, government started to ease some regulations such as decrease of value-added tax and changes in tariff structure.

2.4.4. Cold storage

Referring to EU - Indonesia Business Network (2016), cold storage is essential part of domestic logistics in Indonesia. It can be divided in four main groups such as blast chillers, freezer rooms, blast rooms and blast freezers. There is considerable number of industries which have a high demand for cooling facilities. With more than 800 fishery ports in Indonesia, the demand for cold storage comes mainly from fishery sub-sector. With the production of around 6.52 million tons of captured fish and 14.47 million tons of aquaculture in 2015 there is a certain requirements for storing and transporting maritime resources for both domestic consumption and import/export purposes. Throughout the years there was noticeable inefficiency of cooling facilities and unfulfilled demand across the country. According to EU - Indonesia Business Network (2016), development of cold storage will lead Indonesia to sustainable economic growth.

In previous years cold storage capacity increased only by 6%, while the production only for fishing industry in 2014 reached 7.2 million. However, government attempt

to fix the current situation and in its regulations for cold storage development introduce 100% openness for foreign investments. Cooling facilities are highly depended on capital-intensive investments, for example, in equipment with temperature control and energy supply (EU - Indonesia Business Network, 2016). According to Seatrade Maritime News (2016), Maersk supported the initiative of Joko Widodo development plan and together with other interested companies might be the potential investor for cold storage. Meantime, EU – Indonesia Business Network 2016), notes that current government engaged the State Logistic Agency to invest into cold storage project about US$152 mln. Additionally, current government is planning to allocate US$17.1 mln to development of 58 cold storages and ice factories across the country.

2.4.5. ICT for maritime

According to EU - Indonesia Business Network (2015), majority of the ports in Indonesia are still dependent on wired network, which sets Indonesian ports far from having highly efficient ports.

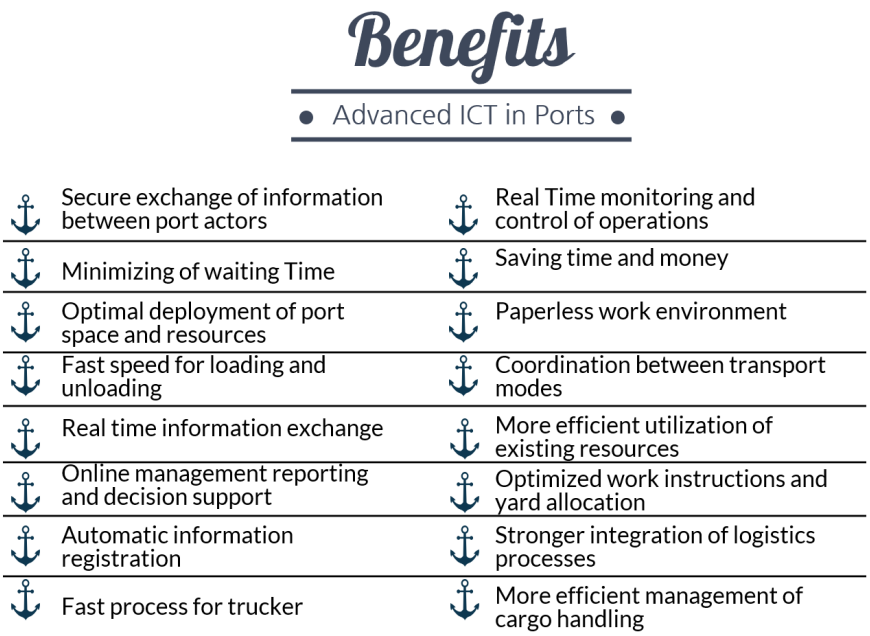


Figure 15. ICT benefits for ports

Source: Rasha, (2016)

In 2016, Rasha conducted study on the role of information technologies in modern ports, where he identifies the main benefits for ports of advanced ICT (Figure 15). Accommodation of such benefits can reduce cost for transportation and improve efficiency of domestic ports in Indonesia. The development of maritime ICT is necessary to support targets of national development plans and Global Maritime Fulcrum doctrine.

Indonesian telecommunication corporation PT Telekomunikasi Indonesia Tbk, started to develop information and telecommunication broadband access in 24 Indonesian ports. The amount of investments for the project reached US$6,7 mln. Referring to EU - Indonesia Business Network (2015), in 2015 the ICT systems were developed in such ports as Tanjung Priok, Makassar, Belawan, Tanjung Perak, Sorong and Batam.

2.5. Role of Investments in National Economic Development

As it was assessed in previous chapters, the national development plans of the Indonesian president Joko Widodo include enormous number of capital intensive maritime infrastructure projects and emphasise the need to create new investment opportunities for both private and public investors. To sum up Table 7 represents the overall picture of investment needs and projects in described above prioritized maritime sub-sectors based on government planning. Since this study is aiming to analyse the impact of investments on national economy, it is important to review previous studies concerning this topic.

Table 7. Investment planning for prioritized maritime sub-sectors.

Industry	Investment planning, US$
Shipbuilding	830 million
Ports	5.1 billion
Shipping services	7.8 billion
Cold Storage	169.1 million
ICT for maritime	6.7 million
Total	13.9 billion

Source: Compilation of sources from previous sub-chapters

Large and growing body of literature has investigated relationship between economic growth and investments. Previous studies have reported a positive correlation between foreign direct investments (FDI) and economic improvements (Li and Liu, 2005; Iamsiraroj, 2016; Borensztein, Gregorio and Lee, 1998). Li and Liu (2005) proves strong complementary connection between economic growth and FDI in both developed and developing economies. Moreover, the results of the study points out on indirect positive effect of investments on human capital. Likewise, the results of regression analysis made by Iamsiraroj (2016), shows that economic growth per capita is also driven by FDI as well as by labour force, economic independence and trade openness. At the same time, Borensztein, Gregorio and Lee (1998) concluded that there is also a noticeable positive correlation between domestic investments and national economic growth. However, the FDI are seems to be more effective than domestic investments due to more qualified management and advanced technologies, even though domestic businesses have better knowledge of national market. The findings are point out that FDI is seen as a complementary addition to domestic investments. In addition to that,

Wehinger (2011) mention that long-term investments contribute to economic growth by funding infrastructure projects. Long-term investments can develop governance of corporations, increase return on pensions and savings. Moreover, in 2013, Leitao and Rasekhi traced the link between FDI and economic growth on example of Portuguese economy. The founding reveal that FDI stimulate domestic economy through improvement of management and technology, increase in competition, educating labour force and improving local markets

Furthermore, the study carried out by Abiad, Furceri and Topalova (2015) on macroeconomic impact of public investments in infrastructure, showed that public investments lead to noticeable decrease in unemployment rate both in short-term and medium-term. It was proven that in short-term the unemployment rate decreases by 0.11%, while in medium-term it drops by 0.35%. Additionally, it was founded that statistically the impact of private investments on GDP is not significant. However, it was proved that it become significant in case when private investments are being accompanied by public investments. Moreover, the study had proven that increase in efficiency of public investments lead to increase in private investments.

Nevertheless, there are studies which questions positive relationships and analyse negative impact of investments on economic growth. In an analysis of FDI spill-over effects on manufacturing in Malaysia performed by (Ariffin, Hadi and Ibrahim, 2012), there were found four negative relationships between FDI and some manufacturing sub-sectors. The study gives two possible explanations for such outcome. Firstly, it might be a consequence of local policy, which allows companies to outsource inputs from abroad. Secondly, the FDI can put a pressure on domestic companies, which does not receive investments. Additionally, the analysis conducted by (Ariffin, Hadi and Ibrahim, 2012) identifies both positive and negative effects on Venezuela's economy. On one hand, the study demonstrated increase in productivity in individual domestic firms. On the other hand, the productivity of all domestic firms decrease with the larger amount of FDI's. The net effect on domestic economy is insignificant.

From discussed above matters we can note that Jokowi's development policies which strive to attract foreign and government funds may result in both positive and negative effects. To be able to analyse the impacts on Indonesian economy we will proceed with the next chapter, which will give us an overview on employed methodology.

2.6. Assumptions

As it was mentioned previously, this study focuses on industries prioritized for investments by Indonesian government, such as ports and terminals, shipping services, shipbuilding, cold storage and ICT for maritime. However, due to data constraints, this study can not divide industries provided in Indonesian Input/Output Table precisely into mentioned sub-sectors. The data given in Input/Output table provide with such industries as ship and ship repair services; roads, bridges and ports; other buildings; seaborne transportation services; river, lake transportation and crossings; transportation support services; computer and IT consultation services. Each of this industries include maritime sub-sectors, which were

prioritized for investments by government, but together with some other sectors (Table A1). The reader should bear in mind the assumption that by investing in prioritized sectors, investments should also be given to other sub-sectors industries mentioned above in the given Input/Output table.

3. Methodology

3.1 Input/Output analysis

The Input/Output analysis was invented by economist Wassily Leontief in 1973, who aimed to investigate mutual relationship between different industries of a complex economies. The uniqueness of the model is recognized in its ability to assess the impacts of multiplicative effects on incomes, labour, industrial output and household (Haralambides, 1996). This information is highly valuable for studies which aimed to assess the impact of various policies, including investment plans. There is an increasing amount of published studies investigating the impact of investments on the host economy using Input/Output analysis. The study conducted by Dobrescu, Gaftea and Scutaru (2010), investigated the impact of investments on Romanian economy by using I/O analysis for 10 different industries. Similar studies were done for state of Arizona, China -Laos and Bandung district in Indonesia by Lim and Dall'bera (2015), Thongvanh (2016) and Anas, Tamin and Wibowo (2015) respectively. The studies provide the results, where they describe the share of certain industries' contribution to GDP, efficiency of investments based on change in taxes and industrial output.

The I/O analysis is a linear model, which will help to analyze the relationship between Indonesian local industries as an aftereffect of investing in maritime sector through capturing direct, indirect and induced effects. Induced effects, also known as income effects, represent new workplaces and value-added generated as a result of spending by those employees, who receive salaries from maritime related activities in Indonesia. Direct effects created by investments in maritime industry include the amount of new generated jobs together with the added value by sector's activity. Second-order growth effects cover labor, import/export effects. Indirect effects cover employment and value added depend on the relations between supply industries and maritime sector.

The principal behind the model can be explained as following: each industry aims to fulfill its demand by generating output to its final consumer, and in addition, creates an intermediate supply for other industries, which use it as a factor of production. Thus, by manipulating with investment data, the results of the study will allow to investigate to what extent each dollar of investments in maritime industry will have an impact on outputs of the local industries in Indonesia as well as on its primary inputs (labor, salaries, household income, taxes).

Mainly the analysis is based on the data provided by local statistical institution in the form of standardized Input/Output table designed specifically for I/O methodology. The allocation of industry's production should be read horizontally over corresponding row (Figure 16). The inputs of the local industries should be read vertically down with accordance to the relevant column. The inter-industry flow is shown in Figure 16 as green shaded area, primary inputs (wages, gross operating surplus, taxes and gross value added) are in shaded red area, and final demand is allocated in shaded blue area. The number of industries can deviate from couple of hundreds to thousands sectors depending on study requirements. For example,

transportation support services can be used as the whole or can be divided into cold storage service, gas and liquid bulk storage, stuffing and stripping of containers etc. (Haralambides, 1996).

		Intermediate demand					Final Demand	Investments	.....	Total Input
		Agriculture	repair Ship service and ship	.....	Jewellery	Ports, roads and bridges				
Intermediate inputs	Agriculture									
	Ship and ship repair services									
	.....									
	Jewellery									
	Ports, roads and bridges									
Primary inputs	Wages									
	Gross operating surplus									
	Taxes									
	Gross added value									
Total Output										

Figure 16. Input/Output Table

Source: Own interpretation based on Bossche et al. (2015)

The following presentation of models is based on (Haralambides, 1996). The basic I/O analysis is an a set of simultaneous linear equations, which aim to calculate distribution of industry's production throughout Indonesian economy. The total output of the industry can be calculated as following:

$$(1)\ X_i = \sum_{j=1}^{n} z_{ij} + Y_i$$

where

i = 1,2,3,4….n

z_{ij} - the output value of industry i which is transferred as an input to industry j in an n-industry economy

Y_i - an industry i, which sales to final demand (investment, export, household consumption etc.)

Total output also can be calculated by adding value added inputs:

$$(2)\ X_i = \sum_{j=1}^{n} z_{ij} + W_i$$

where

i = 1,2,3,4….n

z_{ij} - the output value of industry i which is transferred as an input to industry j in an n-industry economy

W_i - value added inputs (capital, labour etc.)

In other words, the values in column i show the spendings of that sector on materials, services, wages and other inputs from the remaining industries in national economy.

The national gross output can be computed either by summation of value of industrial output and gross national income or by summation of industrial sales to final demand:

$$(3)\ X = \sum_{i=1}^{n} X_i = \sum_{i=1}^{n}\sum_{j=1}^{n} z_{ij} + \sum_{i=1}^{n} Y_i = \sum_{i=1}^{n}\sum_{j=1}^{n} z_{ij} + \sum_{i=1}^{n} W_i$$

where

X_i - the total industrial output

z_{ij} - the output value of industry i which is transferred as an input to industry j in an n-industry economy

W_i - value added inputs (capital, labour etc.)

$$(4)\ Y = \sum_{i=1}^{n} Y_i = \sum_{i=1}^{n} W_i = W$$

where

Y_i - an industry i, which sales to final demand (investment, export, household consumption etc.)

W – gross national income

On of the fundamental concepts and first steps in Input/Output analysis is defining structural matrix with the help of technical coefficients. Typical technical coefficient can be calculated as:

$$(5)\ a_{ij} = \frac{z_{jj}}{x_j}$$

where

X_j – total output of an industry j

The coefficient a_{ij} is called the input coefficient and represents the output of the industry i captured by industry j of its total output j per unit. The compilation of all input coefficients corresponding to each industry is called structural matrix (Leontief, 1986).

With the help of Input Output analysis it is possible to find the change of total outputs of all industries in case when the shift in demand happened in another industry. This can be calculated as follows

$$(6)\ X = AX + Y$$

$$X - AX = Y$$

Considering that IX = X, the equation will take a form of:

$$Y = IX - AX = (I - A) * X$$

$$X = (I - A) * Y$$

$$(7)\ X = (I - A)^{-1} * Y$$

where

X – total output

I – identity matrix

A – structural matrix of technical coefficients

Y – final demand

The matrix $(I - A)^{-1}$ is called Leontief inverse, which consists of α_{ij} coefficients. Each coefficient represents the impact on industrial output i due to change in the final demand of industry j (Haralambides, 1996).

For example, the new policy of Jokowi's cabinet totroduce an investment project for building new 100 vessels for better domestic inter-island connectivity. This might result in higher demand for steel, paint and equipment industries. Furthermore, the better inter-island connectivity might lead to increase in domestic trade, what creates higher outputs from agriculture, food, commodities and other industries in multiplicative manner. Hence, increase in well-being and most probably higher wages and employment. In such way, the output of many industries will have to boost and will have an impact on those sectors whose output is demanded as an input. The shipbuilding sector will need input from steel industry, the steel industry may require more purchases from iron ore sector etc. Further in this study explanations will be provided on the example of shipbuilding industry. The reader should keep in mind that methodology identically applies for other prioritized for investments industries.

Leontief inverse can be also calculated with the help of Excel. Matrix I is an initial matrix, which by definition consist of 0 everywhere except 1 in the diagonal (Figure 17).

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

Figure 17. Initial Matrix

Source: Own interpretation

Excel dimension	A	B	C	D	E	....	GE
1		IO number	1	2	3	....	185
2	IO number	Products	Rice	Corn	Sweet potato	....	Other services
3	1	Rice	14.185.77	0	0	....	0
4	2	Corn	0	3.413.797	0	....	0
5	3	Sweet potato	0	0	366,467	....	0
6	4	Cassava	0	0	0	....	0
7	5	Tuber crops	0	0	0	....	0
.....	.....	.....	.....	.....	.....	.....	.....
187	185	Other services	229,141	35,804	3,293	.....	32.617.485
188	2100	Total domestic input to the base price	212.757.116	41.503.048	6.080.880	.....	101.247.311

Figure 18. Input/Output table in Excel

Source: Own interpretation

Matrix A consist only of intra-industry flow values taken from Input/Output table (Figure 18) divided by "total domestic input" row from the same table (Figure 18). As a result we receive purchasing value of each industry of the one unit produced. This matrix is called matrix A (Figure 19).

Excel dimension	A	B	C	D	E	....	GE
1		IO number	1	2	3	....	185
2	IO number	Products	Rice	Corn	Sweet potato	....	Other services
3	1	Rice	=C3/C187	0	0	....	0
4	2	Corn	0	0,0822541	0	....	0
5	3	Sweet potato	0	0	6,027E-05	....	0
6	4	Cassava	0	0	0	....	0
7	5	Tuber crops	0	0	0	....	0
.....	.....	.....	.....	.....	.....	.....	.....
187	185	Other services	1,07701E-06	8,627E-07	5,415E-07	.....	0,322156556

Figure 19. Matrix A

Source: Own calculation

The reader should note that the dimension of matrix I and matrix A should be the same to proceed to the next step. After defining I and A matrices it is necessary to subtract matrix I from matrix A to receive (I-A) matrix, which we need to inverse afterwards. To subtract matrices the next formula can be applied: =C3:GE185 – C98:GE383, where C3:GE185 is matrix I and C98:GE383 is matrix A. To run the formula it is necessary to click Ctrl + Shift + Enter to receive the result in a form of matrix. Finally, we should employ =MINVERSE function to inverse matrix (I – A).

The measures provided by Leontief Inverse $(I - A)^{-1}$ provide us with such valuable indicators as multipliers. These indicators can be used to capture the impact of the change in investments on household incomes and gross industrial output. Multipliers can be divided into total and simple multipliers depending on the type of economy represented in Input/Output model. Simple multipliers, also known as Type I multipliers, represents direct and indirect effects based on how goods and services spread throughout economy (Figure 20). Total multipliers, known as Type II multipliers, additionally calculate induced effects based on the spendings made by employees (Bess and Ambargis, 2011). Type I and Type II effects are calculated depending on the type of economy used for Input/Output model. The closed economy model is built on an assumption that the demand is spread out only domestically. On the other side, open economy model includes exports and imports, thus, it is open for external demand (Haralambides, 1996) . The type of model used in this study is open. Hence, the results of the Leontief model will be focused on capturing direct and indirect effects.

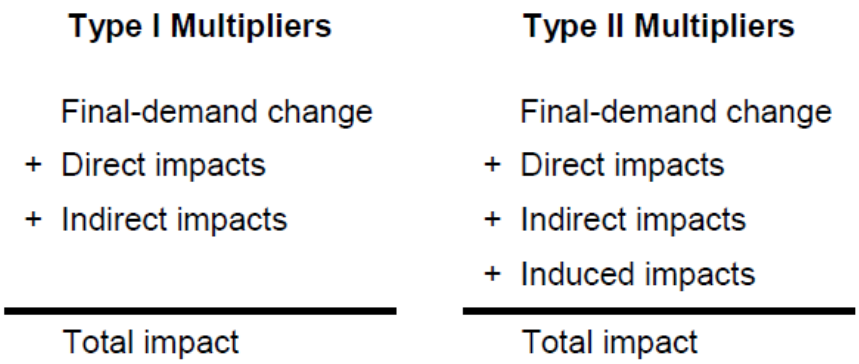


Figure 20. Type I and Type II Multipliers

Source: Bess and Ambargis (2011)

Direct effect created by $1 investment within maritime industry measures the impact on industrial output, income and GVA resulting directly from roads, bridges and ports, IT, seaborne trade services, ship building and sip repair service, other buildings, transportation support services, river/lake transportation and crossings. The element of direct effect, for example, for shipbuilding, extracted from the cell located on the crossing of “shipbuilding” row and “shipbuilding” column.

Indirect effect created by $1 investment within maritime industry measures the impact on industrial output, income and GVA depending on supply relationship

between maritime industry and other sectors of Indonesian economy. Indirect effects are calculated as a difference between total direct effect and the multiplier of inter-industry flow, for example, the multiplier on the crossing of “shipbuilding” row and “shipbuilding” column (Raabová, 2014).

Direct and indirect effects are the part of the linkage analysis. Linkage analysis was developed to investigate the interdependency of output structure. The main tools for this analysis is identification of backward and forward linkages. Backward linkage is identified as the sum of the Leontief-inverse column, while forward linkage in the sum of the Ghosh-inverse row. Current study employs only Leontief-inverse. Therefore, the analysis is based on the backward linkages, which represents the sum of direct and indirect effects.

3.2. Output Multiplier

Assume that the investments for Shipbuilding industry increases by $1 as a result of Jokowi’s development policies. Thus, the calculation for the change in investments will be represented in column vector ∆I (nx1) with 1 at the “shipbuilding” row and zeroes everywhere else within the column. The result of the change can be expressed by:

$$\Delta X_{shb} = (I - A)^{-1} * \Delta I_{shb}$$

where

ΔX_{shb} – change of the total output due to $1 investment in shipbuilding

ΔI_{shb} – change in investments in shipbuilding

As a result we get the shipbuilding column which in next calculations should be recognized as $(I - A)^{-1}_{shb}$. In other words $(I - A)^{-1}_{shb}$ represents Leontief Inversion impacted by $1 investment change in shipbuilding industry. In the same way calculation should be done for other priority sub-sectors of Indonesian maritime industry.

The simple output multiplier can be found as a sum of all α_{ishb} coefficients:

$$O_s = i' * (I - A)^{-1} * \Delta I_{shb} = \sum_{i=1}^{n} \alpha_{ishb}$$

The result captures direct and indirect effects on due to $1 change in investments.

In Excel this calculation can be simply made by multiplying the created column (with zeroes everywhere and 1 on the crossing with “shipbuilding” row) by the Leontief inverse $(I - A)^{-1}$ with the function =MMULT (Figure 21). As the result we will get the

shipbuilding inverse column $(I - A)^{-1}_{shb}$, which represents direct and indirect effects of investing in shipbuilding industry and called output multipliers (Figure 22).

	IO number	1	.....	132	.....	185	Change of $1 Investment
IO number	Products	Rice	.....	Ship and ship repair service	.....	Other services	0
1	Rice	1,07145344	.....	2,589E-05	.....	2,365E-05	0
2	Corn	2,2598E-06	.....	6,67956E-06	.....	3,031E-06	0
3	Sweet potato	5,5347E-08	.....	3,75292E-08	.....	9,816E-08	0
4	Cassava	2,6966E-06	.....	3,62814E-06	.....	3,869E-06	0
.....	.....	.....	.....	.....	.....	.....	0
132	Ship and ship repair service	1,0446E-06	.....	1,315681119	.....	3,197E-07	1
.....	.....	.....	.....	.....	.....	.....	0
183	Arts, entertainment and recreation services	2,9532E-07	.....	2,17596E-05	.....	4,32E-08	0
184	Household and private goods reparation services	3,2463E-06	.....	4,41465E-05	.....	3,851E-07	0
185	Other services	3,704E-06	.....	1,19366E-05	.....	1,4752698	0

Figure 21. Leontief inverse and investment change

Source: Own calculation

	IO number	132
IO number	Industry	Ship and Ship repair service
1	Rice	2,589E-05
2	Corn	6,67956E-06
3	Sweet potato	3,75292E-08
4	Cassava	3,62814E-06
.....	.....	.....
132	Ship and ship repair service	1,315681119
.....	.....	.....
183	Arts, entertainment and recreation services	2,17596E-05
184	Household and private goods reparation services	4,41465E-05
185	Other services	1,19366E-05
Result	Indirect Effect	0,006628533
	Direct effect	1,315681119
	Total effect	1,322309652

Figure 22. Output multiplier

Source: Own calculation

3.3. Income Multipliers

Income multipliers measure the effect of $1 change in maritime investments on incomes earned by citizens due to services and products they provided. The element α_{ishb} of the "shipbuilding" column $(I - A)^{-1}_{shb}$ represents direct and indirect impact of $1 investment in shipbuilding industry on other sectors. Additionally, element H_{ri} of the augmented matrix A_1 represents the income required per dollar of industrial output. Hence, the element $H_{ri}\ \alpha_{ishb}$ measures direct and indirect amount of incomes generated in other sectors from $1 investment in shipbuilding industry.

The simple income multiplier for the shipbuilding industry will be calculated as:

$$I_{sh\cdot b\cdot} = H_r * \left((I - A)^{-1} \right)_{sh\cdot b\cdot} = \sum_{i=1}^{n} H_{ri} * \alpha_{ish\cdot b\cdot}$$

In Excel it is done by simple multiplication between transposed "wages" row and shipbuilding inverse column $(I - A)^{-1}_{shb}$. The founded element $I_{sh.b.}$ shows the impact of $1 investment in prioritized sectors on household incomes. The augmented matrix A_1 is a combination of simple matrix A with additional "household expenditures" column (H_c) and "wages" row (H_R).

$$\overline{\mathbf{A}} = \left[\begin{array}{c|c} \mathbf{A} & \begin{matrix} H_{1C} \\ \vdots \\ H_{nC} \end{matrix} \\ \hline H_{R1} \cdots H_{Rn} & h \end{array}\right]_{(n+1)\,x\,(n+1)}$$

Figure 23. Augmented matrix

Source: Haralambides (1996)

3.4. Gross Domestic Product Multipliers

The Gross Domestic Product multiplier shows the effect of $1 change in maritime investments on GDP of Indonesia. Since available in IO table elements of Gross Value Added and Net Taxes are a part of Gross Domestic product, it is possible to find GDP multiplier. According to Raabová (2014), GDP is represented by:

GDP = GVA + Net Taxes = (Output – Intermediate Inputs) + (Taxes – Subsidies on products)

The GDP multipliers are calculated similarly to income multipliers. The element α_{ishb} of the "shipbuilding" column $(I - A)^{-1}_{shb}$ represents direct and indirect impact of $1 investment in shipbuilding industry on other sectors. Additionally, element D_{ri} of the augmented matrix A_1 represents the gross domestic product coefficient per dollar of industrial output. The GDP technical coefficient calculated as the sum of the rows "gross value added" and "taxes without production subsidies". Hence, the multiplication of D_{ri} and α_{ishb} elements measures direct and indirect amount of contribution to GDP generated in other sectors from $1 investment in shipbuilding industry. The calculation of GDP multiplier is represented as:

$$G_{sh \cdot b \cdot} = D_r * \left((I - A)^{-1} \right)_{sh \cdot b \cdot} = \sum_{i=1}^{n} D_{ri} * \alpha_{ish \cdot b \cdot}$$

where

D_r - technical coefficient of GDP

α_{ishb} – the element of the "shipbuilding" column from matrix $(I - A)^{-1}_{shb}$, which represents direct and indirect impact of $1 investment in shipbuilding industry on other sectors

The calculation in Excel is simply done by transposing row "GDP" to a column and multiplying it with the shipbuilding inverse column $(I - A)^{-1}_{shb}$. The same calculations are done for all other maritime sub-sectors.

4. Results & Analysis

The Input/Output analysis helps us to run the model for seven different industries, which include prioritization by government on maritime sub-sectors for future investments (Table A1). Using the Input/Output table, extracted from Indonesian statistics institution Badan Pusat Satistik, we examined the impact of $1 investments in prioritized maritime sub-sectors on Indonesian economy. The ideal split of the industries would include analysis made with regards to shipbuilding, cold storage, ports, ICT for maritime and shipping sectors. The initial Input/Output table did not include mentioned sub-sectors separately. Therefore, with the help of Indonesian participants of this project, the request to Badan Pusat Statistic was made in order to split this sectors from other industries. However, the request was not proceed. Thus, the analysis had been made with the industries, which include maritime sub-sectors with some of other industries. For example, ports are a part of the “ports, roads and bridges” industry, cold storage is a part of “transportation support services” sector together with cargo handling etc. The full description of sectoral split is included in Table A1.

The economic impact was measured in relation with three different linkages: 1) Output multiplier measures the difference in production transactions within the industry (direct effect) and with other industries (indirect effect); 2) Income multiplier entails the additional income created through investments within sub-sector (direct effect) and income generated for other industries (indirect effect); 3) GDP multiplier asses the rise in gross domestic product generated from sub-sector itself (direct effect) and from interaction between industries (indirect effect).

4.1. Impact on Output

One of the maritime sub-sectors that derives the most benefits from investment is the ship and ship repair services. As it is apparent from figure below, $1 of investments in shipbuilding will generate $1.31568 of output within shipbuilding sector. Additionally, investments will help computer and IT services, and transport support services increase its output by $1.107528 and $1.0657405 respectively. Contribution to seaborne transportation industry is also considered to be significant and results in $1.0080360 increase in output. Despite all the expectations, investments in ports, which are included in “ports, roads and bridges” and “other buildings” sectors, will increase that industry’s output only by $1.0003616 and $1.0000270.

Indirect effect measures the impact of investing $1 in each prioritized maritime sub-sector on industrial output of all other industries present in Indonesian economy. Investing $1 in ports will benefit the output of all other industries the most. Specifically, investment in “ports, bridges and roads” and “other buildings” will increase the output of all industries by $1.05 and $0.93 respectively. Additionally, $1 investment in “ports, bridges and roads” benefits the most such industries as “transportation trading other than car and motorcycles” (US$0.095), “minerals of all kinds” (US$0.089), “refined oil and gas products” (US$0.087) etc. The list of

complete contribution of investing in “ports, roads and bridges” and “other buildings” to all industries can be find in Table A2 and A3 respectively.

Furthermore, significant contribution comes from investing in coastal, ocean-going and inland shipping services. It will benefit the most “refined oil and gas” (US$0.35), ‘transportation support services” (US$0.14) and “crude oil” industries (US$0.12) industries. Table A4 and A5 represents top 20 industries which benefits the most from investment ocean-going and inland transportation.

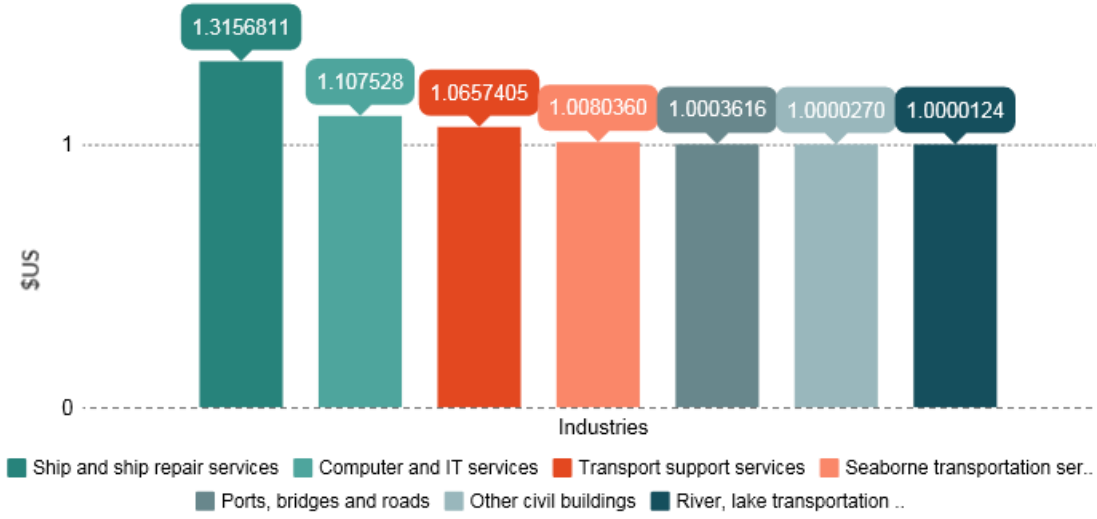


Figure 24. Output Direct Effect

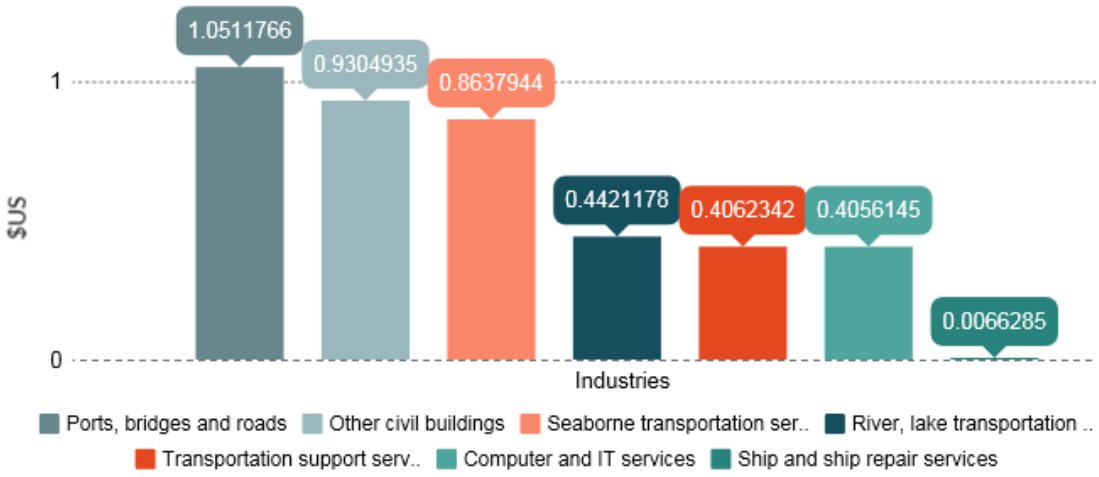


Figure 25. Output Indirect Effect

The spill over effect as a result of investment in “transportation support services” and “computer and IT services” is less beneficial for the rest of the industries than in other maritime sub-sectors. However, investments in “transportation support services” increase the most the output of “roads, bridges and ports” (US$0.086), “refined oil and gas products” (US$0.057), “telecommunication services” (US$0.043)

and “seaborne transportation services” (US$0.043) (Table A6). At the same time, investment in IT services contributes the most to “electronic and communication goods and accessories” (US$0.1), “telecommunication services” (US$0.077) and “programming and broadcasting of films” (US$0.048). Amid the maritime sub-sectors IT services benefits the most “ports, bridges and roads” (US$0.0015) which take 26th place among other industries (Table A7). The least contributive occurred to be shipbuilding, which is only US$0.0066 in total for all industries. The increase in output for first 20 industries described in Table A8.

The results described above gives us an understanding of increase in industrial output of $1 investment to maritime sub-sectors. To see the broader picture we can apply output multipliers to amount of investments planned to realize by government development policies (Table 8). Since “ports, bridges and roads” together with “other civil building construction” industry include port infrastructure, the multipliers were combined to see the overall impact of investing in ports. The same approach was applied to “seaborne transportation services” and “river, lake transportation and crossings” industries, since both of them include cargo and passenger vessels.

Table 8. The impact of planned maritime investments on industrial output

IO Table No	Industry	Direct Effect, US$	Indirect Effect, US$
132	Shipbuilding	$ 1,092 bln	$ 5,5 mln
152	Ports, bridges and roads	$ 10,2 bln	$ 10,1 bln
153	Other Civil Building Constructions		
159	Seaborne transportation services	$ 15,6 bln	$ 10,1 bln
160	River, Lake transportation and crossings		
162	Transportation support services	$ 180,2 mln	$ 68,7 mln
169	Computer and IT services	$ 7,4 mln	$ 2,7 mln
Total		$ 27,1 bln	$ 20,3 bln

As can be seen from the table above, investments in shipping might significantly impact the productivity of other industries throughout the country with the contribution of about US$15.6 billion and increase its own output by US$10.1 billion. From this we can conclude that shipping investment considerably benefits the output of other industries as much as it benefit the its own industry. However, the reader also should remember that the planned amount of investments in shipping was initially higher than to other maritime sub-sectors (Table7). At the same time investments in other maritime sub-sectors contribute more to the sub-sector itself than to other industries. However, all spill-over effects are considered to be high. The total contribution of investments in all prioritized maritime sub-sectors accounts

directly for $27.1 billion and indirectly for $20.3 billion, which is a significant benefit for all Indonesian industries. However, the reader should bear in mind that this amount of output is planned to be generated s a part of long-term development plan. Thus, not yearly.

4.2. Impact on Income

The income multiplier will give us an understanding on $1 investment contribution to income of Indonesian citizens across the economy in different industries. The study shows that by far the biggest direct contribution of investment to the income is provided to “transportation support services” sector. The salary of each employee involved in port operation services (mooring, cargo handling, piloting), cold storage or other infrastructure support service will increase by US$0.25 as a result of $1 investment. Investments in those services will help to maintain effective cargo handling and will help to increase export of fisheries due to higher quality of product, supported with developed cold storage facilities (EU – Indonesia Business Network, 2016). As it is observed in the result of given analysis, the improvement of this activities indeed contribute the most to the income of “transportation support services” employees. The least beneficial investment impact on income comes from “seaborne transportation services”. Every seafarer on coastal and ocean-going vessels will receive from US$1 investment in shipping only extra US$0.09. However, $1 of investment in “river, lake transportation and crossings” industry gives an extra US$0.2 to the income of employees occupied in inland waterway transportation. Development of inland transportation will benefit employees more than those working on coastal and ocean-going vessels.

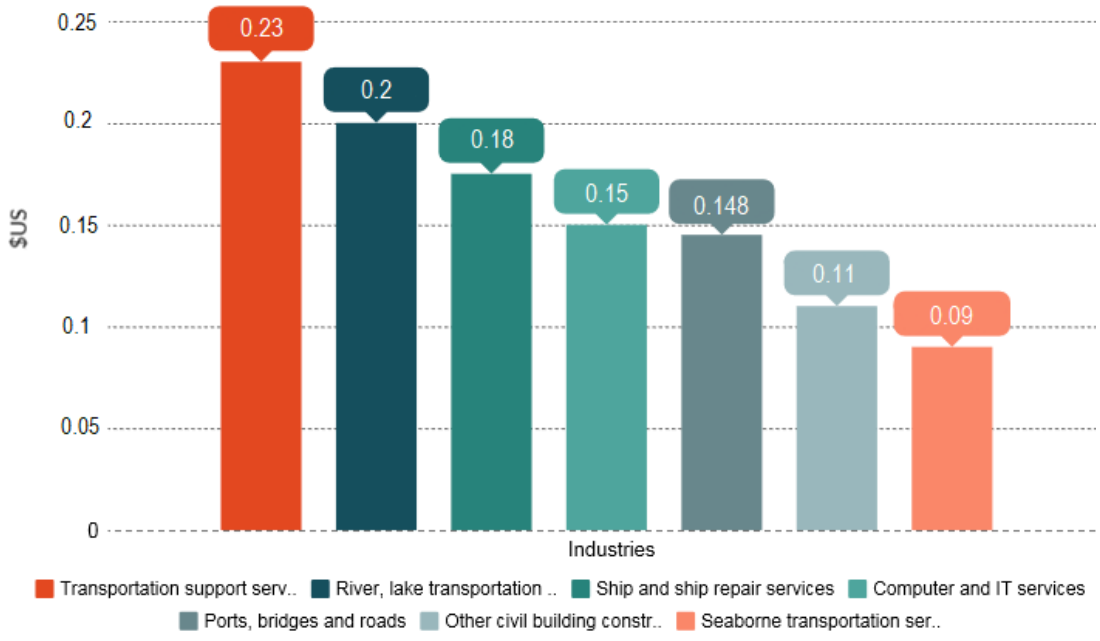


Figure 26. Income Direct Effect

The employees of shipbuilding industry will enjoy additional US$0.18, while employees of IT services and ports will gain considerably less. The gain will amount to only US$0.15, US$0.148 and US$0.11 respectively. However, $1 investment in ports in total will benefit employees of other industries more than its own sector. $1 of investment in "ports, bridges and roads" together with "other civil building construction", which also include ports (Table A1), creates additional US$0.155 and US$0.123 respectively. Investment in ports brings the biggest contribution to such industries as "minerals of all kinds" (US$0.026), "transportation trading other than car and motorcycle" (US$0.017), "non-metal products" (US$0.014), "refined oil and gas products" (US$0.01) and "land transportation other than railway" (US$0.008). Table A9 and A10 includes top 30 industries, which benefit worker's incomes from $1 investment in "ports, bridges and roads" and "other civil building construction" industries respectively.

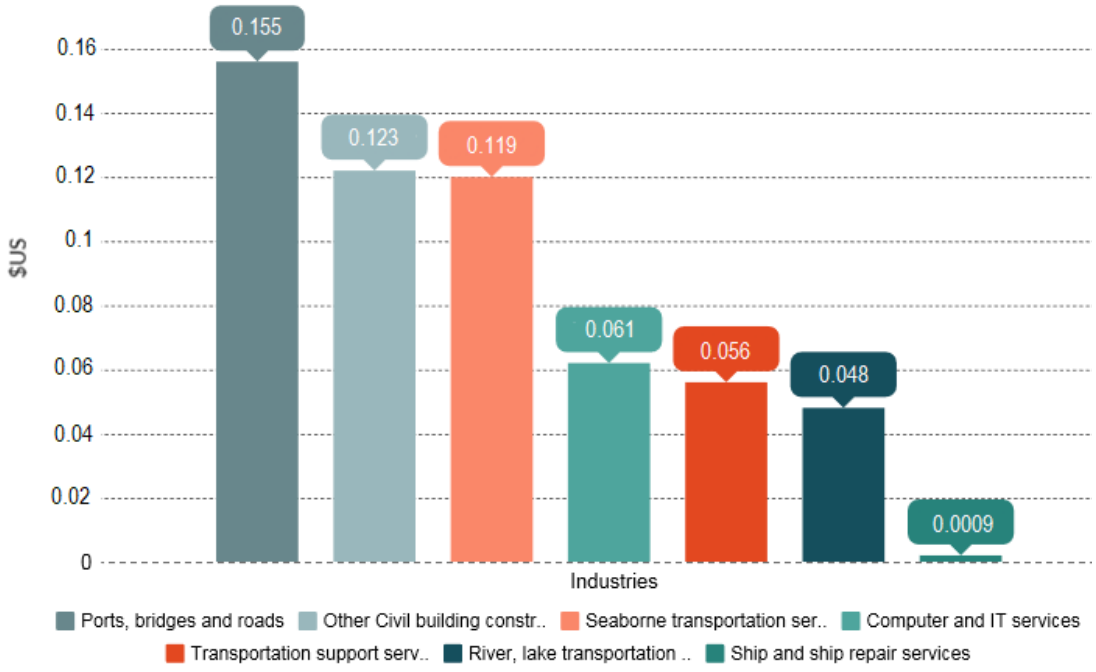


Figure 27. Income Indirect Effect

Though seaborne transportation did not derive much benefits directly from investments, it has a significant impact on the income of employees from other industries. $1 of investment in shipping creates an extra US$0.119 of total income to workers throughout economy. The biggest income benefit is apportioned to workers employed in "refined oil and gas products" industry (US$0.043) and "transportation support services" sector (US$0.029) (Table A11). Additionally, $1 of investment in "seaborne transportation services" industry indirectly creates significant benefit to other maritime sub-sectors. Table A11 shows that "transportation support services", "roads, bridges and ports" and "computer and IT services" are included in top 30 sectors which receive income contribution from US$1 investment in shipping. In other words, investment in Indonesian shipping will significantly boost incomes in

some other maritime sub-sectors. The less contributive to the income is “ship and ship repair” industry. In total the US$1 of investment brings only US$0.0009 of extra income to other industries.

Additionally, investment in “transportation support services” indirectly increase the income for port employees. As it is visible from Table A14, US$1 of investment in this sector creates additional US$0.23 to income for port workers. At the same time “computer and IT services” create additional income mostly in IT related industries such as “telecommunication services” (US$0.013), “electronic and communication goods and accessories” (US$0.01) and “programming and broadcasting of films and recording” (US$0.009). However, there is also significant benefit for employees from “roads, bridges and ports” industry, sine $1 investment in IT services will create extra $0.00022 of income for port and infrastructure workers. The contribution to “roads, bridges and ports” industry is within top 30 industries benefiting from investments in IT services (Table A15).

The results described above gives us an understanding of increase in income due to US$1 investment in maritime sub-sectors. To see the broader picture we can apply these income multipliers to amount of investments planned to realize by government development policies (Table 9).

Table 9. The impact of planned maritime investments on income

IO Table No	Industry	Direct Effect, US$	Indirect Effect, US$
132	Shipbuilding	$ 123,6 mln	$ 128,7 mln
152	Ports, bridges and roads	$ 1 bln	$ 1,2 bln
153	Other Civil Building Constructions		
159	Seaborne transportation services	$ 2,9 bln	$ 915,6 mln
160	River, Lake transportation and crossings		
162	Transportation support services	$ 33,6 mln	$ 8,1 mln
169	Computer and IT services	$ 1,2 mln	$ 6,476
Total		$ 4.1 bln	$ 2.29 bln

As it can be seen from the table above the biggest direct income contribution of investments comes from investment in shipping. Even though shipping is planning to receive significantly more investments than other industries, the indirect impact on income is higher from port investment. In total all long-term planned investments in given maritime sub-sectors will directly result in US$4.1 billion additional income in maritime sub-sectors itself. At the same time investments in maritime sectors will

indirectly generate US$2.3 billion of extra income in different industries across the economy.

4.3. Impact on Gross Domestic Product

The Gross Domestic Product multiplier shows the contribution of US$1 investment in 7 prioritized maritime sub-sectors to GDP of Indonesia. The biggest benefit capture “transportation support services” and “computer and IT services” sectors. Additional US$1 of investments generates US$0.62 and US$0.57 extra contribution to GDP. In other words, US$1 of investments increase the output value of cargo handling, cold storage, infrastructure by US$0.62 and IT services by US$0.57. Ship and ship repair services has also noticeable increase in output value, which amounts for US$0.56. “Seaborne transportation” and “other civil building construction” sectors derives the least in comparison with other sub-sectors, but still remains high in general. The “seaborne transportation” output value raise by US$0.31, while “other civil building construction” industry enjoy the increase of US$0.29. The value of port infrastructure output is surprisingly low in comparison with other sub-sector. However, we should admit that port cargo handling services are also included in “transportation support services” sector.

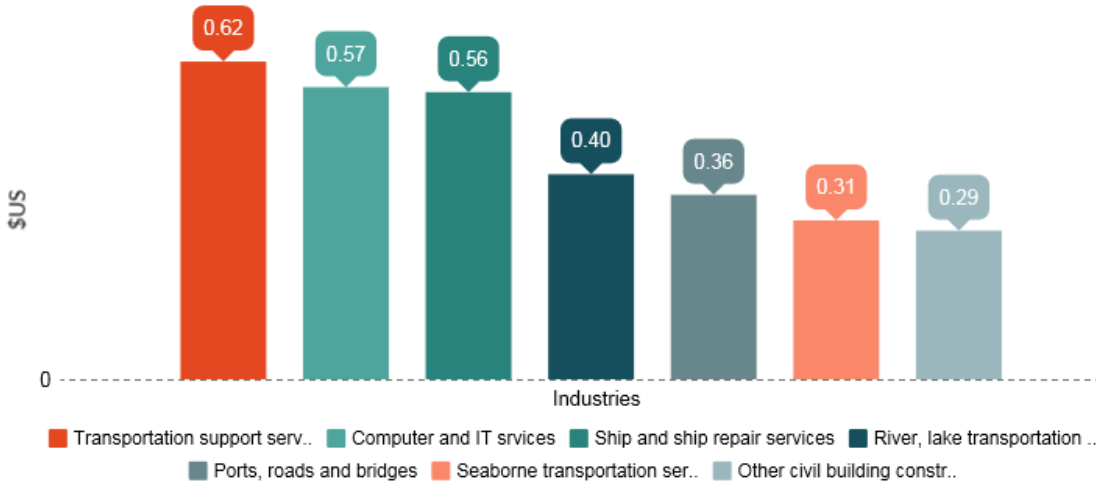


Figure 28. GDP Direct Effect

Even though investment brings comparatively low production value to port infrastructure directly, it creates a great impact on the output of other industries in Indonesian economy. The total contribution to GDP of other industries due to investment in “ports, roads and bridges” sector amounts for US$0.55. The highest benefits are captured by “minerals of all kinds” (US$0.07), “transportation trading other than car and motorcycle” (US$0.064) and “refined oil and gas products” (US$0.04). The list of the first 30 industries, which benefit from investments in “ports, roads and bridges” sector included in Table A17. Interestingly, the US$1 investment in “seaborne transportation” increases the value of “transportation support services” sector by US$0.08, which higher than the contribution of US$1 investment in “ports, roads and bridges” to its top industry “minerals of all kinds”. We

should note that even though “ports, roads and bridges” contributes the most to other industries in total, the benefit of investment in some of other maritime sub-sectors distributed less evenly among the all industries. Additionally, “seaborne transportation” sector increase significantly the output value of “refined oil and gas products” (US$0.17). The least amount of spill-overs represent “ship and ship repair services”. Its indirect effect reach only US$0.0032 in total.

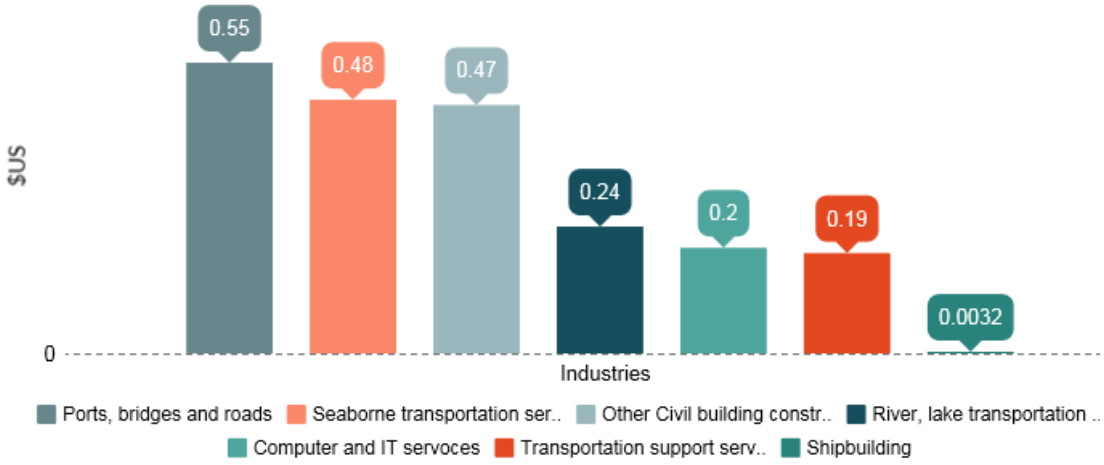


Figure 29. GDP Indirect Effect

To analyse the impact of long-term investment planning on GDP we multiply the contribution to GDP from US$1 investment with the amount of investments planned to be realized in long-term planning (Table 10).

Table 10. The impact of planned maritime investments on GDP

IO Table No	Industry	Direct Effect, US$	Indirect Effect, US$
132	Shipbuilding	$ 462.3 mln	$ 2.7 mln
152	Ports, bridges and roads	$ 3.3 bln	$ 5.2 bln
153	Other Civil Building Constructions		
159	Seaborne transportation services	$ 5.5 bln	$ 5.6 bln
160	River, Lake transportation and crossings		
162	Transportation support services	$ 104.8 mln	$ 32.1 mln
169	Computer and IT services	$ 3.8 mln	$ 1.3 mln
	Total	$ 9.4 bln	$ 10.9 bln

The contribution of shipping related investments accounts for US$5.5 billion, which is 0.59% of Indonesian GDP. The investments in fleet will contribute to GDP equally from industry itself and from other industries in total. The contribution of port related investments account for 0.35% directly and 0.56% indirectly. In total shipping industry with current investment planning will increase GDP by 1% from maritime sub-sectors and 1,17% indirectly from the rest of industries.

5. Conclusion

The new government, under Joko Widodo's leadership, announced a very ambitious plan for Indonesian economic development, which include enormous amount of investments to be spent on different industries across the country. Literature reviews shows that maritime industry plays a key role towards strategic economic improvement. Therefore, this study is aiming to investigate the impact of maritime investments on Indonesian economy. The large body of studies proved that economy is responsive to investment realizations. Thus, the main research question addressed in this thesis is:

"**What is the impact of the investments in Indonesian maritime sectors on production output of local industries, wages and GDP?**"

Previously conducted studies on investment plans of the new cabinet and development masterplans specify the improvement of 5 sub-sectors of maritime industry such as ports, cold storage, ICT for maritime, shipping and shipbuilding. The total amount of investments in these sub-sectors is accounted for US$5.1 billion. Such a significant contribution to industrial development might create spill-overs on production of other industries in Indonesian economy. Additionally, investment in maritime sectors might contribute to household income and GDP. Therefore we employ Input – Output analysis to investigate how US$1 of investments will have impact on above mentioned indicators. Input – Output analysis is widely used for assessing mutual relationship between industrial production and primary inputs (incomes, gross values added, taxes etc.). This information is highly valuable for studies which aimed to assess the impact of various policies, including investment plans. The data used in analysis is extracted from statistical institutions in the form of Input – Output table, which already include all relevant basic relations in economy. The data is represented as purchases between industries and household. However, due to data constraints it was not possible to split prioritized maritime sub-sectors from those given in Input – Output table. Therefore, the study analyses those sectors which include ports, cold storage, ICT for maritime, shipping and shipbuilding. Namely such sectors as "ship and ship repair services" (shipbuilding), "transportation support services" (cold storage), "seaborne transportation services" (ocean-going shipping), "river, lake transportation and crossings" (inland shipping), "computer and IT services" (ICT for maritime), "ports, roads and bridges" (ports), "other buildings" (ports).

The analysis of defined industries shows that $1 of investment will benefit shipbuilding industry the most in terms of production. The output of the industry will increase by US$1.31. This finding is highly significant and shows how important it is for shipbuilding to receive funds for higher production outputs. Moreover, increase in production of invested industry also proves the importance to the whole economy. The highest indirect contribution to other industries in terms of production, income and GDP brings US$1 of investment to "ports, bridges and roads". The industry will in total indirectly contribute US$1.05 to production, to US$0.16 to income and US$0.6 to GDP. In other words, investment in ports benefit the most the production

of all industries across Indonesia, GDP and household income. Ports should be a priority sector for investments. However, according to literature review, the highest amount of investments apportioned by government should be directed to shipping industry. Additionally, employees of “transportation support services” will enjoy the highest benefit from such investments. Each additional US$1 of investment will increase wages of people involved in cargo handling, cold storage of other infrastructure service by US$0.23.

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Appendix

Table A1. Specification analysed maritime sub-sectors

IO code	KBKI 2010	Description
132		**Ship and ship repair services**
	49311	Cruise ship, excursion ship and similar kinds of water transportation designed to carry passengers; ferry of all kinds
	49312	Tanker ships
	49313	Reefer ships except tanker
	49314	Other kinds of water transportation designed to carry goods and passengers
	49315	Fishing boats, factory ships and other kinds of water transportation to process/preserve fish
	49316	Tow and tug boats
	49319	Other water transportation (including lightship, fire fighting vessel, dredging ship, floating cranes, floating docks, warship and life boat except raft), except floating or submerged drilling and production platform
	49320	Floating or submerged drilling and production platform
	49390	Other floating structures
	49410	Sail boat (except inflatable) with or without motor
	49490	Other water transportation for leisure or sports; raft and canoe
	88821	Shipbuilding services
	88822	Shipbuilding services for leisure or sports craft
152		**Roads, bridges and ports**
	53253	Sewage and waste management facilities
	54221	General construction service for bridge and flyover
153		**Other buildings**
	53211	Freeway, highways and roads
	53212	Railway
	53213	Airport runway
	53221	Bridge and freeway flyover
	53231	Water tunnel, and other water supply channels, except pipes
	53232	Ports, channel/water ways and related facilities
	53233	Dam

IO code	KBKI 2010	Description
	53234	Irrigation and flood control infrastructures
	53241	Long distance pipeline
	53242	Long distance communication and electricity cables
	53251	Local pipeline
	53252	Local cable and building
	53261	Mining construction
	53262	Electric power plant construction
	53269	Other constructions for manufactures
	53270	Sports facilities and open air recreation facilities
	54211	General freeway construction, main roads and roads, except flyovers
	54212	General construction services for railway
	54213	General construction services for runway
	54222	General construction services for tunnels
	54231	General construction services for water tunnel, and other water supply channels, except pipes
	54232	General construction service for ports and other buildings of the same kinds
	54233	General construction services for ports and related buildings
	54234	General construction services for irrigation and flood control infrastructures
	54241	General construction services for long distance pipeline
	54242	General construction services for long distance communication and electricity cables
	54251	General construction services for local pipeline
	54252	General construction services for local cable and building
	54253	General construction services for sewage and waste treatment facilities
	54261	General construction services for mining construction
	54262	General construction services for electric power plant construction
	54269	General construction services for other constructions for manufactures
	54270	General construction services for sports facilities and open air recreation facilities

IO code	KBKI 2010	Description
	54290	General construction services for other civil constructions
	54341	Well drilling services for fresh water
	54342	Septic tank installation services
159		**Seaborne transportation services**
	64231	Coastal and ocean-going passenger ferry services
	64232	Coastal and ocean-going passenger cruise services
	64239	Coastal and ocean-going other passenger transportation services
	65211	Coastal and ocean-going reefer vessel services
	65212	Coastal and ocean-going tanker services
	65213	Coastal and ocean-going inter-modal container vessel services
	65219	Coastal and ocean-going services for other cargo types
	66021	Coastal and ocean-going passenger ship leasing services with operator
	66022	Coastal and ocean-going cargo ship leasing services with operator
160		**River, lake transportation and crossings**
	64121	Inland waterway passenger ferry services
	64122	Inland waterway passenger cruise services
	64129	Inland waterway other passenger services
	64133	Water transportation services for tourism except cruise ship
	65221	Inland waterway reefer vessel services
	65222	Inland waterway tanker services
	65229	Inland waterway services for other cargo types
	66023	Inland waterway passenger ship leasing services with operator
	66024	Inland waterway cargo ship leasing services with operator
162		**Transportation support services**
	67110	Stuffing and stripping of containers
	67190	Stuffing and stripping of other cargoes
	67210	**Cold storage service**
	67220	Gas and liquid bulk storage services
	67290	Other storage and warehousing services
	67310	Train hauling and pushing services

IO code	KBKI 2010	Description
	67390	Other supporting services for railway transportation
	67410	Bus terminal services
	67420	Road, bridges and tunnel operation services
	67430	Parking services
	67440	Towing services for private and commercial vehicles
	67490	Other land transportation supporting services
	67511	Coastal and deep water ports and waterway operation services (excluding cargo handling)
	67512	Inland and waterway ports operation services (excluding cargo handling)
	67521	Piloting and mooring services for coastal and ocean-going vessels
	67522	Piloting and mooring services for inland vessels
	67531	Rescue vessel services for coastal and deep water areas
	67532	Rescue vessel services for inland water area
	67590	Other water transportation supporting services
	67610	Airport operation services, except cargo hnadling
	67620	Air traffic control services
	67630	Other supporting services for airborne transportation
	67640	Other supporting services for outer space tranpsortation
	67910	Freight forwarding agent and other freight services
	67990	Supporting services for other transportation
169		**Computer and IT services**
	83131	IT consultancy services
	83132	IT support services
	83141	IT application design and development services
	83142	IT-based network and system design and development services
	83151	Website hosting services
	83152	Application providing services
	83159	Hosting and other IT infrastructure providing services
	83161	Network management services
	83162	Computer system management services

IO code	KBKI 2010	Description
	83633	Sales of advertising space on the Internet (except those with commission)
	85991	Other information services
	87332	PC installation and fitting services

Source: Badan Kepala Pusat Statistik (2009)

Table A2. Output contribution of $1 investment in “roads, bridges and ports” industry

No	IO table No	Industry	Output contribution, US$
1	152	Road, bridges and ports	1.00036164457728
2	156	Transportation trading other than car and motorcycle	0.095198978855974
3	48	Minerals of all kinds	0.089582370099467
4	95	Refined oil and gas products	0.087343358143089
5	94	Non-metal products	0.080404845652264
6	114	Iron and base steel	0.0587633938909
7	158	Land transportation other than railway	0.049074981251551
8	117	Metal building materials	0.0458862190262
9	38	Crude oil	0.04330258278945
10	113	Cement	0.03705392769014
11	115	Non-iron base metal	0.035751064088486
12	87	Plywood and similar	0.032159082429702
13	96	Base chemical except fertilizer	0.029431208315814
14	39	Natural gas and geothermal	0.029111121304558
15	112	Clay, ceramic and porcelain products	0.027856466890385
16	175	Professional, scientific and technical services	0.016727607143264
17	46	Gold ore	0.015576616013146
18	31	Wood	0.015394031508593
19	131	Motor vehicle except motorcycle	0.013960063009131
20	37	Coal and lignite	0.012764067611194
21	130	Other machines and accessories	0.01260418204789
22	88	Building materials from wood	0.012245669350371
23	165	Food and drink provision	0.011067775317924
24	170	Finance and banking services	0.010308886940579
25	168	Telecommunication services	0.009334385610504
26	120	Other metallic goods	0.007868856227267
27	176	Rental services and business support services	0.007841957649388
28	150	Electricity, gas, drinking water and communication installation	0.007766204719526
29	41	Tin ore	0.00727199780308
30	30	Farming, forest tree, fishery services	0.00682624047185

Table A3. Output contribution of $1 investment in “other buildings” industry

No	IO table No	Industry	Output contribution, US$
1	153	Other buildings	1,000026959
2	156	Transportation trading other than car and motorcycle	0,102840906
3	114	Iron and base steel	0,084886391
4	95	Refined oil and gas products	0,07511088
5	115	Non-iron base metal	0,067581331
6	110	Plastic goods	0,061817651
7	48	Minerals of all kinds	0,06026344
8	31	Wood	0,051725491
9	117	Metal building materials	0,043642355
10	158	Land transportation other than railway	0,042489294
11	38	Crude oil	0,036309043
12	120	Other metallic goods	0,03445691
13	39	Natural gas and geothermal	0,0288288
14	96	Base chemical except fertilizer	0,028724257
15	87	Plywood and similar	0,027689474
16	86	Swan timber	0,027048766
17	46	Gold ore	0,024498239
18	98	Synthetic resin, plastic material and synthetic fiber	0,023248917
19	41	Tin ore	0,011330459
20	18	Rubber	0,008387867
21	150	Electricity, gas, drinking water and communication installation	0,006449447
22	130	Other machines and accessories	0,005852763
23	170	Finance and banking services	0,004448293
24	147	Water supply	0,004025121
25	32	Other forest products	0,003946352
26	47	Silver ore	0,003628631
27	108	Crumb rubber and smoked rubber	0,003351922
28	131	Motor vehicle except motorcycle	0,003340659
29	155	Car and motorcycle reparation and maintenance	0,003323451
30	145	Electricity	0,003096796

Table A4. Output contribution of $1 investment in “seaborne transportation services” industry

No	IO table No	Industry	Output contribution, US$
1	159	Seaborne transportation services	1,008035971
2	95	Refined oil and gas products	0,353762223
3	162	Transportation support services	0,137387541
4	38	Crude oil	0,123618042
5	39	Natural gas and geothermal	0,06885546
6	176	Rental services and business support services	0,03641757
7	170	Finance and banking services	0,026067707
8	150	Electricity, gas, drinking water and communication installation	0,024232462
9	152	Road, bridges and ports	0,011182287
10	168	Telecommunication services	0,008388242
11	161	Air transportation	0,005430887
12	175	Professional, scientific and technical services	0,005229938
13	156	Transportation trading other than car and motorcycle	0,004795068
14	171	Insurance services	0,003690798
15	114	Iron and base steel	0,003418986
16	131	Motor vehicle except motorcycle	0,003088004
17	51	Oil and gas mining services	0,002640622
18	158	Land transportation other than railway	0,002478401
19	130	Other machines and accessories	0,002292903
20	145	Electricity	0,002243753
21	52	Other mining and excavation services	0,001943325
22	169	Computer and IT consultation services	0,001905471
23	177	General government services	0,001782055
24	94	Non-metal products	0,00176137
25	117	Metal building materials	0,001599569
26	110	Plastic goods	0,001567088
27	121	Electronic and communication goods and accessories	0,001541069
28	96	Base chemical except fertilizer	0,001501806
29	167	Programming and broadcasting of films and recording	0,001484447
30	173	Other financial institutions	0,001426005

Table A5. Output contribution of $1 investment in “river, lake transportation and crossings” industry

No	IO table No	Industry	Output contribution, US$
1	160	River, lake transportation and crossings	1,000012353
2	95	Refined oil and gas products	0,266991565
3	38	Crude oil	0,092936064
4	39	Natural gas and geothermal	0,051566237
5	176	Rental services and business support services	0,003068306
6	175	Professional, scientific and technical services	0,002769814
7	150	Electricity, gas, drinking water and communication installation	0,002482338
8	171	Insurance services	0,002091607
9	51	Oil and gas mining services	0,001983053
10	159	Seaborne transportation services	0,001902576
11	52	Other mining and excavation services	0,001444174
12	131	Motor vehicle except motorcycle	0,001331551
13	145	Electricity	0,001299271
14	130	Other machines and accessories	0,001261491
15	169	Computer and IT consultation services	0,001185538
16	170	Finance and banking services	0,001138921
17	177	General government services	0,000864917
18	168	Telecommunication services	0,000864694
19	37	Coal and lignite	0,000808586
20	156	Transportation trading other than car and motorcycle	0,000662868
21	161	Air transportation	0,000546527
22	162	Transportation support services	0,000359019
23	114	Iron and base steel	0,000303763
24	121	Electronic and communication goods and accessories	0,000289855
25	158	Land transportation other than railway	0,00027966
26	173	Other financial institutions	0,000264839
27	167	Programming and broadcasting of films and recording	0,000239521
28	129	Office and accounting machinery	0,00022026
29	96	Base chemical except fertilizer	0,000169214
30	110	Plastic goods	0,000161429

Table A6. Output contribution of $1 investment in “transportation support services” industry

No	IO table No	Industry	Output contribution, US$
1	162	Transportation support services	1,065740485
2	152	Road, bridges and ports	0,086247672
3	95	Refined oil and gas products	0,057644403
4	168	Telecommunication services	0,043415451
5	159	Seaborne transportation services	0,043292123
6	161	Air transportation	0,036405962
7	38	Crude oil	0,0212368
8	39	Natural gas and geothermal	0,012263955
9	156	Transportation trading other than car and motorcycle	0,009546764
10	48	Minerals of all kinds	0,007753378
11	94	Non-metal products	0,006997594
12	114	Iron and base steel	0,005246185
13	176	Rental services and business support services	0,004917046
14	158	Land transportation other than railway	0,004797833
15	117	Metal building materials	0,004024679
16	134	Airplane and plane repair service	0,003551863
17	113	Cement	0,003223439
18	115	Non-iron base metal	0,003141367
19	87	Plywood and similar	0,002820106
20	175	Professional, scientific and technical services	0,002778291
21	96	Base chemical except fertilizer	0,002730491
22	170	Finance and banking services	0,002721899
23	165	Food and drink provision	0,00248517
24	112	Clay, ceramic and porcelain products	0,002416244
25	150	Electricity, gas, drinking water and communication installation	0,00208233
26	177	General government services	0,002029161
27	121	Electronic and communication goods and accessories	0,001765502
28	131	Motor vehicle except motorcycle	0,001608975
29	130	Other machines and accessories	0,001459821
30	46	Gold ore	0,00138014

Table A7. Output contribution of $1 investment in “computer and IT services” industry

No	IO table No	Industry	Output contribution, US$
1	169	Computer and IT consultation services	1,107528041
2	121	Electronic and communication goods and accessories	0,104510111
3	168	Telecommunication services	0,077618948
4	167	Programming and broadcasting of films and recording	0,047812067
5	176	Rental services and business support services	0,035363921
6	175	Professional, scientific and technical services	0,033921422
7	156	Transportation trading other than car and motorcycle	0,016525816
8	124	Electric motor and accessory	0,007854044
9	126	Other electric equipment	0,006388606
10	130	Other machines and accessories	0,00637805
11	95	Refined oil and gas products	0,005828722
12	98	Synthetic resin, plastic material and synthetic fiber	0,005271238
13	122	Measurement tools, photography, optic and clock	0,00482482
14	123	Electric generator and motor	0,004804542
15	158	Land transportation other than railway	0,003827825
16	96	Base chemical except fertilizer	0,003241443
17	110	Plastic goods	0,003198408
18	170	Finance and banking services	0,00314299
19	177	General government services	0,003112635
20	145	Electricity	0,002993921
21	38	Crude oil	0,002976742
22	129	Office and accounting machinery	0,002863876
23	39	Natural gas and geothermal	0,001804839
24	92	Paper and cartons goods	0,001518611
25	155	Car and motorcycle reparation and maintenance	0,001494677
26	152	Road, bridges and ports	0,001494395
27	173	Other financial institutions	0,001395582
28	150	Electricity, gas, drinking water and communication installation	0,001335118
29	128	Prime mover engine	0,001257804
30	166	Publishing business	0,001163752

Table A8. Top 20. Output contribution of $1 investment in “ship and ship repair” industry

No	IO table No	Industry	Output contribution, US$
1	132	Ship and ship repair service	1,315681119
2	121	Electronic and communication goods and accessories	0,000342256
3	168	Telecommunication services	0,000330299
4	156	Transportation trading other than car and motorcycle	0,000310872
5	122	Measurement tools, photography, optic and clock	0,000204309
6	182	Private health and social activities services	0,000189905
7	95	Refined oil and gas products	0,000188233
8	176	Rental services and business support services	0,000187442
9	155	Car and motorcycle reparation and maintenance	0,000172736
10	165	Food and drink provision	0,000156068
11	130	Other machines and accessories	0,000156032
12	181	Private education services	0,000151782
13	129	Office and accounting machinery	0,000145084
14	175	Professional, scientific and technical services	0,000128863
15	171	Insurance services	0,000126071
16	96	Base chemical except fertilizer	0,000121738
17	124	Electric motor and accessory	0,000118542
18	38	Crude oil	0,000110846
19	161	Air transportation	0,000108118
20	102	Soap and cleaning products	0,000106562
21	110	Plastic goods	0,000103649
22	154	Car and motorcycle trading	9,90825E-05
23	64	Bread, biscuits and similar	9,42404E-05
24	105	Pharmaceutical product	9,32724E-05
25	119	Kitchen wares, tools, metal house and office furniture	8,03585E-05
26	173	Other financial institutions	7,94517E-05
27	98	Synthetic resin, plastic material and synthetic fiber	7,91403E-05
28	123	Electric generator and motor	7,56604E-05
29	150	Electricity, gas, drinking water and communication installation	7,53679E-05
30	85	Footwear	7,31718E

Table A9. Income contribution of $1 investment in “ports, roads and bridges” industry.

No	IO table No	Industry	Income contribution, US$
1	152	Road, bridges and ports	0,14896537
2	48	Minerals of all kinds	0,026341984
3	156	Transportation trading other than car and motorcycle	0,017990813
4	94	Non-metal products	0,01374434
5	95	Refined oil and gas products	0,010591047
6	158	Land transportation other than railway	0,007908427
7	117	Metal building materials	0,004758424
8	113	Cement	0,003984636
9	87	Plywood and similar	0,003856169
10	112	Clay, ceramic and porcelain products	0,003706726
11	114	Iron and base steel	0,003258729
12	46	Gold ore	0,003201136
13	38	Crude oil	0,003157697
14	96	Base chemical except fertilizer	0,003110918
15	31	Wood	0,003032659
16	177	General government services	0,002639512
17	170	Finance and banking services	0,002583889
18	131	Motor vehicle except motorcycle	0,002220338
19	39	Natural gas and geothermal	0,002153749
20	175	Professional, scientific and technical services	0,002026215
21	176	Rental services and business support services	0,001894866
22	165	Food and drink provision	0,001760391
23	115	Non-iron base metal	0,001726295
24	168	Telecommunication services	0,001620334
25	30	Farming, forest tree, fishery services	0,001443929
26	155	Car and motorcycle reparation and maintenance	0,001429198
27	88	Building materials from wood	0,001355568
28	130	Other machines and accessories	0,001305496
29	37	Coal and lignite	0,001305452
30	154	Car and motorcycle trading	0,001157099

Table A10. Income contribution of $1 investment in “other civil building construction” industry.

No	IO table No	Industry	Income contribution, US$
1	153	Other buildings	0,112099559
2	156	Transportation trading other than car and motorcycle	0,019434993
3	48	Minerals of all kinds	0,017720658
4	31	Wood	0,010190037
5	95	Refined oil and gas products	0,009107766
6	158	Land transportation other than railway	0,006847144
7	46	Gold ore	0,00503461
8	110	Plastic goods	0,004930481
9	114	Iron and base steel	0,004707382
10	117	Metal building materials	0,004525734
11	120	Other metallic goods	0,003538433
12	87	Plywood and similar	0,003320222
13	115	Non-iron base metal	0,003263268
14	96	Base chemical except fertilizer	0,003036193
15	98	Synthetic resin, plastic material and synthetic fiber	0,002963713
16	18	Rubber	0,002701787
17	38	Crude oil	0,002647716
18	86	Sawn timber	0,002623404
19	39	Natural gas and geothermal	0,002132862
20	41	Tin ore	0,00118059
21	170	Finance and banking services	0,00111495
22	47	Silver ore	0,000986517
23	150	Electricity, gas, drinking water and communication installation	0,000841469
24	155	Car and motorcycle reparation and maintenance	0,00083198
25	32	Other forest products	0,000774759
26	176	Rental services and business support services	0,000727549
27	130	Other machines and accessories	0,000606208
28	131	Motor vehicle except motorcycle	0,000531329
29	40	Iron ore	0,000471234
30	168	Telecommunication services	0,000463042

Table A11. Income contribution of $1 investment in “seaborne transportation services” industry.

No	IO table No	Industry	Income contribution, US$
1	159	Seaborne transportation services	0,094220705
2	95	Refined oil and gas products	0,042896362
3	162	Transportation support services	0,029185351
4	38	Crude oil	0,009014434
5	176	Rental services and business support services	0,008799642
6	170	Finance and banking services	0,006533785
7	39	Natural gas and geothermal	0,005094183
8	150	Electricity, gas, drinking water and communication installation	0,003161646
9	152	Road, bridges and ports	0,001665171
10	168	Telecommunication services	0,001456095
11	177	General government services	0,000983731
12	156	Transportation trading other than car and motorcycle	0,000906177
13	171	Insurance services	0,000797246
14	51	Oil and gas mining services	0,000779343
15	161	Air transportation	0,00073101
16	175	Professional, scientific and technical services	0,000633502
17	52	Other mining and excavation services	0,000538409
18	131	Motor vehicle except motorcycle	0,000491145
19	158	Land transportation other than railway	0,000399394
20	48	Minerals of all kinds	0,000386447
21	155	Car and motorcycle reparation and maintenance	0,000356262
22	167	Programming and broadcasting of films and recording	0,000310108
23	94	Non-metal products	0,000301087
24	173	Other financial institutions	0,000259374
25	169	Computer and IT consultation services	0,000257702
26	130	Other machines and accessories	0,000237491
27	114	Iron and base steel	0,0001896
28	117	Metal building materials	0,000165876
29	121	Electronic and communication goods and accessories	0,000161147
30	96	Base chemical except fertilizer	0,000158743

Table A12. Income contribution of $1 investment in “ship and ship repair services” industry.

No	IO table No	Industry	Income contribution, US$
1	132	Ship and ship repair service	0,176151447
2	181	Private education services	6,28954E-05
3	156	Transportation trading other than car and motorcycle	5,8749E-05
4	168	Telecommunication services	5,73359E-05
5	176	Rental services and business support services	4,5292E-05
6	155	Car and motorcycle reparation and maintenance	4,32421E-05
7	121	Electronic and communication goods and accessories	3,57891E-05
8	182	Private health and social activities services	3,38649E-05
9	171	Insurance services	2,72324E-05
10	165	Food and drink provision	2,48235E-05
11	122	Measurement tools, photography, optic and clock	2,29595E-05
12	95	Refined oil and gas products	2,28247E-05
13	154	Car and motorcycle trading	1,91996E-05
14	130	Other machines and accessories	1,61612E-05
15	85	Footwear	1,60568E-05
16	175	Professional, scientific and technical services	1,56092E-05
17	129	Office and accounting machinery	1,51014E-05
18	161	Air transportation	1,45529E-05
19	173	Other financial institutions	1,44513E-05
20	148	Waste management	1,42652E-05
21	96	Base chemical except fertilizer	1,28678E-05
22	18	Rubber	1,27342E-05
23	124	Electric motor and accessory	1,26515E-05
24	162	Transportation support services	1,26381E-05
25	170	Finance and banking services	1,18484E-05
26	177	General government services	1,15264E-05
27	158	Land transportation other than railway	1,13037E-05
28	64	Bread, biscuits and similar	1,12296E-05
29	164	Accommodation provision	1,1146E-05
30	102	Soap and cleaning products	1,10431E-05

Table A13. Income contribution of $1 investment in “river, lake transportation and crossings” industry.

No	IO table No	Industry	Income contribution, US$
1	160	River, lake transportation and crossings	0,198725
2	95	Refined oil and gas products	0,032375
3	38	Crude oil	0,006777
4	39	Natural gas and geothermal	0,003815
5	176	Rental services and business support services	0,000741
6	51	Oil and gas mining services	0,000585
7	177	General government services	0,000477
8	171	Insurance services	0,000452
9	52	Other mining and excavation services	0,0004
10	175	Professional, scientific and technical services	0,000336
11	150	Electricity, gas, drinking water and communication installation	0,000324
12	170	Finance and banking services	0,000285
13	131	Motor vehicle except motorcycle	0,000212
14	159	Seaborne transportation services	0,000178
15	169	Computer and IT consultation services	0,00016
16	168	Telecommunication services	0,00015
17	130	Other machines and accessories	0,000131
18	156	Transportation trading other than car and motorcycle	0,000125
19	37	Coal and lignite	8,27E-05
20	162	Transportation support services	7,63E-05
21	161	Air transportation	7,36E-05
22	145	Electricity	6,58E-05
23	167	Programming and broadcasting of films and recording	5E-05
24	173	Other financial institutions	4,82E-05
25	158	Land transportation other than railway	4,51E-05
26	155	Car and motorcycle reparation and maintenance	3,65E-05
27	121	Electronic and communication goods and accessories	3,03E-05
28	154	Car and motorcycle trading	2,62E-05
29	129	Office and accounting machinery	2,29E-05
30	165	Food and drink provision	2,06E-05

Table A14. Income contribution of $1 investment in “transportation support services” industry.

No	IO table No	Industry	Income contribution, US$
1	162	Transportation support services	0,226396
2	152	Road, bridges and ports	0,012843
3	168	Telecommunication services	0,007536
4	95	Refined oil and gas products	0,00699
5	161	Air transportation	0,0049
6	159	Seaborne transportation services	0,004046
7	48	Minerals of all kinds	0,00228
8	156	Transportation trading other than car and motorcycle	0,001804
9	38	Crude oil	0,001549
10	94	Non-metal products	0,001196
11	176	Rental services and business support services	0,001188
12	177	General government services	0,00112
13	39	Natural gas and geothermal	0,000907
14	158	Land transportation other than railway	0,000773
15	170	Finance and banking services	0,000682
16	117	Metal building materials	0,000417
17	165	Food and drink provision	0,000395
18	113	Cement	0,000347
19	87	Plywood and similar	0,000338
20	175	Professional, scientific and technical services	0,000337
21	112	Clay, ceramic and porcelain products	0,000322
22	114	Iron and base steel	0,000291
23	171	Insurance services	0,000291
24	96	Base chemical except fertilizer	0,000289
25	46	Gold ore	0,000284
26	150	Electricity, gas, drinking water and communication installation	0,000272
27	31	Wood	0,000268
28	131	Motor vehicle except motorcycle	0,000256
29	155	Car and motorcycle reparation and maintenance	0,000189
30	121	Electronic and communication goods and accessories	0,000185

Table A15. Income contribution of $1 investment in “computer and IT services” industry.

No	IO table No	Industry	Income contribution, US$
1	169	Computer and IT consultation services	0,149786
2	168	Telecommunication services	0,013474
3	121	Electronic and communication goods and accessories	0,010928
4	167	Programming and broadcasting of films and recording	0,009988
5	176	Rental services and business support services	0,008545
6	175	Professional, scientific and technical services	0,004109
7	156	Transportation trading other than car and motorcycle	0,003123
8	177	General government services	0,001718
9	124	Electric motor and accessory	0,000838
10	170	Finance and banking services	0,000788
11	95	Refined oil and gas products	0,000707
12	98	Synthetic resin, plastic material and synthetic fiber	0,000672
13	130	Other machines and accessories	0,000661
14	158	Land transportation other than railway	0,000617
15	122	Measurement tools, photography, optic and clock	0,000542
16	126	Other electric equipment	0,00049
17	155	Car and motorcycle reparation and maintenance	0,000374
18	96	Base chemical except fertilizer	0,000343
19	129	Office and accounting machinery	0,000298
20	110	Plastic goods	0,000255
21	173	Other financial institutions	0,000254
22	152	Road, bridges and ports	0,000223
23	38	Crude oil	0,000217
24	171	Insurance services	0,000199
25	166	Publishing business	0,000182
26	131	Motor vehicle except motorcycle	0,000178
27	150	Electricity, gas, drinking water and communication installation	0,000174
28	92	Paper and cartons goods	0,000158
29	145	Electricity	0,000152
30	18	Rubber	0,000151

Table A16. GDP contribution of $1 investment in “ship and ship repair” industry.

No	IO table No	Industry	Income contribution, US$
1	132	Ship and ship repair service	0,557008497
2	168	Telecommunication services	0,000222134
3	156	Transportation trading other than car and motorcycle	0,000211778
4	155	Car and motorcycle reparation and maintenance	0,000131798
5	148	Waste management	0,000118986
6	176	Rental services and business support services	0,000117424
7	181	Private education services	9,94105E-05
8	182	Private health and social activities services	9,59034E-05
9	171	Insurance services	9,29174E-05
10	95	Refined oil and gas products	8,78147E-05
11	121	Electronic and communication goods and accessories	8,68209E-05
12	38	Crude oil	7,6515E-05
13	175	Professional, scientific and technical services	7,13543E-05
14	165	Food and drink provision	6,77053E-05
15	172	Pension fund services	5,99278E-05
16	154	Car and motorcycle trading	5,8444E-05
17	122	Measurement tools, photography, optic and clock	5,49496E-05
18	39	Natural gas and geothermal	5,27583E-05
19	173	Other financial institutions	5,20269E-05
20	164	Accommodation provision	4,25473E-05
21	130	Other machines and accessories	3,77827E-05
22	161	Air transportation	3,5725E-05
23	119	Kitchen wares, tools, metal house and office furniture	3,52652E-05
24	96	Base chemical except fertilizer	3,52287E-05
25	174	Real estate services	3,51591E-05
26	129	Office and accounting machinery	3,50957E-05
27	170	Finance and banking services	3,49333E-05
28	158	Land transportation other than railway	3,46659E-05
29	162	Transportation support services	3,45994E-05
30	169	Computer and IT consultation services	3,41368E-05

Table A17. GDP contribution of $1 investment in “road, bridges and ports” industry.

No	IO table No	Industry	Income contribution, US$
1	152	Road, bridges and ports	0,360787326
2	48	Minerals of all kinds	0,073057
3	156	Transportation trading other than car and motorcycle	0,064853003
4	95	Refined oil and gas products	0,040747496
5	94	Non-metal products	0,03687872
6	38	Crude oil	0,029891128
7	158	Land transportation other than railway	0,024253334
8	39	Natural gas and geothermal	0,023160848
9	114	Iron and base steel	0,016442295
10	117	Metal building materials	0,01593813
11	87	Plywood and similar	0,014688056
12	31	Wood	0,013223645
13	113	Cement	0,011796718
14	46	Gold ore	0,01051514
15	112	Clay, ceramic and porcelain products	0,009973583
16	175	Professional, scientific and technical services	0,009262412
17	37	Coal and lignite	0,00914036
18	96	Base chemical except fertilizer	0,008516871
19	115	Non-iron base metal	0,008373555
20	170	Finance and banking services	0,00761823
21	131	Motor vehicle except motorcycle	0,006882704
22	168	Telecommunication services	0,006277604
23	14	Vegetable fiber	0,006186129
24	41	Tin ore	0,005993756
25	30	Farming, forest tree, fishery services	0,005514184
26	88	Building materials from wood	0,005160208
27	176	Rental services and business support services	0,004912637
28	165	Food and drink provision	0,004801416
29	155	Car and motorcycle reparation and maintenance	0,004356058
30	173	Other financial institutions	0,003946954

Table A18. GDP contribution of $1 investment in “other buildings” industry.

No	IO table No	Industry	Income contribution, US$
1	153	Other buildings	0,286608153
2	156	Transportation trading other than car and motorcycle	0,070058961
3	48	Minerals of all kinds	0,049146569
4	31	Wood	0,044432774
5	95	Refined oil and gas products	0,03504079
6	38	Crude oil	0,025063591
7	114	Iron and base steel	0,023751642
8	39	Natural gas and geothermal	0,022936233
9	158	Land transportation other than railway	0,020998623
10	46	Gold ore	0,016537765
11	115	Non-iron base metal	0,015828788
12	117	Metal building materials	0,015158746
13	110	Plastic goods	0,015073971
14	87	Plywood and similar	0,012646647
15	120	Other metallic goods	0,012385616
16	86	Sawn timber	0,009988231
17	41	Tin ore	0,009338838
18	98	Synthetic resin, plastic material and synthetic fiber	0,008365147
19	96	Base chemical except fertilizer	0,008312292
20	18	Rubber	0,007178718
21	32	Other forest products	0,003378269
22	147	Water supply	0,003343049
23	170	Finance and banking services	0,003287273
24	47	Silver ore	0,003082781
25	155	Car and motorcycle reparation and maintenance	0,002535795
26	150	Electricity, gas, drinking water and communication installation	0,002220188
27	176	Rental services and business support services	0,001886247
28	168	Telecommunication services	0,001793946
29	131	Motor vehicle except motorcycle	0,001647039
30	174	Real estate services	0,001534354

Table A19. GDP contribution of $1 investment in “seaborne transportation services” industry.

No	IO table No	Industry	Income contribution, US$
1	159	Seaborne transportation services	0,305419287
2	95	Refined oil and gas products	0,165037447
3	38	Crude oil	0,085331692
4	162	Transportation support services	0,07990071
5	39	Natural gas and geothermal	0,054781499
6	176	Rental services and business support services	0,022813984
7	170	Finance and banking services	0,019263942
8	150	Electricity, gas, drinking water and communication installation	0,008341899
9	168	Telecommunication services	0,005641299
10	152	Road, bridges and ports	0,004032969
11	156	Transportation trading other than car and motorcycle	0,003266574
12	175	Professional, scientific and technical services	0,002895921
13	171	Insurance services	0,002720214
14	51	Oil and gas mining services	0,002146581
15	161	Air transportation	0,001794516
16	52	Other mining and excavation services	0,001581594
17	131	Motor vehicle except motorcycle	0,001522473
18	158	Land transportation other than railway	0,00122485
19	177	General government services	0,001105652
20	155	Car and motorcycle reparation and maintenance	0,001085853
21	48	Minerals of all kinds	0,001071773
22	37	Coal and lignite	0,000995905
23	167	Programming and broadcasting of films and recording	0,000978265
24	169	Computer and IT consultation services	0,000975046
25	114	Iron and base steel	0,000956649
26	173	Other financial institutions	0,000933783
27	94	Non-metal products	0,000807875
28	117	Metal building materials	0,000555595
29	130	Other machines and accessories	0,00055522
30	46	Gold ore	0,000503202

Table A20. GDP contribution of $1 investment in “river, lake transportation and crossings” industry.

No	IO table No	Industry	Income contribution, US$
1	160	River, lake transportation and crossings	0,405972249
2	95	Refined oil and gas products	0,124557127
3	38	Crude oil	0,06415238
4	39	Natural gas and geothermal	0,041026169
5	176	Rental services and business support services	0,001922157
6	51	Oil and gas mining services	0,001612039
7	171	Insurance services	0,001541569
8	175	Professional, scientific and technical services	0,001533701
9	52	Other mining and excavation services	0,001175355
10	150	Electricity, gas, drinking water and communication installation	0,000854532
11	170	Finance and banking services	0,000841658
12	131	Motor vehicle except motorcycle	0,000656492
13	169	Computer and IT consultation services	0,00060665
14	168	Telecommunication services	0,000581528
15	37	Coal and lignite	0,000579029
16	159	Seaborne transportation services	0,000576451
17	177	General government services	0,000536626
18	156	Transportation trading other than car and motorcycle	0,00045157
19	130	Other machines and accessories	0,000305467
20	145	Electricity	0,00026848
21	162	Transportation support services	0,000208796
22	161	Air transportation	0,000180588
23	173	Other financial institutions	0,000173423
24	167	Programming and broadcasting of films and recording	0,000157847
25	158	Land transportation other than railway	0,000138211
26	155	Car and motorcycle reparation and maintenance	0,000111128
27	114	Iron and base steel	8,49943E-05
28	154	Car and motorcycle trading	7,97909E-05
29	121	Electronic and communication goods and accessories	7,35282E-05
30	165	Food and drink provision	5,61842E-05

Table A21. GDP contribution of $1 investment in “transportation support services” industry.

No	IO table No	Industry	Income contribution, US$
1	162	Transportation support services	0,619804537
2	152	Road, bridges and ports	0,031105818
3	168	Telecommunication services	0,029197959
4	95	Refined oil and gas products	0,026892315
5	38	Crude oil	0,014659446
6	159	Seaborne transportation services	0,013116843
7	161	Air transportation	0,01202954
8	39	Natural gas and geothermal	0,00975722
9	156	Transportation trading other than car and motorcycle	0,006503602
10	48	Minerals of all kinds	0,006323102
11	94	Non-metal products	0,003209537
12	176	Rental services and business support services	0,00308031
13	158	Land transportation other than railway	0,002371136
14	170	Finance and banking services	0,002011473
15	175	Professional, scientific and technical services	0,001538396
16	114	Iron and base steel	0,001467909
17	117	Metal building materials	0,001397933
18	87	Plywood and similar	0,00128803
19	177	General government services	0,001258966
20	31	Wood	0,001168745
21	165	Food and drink provision	0,001078115
22	113	Cement	0,001026234
23	171	Insurance services	0,000992359
24	46	Gold ore	0,000931677
25	37	Coal and lignite	0,000922652
26	112	Clay, ceramic and porcelain products	0,000865099
27	131	Motor vehicle except motorcycle	0,00079327
28	96	Base chemical except fertilizer	0,000790156
29	115	Non-iron base metal	0,000735766
30	150	Electricity, gas, drinking water and communication installation	0,000716831

Table A22. GDP contribution of $1 investment in “computer and IT services” industry.

No	IO table No	Industry	Income contribution, US$
1	169	Computer and IT consultation services	0,566731846
2	168	Telecommunication services	0,052200652
3	167	Programming and broadcasting of films and recording	0,031508628
4	121	Electronic and communication goods and accessories	0,026511304
5	176	Rental services and business support services	0,02215392
6	175	Professional, scientific and technical services	0,018782972
7	156	Transportation trading other than car and motorcycle	0,011257986
8	95	Refined oil and gas products	0,00271922
9	170	Finance and banking services	0,002322658
10	124	Electric motor and accessory	0,002096006
11	126	Other electric equipment	0,002055721
12	38	Crude oil	0,002054801
13	177	General government services	0,001931193
14	98	Synthetic resin, plastic material and synthetic fiber	0,001896634
15	158	Land transportation other than railway	0,001891748
16	130	Other machines and accessories	0,001544428
17	39	Natural gas and geothermal	0,001435933
18	122	Measurement tools, photography, optic and clock	0,001297652
19	123	Electric generator and motor	0,001255119
20	155	Car and motorcycle reparation and maintenance	0,00114044
21	96	Base chemical except fertilizer	0,000938016
22	173	Other financial institutions	0,000913861
23	110	Plastic goods	0,000779918
24	174	Real estate services	0,000707523
25	129	Office and accounting machinery	0,00069277
26	171	Insurance services	0,000680459
27	145	Electricity	0,00061866
28	131	Motor vehicle except motorcycle	0,000552666
29	152	Road, bridges and ports	0,000538964
30	92	Paper and cartons goods	0,000500269