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Thesis for the Degree of Master of Management of Technology

Economic Analysis of Spillover Effects from the Seaport Construction in Vietnam

by

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베트남 항만건설로 인한 파급효과의 경제분석

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by

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Economic Analysis of Spillover Effects from the Seaport Construction in Vietnam

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Abstract

Since Vietnam joined the World Trade Organization in 2008, the number of cargoes has increased significantly. The import-export turnover has been tripled from 70 billion USD in 2012 to 203.05 billion USD in 2018. Since the exploitation capacity has fallen short of the demand for port services through the seaport system, a series of investment projects to build a new port has been approved by the Vietnamese Government which led to the rush for port construction in the majority of coastal provinces. It should be noted that the investment in port construction may be counterproductive when there exists a large imbalance in the number of goods received among regions. It is obvious that the southern part of the country attracts a variety of industries. Accounting for about 57% of the goods received through ports, the southern clusters are currently overloaded in 2018. On the other hand, the central port clusters have managed only 13% of the total throughput and are thus in shortage of goods received. It is hence critical to take a holistic approach to analyzing economic impacts of port construction in relation to the status of industrial development in the area. This study is aimed at analyzing the economic impacts (that is, spillover effects) of investments in port construction on other industries in the region based on the input-output analysis. Investigated are the production inducement, value-added inducement, and employment inducement of port investments towards 16 different industrial sectors.

Chapter 1. Introduction

It is undebatable that seaports would play a central role in national economy especially for export-driven countries such as Vietnam. The number of export and import turnover increases every year. More specifically, the total export and import turnover has increased from about 70 billion USD in August 2012 to 203.05 billion USD in August 2018 according to the Vietnam General Statistics Office. It is evident that the sea transportation is critical in promoting the economic growth considering the statistical data showing that 90% number of cargoes are transferred by maritime transportation and 100% of inland cargo is transferred by Vietnam ship according to Vietnam Seaport Association. Figure 1 shows the Vietnam import-export turnover from 2010 to 2016 indicating that the number of import-export is continuously increasing especially after Vietnam joined in World Trade Organization (WTO). Comparing to other countries in the local area, Vietnam has the highest growth of container cargo through the port system in 2013 ~ 2020 by 9.2%, followed by Indonesia (7.3%) and Myanmar (3.6%). (Chiang, 2014)

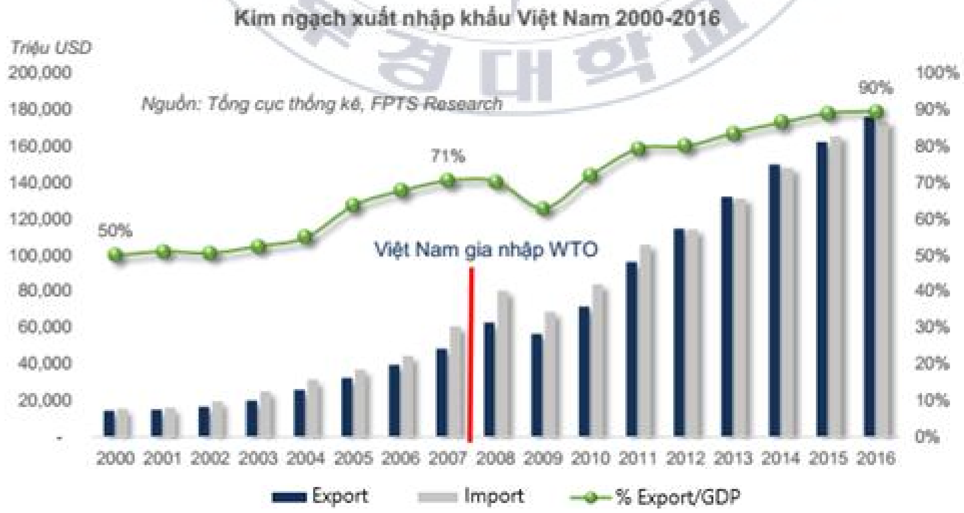

Figure 1. Vietnam's Import-Export Turnover (Unit: million USD)

To meet the increasing demand of cargo transportation, Vietnamese Government has approved a series of port construction and development in 2009. After that, the race of port construction has begun in almost all the regionals that have the coastline. According to the data from General Statistics Office (GSO) of Vietnam, the number of the port has increased from 160 to 272 over the period of 2008 ~ 2019. The port system has increased 4.4 times in the length of the harbor, with about 92.2km of the wharf length and a total capacity of over 550 million tons per year. Considering the rapid increase in port's construction demand, the research about port's economic spillover impact to increase the investor's knowledge about the benefit of the port's construction investment is becoming more significant than ever before.

The impact of the port sector on other industries is undeniable. In light of this, there are many studies emphasizing the important role of port to Vietnamese economy such as "Vietnam seaport development and investment in the period 2005 ~ 2020" , "Policy on the economic and sea island development in Ba Ria-Vung Tau Province" . However, there is a lack of research related to the economic impacts of the port sector on other industries in Vietnam. Hence, this study will provide an in-depth analysis of the port contribution to other industries in Vietnam that further helps improve the national economy from the perspective of value-added, production, and employment. Input-Output (IO) analysis is used in this study to show the interdependencies between different sectors of the Vietnamese economy that affected by the port sector. This thesis is comprised of 5 sections. The next section presents a current status of Vietnamese ports and their impacts on the national economy. Chapter 3 addresses related studies on the economic spillover effects of the port sector. Research methodology will be briefly described in Chapter 4, followed by research findings, conclusions, and discussion in Chapter 5.

Chapter 2. Vietnam Port's Statistics and Future Development

2.1. Vietnam General Statistics

To support the analysis and interpretation of data, this chapter will show the comprehensive picture of Vietnames general statistics that mostly focuses on the Vietnam port and the indicators related to the research. Section 1 shows the geographic, population and employment statistics in Vietnam. Section 2 will elaborate on Vietnam port current status and government's future decision and policy for port investment and development.

2.1.1. Vietnam's Geography and Economy

Vietnam is located in Southeastern Indochina peninsula surrounded by four countries, namely China, Thailand, Cambodia, and Laos. The east of Vietnam is bordered by the East Sea with the length of 3,260 km of coastline. With a natural advantage, the country has a wide sea area, a long coastline and a maritime index of 0.01 (on average 100 km2 of the mainland has 1.0 km of coast), 6 times higher than this ratio of the world (Lines, 2017). Along the coast, there are many bays and deep bays, close to the world's major shipping routes, Vietnam has great potential in developing deep-water ports and large international transit ports. From the backward of the agricultural economy with 90% of the population working in agriculture, Vietnam is gradually shifting to the trend of reducing the proportion of agriculture, forestry, and fisheries, and increasing the share of industry, construction, and service industry.

Specifically, the contribution of industries and services accounts for about 90% of the economic growth which is higher in 2016 than over the period of 2006 ~ 2010. The service sector itself had contributed nearly 50% to growth by sector which was much higher than of the period 2006 ~ 2010 with a 40% contribution. (GSO, 2018).

Figure 2. Vietnamese geographical map

Vietnam's economy is on the rise with the 7.08% of increase of total GDP in 2018 which is the highest increase since 2008 onwards (GSO, 2018). Construction, processing and manufacturing industries continued to be the main contributors to economic growth with a high increase of 12.98%. This contribution is lower than the growth rate of 2017, but much higher than the years 2012 ~ 2016.

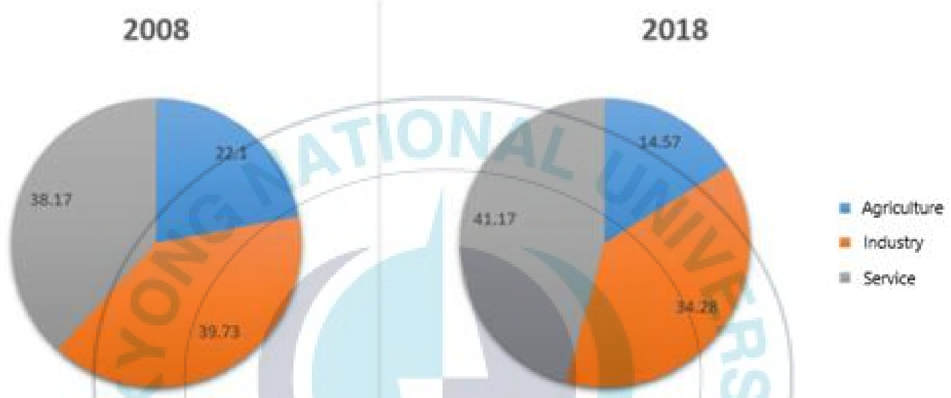

Figure 3. Vietnam's Economic Structure of 2008 and 2018

Along with the growth of GDP, the foreign direct investment (FDI) in Vietnam has also been increased since 2006 after joining WTO. Figure 4 shows the FDI in Vietnam over the period of 1996 ~ 2018 (MPI, 2019). Particularly, FDI in Vietnam in 2006 was 10.2 billion USD which corresponds to more than 45% increase compared to the previous year. This number was higher than the old record in 1996 with 8.6 billion USD. Within twelve years of development, the FDI in Vietnam 2018 has reached 35.5 billion USD, increasing by more than 348% compared to 2006. Mostly, the FDI capital focuses on the manufacturing and processing sectors with more than 10,500 million USD accounting for 72% of total FDI capital in Vietnam.

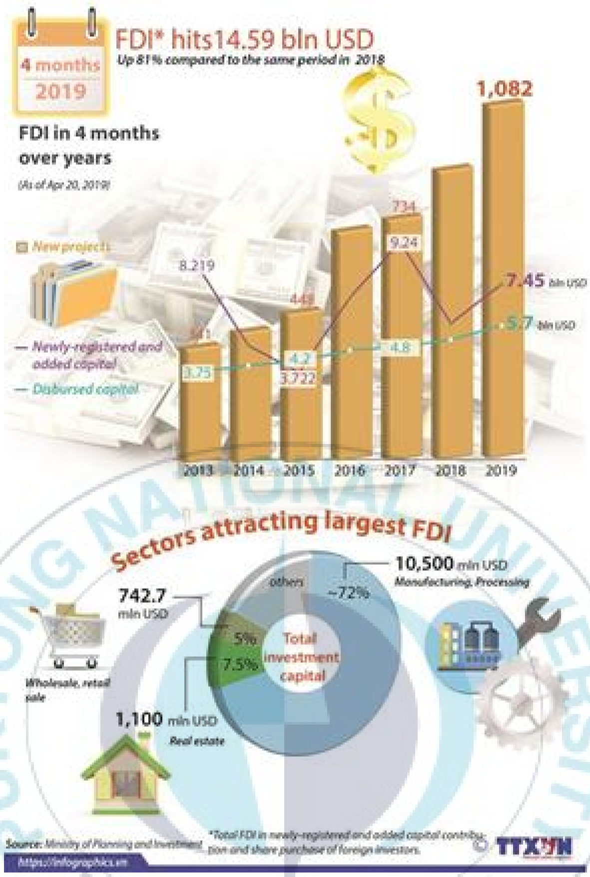

Figure 4. FDI Structure in 2013~2019 (MPI, 2019)

2.1.2. Population and Employment Statistics

Human resources are the most decisive factor in the development of each nation. The level of development of human resources is a key measure of the development of a nation. Therefore, all countries in the world attach great importance to developing human resources. In the twentieth century, there were countries with poor natural resources, but due to the promotion of human resources, socio-economic development, industrialization, and modernization were achieved in just a few decades. According to the overlook in the population, Vietnam is a country with a huge population ranked 14th in the globe. The total land area is 310,060 km^2. and the number of Vietnam population is estimated at 96,963,958 in 2018.

Table 1. Vietnam Population Statistics (GSO, 2018)

Year	Population	% Change	Emigrate	Average Age	Birthrate	Density
2017	95,414,640	1.03	-40000	30.8	1.96	308
2016	94,444,200	1.07	-40000	30.8	1.96	305
2015	93,447,601	1.13	-40000	30	1.96	301
2010	88,357,775	0.97	-175500	29	1.93	285
2005	84,203,817	0.96	-154500	26	1.92	272

There are three distinct divided groups in accordance to the age range, which is under 15 years old group, 15 ~ 64 years old (this group is considered as the group of population in working age), and higher than 64 years old. The group of population in the working-age accounts for 69.3% of the total population as shown in Figure 5, which indicates the labor potential in Vietnam. According to the Ministry of Natural Resources and Environment, Vietnam has approximately 52,207,000 labors in 2018 and this number is increasing yearly at an average of 1.5 ~ 1.6 million employment. With regard to technical and professional qualifications, the percentage of trained workers in the labor force aged 15 and over is 17.9%, of which in urban areas it is 33.7%, 3 times higher than of the rural areas that only has 11.2%, by gender this rate is 20.3% for men and 15.4% for women. The percentage of manpower with a high level of training (from university and above) in the total number of trained workers is increasing from 5.7% in 2010 to 6.4% in

2012 and to 6.9% in 2013. From the productivity perspective, Vietnam Government spends a tremendous amount of effort to improve labor productivity. Based on the calculation of labor productivity, measured by gross domestic product (GDP) at current prices divided by the total number of employees working in one year, the labor productivity moves from 21.4 million VND/person in 2005 to 44.0 million VND/person in 2010 and 63.1 million VND/person in 2012. However, Vietnam labor productivity is evaluated at a low level in many reviews. On the other hand, one is concerned that Vietnam labor productivity tends to rise more slowly than the other developing countries in the same area such as China, India, and Indonesia.

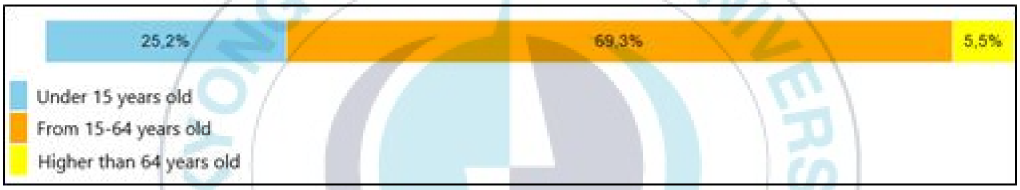

Figure 5. Vietnam's Population Structure in 2018

With regard to the human resources in the maritime industry, the Vietnam Maritime Administration believes that maritime human resource and its productivity are not enough to catch up with the growth of the maritime industry. The target of maritime development through 2030 has emphasized the importance of the maritime human resource, however, the shortage of maritime human resources is still not received much attention from the government. In June 2019, there are 1,600 Vietnam ships and about 40,000 seafarers having the certificate of professional competence. Although the number of crew members is assessed to be able to meet the domestic fleet demand, the ship owners have difficulties in recruiting because the number of candidates applying for vocational training decreases from thousand to dozens. Suggestions for maritime human resource attraction and development are required along with the maritime development plan. The government should spend more efforts to fulfill the demand for maritime human resources.

2.2. Port Statistics and Development Policy

Vietnam is the country with a favorable geographical position for water – way transportation with a dense inland river network and more than 3,260 km of coastline. However, this huge potential still in the process of exploitation.

2.2.1. Seaport Statistics

According to the Ministry of Transport, Vietnam's seaport system is now divided into 6 groups with 45 ports, including 2 international gateway ports, 12 Type I seaports (i.e., regional general port); 18 seaports of class II (i.e., local general ports), and 13 seaports of class III (i.e., offshore oil ports) depending upon the role of port. In general, Vietnam cargo throughput growth rate is higher than expected. The total forecasted volume in 2010 by the approved plan is relatively reasonable, however, if classified by each port group and types of goods, the forecast of the previous plan approved in 1999 is much lower than in reality. The amount of general cargo, containers through Hai Phong port, Ho Chi Minh City in 2007 exceeded the forecast for 2010. (Chiang, 2014) Vietnam has the highest growth rate of container volume over the period of 2013~2020 compared to other countries in the region. The latest statistics of the Vietnam Maritime Administration indicate the total capacity of over 550 million tons/year. Port system is invested synchronously in infrastructure: wharves, buoys, loading and unloading equipment, basic development complete, fully functional, large scale and widely distributed by region. This shows that Vietnam is well implementing the proposed port development plan before. Most seaports make full use of natural conditions, meet the transportation requirements by sea, actively serve the socioeconomic development process of coastal areas as well as the whole country, and create motivations to attract and promote related industries and industries to develop together.

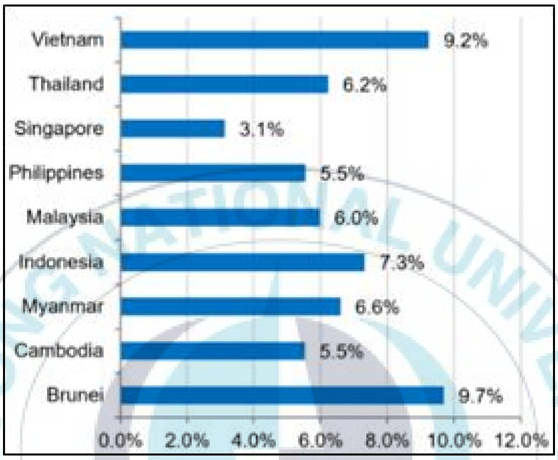

Figure 6. ASEAN Growth Rate of Container Volume in 2020 compared with 2013 (Chiang, 2014)

Vietnam seaport has grown 4.4 times of port length since the first year of seaport planning implementation in 2000. Most of the regional hub ports, such as Hai Phong, Da Nang, Ba Ria – Vung Tau, Ho Chi Minh City, have been upgraded to accommodate ships of up to 30,000 DWT. Many ports, like Cai Mep – Thi Vai (CM-TV), may receive ships of up to 18.300 TEU (194.000 DWT) that can directly connect the transportation of Vietnam with the Northern Europe market. In recent years, output through the port of CM-TV has grown dramatically. The volume of goods through the port only reached more than 731,000 TEU, which thus far corresponds to more than 300% increases. Besides, the seaport block in the Central region is also improved. Before 2014, Da Nang Port has a limited wharf length and thus container ships have to wait in queue for 6~8 hours. After equitization, the ports focused on upgrading the wharf infrastructure and developing container services. The total investment for the period of 2014~2018 is more than 1,900 billion VND, 4 times higher than the period of the previous 5 years 2009~2013. The ports continue to put into use 2 new wharves in the project of expanding Tien Sa port phase 2, with a total investment of nearly 900 billion VND. The output of goods through the port in the past 5 years has increased by an average of 10% per year. The receiving capacity has been raised from 1,800 TEU to 3,500 TEU.

2.2.2. Seaport Development Policy

To catch-up with the speedy growth of the cargo throughput, Vietnam Government has approved the plan for development of Vietnam's seaport system by 2020, orientation to 2030 in 2009 with the purpose of developing the seaport system in accordance to a comprehensive and unified national planning to meet the country's industrialization and modernization requirements; to create material and technical bases for quickly integrating its country and being competitive enough in seaport activities with other countries in the region and around the world, confirming the position and advantages of the country's marine economy; at the same time contributing to the security and defense of the country. Establishing trades and important economic exchanges with the international region as a driving force for the development of coastal, urban and industrial zones is regarded as critical.
The specific goals described in Resolution No.36-NQ/TW are presented in the following:

- To ensure through the whole volume of import and export goods and exchanges between domestic regions by sea to meet the country's socioeconomic development requirements. The estimated volume of cargo through the whole port system at the points in the plan is as follows:

- 500 ~ 600 million tons / year in 2015;
- 900 ~ 1,100 million tons / year by 2020;
- 1,600 ~ 2,100 million tons / year in 2030;

▪ Concentrating on building many deep-water ports for large ships of international standards. More specifically, Van Phong - Khanh Hoa international transshipment port may receive container ships of a capacity of 9,000~15,000 TEU or larger, a tanker of 30,000~40,000 DWT; international gateway ports in Hai Phong and Ba Ria - Vung Tau may receive ships of between 8,000 and 100,000 DWT, container ships of 4,000~8,000 TEU and other key economic regions when conditions permit; specialized ports for petrochemical and metallurgical complexes, coal-fired thermoelectric centers (receiving ships of between 10,000 and 30,000 DWT or larger). Paying attention to renovating and upgrading the existing regional hub ports; to build key local ports according to their functions and sizes suitable to socioeconomic development requirements and capital mobilization capacity;

▪ Developing ports in island districts with sizes suitable to natural and socioeconomic conditions to transport goods and passengers in service of socioeconomic development, security, and defense;

▪ Upgrading and developing the in-depth equipment, loading and unloading technology lines and managing them to quickly overcome the backward situation of technical-technological levels, service quality weaknesses, increasing the capability compete in international integration on seaports;

▪ Studying and combining politics with renovating and upgrading the channel of ships into the port to ensure that the large tonnage vessels enter and exit safely and synchronously with the wharf size and suit the port's role and function.

Chapter 3. Literature Review

3.1. Port Definition and Brief Description

3.1.1. Port Definition

For the purpose of this study, the port is defined as the connection area between land and waterway to encourage the transportation of cargo (cargo port), passenger (passenger port) or the combination of both. Port can be the natural establishment of artificial construction. Meanwhile, a natural port is defended by several prominences of land. In contrast, the artificial port has constructed jetties, sea walls, or breakwater to serve the purpose of providing the shelter for the ship. In the global general transportation sector, the port is mentioned as one of the primary components and linked to the expanding world economy. Besides the general transportation and provide shelter for a ship, the port also gives various services such as pilotage, towing and tug assistance, anchorage berth and berthing service, and supporting services like storage and warehousing, maritime cargo handling services, customs clearance services, and so forth. (Dwarakisha, 2015)

3.1.2. Port Description

The port is emphasized as a complex of berths, docks, and adjacent land where ships and cargoes are served (Trujillo, 1999). To serve this purpose, in the Economic conception written by (Hammami, 2017), they said that the port has two main characteristics. First is the vastness of the port allowed to provide shelter for the ship. Second, its properties and tools are developed to transfer goods or passengers from the ship to an other's type of transportation and vice versa. Each characteristic requires different infrastructure and equipment. This first characteristic is also called the maritime access stage. In this stage, the port acts like a shelter for the ship with many activities, including providing aids for ship navigation, the lock for raising and lowering boats, ships and other watercraft. The second characteristic represents the land access stage, the port changes its role to a versatile distribution center with the road's connection activities, rail network and inland navigation in this stage. Figure 7 shows a schematic of the different types of infrastructures required by a port (Trujillo, 1999). As a role like a versatile distribution center, a port must have stored functions as a result of the combination of infrastructure and superstructure. Figure 7 depicts that port infrastructures are related to stored function and transport function (berths, docks, basins, storage areas, and more). Port superstructure is possible to distinguish between fixed assets (fuel tanks, building, office, and others) and mobile equipment such as cranes, transtainer, van carriers, etc.

There are several elements listed out by the European Union to distinguish what is and what is not considered as a port infrastructure . Nevertheless, port infrastructures are considered as assets, machinery, equipment that can be used to serve the maritime and land access activities. However, this infrastructure is in charge of two different authorities that are port authorities and local government. The maritime access, e.g. infrastructures like breakwaters, lights, buoys, and all elements within the port area are built and managed by the port authorities. Meanwhile, connections to land networks and the remaining forms of maritime access (channels, locks) are generally owned and maintained by the State or local government . Port traditional infrastructure usually is covered by port authorities and there was an argument that these assets should be in the public sector to prevent the monopolization by a private firm in port assets property right. However, there is a trend that increases the participation of a private firm in the building of infrastructure.

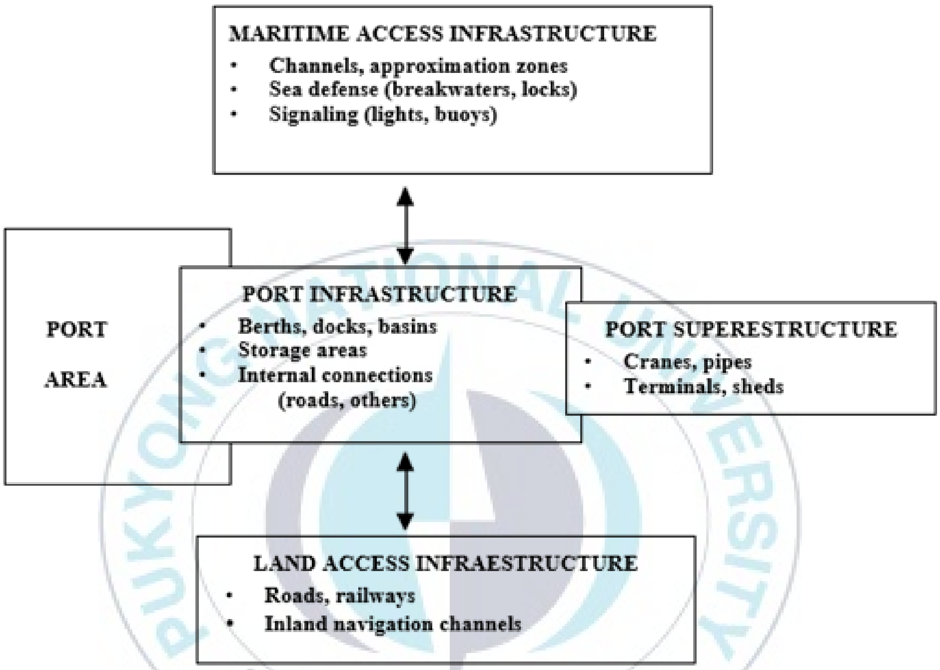

Figure 7. Scheme of Seaport Structure

3.2. Role of Port in Economic Development

The economic spillover impact of the seaport is discussed in many studies before. In which the main impact of seaport can be mentioned in short as follows: 1) the seaport construction and development is mentioned as a part of the transportation development, and a force of the increase in cargo transportation; 2) the employment opportunities can be generated via the port construction and operation; 3) the seaport is considered as a focal point for regional development; 4) the contribution of the seaport to economic growth is greatly increased due to its added value and those of logistics activities that take place in the vicinity of seaports; 5) seaport speed up the insertion of the domestic economy in the international economy; and 6) seaports constitute the real pillars to develop the rest of economic activities .

Three main methodologies that are used to studies the economic impact of the port to others sectors are IO analysis, computable general equilibrium (CGE) and gravity model (Bichou, 2007). CGE model has become popular in the decade as the method to analyze the impact of one or more specific object across difference sectors. It incorporates many economic linkages and can be used to try to explain medium- to long-term trends and structural responses to changes in an economics. Basically, CGE is assumed as IO model improvement version so that CGE and IO analysis have a lot of similarly points. Dixon et al. (1992) has emphasized that the IO model is the core of CGE model, and it provide the major part of data for the construction of CGE analysis. Study on trade reform policies provided by Devarajan and Rodrik (1991) is a good references for CGE model observation.

Gravity model is also one of the good methodology to study the port impact, which is the methodology analyzing the relationship between geographical distance and trade flows. The data of both CGE and gravity model is provided by the national account and input-output table details. However, CGE and gravity models both have their own limitations. For example, CGE model is built on the benchmarking of the perfect competition assumption, constant returns to scale and that both labor and capital move freely between sectors. In fact, each country has its own separate economics structure and inter-sectoral configuration. Therefore, CGE is not consistent with the structure of port industry. During the past few decades, the port accommodation has been admitted by the world. The low of maritime transport cost and the ability of cargo transportation with high volume have created the momentum for the development of global commodity. It has been estimated that around 90% of world merchandise and commodity trade is transported by ship (UNCTAD, 2010) and the cargo volume also increases every year. Berkoz (1999) reckoned that the port has two main advantages. First, is the role of the port as links of hinterlands to points oversea. Second, maritime transport is the cheapest way compared to other transportation systems:

- Airway: low volume of cargo carry
- Railway: require double much energy consumption
- Road transportation: ten times of energy consumption

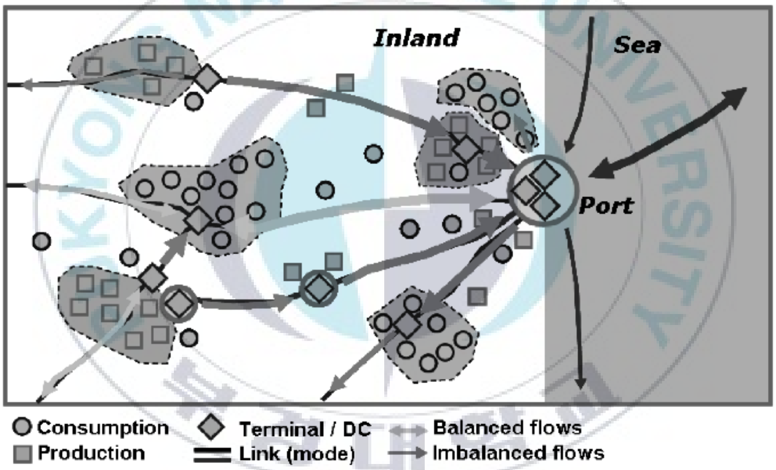

Figure 8. Port Regionalization & Intra-Port Competition: A Multi-Actors Sector (Pallis and Lambrou, 2012)

It is estimated that the higher the transport cost the lower the economic growth rate occurred. Despite the low interrelate rate between the transport cost and economic growth rate, however, in the long-term, this rate may cause a considerable variation in per capita income. Sánchez et al. (2002) found the relationship between the port efficient and a set of variables including controlling for distance, type of product, liner services availability, and insurance costs, among others. In concrete, a 25% improvement of one efficiency factor may render a reduction of approximately 2% in total maritime transport costs. Ferrari (2011) argued that the port could also cause an effect on economic development by throughput and employment. The impact of throughput via the port is positive to the local development, however, this effect was less than 0.5 which was considered weak. On the other hand, the positive impact of employment is stronger and higher compared to other industries. Global accommodation increasing as Global GDP had also increased by 10% from 1990 to 2013 due to the increasein the exported goods value. According to Adomaitis (2014), there were 26 of the world's major metropolitan areas and 35 of them were among the top of 100 container ports and their aggregated real GDP increased by 13% over 2008-2013. Thus, there is undeniable of the positive impact of the port on the economic development in a country. In extending this view, Shanghai is a typical example of such a promising development. In 2002, the Shanghai port created 347.000 jobs include direct and indirect impacts, however, this number has reached 840.000 jobs in 2012. Furthermore, the GDP created by port activities was accounted for 7,6% GDP of the total GDP in Shanghai in 2012. Some research has shown that handling the increasing amount of trade causes a positive impact. For example, research on the impact of European port conducted by OECD estimates that every one million tons of cargo will create 300 jobs in the short-term. (Adomaitis, 2014)

3.2.1. Production Impact

Throughput is known as the port output and port investment activity is the creation of throughput capacity. Domestic production efficiency can be increased via the increasing of capital goods by both international and local trading (Wiegmans, 2002). Most of the coastal countries leverage their potential of the natural resources to develop the strength in sea transportation as an advantage for the increase in the economic perspective. A port investment has a positive effect on the production when its infrastructure is developed to encourage transportation activities to lead to the cost reduction in capital goods transportation for production activities. Normally, the investment can also result in an increase in the indirect benefits in term of microeconomic and macroeconomic. Both microeconomic and macroeconomic benefits will give rise to effects such as increases in employment, production, earnings, and consumption, as well as produce long-term effects in terms of accessibility, the efficiency of the productive-logistic system and possible innovation capabilities (Ferrari et al., 2006)

From a microeconomic perspective, the port operation also causes a change in production activities via the increase in the level of throughput. Specifically, the reduction in the cost of port service will generate an increase in cargo throughput. Besides, the decrease in the cost of port service directly correlated to the degree of competition within the port service market: high competition, high-cost reduction in price and increase in throughput. The increase in throughput usually leads to the increasing returns to scale, therefore causes the fall in the cost of production, generalized cost, price and potentially further increase in profits. Furthermore, the reduction in cost/price also causes the cost reduction in all of the transport cycles so that the firm can get the benefits if the reduction in cost/price takes place in port operation activities.

3.2.2. Value-Added Impact

Value-added is another important indicator that can be used to evaluate the impact of the port on economic. A port is an intermediate area in a country that provides goods import service in which the country itself does not produce sufficient quantity or export goods to contribute to the development of its economy. Moreover, the port also provides value-added service to the product transported and helps to increase the demand for trade. According to Deng (2013), port demand and port activities do not have a direct significant effect on the regional economy. Instead, port proves its effect via port demand and value-added activity. The value-added is not only created by the complication in ports transportation process (e.g. transit of cargo, loading, and unloading of cargo, storing, and distribution), but also in value-added activities, which can be defined as value-added production during transportation, taking place in the vicinity of ports. Nowadays, logistics zone is the consideration of many ports to attract the value-added activities in which labeling, customizing, adding of parts or manuals, configuration, blending and mixing, final assembly, managing of goods and information flows, inventory control and so on are examples of value-added logistics activities among others. Besides, increase the cargo transfer demand is considered a better way for value creation . Taking these arguments into account, the port activities and port demand have a positive impact on economic growth via the impact of value-added creation activities of the port. Besides, the port supply activity has also been proved a positive effect on value-added creation. The three elements that affect the value-added are port supply, port demand, and value-added activity.

A publication of economics contribution of ports to local economies in Korea (Jung, 2011), proved the arguments above when these results suggest that the development of port city regional economy needs to consider about the increase of import-export and the value-added of the port city. However, the port supply was not supported in this study as port supply activity is not directly impacting the regional economies. Instead, it has impacts on port demand and value-added activity as mentioned before. Several studies have shown that port activities have a strong effect on local, regional and national economies (Waters, 1977;

Itami, 1980; Suykens, 1989; Jung, 2011; Altaf, 2018). So value-added is considered as a standard indicator to measure the impact of the port on the economy.

3.2.3. Employment Impact

Employment, value-added, return on investment(ROI) and tax are always mentioned as a set of indicators used to calculate the economic benefits of ports. These indicators are primordial for the decision to invest in port development and must take into consideration. The employment effect created by the port is evident. Among many transport structures such as road, railway, airway, the employment impact of the port is positive and usually highest. Many studies have proved the positive effect of the port to national employment. suggested three major factors that affect the port-city economy and one of them said that the income and employment of the port industry and many port-related industries are generated by the expansion of value-added logistics activities. An employment indicator also can be affected by cargo throughput via the port. Another study by revealed the positive relationship between port throughput and employment. More specifically, the result has shown that an increase of 1 million tons of port net throughput would lead to an immediate increase of about 400-600 jobs.
Depending on processing purpose, employment indicator has different methodologies to analyze. IO model emphasizes the agglomerating and pervasive effect of port activities whereas comparative analysis provides a reference observation to see the change in an economic benefit that has already taken place. In this study, the employment indicators are used to identify the level pervasive of employment effect to the entire economies. In line with this, the IO methodologies will be applied in this study.

3.3. Related Studies

A publication entitled "Economic impact of port sectors on South African economy: An input-output analysis" of (Chang, 2014) discussed in a great deal about the economic spillover impact of the port. In this regard, the authors used the Input-Output methodology to analyze the impacts of the port to other industries within South African via production effects, price change effects and employment effects. The result revealed that whenever the port sector losses one unit of production it will cause a decrease of 17% loss to the entire economy in 2002. Price effects are also one of the indicators mentioned in this research, in terms of increasing price effects, industries that are being affected mostly are the industries that have strongly related to the port sector such as transport and trading services, steel products, cement and so forth. Last but not least, in 2002, the seaport sector had contributed 14,209 and 36,418 jobs direct and indirect, respectively, account for a total of 50,627 people employed in the port sector.

Another research was conducted to compare the economic spillover between the smart port and port using Input-Output methodology in the case of Korea with three indicators such as value-added, production index and employment (Jun, 2018). This research has shown that the smart port industry has a positive effect on the national economy. More specifically, the employment inducement quite positive when 8.6595-11.5151 jobs were created when the output of the smart port industry increased to 1 billion KW. However, the value-added and production were somewhat lower than of the average among 31 industries listed in the research. Furthermore, this research has also shown clearly about the industries that influential the most to the smart port industries are ‘wholesale and retail services,’ ‘business support services,’ ‘electric and electronic devices,’ and ‘financial and insurance services.' These two studies provide policy-makers with significant information for evaluating port and smart port industries. Furthermore, these studies will motivate the future research with respect to the economics spillover impact of the port's sector.

Chapter 4. Research Methodology

4.1. Input-Output Methodology

In the world of economy, every industry is related to another from the standpoint of the input-output perspective. The IO methodology is created as a tool for industries' interrelated examination. First founded by W. Leontief (1905-1999), this research brought back to him Nobel Memorial Prize in Economic Sciences. IO analysis is a quantitative analysis method used in the economic sector to provide an observation of the interrelated among various actors. It appears in the sphere of macroeconomics while the unit analysis is a national economy used for studies the behavior of the aggregate economy. The IO methodology uses economic variables that are observable and measurable as its indicator to measure so it can be assumed as a branch of econometrics. According to Leontief, economic concepts only prove their value when they can observable and measurable. In the Input-Output Economics book of Leontief, he has emphasized that in economics today, theory and fact are two sides of a hand by which it means that theory and fact are not mutually associated.

The IO analysis of Leontief is a combination of theory and economic facts. Therefore, his analysis does not include the theory that is hard to prove in life. Leontief aims while he studies about Input-Output analysis is to provide a tool of economic analysis. However, there are still some problems with measurement error and data collection is supposed to be this method of weakness. The IO table nowadays was developed from Quesnay's tableau economique which represents the circulation of commodities in the economic system is considered as the first IO table. The Tableau was a diagram that representation of how to trace the expenditure through an economy in a systematic way. The Input-Output table nowadays describes the inter-relationship among industries in detail which will be described in the next section.

There are two types of IO applications, namely close model and open model. Open model study is about the question about how many is enough to satisfy the increasing demand. On the other hand, close model research is for the interrelation of industries. More specifically, the close model provides an observation about input-output while it considers the output is to supply the input and vice versa. The model gives us a powerful economic analysis. This research will implement the open model to analyze the spillover impact of port investment.

All of the input and output data appears in the IO table are the composed of data set of system national account (SNA) table, which is basically a square matrix where the number of rows and columns are equals, take receipt of the transaction is the use. SNA table represents the distribution of the various goods which come from different sources and shows the interrelationship among industries. A rule for SNA is each account that comprises a row and a column. In other words, SNA provides an overlooking of statistic information required to analyze the economic where Input-Output analysis is one of the tools that is mostly based on practical data from SNA. The power of input-output analysis is its capacity to analyze economies as they are given by a coherent set of data, namely the national accounts. (Tanaka, 2001)

4.1.1. Brief Description on Input-Output Analysis

IO analysis is a solution for inter-industry within an area of economics. By analyzing the data from the summary statistic of the economic activities, Input-Output analysis describes how industries allocation resources in a multi-sectoral economy. The term inter-industry examination is additionally utilized since the basic motivation behind the information yield structure is the breakdown of the inter-dependence of the industries in an economy. The input-output analysis was generated based on a really simple theory that all of the economic transactions include product or service sales within a period are presented in a square represent for the industries making and industries receiving. The idea of the table and the individual passages are dictated by the number and meaning of the divisions recognized. All the more explicitly, every line in the Input-Output table demonstrates the deals with the sales of an economic sector to all of another and every column deals with the purchase of each sector to another economic sector. For example, to produce one unit of food. The inputs requirement is intermediate food like pork, beef, water, gas, steel, and so forth. Input-Output analysis is a valuable tool for looking for changes in the structure of the economy after a period. It is often utilized as a guide in local or national financial arranging, since it is fit for uncovering the effects of choices or shocks in all sectors, completely representing related and adjusted nature.

4.1.2. Input-Output Tables

IO table is composed of intermediate inputs, primary inputs, and final demand. Intermediate inputs, the main structure of the Input-Output Table, express the sources and distributions of the various goods and services and show the interrelationships between industries concerning production technology in the economy. The input-output table combines production, income, and expenditure of GDP at the same table, allowing the analysis of each industry's production inputs and outputs distribution, providing the interrelationship between each account, and facilitating the improvement of the quality on national accounts statistics. IO tables portray the inter-sectoral flows under the form of tabular and record the purchases and sales across the sector over a period. The describes is built with the structure that every line describes for the way that the totals goods of a sector distributed to another to satisfy the inputs demand of other sectors. Every column represented the combination of productive resources in one industry. The output of each industry is used by two types of consumers. The first one is the intermediate demander who uses the output of production sectors even their output as their resources for production activities. Second is the final demander, usually is government, regions or nations and households. Figure 9 represents the basic IO table. In this table, X_i is the gross output of the i^{th} sector, X_{ij} represents the amount of the i^{th} sector's output used by the j^{th} sector to produce its output, and X_j is the final demands' use of the i^{th} sector's output. The rows of the table describe the deliveries of the total amount of a product or primary input to all users, both intermediate and final. For example, suppose sector 1 represents food products. Then the first row tells us that, out of a gross output of X_1 tons of food products, an amount X_1 is used in the production of food products themselves, an amount of X_{12} must be delivered to sector 2, X_{1i} tons are delivered to sector i, X_{1n} to sector n, and X_1 tons are consumed by final end-users of food products.

Industry	1	2	Final Demand	Total Output
1	X_{11}	X_{12}	Y_1	X_1
2	X_{21}	X_{22}	Y_2	X_2
Value-Added	V_1	V_2		
Total Input	X_1	X_2		

Figure 9. Input-Output Table Description

- Supply-demand balance equation

$$X_{11} + X_{12} + Y_1 = X_1 \quad (1)$$

$$X_{21} + X_{22} + Y_2 = X_2 \quad (2)$$

- Income-expense balance equation

$$X_{11} + X_{12} + V_1 = X_1 \quad (3)$$

$$X_{21} + X_{22} + V_2 = X_2 \quad (4)$$

The columns of the table describe the input requirements to produce the gross output totals. Thus, producing the X_1 tons of food products requires X_{11} tons of food products, along with X_{21} units of output from the sector 2.

4.1.3. Inverse Matrix Coefficient

The input coefficient represents the percent of the raw materials and resources used to generate one unit of production for each sector. They correspond to basic unit prices. It is calculated by using the input raw material to produce one unit of product divided to the total amount input. A list of input coefficients indicated for each industry is referred to as an input coefficient table.

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \quad (5)$$

Input coefficient matrix A is also known as the technical coefficient matrix. Let us say the demand in the industry 1 increased by one unit. To fulfill the increase of one unit of demand, industry 1 must generate the intermediate demands of a_{11} and a_{12} of a unit from the industry 2. Receiving the demands, industries 1 and 2 will further generate the secondary production repercussions, following the respective input coefficients to produce a_{11} and a_{12} units. This series of production repercussions continue infinitely until domestic production levels for the respective sectors can ultimately be calculated as the summation of all production repercussions.

$$a_{11} = \frac{x_{11}}{x_1} \tag{6}$$

Input coefficient matrix indicates the scale of raw materials required to generate one unit of production in each sector, and thus the input coefficient table can be referred to as the basic production unit table. The sum of input coefficients including the gross value-added portion in each sector is defined to be 1.0. Similarly, a_{21} denotes the amount of raw material of industry 1 input from industry 2 to produce one unit of industry 1 output at the percentage. Assume interest for industry 1 has expanded by one unit. Industry 1 will require raw materials, and so forth to create one unit of production. Therefore, industry 1 will create the middle of the road requests of a_{11} and a_{12} units of crude materials to industries 1 and 2, separately, as per the input coefficients. Accepting the requests, industries 1 and 2 will further create the auxiliary generation repercussions, as per the separate info coefficients to deliver a_{11} and a_{12} units. This process will continue until domestic production levels for the respective sectors can ultimately be calculated as the summation of all production repercussions. As such, input coefficients are vital to estimating how much production can be ultimately when the final demand increases one unit.

Direct and indirect effect analysis of certain final demands that appear in an industrial on other industrial sectors is one of the most important analyses in input-output analysis. As expressed previously, input coefficients in the separate mechanical division may assume critical jobs. At the point when the final demand is given, solving the following simultaneous equations will give the domestic production levels of each industrial sector.

$$\begin{matrix} a_{11}x_1 + a_{12}x_2 + y_1 = x_1 \\ a_{21}x_1 + a_{22}x_2 + y_2 = x_2 \end{matrix} \quad \Rightarrow \quad X - AX = Y \quad \Rightarrow \quad X = (I - A)^{-1}Y$$

where I is the identity matrix and

$$(I - A)^{-1} = \begin{bmatrix} 1 - a_{11} & -a_{21} \\ -a_{12} & 1 - a_{22} \end{bmatrix}^{-1}$$

The elements of this lattice are referred to as inverse matrix coefficients or may be called production inducement effects. This table indicates how much production will be ultimately induced in what industry by a demand increase of one unit in a certain industry. Base on this table, it is possible to calculate the production at each sector, corresponding with the final demands immediately at the point of final demand in a sector is given.

The mathematic of production inducement coefficient can be written as simultaneous equations below:

$$X = (I - A)^{-1}Y^d$$

Production inducement effect helps to evaluate the interrelationship among industrials. When the $N \times N$ identity matrix called the Leontief inverse matrix of which elements a_{ij} denotes for direct and indirect outputs in sector i per unit of final demand in sector j. This is the standard demand-driven model of IO analysis. However, this study just only focuses on the domestic production effect on the final demand and therefore the formulas will divide domestic and imports.

$$X = (I - A^d)^{-1}Y^d$$

Besides, value-added is generated through the production activities when the final demand such as consumption and investment take place. The value-added inducement effect refers to the economic effect of the value-added due to an increase in the final demand of the relevant industry sector. (Jun et al. 2018) The value-added inducement effect simultaneous equation will be expressed as follows:

$$V = A^v(I - A^d)^{-1}(Y^d - Z)$$

where A^v is the diagonal matrix for the value-added coefficient.
Simillary, employment inducement effect simultaneous equation may be expressed as follows:

$$L = A^l(I - A^d)^{-1}Y^d$$

where L denotes for employment inducement effect by multiplying the employment coefficient matrix to the inverse matrix coefficient. Whilst, A^l denotes the diagonal matrix of the employment coefficient. This calculation represents the inter-react between industries in the term of employment. Specifically, it answers the question about how many employments will be generated when the increasing of one unit of port construction is taken place.

4.2. Data Collection

In this study, there are 3 steps of data collection as follows:

1. Located indicators that are related to the research such as an IO table, employment data, and so forth.
2. Collecting data from reliable data sources such as GSO of Vietnam, Asian Development Bank (ADB) and the Maritime Administration.
3. Sectors re-classification among differences data set.

4.2.1. Data Collection Process

The Leontief's IO model is considered a greatly simplified theoretical economic model. It is considerably elaborated and refined purely statistical data, allowing theory and empirical implementation to meet (Minnitt 2000) IO analysis has been used widely to analyze the spillover impact among industries while the port is also one of its applications. It can evaluate the impact of the industry on others quite accurate by using the input-output table as its input to analyze the interdependence of industries in an area and a period. However, the required data of input-output methodology is complex. The input of the Leontief Model is the collection of huge data used to describe the economic system . One of the problems required to solve is the source of the IO table which refers to the core of the IO model. In 1986, Vietnam's economy shifted to market economic, and to appropriate with the change, the GSO of Vietnam decided to apply the United Nations' System of National Accounts (SNA) instead of Material Product System (MPS). The application of SNA has started since 1990 when GSO compiling the country's annual national accounts through its National Accounts Department (NAD). This initial activity was made conceivable with specialized and budgetary help given by the United Nations Development Program (UNDP). Later, long-term technical assistance granted to help to improve the compilation of the national accounts including the construction of IO tables is provided by ADB. This is also the basis for the first IO table constructed in Vietnam. In the early 1990s, the compilation of SNA-based national IO tables started with the help of the 1989-benchmark IO table (Ngoc et al., 2006).

Most of the variables that use to analyze in IO methodology are dependent upon the IO table. However, one of the difficulties in the input-output analysis is the data collection stage. The quality of the research that uses the input-output methodology depends on the level of detail and the quality of the data available on industries. A reliable source can reduce the possibility of an error during the calculation process. Therefore, solving the first problem for the IO table, in this research, the IO table is provided by ADB yearly since 2010, which is the bank that provided the long-term assistance grant to help improve the compilation of the national accounts including the construction of IO tables of Vietnam at the beginning stages. Besides the IO table, other indicators such as Vietnam employment and throughput in 2017 can be found on the web site of GSO of Vietnam for the employment indicator and Vietnam Maritime Administration for the throughput data in 2017. However, there is one problem from the port expenditure in 2017. The port expenditure will be the address as the final demand coefficient in the calculation process. Port expenditure is not currently available on GSO or Vietnam Maritime Administration. Therefore, the data collection stage for the port expenditure is more complex than others. Specifically, in this research, port expenditure is aggregated by 4 types of port activities such as port construction, maintenance, and operation. Table 2 describes the data for components that account for port spending in 2017.

Table 2. Port Construction Budget

Port Construction Plan				
Port Construction Project	Unit		million VND	
	Period	Total	State Budget	FDI
Hai Phong International Gateway Port	2013 ~ 2019	18,624,333	18,612,533	11,800
Yearly Avg.	2,660,619			

In the decision on approving the plan for maintenance of seaport infrastructure on December 30th, 2016, provided by Minister of Transportation Administration, it has specified the plan for maintenance of the port system. However, on June 14, 2017, the Transportation Administration updated the revision in the plan of seaport infrastructure maintenance. Specifically, there has been a change in the budget for the maintenance of the seaport system in the South making the total maintenance budget increase from 759,000 billion VND to 837,710 billion VND that was mostly related to the increase of Quan Chanh Bo channel. Table 3 shows the total seaport maintenance budget after the updated decision on June 14, 2017.

Table 3. Budgets for Seaport Maintenance in 2017 (Unit: million VND)

<table>
<tr><td colspan="2">Dredging and Maintaining Maritime Channels</td><td rowspan="12">Grand Total</td><td rowspan="12">926,277</td></tr>
<tr><td>North</td><td>271,962</td></tr>
<tr><td>South</td><td>565,748</td></tr>
<tr><td>Subtotal</td><td>837,710</td></tr>
<tr><td colspan="2">Reparing Work Properties to Ensure Safety</td></tr>
<tr><td>North</td><td>24,358</td></tr>
<tr><td>South</td><td>46,920</td></tr>
<tr><td>Subtotal</td><td>71,278</td></tr>
<tr><td colspan="2">Maintenance for Seaport Infrastructure</td></tr>
<tr><td>Cai Lan Port 5, 6, 7 Bridges</td><td>17,029</td></tr>
<tr><td>An Thoi Seaport</td><td>260</td></tr>
<tr><td>Subtotal</td><td>17,289</td></tr>
</table>

Port operating expenses are in the Estimated Decision of Government revenue and expenditure in 2017. Table 4 shows the spending of the Vietnamese Government for water transportation in 2017.

Table 4. Port Operation Expenses (Unit: Thousand VND)

	Regular Spendings	Irregular Spendings	Subtotal
Port Authority	4,488,872	-	4,488,872
Inland Waterway Administration	11,460,856	285,000	11,745,856
South Inland Waterway Departments	6,964,936	-	6,964,936
North Inland Waterway Departments	9,515,726	-	9,515,726
Inland Waterway	-	17,421,860	17,421,860
Grand Total	50,137,250		

The difference in the content between regular spendings and irregular spendings is specified in article 6, section 2 and section 3 Circular 145/2017/TT-BTC published on December 29, 2017. Specifically, regular spendings and irregular spendings will be expressed as in the below:

- Regular spendings: Salary payment, wage, wage allowances, contributions according to current regulations, spending on professional operations, public services, office supplies, information, communications and propaganda, depreciation of fixed assets, asset repair and maintenance, machinery and equipment, rent expenses, management expenses, other expenses (including expenditures on performance of obligations to the state budget as prescribed)

- Irregular expenditures of maritime port authorities: Maintenance, maintenance and repair of VTS systems and equipment serving the maritime safety and security of port authorities in the port area sea; expenses for hiring of offices, representatives of port authorities, canoes and official service wharves (if any); expenses for search and rescue of people, cargoes, means and ships in accidents; expenses for handling jobs related to preventing environmental pollution in seaport waters

4.2.2. Industry Re-Classification

The main problem needs to solve is the industry classification. In 2007, GSO of Vietnam decided to launch the Vietnam Standard Industrial Classification (VSIC) which was built based on the International Standard Industrial Classification of All Economic Activities (ISIC Rew.4) and the ASEAN Common Industrial Classification (ACIC). However, the IO table provided by ADB has a different sector classification. In detail, in the IO table, ADB has classified the economy into 35 sectors while GSO of Vietnam has 21 sectors. The imbalance between the industries classification among a set of database leads to the erroneous in the research if it is not addressed. The solution for re-classification for all of the sets of the database is made based on the Vietnam sector classification system, Decision No. 27/2018/QĐ-TTg. The content of Vietnam sector classification system clearly explains economics activities including factors classified into each division. This research will set the list of 16 industries to standardize of 2 types of industry classification.

The re-classification is made by VSIC observation and comparison of IO table and GSO data. The change after re-classification mostly concentrates on 4 categories such as sections number 3, 8, 13, and 16 especially note-worthiness in the classification. Manufacturing sectors in section 3 include other 14 industries in IO table such as food, beverages and tobacco, textiles and textile products, wood and products and footwear, and other heavy manufacturing industries such as coke, chemical, machinery, and so forth are also includes. Transportation and storage in section 8 include three types of transportation such as inland transport, air transport and water transport and other supporting and auxiliary transport activities; activities of travel agencies are also classified in this section. Public administration, defense, and compulsory social security in section 13 include administrative and support service activities and other activities of the Communist Party, sociopolitical organizations, public administration, defense, and compulsory security. Finally, section 16 includes arts, entertainment, and recreation, activities of extraterritorial organizations and bodies, activities of households as employers, and undifferentiated goods and services-producing activities of households for own use.

Table 5. Industry Classification

Number	Industry
1	Agriculture, forestry, and fishing
2	Mining and quarrying
3	Manufacturing
4	Electricity, gas, and water supply
5	Construction
6	Wholesale and retail trade; repair of motor vehicles
7	Hotels and restaurants
8	Transportation and storage
9	Information and communication
10	Financial, banking and insurance activities
11	Real estate activities
12	Professional, scientific and technical activities
13	Public administration and defense; compulsory social security
14	Education
15	Health and social work
16	Other service activities

Chapter 5. Results and Discussions

5.1. Findings

The IO analysis provides a tool to analyze the impact in port construction and port organization to 16 industries of Vietnam economics. Using the IO table provided by ADB, the impact of port construction has been examined of $1 million investment. The economic impact was measured in relation with three different linkages: 1) Production multiplier describes the transaction activities within the industry (direct impact) and other industries (indirect impact); 2) Value-added multiplier describes the number of value-added that is generated in the port construction activities within the industry (direct impact) and other industries (indirect impact); 3) Employment multiplier describes the number of employments that are generated in the change of $1 million in port construction within the industry (direct impact) and to other industries (indirect impact).

The result of IO analysis demonstrates the contribution's coefficients of the construction sector on all of 16 sectors within the Vietnam economic industry, the production inducement coefficients is 1.85228, the value-added inducement coefficients are 0.54782 and the employment inducement coefficients are 0.15551, as shown in Table 6. With the coefficient effect of 1.85228, the production inducement coefficients revealed that with the increase of 1 USD investment in the final demand of construction, it will generate 1.85228 USD in all of the 16 industries in both direct effects and indirect effects. Specifically, the increasing of 1 unit in the final demand of the construction sector will contribute 1.08077 USD to itself (direct effect) and 0.77151 USD to other (indirect effect) 15 sectors regarding production inducement effect. Among 16 industries that are affected by the investment of 1 unit in seaport construction, manufacturing; agriculture, forestry, and fishing; transportation and storage; mining and quarrying are industries that have the highest inducement coefficient, respectively. It represents that when the construction sector increases 1 unit of final demand, these industries will benefit the most.

The value-added inducement coefficient showed the results of 1 unit of investment in the construction sector will contribute to allover 16 industries 0.54782 USD of value-added. In which, 0.31859 USD will directly contribute to the construction itself, and the other 0.22923 USD will indirectly separate from the other 15 industries. The port construction effect respect to the value-added contribution those industries such as Manufacturing; Wholesale and retail trade, repair of motor vehicles and motorcycles; Agriculture, forestry, and fishing; are the industries that were affected the most when the increasing of 1 unit in final demand of construction taken place, respectively.

In term of labor inducement coefficient, in allover, the economy of 16 industries will generate 0.15551 employment when the construction sector increase 1 USD investment in final demand. The direct effect is 0.10203 and others 0.05348 value of indirectly generated in the rest of 15 industries exclude the construction sector. Within 16 industries, Agriculture, forestry, and fishing; Manufacturing; and Wholesale and retail trade, repair of motor vehicles and motorcycles are the industries that have the highest labor inducement coefficient.

Each choice will lead to different benefits so the government should consider the benefit before making decisions. These two tables will provide clear information about the benefits for the investment decision by comparing the spillover effect of the investment in two differences industries. For example, compared to the manufacturing sector, the contribution of the construction sector somewhat smaller as shown in

Table 7. Specifically, in terms of production, the investment of 1 USD in the manufacturing sector will generate 1.99982 USD compared to 1.85228 USD that is generated by the invest of 1 USD in the construction sector. However, the benefits of the investment of 1 USD in the construction sector seemly higher than the manufacturing sector in term of the value-added contribution while the calculation shows the value-added inducement coefficient of construction is 0.54782 while manufacturing is 0.51103, and the employment inducement coefficient of construction is 0.15551 compare to 0.13075 of the manufacturing sector. Unlike the construction sector, the manufacturing sector has a lower impact on other industries. Specifically, the indirect inducement effect of the construction sector is 0.77151 while the manufacturing sector is just only 0.41681 in terms of production that is 29.84% lower. The indirect employment inducement effect of the construction's sector is 0.08474 and the manufacturing sector is 0.05348, which is 22.61% lower. However, in terms of the value-added contribution, the manufacturing sector has a better contribution to other industries than the construction sector while the indirect effect contribution of the manufacturing sector is 6.87% higher than the construction sector.
While Table 6 provides the inducement coefficient in all of the 16 industries, Table 8 goes further in the specific case in the port investment of Vietnam in 2017 to see its impact on the economy in summary.

In 2017, the Vietnam Government spent 159.83 million USD for the port construction and development. Table 8 will summary the effect of the investment in port construction and development on the economic perspective in 2017. In summary, the increase in investment 159.83 million USD was taken place of the port construction sector, all the 16 industries would gain the benefit of 383.62 million USD and 24.9 thousand employments in general. Of note here is that 223.67 million USD was generated within the port's construction sector and 159.95

million USD, 16.3 thousand of employments were directly created in the port construction sector and other 8.5 thousand of employments distributed to the other 15 industries.

Table 6. Estimation of Production, Value-Added, and Employment Inducement Effect for Each Industry of Construction Sector

Sector	Production Inducement	Value-Added Inducement	Labor Inducement
Agriculture, forestry, and fishing	0.06461	0.02465	0.02187
Mining and quarrying	0.02083	0.00932	0.00021
Manufacturing	0.52626	0.10349	0.01530
Electricity, gas and water supply	0.01471	0.01077	0.00038
Construction	1.08077	0.31859	0.10203
Wholesale and retail trade; repair of motor vehicles	0.05952	0.03786	0.01091
Hotels and restaurants	0.00558	0.00212	0.00087
Transportation and storage	0.02190	0.00782	0.00196
Information and communication	0.00379	0.00119	0.00019
Financial, banking and insurance activities	0.02627	0.01536	0.00068
Real estate activities	0.00568	0.00410	0.00016
Professional, scientific and technical activities	0.01952	0.01082	0.00046
Public administration, defense; compulsory social security	0.00010	0.00008	0.00003
Education	0.00060	0.00049	0.00010
Health and social work	0.00027	0.00012	0.00001
Other service activities	0.00186	0.00104	0.00037
Totals	1.85228	0.54782	0.15551

Table 7. Estimation of Production, Value-Added, and Employment Inducement Effect for Each Industry of Manufacturing Sector

Sector	Production Inducement	Value-Added Inducement	Labor Inducement
Agriculture, forestry, and fishing	0.18873	0.07201	0.06387
Mining and quarrying	0.03599	0.01610	0.00037
Manufacturing	1.58301	0.31130	0.04601
Electricity, gas and water supply	0.02916	0.02136	0.00075
Construction	0.00449	0.00132	0.00042
Wholesale and retail trade; repair of motor vehicles	0.07891	0.05019	0.01446
Hotels and restaurants	0.00392	0.00149	0.00061
Transportation and storage	0.02859	0.01020	0.00256
Information and communication	0.00335	0.00105	0.00017
Financial, banking and insurance activities	0.02207	0.01291	0.00057
Real estate activities	0.00565	0.00408	0.00016
Professional, scientific and technical activities	0.01328	0.00736	0.00031
Public administration, defense; compulsory social security	0.00013	0.00010	0.00003
Education	0.00062	0.00051	0.00010
Health and social work	0.00020	0.00009	0.00001
Other service activities	0.00172	0.00096	0.00034
Totals	1.99982	0.51103	0.13075

The analysis result reveals that the values of production and value-added inducement are 296.05896 and 87.56095, respectively, and the employment inducement effects is 24.85604 (Table 8). The analysis has been conducted with the value of the government invest in port construction in 2017, representing the change of output in 16 industries that are taken place when the final demand for 159.83 million USD of port construction increases. Specifically, the production inducement coefficient is 296.05896 generated a production inducement effects of 296.05896 million USD; the value-added inducement coefficient is 87.56095 generated value-added inducement effects of 87.56095 million USD, and employment inducement coefficient is 24.85604 generate an employment inducement effects of 24.85604 thousand employments for both direct and indirect effects. Next, when the output of the port construction industry increases by 159.83 million USD, the value-added of 50.92189 is induced in the port construction industry itself, and the range of value-added inducement effect by other industries is 0.01209-16.54103. 'Manufacturing', 'Wholesale and retail trade; repair of motor vehicles and motorcycles', and 'Agriculture, forestry, and fishing' are the industries that have the highest value-added inducement effect respectively. Last but not least, the changing employment inducing effect by the investment of 159.83 million USD will generate 24.85604 thousand jobs. In which, contribute 16.30743 thousand jobs directly to the port construction industry itself and indirectly contribute 8.54860 thousand jobs to the other 15 industries.

Overall, the three industries that are affected the most by the change of the final demand in the port construction industry are as other: 'manufacturing'; 'agriculture, forestry, and fishing'; 'whole and retail trade; repair of motor vehicles and motorcycles'. These industries' characteristic is closely related to the transportation activities so the investment of port construction can be assumed as its driving force for growth. The port industry mostly related to the transportation industry so the industries that are related to transportation such as 'whole and retail trade; repair of motor vehicles and motorcycles' are greatly affected.

Table 8. Summary of Port Construction Effects

	Direct effects	Indirect effects	Total
Profit	223.66627	159.95365	383.61991
Employment	16.30743	8.54860	24.85604

Table 9. Estimation of Production, Value-Added, and Employment Inducement Effect for Each Industry

Sector	Production Inducement	Value-Added Inducement	Labor Inducement
Agriculture, forestry, and fishing	10.32765	3.94046	3.49515
Mining and quarrying	3.32945	1.48985	0.03427
Manufacturing	84.1138	16.54103	2.44486
Electricity, gas and water supply	2.35149	1.72209	0.06023
Construction	172.74438	50.92189	16.30743
Wholesale and retail trade; repair of motor vehicles	9.51397	6.05141	1.74301
Hotels and restaurants	0.8916	0.33958	0.13867
Transportation and storage	3.50093	1.24945	0.3139
Information and communication	0.60588	0.18961	0.02999
Financial, banking and insurance activities	4.19918	2.45514	0.10927
Real estate activities	0.90763	0.65545	0.02588
Professional, scientific and technical activities	3.12056	1.72926	0.07313
Public administration, defense; compulsory social security	0.01582	0.01209	0.00412
Education	0.09559	0.07852	0.0155
Health and social work	0.04331	0.01886	0.00165
Other service activities	0.29771	0.16625	0.05898
Totals	296.05896	87.56095	24.85604

5.2. Discussion and Concluding Remarks

To satisfy the rapid increase in the demand for cargo trading after Vietnam joined the WTO. Vietnam government has approved a variety of port construction projects and along with that is the enormous amount of investments for port construction and development. However, many studies have shown that the port construction race in Vietnam is one of the reasons that lead to counterproductive when the imbalance in the number of goods received between regions. This study is aimed at analyzing the economic impacts (that is, spillover effects) of investments in port construction on other industries in the region based on the input-output analysis. The research's result will provide an overlook of how to port construction impacts to the economy at the national level so that the government's future decisions and future research in port construction will be more efficient.

The result has shown that with every 1 million USD increasing in the final demand of port construction will generate 1.85228 million USD of production, 0.54782 million USD of value-added, and 0.15551 thousand of employments in entire 16 industries on the national level. In general, these effects of port construction on the economy are positive. Mostly, the change when the final demand in port construction increase taken place focus on industries that are strongly related to the transportation and depend on the import-export activities such as 'manufacturing'; 'agriculture, forestry, and fishing'; 'whole and retail trade; repair of motor vehicles and motorcycles'. Within the year 2017, the Vietnam government has spent 159.83 million USD to maintain and develop the port system. All of the 16 industries within Vietnam's economic gain the benefit of 296.05896 USD of production, 87.56095 of value-added, and created 24.85604 thousand of employments. Through the result, it can be concluded that the port construction has a positive effect on Vietnam's economy on the national level. However, mostly the impact focuses on the sectors related to 'the manufacturing', 'agriculture, forestry, and fishing'. Based on this research, we may forward some interesting suggestions. First, the government should consider the balance of the port's investment capital. The port construction is significant to catch-up with the increase of cargo, however, improved port efficiency is equally important. It should be done by the creation of specializing in the clusters of port-related economic activity. Second, the port construction seems more efficient in the manufacturing and agriculture sectors. The linkages between the port and these industries area are necessary to increase the efficiency of the port construction. Many studies have shown the linkage between port construction and regional economic. Specifically, volumes and types of cargo have a relationship with the local economic structures. For example, the agricultural and industrial regions are more specialized in bulk traffic . The government should integrate the local characteristics and economic structure in the port construction plan to reduce transportation cost and transportation time so that it improves the spillover impact of the port construction within the local economic development.

The research has shown an interesting positive aspect of the port construction stands on the economic spillover impact. However, there are some limited that need to be solved. Firstly, this research approaches the port construction effect on the national level. We used various relatively broad indicators to measure the economic spillover impact, which represents the entire port construction sectors. In future research, the spillover impact should be done on a smaller scale such as the regional level. This study will be a tool for data comparison. Secondly, due to data limitations, this research has not approached the port construction spillover to stand on the port operation perspective. In future research, the research of port operation spillover should be explored in greater detail in terms of port operation.

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베트남 항만건설로 인한 파급효과의 경제분석

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요 약 문

베트남은 2008년 세계무역기구(WTO)에 가입한 이후 급속한 경제성과 더불어 외국인 직접 투자의 증가 등으로 화물 물동량이 크게 증가하였다. 2012~2018년에 걸친 수입 및 수출액은 700억 달러에서 2,030억 달러로 거의 세 배 가까이 증가하였다. 베트남 항만 협회에서 발간한 통계자료에 의하면 베트남 전체 물동량 중 해상 운송으로 화물의 90%가 이송되고 내륙 화물의 100%가 베트남 선박에 의해 이송되고 있다. 이와 같이 항만은 베트남의 국가경제 성장을 촉진하는데 큰 역할을 한다. 베트남 정부는 증가하는 화물 운송 수요를 충족하기 위해 2009년에 일련의 항만 건설 및 개발을 마련하였다. 이와 같이 국가경제에 대한 항만의 중요성을 감안할 때 항만건설 수요의 급속한 증가와 더불어 항만의 경제적 파급효과에 관한 연구는 그 어느 때보다 더 중요해지고 있다. 이 연구에서는 투입산출분석법을 이용하여 베트남의 항만건설에 따른 여타산업으로의 파급효과를 생산액, 부가가치액 및 고용창출의 측면에서 분석하였다. 분석결과를 살펴보면 항만건설에 대한 투자는 여타산업의 생산액 및 부가가치 창출액 증대에 기여할 뿐만 아니라 상당한 고용창출효과를 가져다준다는 것을 알 수 있다. 본 연구의 결과는 베트남의 항만건설 정책을 수립하는데 유용하게 활용될 수 있을 것으로 기대된다.