

DEVELOPING INLAND WATERWAYS TRANSPORT

Focusing scope on Saigon-Dongnai River System

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Abstract <p>Vietnam has many favorable geographical conditions which can be utilized to further boost the country's economic performance, such as many long rivers that have potential for developing waterways transport. Moreover, there are concerns that the inland waterways transport in the South is underperforming even though there are many rivers in this country's region. In this context, this study focused on the Saigon-DongNai River System with its minor routes that contribute significantly to the economic development in the South of Vietnam.</p> <p>This study was conducted with the objective of developing inland waterways transport in the Saigon-DongNai River System. In order to reach this research objective, the qualitative research approach was applied, and the primary data was collected from in-depth interviews with five experts.</p> <p>According to the results, the current performance of inland waterways transport in the Saigon-DongNai River System was not very high. The main strengths of the Saigon-DongNai River System were the economic benefits compared to road transportation and the focus of the government to develop inland waterways transportation evidenced by the plan to move the Saigon River Ports to other locations. However, there were certain weaknesses that limited the development, including complex and unfavorable geographical conditions in some locations, the poor connection with road transportation and industrial parks. Moreover, low managerial capabilities of the local governments and the transportation companies as well as even the local people in sustaining the natural conditions of the surrounding inland waterways could be identified. The weaknesses also included less efficiency in the national strategic development of inland waterways and the small business scale as well as lack of professional services among the players of inland waterways.</p> <p>Based on that, several solutions were proposed, including intermodal transport, multi-modal transport, financial and funding resources, human resource development as well as facilities and infrastructure development.</p>		
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1 INTRODUCTION

1.1 Background of the study

Vietnam is one of emerging economies in the globe with an annual GDP growth rate of more than 7% in 2018 (Asian Development Bank 2019). The country has many favorable geographic conditions which can be utilized to further boost the economic performance. It is said that Vietnam has more than 2,600 rivers with the length of more than 42,000 kilometers that are considered as potential for developing waterway transport (VietnamNet, 2018). The development of inland waterway transport becomes important to the economic development of the country since it is determined as a key connector between the other modes of transportations, including railways, aviation, road, and maritime transportation (Ministry of Transport, 2017). Currently, the inland waterway transport in the North of Vietnam is divided into three main corridors, including QuangNinh – VietTri via the Duong River, QuangNinh – NinhBinh via the Luoc River, and LachGiang – Hanoi. In the South of Vietnam, there are five minor routes, two vertical routes, and five horizontal routes. In addition, the country's inland waterway transport is being managed by the Vietnam Inland Waterways Administration (VIWA) which is an agency of The Ministry of Transport. However, the main issue is that only 20% of the total inland waterway routes' length is being exploited and managed by VIWA (Ministry of Transport, 2017).

Moreover, there is a concern according to which the inland waterways transport in the South is underperforming even though there are more rivers in this region of the country. In this context, this study paid attention to the Saigon-DongNai River System consisting of minor routes which contribute significantly to the economic development in the South of Vietnam. It has also been identified that there is no evidence from previous research for inland waterways in the country. Most of the research papers were published by the government agencies or international organizations. In addition, there is no official evaluation to this type of transport in the South in general and in the Saigon-DongNai River System specifically.

1.2 Research objectives and research questions

This study was conducted with the objective of developing inland waterways transport in the Saigon-DongNai River System. This research objective was attempted to be reached by focusing on the following research questions:

- ❖ What is the current performance of inland waterways transport in the Saigon-DongNai River System?
- ❖ What are the strengths and the weaknesses of inland waterways transport in the Saigon-DongNai River System?
- ❖ What are the business and operation plans to further improve the performance of inland waterways transport in the Saigon-DongNai River System?

1.3 Aim of the thesis

By answering the research questions, it was believed that this study would enrich the literature about inland waterways transport in Vietnam, given the fact that, there is no evidence about the performance, the strengths, and the weaknesses of inland waterways transport in Vietnam. It was hoped that the present study would help future researchers who want to conduct studies in this area to validate their findings. It was also hoped the managers of the Saigon-DongNai River System could enhance their understanding of the inland waterways transport so that they could develop proper business and operation plans to further improve the performance of this transport system.

1.4 The thesis outline

There are five chapters of the thesis.

Chapter 1: Introduction

This chapter provides the readers with some basic information related to the inland waterways transport in Vietnam. The research objectives are proposed after the prob-

lem statements are highlighted. When the research objectives are proposed, the research questions are delivered, and the answers of these research questions help to achieve research objectives. Significance of the study and the scope of work are presented.

Chapter 2: Literature Review

This chapter explores the concept of inland waterways transport. Some business examples of how-to setup and to maintain inland waterways transport are examined. It will help to identify the key success factors to the proper performance of the inland waterways transport system.

Chapter 3: Research Methodology

This chapter discusses about the research process and how the data was collected. The data collection instrument is presented and the key characteristics of the participation. Moreover, this chapter discusses the way of analyzing the data.

Chapter 4: Data Analysis and Finding

This chapter presents the results of analyzing the data which was collected from relevant persons who had good knowledge related to inland waterways transport in Vietnam. The findings are presented in order to gain an adequate understanding of the current strengths and weaknesses of this transport system.

Chapter 5: Conclusion and Recommendation

This chapter gives a summary of the key findings in the previous chapters. It provides the answer for each research question. Recommendations are delivered to further improve the performance of inland waterways transport in Vietnam.

Chapter 6: Reflections and future suggestions

This chapter reflects the author's acknowledgement and shows what advantages and limitations the author was facing when writing the thesis. Furthermore, some future suggestions for deeper research on this matter are mentioned.

2 LITERATURE REVIEW

2.1 Inland waterway transport

In this section, the concept of inland waterways transport is discussed. Some concepts of this key term are explored from the perspective of other researchers. One of the concepts of inland waterways transport was provided by Putz (2016) who defined it as an alternative transportation mode to both railways and road transportations. Moreover, Putz states that the use of inland waterways transport imposes several benefits related to environmental friendliness, such as lower energy consumption and less noise generation. In fact, inland waterways transport is categorized under the water traffic mode, along with deep sea shipping and short sea shipping (Gronalt, M., Hauslmayer, H., Posset, M., and Rojas-Navas 2010) (See Figure 1). In fact, inland waterways transportation is perceived as the most effective transportation method in terms of energy consumption. Moreover, the travel distance is more than three times higher than with road transportation for one ton of cargo. (Viadonau 2012.)

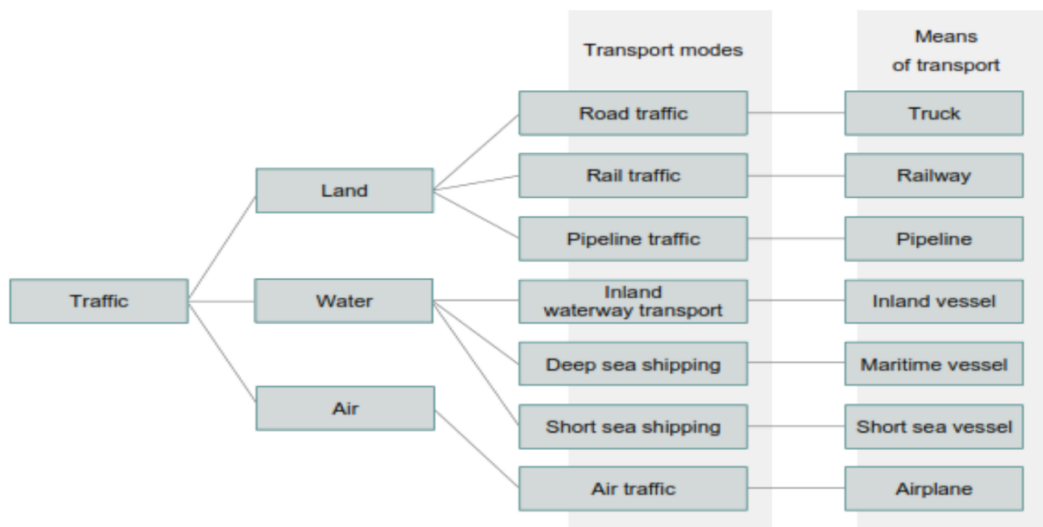


Figure 1: Modes of transportations

Source: Gronalt et al. (2010)

According to the Organization for Economic Cooperation and Development – OECD (2019), inland waterways transport is described through the vessel types used in this transportation mode, and it refers to floating crafts which are designed and used to

deliver goods or used as public transportation method of passengers throughout navigable inland waterways. Furthermore, navigable inland waterways are perceived as a stretch of water in which crafts with loading volume higher than 50 tons can be navigated (Ministry of Statistics and Programme Implementation of India, 2019).

Inland water transport has an important role in enhancing economy development of a country. The inland waterways transport depends heavily on these following factors: geographical conditions of the area, social-economic situation of the region, level of the surrounding road and land transport development, etc. (Waterwiki, 2006). Hence, when implementing a specific development plan for inland waterway transport requires significant planning phase with significant researching from nature and social perspective and budgeting considerably.

Particularly, Golebiowski (2016) explored inland water transport in Poland, and this researcher highlighted some of the benefits of developing and using this transportation mode. It is argued that inland waterways transport is suitable for bulk goods or large sized cargos and containers. Moreover, Golebiowski (2016) addresses the economic benefits of inland waterways transportation since it has lower energy consumption than cars or road transportation, which means that it creates less air pollution. The key benefits of using inland waterways transportation in comparison with road and rail transportation are stated below:

Table 1. Comparison between inland waterways transport and other modes

Economic Benefits	Number of kilometer for 5 liter of fuel and 1 ton of cargo, kilometer	Amount of cargo transport per 1 kilometer and 1 liter of fuel, tonnes
Inland waterways transport	500	127
Rail transport	333	97
Road transport	100	50
Environmental Benefits	Noise cost	Carbon footprint level per ton-kilometer

Inland waterways transport	Base line	33.4
Rail transport	70 times higher	48.1
Road transport	87 times higher	164

Source: Golebiowski (2016)

The table above clearly shows that inland waterways transport has a higher number of kilometers of transport with the same fuel consumption and same cargo amount. In more detail, logistics service providers can transport one ton of cargo with five liters of fuel in 500 kilometers, while the lengths of transport in rail and road are 333 and 100 kilometers respectively. On the other hand, logistics service providers are able to transport 127 tons per one kilometer with one liter of fuel, while rail transport and road transport can only handle 97 tons and 50 tons respectively. Moreover, using inland waterways transport also helps to reduce the negative impact of the operations on the external environment. The table above indicates that the noise level of inland waterways transport is much lower than that of rail and road transport in which rails can generate a noise level 70 times higher than the noise level generated by inland waterways transport. In addition, the carbon footprint of inland waterways transport is only 33.4 grams of CO₂ per ton-kilometer, while rail and road generate 48.1 gram and 164 grams respectively. In addition, inland waterways transport also has a lower accident rate compared to rail and road transport. If the baseline for inland waterways transport is set at one, the rail transport has an accident rate seven times higher, while road transport has an accident rate 178 times higher.

2.2 Inland waterways classification – an European example ECMT/UNECE classifications

According to UNECLAC (2016), the Inland waterways transport (IWT) classification can be determined by many different categories according to the main objectives of the classification. For instance, when determining the capability of the waterways or ports to accommodate a certain amount of cargo ship traffic, the classification goes through AGN Agreement. Another classification of IWT is about safety navigation of waterborne traffic. The waterways are divided into four zones based on the size of

the waves. Nevertheless, the most common classification used and applied throughout EU territory is the ECMT/UNECE classifications- based on the economical capacity. This classification is explained into details in the following section.

The ECMT/UNECE classification was first introduced in 1954, established by the efforts of several organizations in Europe, including European Conference of Ministers of Transport (ECMT), the World Association for Waterborne Transport Infrastructure (PIANC) and the United Nations Economic Commission for Europe (UNECE). Later it was revised and fully updated in 1992.

The classification sorts inland waterways into ten main classes, mainly based on the capacity to accommodate vessels of certain sizes. The first criteria are horizontal dimensions of vessels such as maximum length, draught, tonnage and the secondary criteria are the vertical dimensions such as draft and maximum height under bridges. Additionally, the another parameter was based upon technical criteria for navigable inland waterways and it was divided into ten different classes dependent on the regional level, national level, and local level.

The figures below summarizes the ECMT/UNCE inland waterways classification

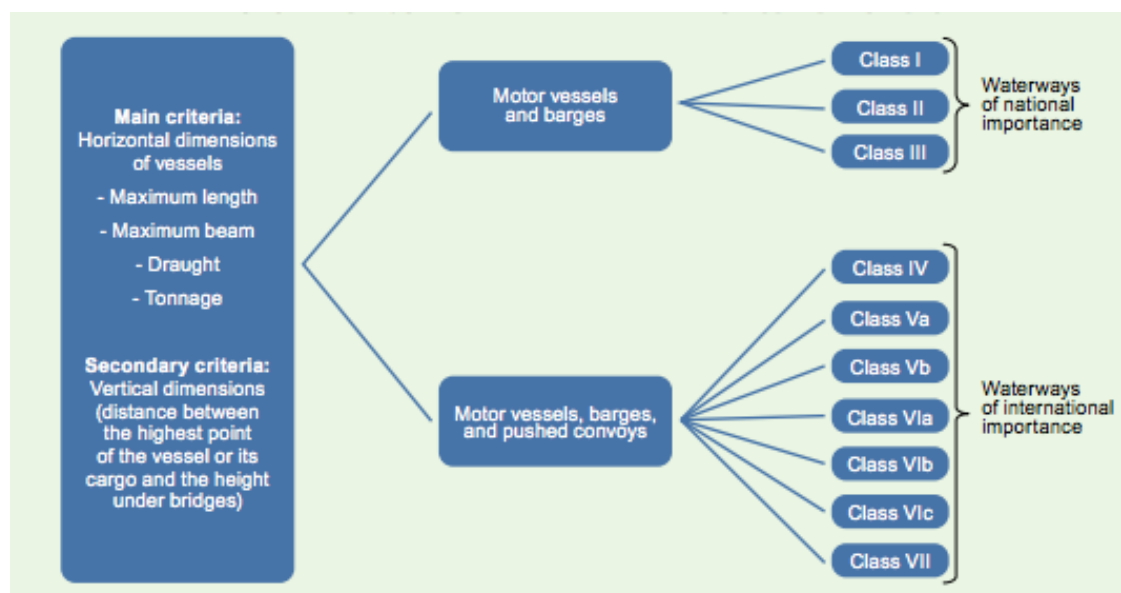


Figure 2. ECMT/UNCE classification system

(Souce: ECLAC Infrastructure Services Unit, 2016)

Operational criteria were developed for these three levels. In which, it strongly recommended or required inland waterways vessels must ensure their navigability functions during the navigation period, there were not breaks during lower water period, the navigation must be workable 24 hours per day and even during public holidays, the development of the maps for navigation and they will be integrated into information system.

2.3 Factors affecting the development of inland waterways transport

According to Royal HaskoningDHV (2019), key factors affecting the development of inland waterways transportation are the balance between the transportation means and natural physical conditions, and how the vessels' navigability can be improved. Moreover, Royal HaskoningDHV (2019) suggests that inland waterways transport projects should be developed to further improve the performance of this transportation system by conducting surveys and measurements, designing master development plans, measuring of economic values, estimating cargo volumes, assessing social and environmental impacts as well as by developing infrastructure and aids to navigation. On the other hand, Royal HaskoningDHV (2019) emphasizes the importance of the natural physical conditions and the vessels' navigability as the two most important factors affecting the development of inland waterways transport.

Other researchers have also provided different points of view about the factors affecting the development of inland waterways transport. Praveen and Jegan (2015) explored the key issues and challenges for inland waterways transport in India. They grouped the different challenges and issues into seven categories, namely technical, financial, regulatory, geography, and project management approaches. The technical challenges include inadequate water depth, inadequate air draft, shortage of inland waterways transport vessels, lack of terminals, lack of navigation infrastructures, shortage of facilities used for maintenance, repair and overhauls as well as lack of integration with other transportation modes. The financial challenges refer to the lack of investment from the government as well as the private sector. The regulatory chal-

lenges are related to the policy parity and other issues related to legal and administrative perspectives (i.e. long days required for fulfilling administrative requirements and operational delays). The geographical challenges are related to inefficient connectivity between rivers due to geographical distances and characteristics. Finally, the project management approach is considered a challenge due to the shortage of long-term cargo commitments and the lack of proactiveness in developing modal shift incentives.

Emmanuel and colleagues (2018) developed a research paper about the opportunities and challenges of inland waterways transport in the Southwest Coastal Belt of Nigeria. They used a quantitative analysis method with Explanatory Factor Analysis (EFA) to explore the main components of the challenges in inland waterways transport in the selected region. The primary data was collected from a questionnaire sent to 415 respondents in eight government agencies and 570 respondents as residents. There were seven components to be extracted from the EFA process, including under-utilization of inland waterways, the monthly income of the residents, the educational level of the residents, the occupations of the residents, insufficiency of terminal facilities, and terminal infrastructures. Moreover, these researchers also pointed out some opportunities for the further development of inland waterways transport, namely political support and functional facilities of the port.

A report which was developed by INeS Danube (2019) paid attention to economic geography and how it influenced on the infrastructure of inland waterways. INeS Danube (2019) examined different inland waterways navigation in the E.U., China, and Brazil and identified some factors influencing the competitiveness of inland waterways navigation. These factors consisted of fairway depth, bridges, maintenance, ports, information services, and weather conditions. The fairway depth was selected because of the level of fairway depth determined the tons of goods transported by inland cargo vessels. The bridges referred to the clearance level of the bridges, which was measured by the gap from the bridges to the water surface. Maintenance was considered a cycle with the involvement of monitoring, planning, information collection, and execution of activities to ensure the proper operations of the inland waterways navigation. The ports covered the water-side area, port area and hinterland. Moreover, the

competitiveness of inland waterways would be enhanced through the fact that ports were designed to connect with different transportation modes, such as rail and road as well as to contain value-added services, such as packaging, sanitation and quality checks. The information services were found very important to inland waterways transport, and they should be designed to have three basic functions, including river information services to assist the vessels, notices to shippers to ensure the safety of inland waterways transport, and electronic reporting of goods. Finally, the weather conditions must be measured in terms of water depth and the speed of the vessels. Otherwise, measurements of other weather conditions, such as ice on water, windy weather and reduction in visibility must be developed to reduce the transportation accidents.

Janjevic and Ndiaye (2014) provided a research paper about inland waterways transport for city logistics with high attention towards the role of local public authorities. They drew great attention the significant role of inland waterways transport in delivering containerized goods and palletized goods to different buyers in the E.U. However, such transportation mode is suitable when the cities have a high density of waterways networks. In addition, Janjevic and Ndiaye (2014) claim that inland waterways transport development is further improved when local public authorities play the role of enablers towards incentive schemes. Moreover, local public authorities should take into account the development of environmental and social benefits from using inland waterways transport by implementing supportive policies towards the ports under their authorities and long-term commitment to the use of inland waterways transport for distributing goods to different urban areas. This research paper also highlights the importance of the cooperation between the private and public sector in the development of the inland waterways transport system and facilities. On the other hand, the public-private partnership must be established as a crucial success factor for developing inland waterways transport. (see Table 2)

Table 2. Key success factors

Author	Key success factors
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Janjevic and Ndiaye (2014)	<ul style="list-style-type: none"> ▪ Local public authorities
Praveen and Jegan (2015)	<ul style="list-style-type: none"> ▪ Technical challenges ▪ Financial challenges, ▪ Regulatory challenges ▪ Geography challenges ▪ Project management approach challenges
Emmanuel, O. A., Ifabiyi, P. I., and Chijioke, A. U. (2018)	<ul style="list-style-type: none"> ▪ Under-utilization of inland waterways ▪ Monthly income of residents ▪ Education level of residents ▪ Occupation of residents ▪ Insufficiency of terminal facilities ▪ Terminal infrastructures
Royal Haskoning-DHV (2019)	<ul style="list-style-type: none"> ▪ Natural physical condition ▪ Vessels' navigability
INeS Danube (2019)	<ul style="list-style-type: none"> ▪ Fairway depth ▪ Bridges ▪ Maintenance ▪ Ports ▪ Information services ▪ Weather conditions

2.4 Business example of inland waterways transport management

In the global context, there are some business examples of how to develop and to sustain inland waterways transport. In this section, the researcher collected some evidence related to inland waterways transport management in other countries in order to understand how this transportation could be developed and sustained. By doing that, the author collected sufficient information about the management of inland waterways transport and how apply the know-how to the Vietnamese context.

The World Bank (2009) published a research paper on the sustainable development of inland waterways transport in China. This paper was developed in cooperation with

The Ministry of Transport of China. The report states that China is a country with a highly navigable waterways system with a total length of 61,000 kilometers, which is much higher than in the U.S. (40,000 kilometers) and E.U. (35,000 kilometers). The government of China has developed a national standard for inland waterways transport based on the weight of the vessel and the water depth. According to the standard, there are seven channels to be developed with the weight of the vessel to range from 50 tons to 3,000 tons, while the water depth is from 0.7 meters to 4.0 meters. The greater the water depth, the more weight of the vessel to be navigated in the inland waterways system of China. The research report also states that inland waterways transport had significantly lower costs compared to road and rail transport. On the other hand, road transport stands for the highest costs per 20-foot containers, followed by rail transport and inland waterways transport. In contrast, road transport has the lowest time consumption, while inland waterways transport are in the second place, and rail transport has the highest time consumption in some of the examined transportation routes. The research report states that the overall responsibility for policy and administration of inland waterways transport in China is under the Ministry of Transportation and it strongly recommends cooperation with the Ministry of Water Resources in order to create a proper master plan for the future development of inland waterways transport. The research report also denotes that the Government of China recognizes the importance of developing the inland waterways transport system by reflecting that the total investment in 2016 was more than two times greater compared to 2000. The Government of China has also developed a national plan with a vision of 2020 in order to deliver a stable long-term financing model, to find financial resources, to enhance the cooperation between different units for better ports planning, to propose the national standards of a vessel fleet, to improve the technologies applied in inland waterways transport, and to protect the environment from inland waterways transport activities. A lesson learnt from China was that the financial resources invested in inland waterways transport came from domestic loans, provincial budgets and inland waterways funded by the Ministry of Transportation.

Li and Notteboom (2012) developed a research study about the development of inland waterways transport system in Belgium. They identified that Belgium consumed high

share in E.U. barge freight transport due to the length of waterways. In Belgium, inland waterways transport was managed by 3 layers of administrators, including European level, regional level, and waterways level. The relationship between departments and agencies was discussed in this research paper and throughout the planning, the approval, and the implementation process. Key findings adhered that the master plan of inland waterways transport development was prepared by waterway managers and the plan must be subjected to E.U.'s regulation and Belgium's policies. Then, the master plan was submitted to Ministry of Transportation for approval and the implementation process was carried after approvals. Li and Notteboom (2012) addressed the importance of the Public-Private Partnership (PPP) to develop inland waterways transport system due to high investment cost. The PPP is operated under concession agreement in which the waterway managers grant a concession to a private inland port operator to finance and rehabilitate or modernize a specific terminal or an entire port. The research study also discussed about land use issue as well as the environmental protection.

Asian Development Bank (2016) provided international practices of inland waterways transport management in the E.U. At first, inland waterways transport management should be managed through four levels, including Multinational River Commission, E.U. Commission, national governments, and United Nations Economic Commission for Europe. This report explored how the management of inland waterways transport in Belgium, Germany, Netherlands, and Austria. It identified that general tasks in inland waterways transport management consisted of infrastructure management, traffic management, flood control, and maintenance. All inland waterways transport management system in examined countries do have the planning period with finance and tariffs to clearly determine. Regard to the fees, it was calculated upon on rental cost, transshipment fees, railways fees in the port, special services fees, etc. Moreover, inland waterways transport activities are monitored throughout information technology system. For example, Austria's inland waterways transport system was designed to cover the area of lock supervision, weir supervision, and water level supervision. The information system was designed to monitor maintenance required for each part of

the inland waterways. Automatic Identification System (AIC) was implemented to check the issues automatically.

3 RESEARCH METHODOLOGY

3.1. Research method approach

At the beginning phase of the study, the researcher had considered to apply two different research method, one is qualitative research and the other one is quantitative research.

Denzin and Lincoln (2015) has pointed out that “qualitative research involves the studied use and collection of a variety of empirical materials – case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts – that describe routine and problematic moments and meanings of a certain matter.” In other words, the qualitative approach is a method of gathering non-numerical data and interpret these gathered data into understanding and findings on the mentioned matters. This method includes various approaches, such as observations, interviews, surveys, content analysis of text materials.

Meanwhile, quantitative research gives a results based on the expression of statistical measurements from numerical data. Quantitative researchers are usually proceed with numbers, logic and constant data and details.

After consideration on the research situation and available resources, the researcher decided to use qualitative research approach. This was because of the focus on the assessment of inland waterways transports in the Saigon-DongNai River System and it did not involve statistics or econometric modeling for hypothesis verification. Furthermore, there were not enough available statistics for the researcher to generate precise findings.

3.2. Research framework

In this study, a research framework was developed and it is illustrated below:

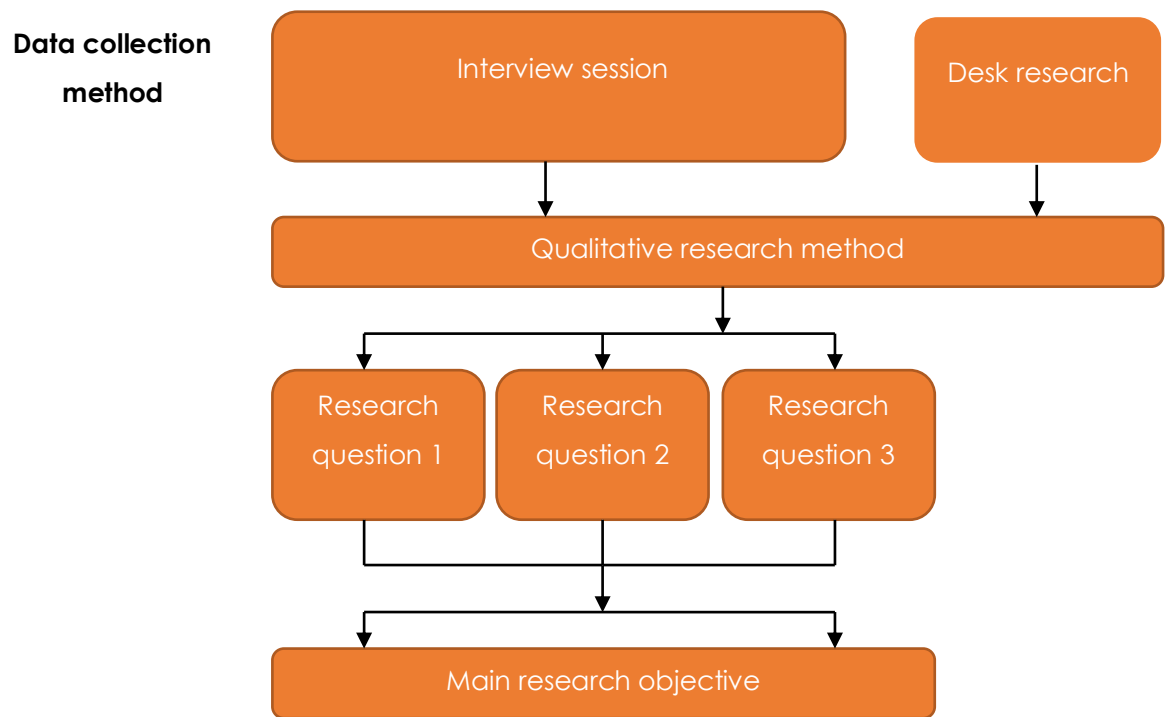


Figure 3: Research framework

As illustrated in the figure above, the main research objective was approached by using the three research questions listed in the First Chapter. To answer the three research questions, the researcher decided to use the qualitative rather than the quantitative approach. The reason for this is discussed in more detail in the next section of the Third Chapter. To support the qualitative research method, the researcher conducted the interview with experts and implemented desk research. The interviews with the experts were conducted with five experts who were working in the Saigon-DongNai River System Administration. Moreover, desk research was implemented by the author, and it required the collection of published journals, books, e-books and government data reports with similar topics about inland waterways transportation development and management.

3.3. Data collection

There were two types of data that were collected in this study, namely primary data and secondary data. In this study, the primary data was collected through interviews with experts in inland waterways transport in Vietnam. Since the study focused on

inland waterways transport development in the Saigon-DongNai River System, the author selected experts who were the employees from the organizations/companies operating in the port of Saigon-Dongnai river.

The secondary way of achieving data is secondary data retrieval. The researcher selected journals and books with contents similar to the topic of the study. It meant that the researcher collected journals and books with the objective of identifying the key factors affecting the development of inland waterways transport as well as how inland waterways transport systems were developed and maintained in some countries in the world. By collecting secondary data, the author believed that he could enhance his understandings of inland waterways transport and capture the best practices in the development of this transportation system in other countries.

3.4. Interview questions and implementation design

There are some interviews questions to be developed in the research study. These interview questions are summarized as below:

Table 3. Interview questions

No	Interview question	Research questions
1	1.1. Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System? 1.2. What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System? 1.3. What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?	What is the current performance of inland waterways transport in Saigon-DongNai River System?
2	2.1. What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?	What are the strengths and the weaknesses of inland waterways transport

	2.2. What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?	in Saigon-DongNai River System?
3	<p>3.1. Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?</p> <p>3.2. Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?</p> <p>3.3. Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?</p> <p>3.4. Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?</p>	What are development plans to further improve the performance of inland waterways transport in Saigon-DongNai River System?

Table above shows that each research question is addressed through numerous interview questions. In overall, there are nine interview questions were developed. The first three interview questions were used to answer for the first research question. The following two interview questions were used to answer the second research question. Finally, the last four interview questions were used to answer the last research question of the research study.

The researcher implemented the interviews with five experts who are working in Saigon-DongNai River System Administration to identify the answers. Convenient sampling was chosen since only those who were willing to participate into the interviews were selected. The interview session was conducted via phone calls and similar platform. The language used in the interview between the researcher and the interviewees was Vietnamese. Later, the main key points and findings from the interview were

noted and translated by the researcher. The translated content of the interview can be found in the Appendix section. It was the desire of the interviewees to keep their personal information safe and secret, so the author did not show the name of them. The researcher hid the name of the experts by making a coding for each of them as Expert 1, Expert 2, Expert 3, Expert 4, and Expert 5.

4 DATA ANALYSIS AND FINDING

4.1. The current situation of inland waterways transport in Saigon-DongNai River System

4.1.1. The geographical condition of Saigon-DongNai River System

In this section, geographical condition of Saigon-DongNai River System was explored. The information was extracted from interviews with five experts. It was found that Saigon-DongNai River System is formulated from geographically connection between two rivers, namely Saigon River and Dong Nai River. These two rivers are geographically located in different areas. While Saigon River is closed to the North of Ho Chi Minh City, Dong Nai River is more closed to the East and it is closed to Dong Nai Province. Geographical location of the two rivers is illustrated in the figure below:

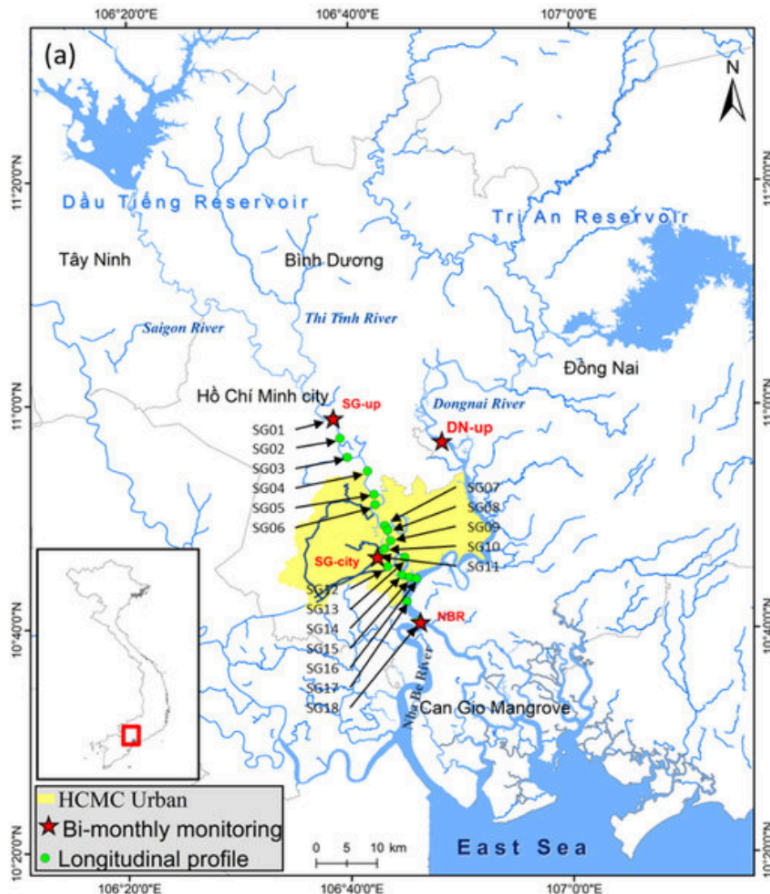


Figure 4: Geographical Condition of Saigon River and Dong Nai River

Through the interviews with the experts, the researcher was able to extract some key information related to geographical characteristics of the two rivers. Saigon River is very closed to the boundary of Vietnam with Cambodia and its length is about 230 kilometers from south to southeast. This river connects with Ho Chi Minh City of Vietnam through an interconnection with Dong Nai River. All the experts confirmed the importance of Saigon River to the economic and social development in Ho Chi Minh City since it provides the water source for local habitats and the operation of Saigon Port. As mentioned above, Dong Nai River connects Saigon River with Ho Chi Minh City in term of geographical condition. Dong Nai River has 586 kilometers in length and it is considered as the longest river in Vietnam. The geographical condition of Dong Nai River, therefore, is more complex. Its flow goes through some provinces in the south of Vietnam, including Binh Duong, Binh Phuoc, Dak Nong, Ho Chi Minh City, and Lam Dong. Dong Nai River also connects with Da Dang River and Da Nhim River which are

located in the central and highlands of Vietnam and it is also connected with the East Sea.

It could be observed that Saigon River and Dong Nai River connects two most developed provinces and cities of Vietnam, namely Ho Chi Minh City and Dong Nai Province. Both this city and province are belonged to Southeast region of Vietnam. While Ho Chi Minh City has total land size area of more than 2,000 kilometers square, Dong Nai Province has total land size is more than double of about 5,800 kilometers square. Although Ho Chi Minh City has lower land size, it is considered as the most populous city of the country with more than 8.5 million people in the end of 2018 while Dong Nai Province has about three million people. Thus, Ho Chi Minh City has much higher population density compared to Dong Nai Province. Currently, the city has population density of 4,171 people per kilometer square while the population density in Dong Nai Province is about 526 people per kilometer square. With higher population, it is easily to explain that Ho Chi Minh City has higher number of people who are under working ages compared to Dong Nai Province. In the end of 2018, Ho Chi Minh City has about 4.5 million people who are in working age group while this number in Dong Nai Province is about 1.7 million people. However, the percentage of people who in working ages in Dong Nai Province is higher than Ho Chi Minh City. Indeed, the percentage of people who in working ages over total population of Dong Nai Province is 53.5% while this ratio in Ho Chi Minh City is 50.5%. Both Ho Chi Minh City and Dong Nai Province has lower percentage of people in working ages in total population when comparing to the country level which is about 57.3% in the end of 2018.

The interview with the experts also explored that Saigon River and Dong Nai River brings provincial competitiveness to both Ho Chi Minh City and Dong Nai Province. It is verified through the provincial competitiveness index (PCI) score. Obtained result shows that this city and province is not being ranked in excellent and high tier of PCI ranking for 63 cities and provinces of Vietnam. Currently, PCI scores of Ho Chi Minh City and Dong Nai Province are 65.34 and 63.84 and their ranking level are 10 and 26 respectively. Both Ho Chi Minh City and Dong Nai Province have mid-high tier. Therefore, it is required to explore how the values of Saigon River and Dong Nai River to the city and province in order to capture the main strengths and the weaknesses.

4.1.2. The types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System

In the second part of the first section, the researcher would like to explore what the types of the vessels and the amount of cargo which can be transported through Saigon-DongNai River System. To do that, the researcher collected the information related to key riverports located in this river system. This information will be used to verify the answers provided by the experts through interviews. It is reported that Ho Chi Minh City consumed almost the total volume of goods transported through waterways system in Southeast of Vietnam. In more detail, total volume of goods shipped through waterways system in Southeast of Vietnam was more than 19,573 million tons and total shipped volume of Ho Chi Minh City was about 19,373 million tons. Saigon-DongNai River System has three main riverports, including Saigon River Port, Cat Lai River Port, and Hiep Phuoc Riverport.

Table 4. Types of vessels and amount of cargo in Saigon-DongNai River System

Key riverports	Type of vessels & Amount of cargo	
	Types of vessels	The amount of cargo
Saigon River Ports	35,000 tons	3.5 million TEUs
Cat Lai River Port	50,000 tons	5.4 million TEUs
Hiep Phuoc River Por	30,000 tons	1.5 million TEUs

Through the interviews with all experts, the types of vessels and the amount of cargo were both explored. Saigon River Ports are the consolidation of many small ports located across Saigon River through the main areas of Ho Chi Minh City and it can accept the vessels up to 35,000 tons and the amount of cargo is designed at 3.5 million TEUs. All reports are currently mainly used for domestic transportation which is about 70% of designated cargo volume. However, the experts addressed that the riverports are too closed to city's center so that it cannot be expanded. In fact, the government of Ho Chi Minh City has implemented the direction to move all riverports located in Saigon River Ports to other areas in order to bring better look to the city's center. The

second port is Cat Lai River Port and it is considered as the most important port in Saigon River. Unlike other riverports, Cat Lai River Port is under the management of Ministry of Defense of Vietnam and it was delivered to the operation in 2006. The designated cargo through Cat Lai River Port is 5.4 million TEUs since 2015. Before that, this riverport only handled up to 3.5 million TEUs. The upgrade of Cat Lai River Port was through two phases. The first phase was to upgrade the amount of cargo from 3.5 million TEUs to 4.2 million tons and the second phase continued to increase the amount of cargo to 5.4 million TEUs. The experts informed that this riverport was upgraded due to the utilization in 2012 was more than 80% and the upgradation can contribute more to the economic development in surrounding areas. Cat Lai River Port also can handle the ship up to 50,000 tons which is highest compared to other important riverports. The last important port is Hiep Phuoc Port which can handle the vessels of 30,000 tons and designated cargo volume is about 1.5 million TEUs. The small designated cargo volume is explained by low utilization of this port compared to Saigon River Ports and Cat Lai River Port. The experts also mentioned about the plan of the government of Ho Chi Minh City and Dong Nai Province to invest into Hiep Phuoc River Port to the main riverports until 2020 since all riverports in Saigon River Ports system will be removed. It is asserted that this plan will turn Hiep Phuoc River Port to the most modern riverports in Vietnam and it can handle the vessels up to 50,000 tons.

4.1.3. The current performance of inland waterways transport in Saigon-DongNai River System

The last part of the first section was conducted with the objective of revealing the current performance of inland waterways transport in Saigon-DongNai River System. To evaluate the performance of inland waterways transport in this river system, the researcher examined and summarized the answers of the experts. Despite of favorable geographical condition, the use of inland waterways transport in Saigon-DongNai River System was still underperforming. This conclusion was extracted when the researcher asked the experts to provide their general evaluation towards the inland waterways transport in Saigon-DongNai River System. In fact, the goods are often shipped through

road transportation which is accounted for more than 70% of total shipped goods volume. Several reasons were highlighted by the experts such as poor connection between road and river system, the lack of knowledge about the benefits of using inland waterways system, etc. However, all experts agreed that the key issue refers to low investment of the provincial government in Ho Chi Minh City and Dong Nai Province to develop inland waterway system through their river ports. Despite of the limitations, the performance of riverports in Ho Chi Minh City and Dong Nai Province is highly promising when comparing to other riverports located in other cities and provinces of Vietnam.

Table 5. The performance of riverports in Saigon-DongNai River System

Criteria	Ho Chi Minh	Dong Nai
1. Inland waterways system		
1.1. Number of ships	46,617	5,433
1.2. Total cargo volumes (tons)	29,860,006	5,742,772
2. Sea transportation system		
2.1. Total vessels	20,858	3,657
2.2. Total cargo volume (tons)	235,929,683	10,861,320
3. Overall system		
3.1. Total ships & vessels	67,475	9,090
3.2. Total goods volume (tons)	265,789,789	16,604,092

The performance of riverports in Saigon-DongNai River System is explored through two main criteria, including ships transporting through and the shipped goods. By ships, riverports in Ho Chi Minh City welcomed more than 46,000 vessels with total cargo volumes of 29,860,006 tons. The riverports in Dong Nai Province, however, only received 5,433 vessels with total cargo volumes of 5,742,772 tons. It is clearly showing that riverports in Ho Chi Minh City have high cargo transportation compared to riverports in Dong Nai Province. The experts mentioned that inland waterways through Saigon-DongNai River System is still much lower than sea the amount of cargo through seaports. This answer of the experts was verified through the performance of inland

waterways and sea transportation in Ho Chi Minh City and Dong Nai Province. While the number of ships through inland waterways system in this city and province is consume an average of 64% of total ships and vessels, good cargo volumes through inland waterways system was averaged at 23% of total volumes. In more detail, seaports in Ho Chi Minh City consumed 89% of total cargo volume while seaports in Dong Nai Province consumed 65% of total cargo volume. This finding strengthens the finding of which the companies in this city and province are still prefer to road transportation over riverway transportation.

4.2. The strengths and the weaknesses of inland waterways transport in Saigon-DongNai River System

4.2.1. Main strengths of inland waterways transport in Saigon-DongNai River System

Main strengths of inland waterways transport in Saigon-DongNai River System was explored through the interviews with the experts. During the interviews with the experts, there were two major strengths of inland waterways transport in Saigon-DongNai River System, including the economic benefit and the commitment of the government to develop this type of transportation.

The first strength of inland waterways transport in this river system was agreed by all experts as economic benefits. It was identified that the transportation cost through inland waterways in Saigon-DongNai River System was cheaper than road transportation. For example, Expert A said that the transportation cost of goods from Dong Nai to Can Tho is suitable for the manufacturers who want to ship a large goods volume. Expert D calculated and provided the fact that the cost of goods shipped through inland waterways can be 5-7 times lower than road transportation. Similarly, Expert B and Expert E said that the main strength if inland waterways transport was that it could handle more cargo compared to road containers. While one ship in waterways system can transport 15-100 containers, one car in road transportation can handle only 2 containers with length of 20 feet. Expert C said that the development of inland waterways transport could help to reduce the traffic issues (i.e. traffic jam) in the highway that

connects Ho Chi Minh City to other cities and provinces in the south of Vietnam. Furthermore, the development of inland waterways transportation can help reducing the carbon footprint generated by means of road transportation.

The second strength of inland waterways transport in Saigon-DongNai River System was focused as the attention of government bodies in Ho Chi Minh City and Dong Nai Province towards the development of this transportation route. Expert B said that the direction of the government in Ho Chi Minh City to move all riverports in Saigon River Ports system to other locations is the right move since it will bring opportunity for further development. Expert A, B and E said that Saigon River Ports cannot be upgraded at the moment since they are located too close to the city's centers. The expansion of Saigon River Ports will affect the city landscape and it is not good to both local habitats and the tourists who visit to Ho Chi Minh City. This plan of moving all riverports will help Ho Chi Minh City to further upgrade the capacity of inland waterways transportation and brings the economic benefits to the city and surrounding provinces.

4.2.2. Main weaknesses of inland waterways transport in Saigon-DongNai River System

In the previous section, two main strengths of inland waterways transport in Saigon-DongNai River System had been highlighted. In this section, main weaknesses of inland waterways transport in Saigon-DongNai River System was explored through the interviews with the experts. The researcher believed that inland waterways transport in this river system was still underperforming although there was the support from the government and the economic benefit is visible. The objective of identifying main weaknesses is to help the government bodies and the inland waterways transportation management companies to understand existing issues so that they can provide the plans to overcome.

The first weakness of inland waterways transport in Saigon-DongNai River System refers to geographic condition. It was identified that both Saigon River and Dong Nai River suffered high speed of water flows, especially during flood seasons. It led to un-

predicted water flow and it could bring the damage and the accidents to inland waterway transportation activities. All experts agreed that geographic condition is one of the main weakness to develop inland waterways transportation. Expert B said that some areas in Saigon River and Dong Nai River were too small so that it affected to the operation of larger ships or might lead to the jam during waterways transportation activities of the ships. Expert E proved that the geographical difficulty requires strong investment from the local government to change the natural condition and this investment is often very large.

The second weakness of inland waterways transport in Saigon-DongNai River System refers to the poor connection with road transportation. Some experts (Expert B, Expert C, and Expert D) stated that Vietnam has not good transportation development plan, showing through the fact that the interconnection between riverports and other main transportation modes like road and railways is still limited. Expert A provided a business case example of Cat Lai River Port. This port can handle the ship up to 18,000 TEUs but it does not have proper infrastructure in term of road connection or very small roads to connect this riverport with other logistic infrastructure, leading to the cost to be increased by more than 30% and therefore, losing its competitiveness. Expert C also said that very few riverports in Saigon-DongNai River System have established direct connection with near-by industrial zones. It is critical issue since the companies in industrial zones could not perceive the benefit of using inland waterways transportation.

The third weakness of inland waterways transport in Saigon-DongNai River System refers to the managerial capacity of the local governments, the transportation companies, and even local people. Expert E mentioned the fact that most of rivers in the South of Vietnam often face up with the climate change effect. For example, the river is dried during specific months and it impacts to the transportation of bigger ships. However, it is not the biggest issue since the expert confirmed the poor managerial capacity of riverport management companies since they could not control other companies and local people to exploit the sand from Saigon River and Dong Nai River. Expert D agreed that the natural resource exploitation must be conducted in sustainable ways in order to not affect negatively the flow or rivers, to avoid landslide and shadow

breaches, etc. In this context, the role of government ministries like Ministry of Natural Resources and Environment is questionable since it must provide the guideline and legal framework to assist local provincial bodies in controlling natural resources exploitation in river areas.

The fourth weakness of inland waterways transport in Saigon-DongNai River System refers to the strategic development of inland waterways in Vietnam. Expert B confirmed that the government does not provide clear strategy for the development of this transportation mode. This expert provided an example of inefficient infrastructure development in Ho Chi Minh City (Tan Son Nhat International Airport) and routes to Cat Lai Riverport and it often leads to the traffic jam and therefore reducing the logistics efficiency of the partners involved into the transportation process. Expert A stated that inland waterways transportation is both managed by Vietnam Inland Waterways Administration (VIWA) and Vietnam Maritime Administration (VMA). Thus, all activities related to inland waterways transportation are being managed double by VIWA and VMA and it can lead to unwanted result such as higher time to process or the transportation companies do not know which government bodies (VIWA or VMA) manage this river route. Moreover, Expert C said that local governments in Ho Chi Minh City and Dong Nai Province are not always focusing on the condition of their waterways system. This expert pointed out the fact that the governments have not dredged the rivers and the canals frequently or the budget for this activity is still very small. In addition, Expert D mentioned that the Prime Minister of Vietnam has issued the policy related to the development of inland waterways transport in Vietnam. However, this policy only focuses on the capital spent for maintenance services and there is lack of policies related to favorable conditions such as interest rate for investment, corporate income tax, etc. Expert E also pressed that if the government can increase the state budget to develop inland waterways transport, it will bring more benefits to the national economy. This expert further explained that the investment to inland waterways is more efficient compared to the investment into road transportation even if the investment amount is increased few percentages.

The fifth weakness of inland waterways transportation is Saigon-DongNai River System refers to the finding of which most of the companies in this service are very small or it

is household business. In this context, some experts (Expert A, Expert C, and Expert E) indicated that the players which are providing inland waterways transportation in Saigon-DongNai River System are rather lack of professional organization, old equipment or the equipment is not qualified. In fact, Vietnam government also issued the regulation related to the requirements of doing business in inland waterways transport but there is no frequent checking, leading to the gap between the regulation and actual business practices. For example, Expert A said that all the ships must be equipped by Automatic Identification System (AIS) when they move in inland waterways system. However, this expert did not see that this system is fully equipped in all the ships. Expert C also stated that the lack of focus on inland waterways transport leads to the fact that most of riverports in Vietnam in general and in Ho Chi Minh City and Dong Nai Province in particular are low grade in term of port size and it is only able to handle small ships or vessels. When the business scale is small, it brings negative impact to the future investment since the investors do not want to invest into small business scales.

5 CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This research study was developed from the interests of the author towards the development of the Inland waterways transport (IWT) in Saigon-Dongnai river particularly. The study was implemented with the a clear objective. By giving out three research questions, the researcher had conducted different methods of data collection, now the researcher is able to answer these research questions.

The answers are mentioned accordingly to the questions below.

❖ **What is the current performance of inland waterways transport in Saigon-DongNai River System?**

The main answer for this research question is that current performance of inland waterways transport in Saigon-DongNai River System is not so high. In other words, the business and operational performance are underperformance given to the fact that Saigon River and Dong Nai River have good geographical characteristics. It is identified that inland waterways through Saigon-DongNai River System is still much lower than sea the amount of cargo through seaports.

❖ **What are the strengths and the weaknesses of inland waterways transport in Saigon-DongNai River System?**

The main strengths of inland waterways transport in Saigon-DongNai River System are economic benefits compared to road transportation and the focus of the government to develop inland waterways transportation, evidenced through the plan to move Saigon River Ports to other locations. However, there are some weaknesses that limit the development. They are complex and unfavorable geographical conditions in some waterways' locations, the poor connection with road transportation, industrial parks, etc., low managerial capabilities of the local governments, the transportation companies, and even local people in sustaining the natural condition surrounding inland waterways, less efficiency in national strategic development of inland waterways, and the small business scale and lack of professional services in players of inland waterways. It is concluded that two main strengths of inland waterways transport in Saigon-DongNai River System cannot help to boost the performance of this transportation mode since

they are so many weaknesses. The issues which are being existed in inland waterways transport in Saigon-DongNai River System reduces the competitiveness of Ho Chi Minh City and Dong Nai Province and it negatively impacts on the economic development and natural environment. To overcome these weaknesses while still leveraging the main strengths, a proper business plan and operational plan must be developed in order to

❖ **What are business and operation plans to further improve the performance of inland waterways transport in Saigon-DongNai River System?**

This research question will be fulfilled in the second section of Chapter 5.

5.2. Development plan recommendations

Regard the development plan for inland waterways transport in Saigon-DongNai River System, the researcher proposes four areas must be put into the improvement, including operating model recommendation, human resource recommendation, financing model and funding resources, and facilities and infrastructure required for further development. Each of them will be discussed in detail below:

5.2.1. Operating models recommendation

There are some recommendations related to operating models of inland waterways transport. The first operating model is Intermodal Transport. This operating model is illustrated in the figure below:

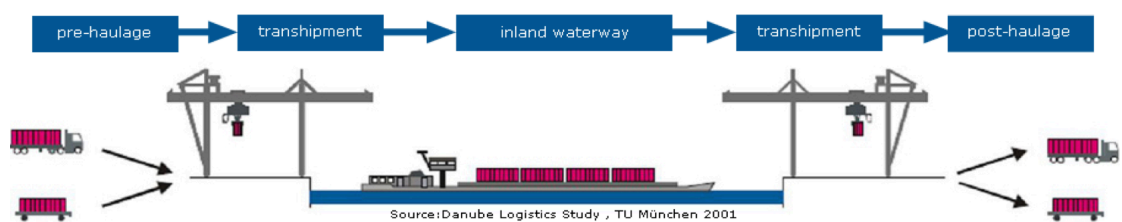


Figure 5: Intermodal Transport

In Intermodal Transport, it does not require goods to be loaded from the containers or swap bodies or semi-trailers. By applying Intermodal Transport, the time to load goods is reduced and therefore reducing waiting times to the ships or the vessels when transporting to inland waterways of Saigon-DongNai River System. In addition, this

model requires the establishment of transshipment to move the containers to the ships as well as loading the containers to the trucks to transport to demanded locations. Other benefit of using Intermodal Transport is that it reduces the carbon footprint from the operations at pre-haulage and post-haulage since the goods are not loaded and reloaded from the containers.

Other operating model which can be applied in Saigon-DongNai River System is Multi-modal Transport. This operating model is illustrated in the figure below:

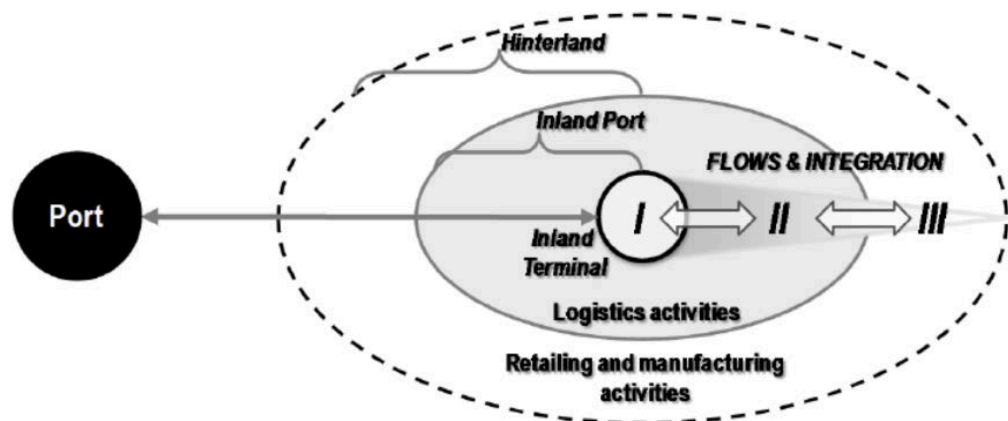


Figure 6: Multi-Modal Transport

The development of Multi-Modal Transport is sourced from the ideas of which inland waterways must operate well with different transportation modes (i.e. railway, road, sea ports, etc.) and economic activities in located areas. This operating model is illustrated through three tier system. The first tier is inland ports with the coverage of inland terminals and logistics activities conducted inside. The second tier refers to logistics activities around the inland terminals and there are other participants as logistics companies. The third tier is retailing and manufacturing activities in the hinterland. The appearance is to increase the proximity between the operations and the inland waterways so that the transportation cost will be reduced.

5.2.2. Human resource recommendation

Since many players in inland waterways transport in Saigon-DongNai River System are rather small and organize under household business, human resource quality turns to important part. The government bodies in Ho Chi Minh City and Dong Nai Province

must provide the trainings to the players frequently. The trainings will be delivered without fees to motivate more people to join the trainings. The trainings' content must be focused on how to navigate the vessels or the ships, the geographical conditions of Saigon-DongNai River System, and the quality inspection to ensure the safety business.

Behind that, Ministry of Education and Training must strengthen training and standardization of teachers to ensure national standards, gradually reaching regional and international standards. The government bodies in Ho Chi Minh City and Dong Nai Province must regularly update and supplement training programs to meet the changing of the labor market. The companies which are operating under inland waterways transport must reasonably allocate time to their employees to learn new skills to further develop their professional knowledge. In addition, the forms of training and re-training must be increased along with the of socialization of training and strengthening the coordination and cohesion between different parties.

In addition, human resource quality in inland waterways transport can be improved through the incentive to the players if they qualify for the trainings. For example, if the players pass all trainings provided by the government, they receive lower tax rate for their businesses. Vietnamese government should work with Ministry of Training and Education to develop the vocational schools near to Saigon-DongNai River System and it provides good human resources for the future development of inland waterways transport.

5.2.3. Financial model and funding resources recommendation

One of the critical issues in developing inland waterways transport in Saigon-DongNai River System is that there is lack of the government supports in finance area. The government should provide financial supports to all the shipping companies and the river-port management agencies. The first action is that all of players must be exposed to lower corporate income taxes. For example, the corporate income taxes must be reduced by 50% compared to 20-25% as current regulated. The second action refers to the cost of borrowing money from the local banks to develop this transportation. The government must assign State Bank of Vietnam (SBV) as responsible government body to work with local commercial banks to provide the funding resources at cheaper price

to all players in inland waterways transport. This funding resources enable the opportunity to the players to borrow money for working capital injection for their daily businesses and operations. The interest rate must be lower than average lending interest rate for household and SME businesses and the researcher suggests that the interest rate must be half of normal lending interest rate in the market.

Moreover, the government must find funding resources for maintenance services of all facilities and equipment used in inland waterways system. To do that, the government must apply some types of fees when the players utilize services from inland waterways system. There are 3 different fees that can be collected from the players, including fees to use water routes, registration fees, and fuel taxes. Among these fees, registration fee is considered as the most important funding resources. The researcher suggests that the government can apply the fees per registered ton of vessel or ship and it can bring good funding resources to renovate inland waterways of Vietnam. After the fees are collected, it will be used for other purposes, including fixing geographical issues such as expanding the water routes to get bigger ships, education programs to the households and small companies which are doing business in inland waterways transports in Saigon-DongNai River System. Behind of that, the government should pay attention to fuel taxes. It is calculated upon on the quality check of each ship or vessel visiting though inland waterways transport of Saigon-DongNai River System. The fuel taxes can be used as financial resources to invest into green solutions which have lower negative impacts on the natural environment. Moreover, it is perceived that fuel taxes can be used as motivation scheme to the players to invest more into green solutions such as purchasing new vessels or ships with higher energy efficiency and lower carbon footprint. Finally, the financial model which is designed upon on Private – Public Partnership (PPP) must be applied. Since the investment to upgrade or to build new inland ports is very high, the government's budget may not be sufficient and therefore, it requires the investment from private sector.

5.2.4. Facilities and infrastructure recommendation

Facilities and infrastructure must be upgraded to increase the value contributed by inland waterways transport in Saigon-DongNai River System. The government of Vietnam and local government bodies in Ho Chi Minh City and Dong Nai Province must work closely to implement construction projects in which several roads and bridges must be established to connect river ports with industrial parks and other economic areas. Key roads and bridges which must be upgraded or built are Ben Luc – Long Thanh Highway, North – South Road, and Phuoc An Bridge. Other facilities and infrastructure are the inland container depots (ICDs) to support the riverports which are far away to factories and industrial parks. The development of ICDs will reduce the time and the cost to ship goods from riverports to different area since it allows the inventory setup to reduce negative impact from waiting the next schedule. In order to develop new ICDs, there are some requirements related to the location, including land area for constructing ICDs is more than 10 hectares and ICDs must be connected with main national roads or highway roads. Therefore, government bodies in Ho Chi Minh City and Dong Nai Province must assign respective parties to develop the master plan in term of land utilization and the plan to develop more roads to connect with new ICDs. Other recommendation refers to the upgradation of information technologies to strategically manage all activities in river ports. To do that, the government of Vietnam must assign Ministry of Information and Communication to prepare the plan for digitalization of all operations of inland waterways transport in which it formulates the use of big data which is collected from all inland waterways transport activities not only in Saigon-DongNai River System but also other locations of the country. Then, a smart system must be developed with the consultation from external agencies in order to smartly manage the overall working flows and daily activities of the ships or the vessels transporting through inland waterways.

6 Reflections and future suggestions

This research has provided many great and useful information for the self-development of the author. The research has given very good opportunities for the author to

learn how to conduct research in a correct manner and the author has explored new things about logistics in general and inland waterways transport specifically.

However, there are still some limitations that hope to be improved in the future research. The first limitation was that there was a lack of available resource on the subject of the study. Since inland waterways transport was still underperformance and it receives less attention from the government, there are not so many evidences or the reports about this transportation system. Therefore, the researcher was not able to verify the answers provided by the experts. The second limitation of the research study was that the author did not take the information from the customers and the shipping companies which are operating in Saigon-DongNai River System. Therefore, future researchers must conduct their studies with more data collected from different groups of respondents, either the customers or the services providers to make the findings to be comprehensive. Future researchers can make an online survey with many customers and the providers to get the findings more reliable and less subjective.

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Appendices

Appendix 1. Interviewees personal information

Mr. Do Hong Thai – Vietnam National Maritime Administration

Mr. Tran Trung Chinh – Saigon Newport Company

Mr. Pham Tuan Anh – Vietnam Maritime Safety South

Mr. Tran Minh Thuan- Vietnam Maritime Safety South

Mrs. Nguyen Hong Nga – STC Agencies Company

Appendix 2.

Table 6. Interview summary

Expert	Content
A	<p>Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System?</p> <p>Saigon-DongNai River System is formulated from geographically connection between two rivers, namely Saigon River and Dong Nai River. Saigon River to the economic and social development in Ho Chi Minh City since it provides the water source for local habitats and the operation of Saigon Port. The economic activities in these two rivers contributed a lot to the development of Ho Chi Minh City and Dong Nai City.</p> <p>What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System?</p> <p>As far as I know, the amount of cargo is different by the ports. I means different ports have different requirement or maximum of cargo or vessel types. For example, Saigon River Port can be fit to the vessels up to 3,500 tons or 3.5 million TEUs while Cat Lai River can be fit to the vessels up to 40,000-50,000 tons or more than 5 million TEUs. However, I know that Ho Chi Minh Government wants to move all ports in Saigon River to other locations to increase the positive landscape of the city. I think it is good for local people life as well as improving the tourism performance of Ho Chi Minh City.</p> <p>What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?</p>

My evaluation to current performance of inland waterways transport in Saigon-DongNai River System is not so high but it is not so bad. Household business can earn benefit from this transportation. I think SMEs also gain the benefit from inland waterways transport. However, the amount of cargo of inland waterways transport is much lower than seaports. The monetary benefits or the revenues are still lower than expectation of the government.

What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?

Of course, economic benefit is real when using inland waterways transport. The transportation cost of goods from Dong Nai to Can Tho is suitable for the manufacturers who want to ship a large goods volume. Moreover, Saigon River Ports cannot be upgraded at the moment since they are located too close to the city's centers. Herein, the effort of the government to develop inland waterways transport can be considered as main strength.

What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?

The first weakness is geographical condition since natural condition is not always good in all river areas. Saigon River and Dong Nai River suffers high speed of water flows, especially during flood seasons. It leads to unpredicted water flow and it can bring the damage and the accidents to inland waterway transportation activities. All experts agreed that geographic condition is one of the main weakness to develop inland waterways transportation. I also think that poor facilities can be a weakness point. For example, Cat Lai River Port can handle the ship up to 18,000 TEUs but it does not have proper infrastructure in term of road connection or very small roads to connect this riverport with other logistic infrastructure, leading to the cost to be increased by more than 30% and therefore, losing its competitiveness. Other issue refers to the duplication in government management towards inland waterways transport. I observe that inland waterways transportation is both managed by Vietnam Inland Waterways Administration (VIWA) and Vietnam Maritime Administration (VMA). Thus, all activities related to inland waterways transportation are being managed double by VIWA and VMA and it can lead to unwanted result such as higher time to process or the transportation companies do not know which government bodies (VIWA or VMA) manage this river route. Finally, I think most of the companies in this service are

very small or it is household business. All the ships must be equipped by Automatic Identification System (AIS) when they move in inland waterways system. However, I do not see this system is fully equipped in all the ships.

Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?

I think inland water way transport should be operated under intermodal or multi-modal.

Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?

Yes, human resource is important. Without quality people, you cannot do anything. I strongly believe that the government bodies in Ho Chi Minh City and Dong Nai Province must regularly update and supplement training programs to meet the changing of the labor market. The companies which are operating under inland waterways transport must reasonably allocate time to their employees to learn new skills to further develop their professional knowledge. In addition, the forms of training and retraining must be increased along with the of socialization of training and strengthening the coordination and cohesion between different parties.

Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?

For me, the financial model which is designed upon on Private – Public Partnership (PPP) must be applied. Since the investment to upgrade or to build new inland ports is very high, the government’s budget may not be sufficient and therefore, it requires the investment from private sector.

Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?

I think, the government of Vietnam must assign Ministry of Information and Communication to prepare the plan for digitalization of all operations of inland waterways transport in which it formulates the use of big data which is collected from all inland waterways transport activities not only in Saigon-DongNai River System but also other locations of the country.

B	<p>Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System?</p> <p>I think Saigon-DongNai River System is geographically formulated from two rivers, Saigon River and Dong Nai River. They are geographically located in different areas. While Saigon River is closed to the North of Ho Chi Minh City, Dong Nai River is more closed to the East and it is closed to Dong Nai Province. I strongly believe that the economic development of two cities are much depended on how the river system is developed.</p> <p>What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System?</p> <p>I do not have much information about the amount of cargo but I know that Saigon Port can be fit more than 30,000 tons of vessels and the biggest port is Cat Lai which can be fit up to more than 50,000 tons of vessels. Other important port is Hiep Phuoc River port which can be fit about 30,000 tons of vessels. In my opinion, Hiep Phuoc River port has more change to develop further since there are no ways for Saigon Port to expand.</p> <p>What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?</p> <p>By ships, riverports in Ho Chi Minh City welcomed more than 46,000 vessels with total cargo volumes of 29,860,006 tons. The riverports in Dong Nai Province, however, only received 5,433 vessels with total cargo volumes of 5,742,772 tons. It is clearly showing that riverports in Ho Chi Minh City have high cargo transportation compared to riverports in Dong Nai Province. Although, inland waterways through Saigon-DongNai River System is still much lower than sea the amount of cargo through seaports.</p> <p>What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?</p> <p>For me, the main strength of inland waterways transport in Saigon-DongNai River System is economic benefit. For example, it can handle more cargo compared to road containers. While one ship in waterways system can transport 15-100 containers, one car in road transportation can handle only 2 containers with length of 20 feet. Moreover, the direction of the government in Ho Chi Minh City to move all riverports in Saigon River Ports system to other locations is the right move since it will bring opportunity for further development.</p>
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What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?

The first weakness is not coming from the river ports themselves but from natural condition. Some areas in Saigon River and Dong Nai River are too small so that it affects to the operation of larger ships or may lead to the jam during waterways transportation activities of the ships. Other weakness is the poor connection with road transportation. I also perceive that government does not provide clear strategy for the development of this transportation mode. This expert provided an example of inefficient infrastructure development in Ho Chi Minh City (Tan Son Nhat International Airport) and routes to Cat Lai Riverport and it often leads to the traffic jam and therefore reducing the logistics efficiency of the partners involved into the transportation process.

Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?

Intermodal can be a good option for inland waterway transport in Saigon-Dong-Nai River System. It does not require goods to be loaded from the containers or swap bodies or semi-trailers. By applying Intermodal Transport, the time to load goods is reduced and therefore reducing waiting times to the ships or the vessels when transporting to inland waterways of Saigon-DongNai River System.

Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?

I think human resource quality must be improved through the trainings and technological know-how transfer. Ministry of Education and Training must strengthen training and standardization of teachers to ensure national standards, gradually reaching regional and international standards.

Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?

I do not have answer for this question.

Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?

I do not have answer for this question.

C	<p>Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System?</p> <p>Saigon River is very closed to the boundary of Vietnam with Cambodia and its length is about 230 kilometers from south to southeast. This river connects with Ho Chi Minh City of Vietnam through an interconnection with Dong Nai River. Saigon River and Dong Nai River brings provincial competitiveness to both Ho Chi Minh City and Dong Nai Province.</p> <p>What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System?</p> <p>You know that there are 3 most important ports in Saigon-DongNai River System, including Saigon River Port, Cat Lai River Port and Hiep Phuoc River Port. These ports are suitable to the vessels from 30,000 tons and the amount of cargo more than 1 million TEUs. I think Cat Lai River Port and Hiep Phuoc River Port have more opportunity to develop since Saigon Port is very full and the government of Ho Chi Minh City plans to remove all ports in Saigon River Port system.</p> <p>What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?</p> <p>I think the performance of inland waterways transport in Saigon-DongNai River System is quite good. It is not the strongest performance compare to sea ports but it also contributes a lot to the development of household business or small enterprises in Ho Chi Minh City and Dong Nai Province.</p> <p>What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?</p> <p>The key strength of this river system in term of inland waterways transport is economic benefit. I know that the cost of using this transportation line is more than 5 times lower than traditional transportation like road.</p> <p>What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?</p> <p>For me, geographical issue is the first weakness. We can change natural condition but have to learn to how to do business with these adverse conditions. Otherwise, I think poor connection between river ports and road and other facilities is considered as other weakness. Also, I think very few riverports in Saigon-DongNai River System have established direct connection with near-by industrial zones. It is critical issue since the companies in industrial zones could not perceive the</p>
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benefit of using inland waterways transportation. In addition, local governments in Ho Chi Minh City and Dong Nai Province are not always focusing on the condition of their waterways system. I think the governments have not dredged the rivers and the canals frequently or the budget for this activity is still very small. Moreover, I think there is the lack of focus on inland waterways transport leads to the fact that most of riverports in Vietnam in general and in Ho Chi Minh City and Dong Nai Province in particular are low grade in term of port size and it is only able to handle small ships or vessels. When the business scale is small, it brings negative impact to the future investment since the investors do not want to invest into small business scales.

Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?

I think the best operating model is intermodal transport with the connection between pre-haulage, post-haulage and inland waterways.

Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?

In my opinion, human resource quality in inland waterways transport can be improved through the incentive to the players if they qualify for the trainings. For example, if the players pass all trainings provided by the government, they receive lower tax rate for their businesses. Vietnamese government should work with Ministry of Training and Education to develop the vocational schools near to Saigon-DongNai River System and it provides good human resources for the future development of inland waterways transport.

Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?

Registration fees must considered.

Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?

I do not have answer for this question. Registration fee is considered as the most important funding resources. The researcher suggests that the government can apply the fees at VND 20,000 per registered ton of vessel or ship and it can bring good funding resources to renovate inland waterways of Vietnam. After the fees

	<p>are collected, it will be used for other purposes, including fixing geographical issues.</p>
D	<p>Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System?</p> <p>Saigon River is important to the development of HCM City. Dong Nai River has 586 kilometers in length and it is considered as the longest river in Vietnam. The geographical condition of Dong Nai River, therefore, is more complex. Its flow goes through some provinces in the south of Vietnam, including Binh Duong, Binh Phuoc, Dak Nong, Ho Chi Minh City, and Lam Dong. Dong Nai River also connects with Da Dang River and Da Nhim River which are located in the central and highlands of Vietnam and it is also connected with the East Sea.</p> <p>What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System?</p> <p>I think the vessels with 30,000 tons and above can be fit to all ports in Saigon-DongNai River System. The amount of cargo may be varied by ports but I strongly believe that any cargo less than 3.5 million TEUs can be get in.</p> <p>What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?</p> <p>I do not give high performance to Saigon-DongNai River System in term of inland waterways transport. The most active activities are being happened in the sea-port while inland waterways transport receives less interest from local companies. Only small firms use this transportation channel to deliver goods and materials to desired location in Mekong Delta region.</p> <p>What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?</p> <p>As I calculated, the cost of goods shipped through inland waterways can be 5-7 times lower than road transportation.</p> <p>What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?</p> <p>Geographic condition, of course, is one of the main weakness. Moreover, I identify that the natural resource exploitation must be conducted in sustainable ways in order to not affect negatively the flow or rivers, to avoid landslide and shadow breaches, etc. In this context, the role of government ministries like Ministry of Natural Resources and Environment is questionable since it must provide the</p>

	<p>guideline and legal framework to assist local provincial bodies in controlling natural resources exploitation in river areas. Also, the Prime Minister of Vietnam has issued the policy related to the development of inland waterways transport in Vietnam. However, this policy only focuses on the capital spent for maintenance services and there is lack of policies related to favorable conditions such as interest rate for investment, corporate income tax, etc.</p> <p>Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?</p> <p>I think inland water way transport should be operated under intermodal or multimodal.</p> <p>Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?</p> <p>For me training and re-training are the most important activity to further improve human resource quality in this type of transportation.</p> <p>Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?</p> <p>For me, the government should pay attention to fuel taxes. It is calculated upon on the quality check of each ship or vessel visiting though inland waterways transport of Saigon-DongNai River System. The fuel taxes can be used as financial resources to invest into green solutions which have lower negative impacts on the natural environment.</p> <p>Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?</p> <p>For me, key point here is to apply new technologies in inland waterways management.</p>
E	<p>Would you please provide some overview information related to the geographical condition of Saigon-DongNai River System?</p> <p>Saigon River and Dong Nai River are two important rivers in the South of Vietnam. They are connected with each other and it represents for the two biggest cities in the South. Ho Chi Minh City has much higher population density compared to Dong Nai Province. Currently, the city has population density of 4,171 people per kilometer square while the population density in Dong Nai Province is about 526</p>

people per kilometer square. With higher population, it is easily to explain that Ho Chi Minh City has higher number of people who are under working ages compared to Dong Nai Province. In the end of 2018, Ho Chi Minh City has about 4.5 million people who are in working age group while this number in Dong Nai Province is about 1.7 million people. However, the percentage of people who in working ages in Dong Nai Province is higher than Ho Chi Minh City. Indeed, the percentage of people who in working ages over total population of Dong Nai Province is 53.5% while this ratio in Ho Chi Minh City is 50.5%. Both Ho Chi Minh City and Dong Nai Province has lower percentage of people in working ages in total population when comparing to the country level which is about 57.3% in the end of 2018.

What types of vessels and the amount of cargo can be transported throughout Saigon-DongNai River System?

Ho Chi Minh City Government provided a plan to move all ports in Saigon River Ports to other location. They plan to develop Hiep Phuoc River Port to the next river port destination in the South of Vietnam. Cat Lai Port is also important since it can be fit the vessels more than 50,000 tons or 5.4 million TEUs. Hiep Phuoc Port is now the smaller compared to Saigon River Ports and Cat Lai River Port but it receives high intention from the government to grow up further.

What are your evaluation towards the current performance of inland waterways transport in Saigon-DongNai River System?

In my opinion, current performance of inland waterways transport in Saigon-DongNai River system is not so good. While the number of ships through inland waterways system in this city and province is consume an average of 64% of total ships and vessels, good cargo volumes through inland waterways system was averaged at 23% of total volumes. In more detail, seaports in Ho Chi Minh City consumed 89% of total cargo volume while seaports in Dong Nai Province consumed 65% of total cargo volume. This finding strengthens the finding of which the companies in this city and province are still prefer to road transportation over riverway transportation.

What is your opinions towards the main strengths of inland waterways transport in Saigon-DongNai River System?

I think the main strength is economic benefit, of course. Otherwise, I think the effort of the government is other main strength. You know that the expansion of

Saigon River Ports will affect the city landscape and it is not good to both local habitats and the tourists who visit to Ho Chi Minh City. This plan of moving all riverports will help Ho Chi Minh City to further upgrade the capacity of inland waterways transportation and brings the economic benefits to the city and surrounding provinces.

What is your opinions towards the main weaknesses of inland waterways transport in Saigon-DongNai River System?

I think geographical condition is a main weakness. The geographical difficulty requires strong investment from the local government to change the natural condition and this investment is often very large. Other weakness, I think, is climate change effect. For example, the river is dried during specific months and it impacts to the transportation of bigger ships. However, it is not the biggest issue since the expert confirmed the poor managerial capacity of riverport management companies since they could not control other companies and local people to exploit the sand from Saigon River and Dong Nai River. In addition, government must be improved their capabilities in inland waterway transport. I strongly belief that if the government can increase the state budget to develop inland waterways transport, it will bring more benefits to the national economy. This expert further explained that the investment to inland waterways is more efficient compared to the investment into road transportation even if the investment amount is increased few percentages.

Would you please provide your suggestion towards operating model for inland waterways transport in Saigon-DongNai River System?

Intermodal can be a good option and multimodal should be developed in the long-run. Multi-modal has three tier system. The first tier is inland ports with the coverage of inland terminals and logistics activities conducted inside. The second tier refers to logistics activities around the inland terminals and there are other participants as logistics companies. The third tier is retailing and manufacturing activities in the hinterland. The appearance is to increase the proximity between the operations and the inland waterways so that the transportation cost will be reduced.

Would you please provide your suggestion towards human resource required for proper operations of inland waterways transport in Saigon-DongNai River System?

To serve for future development, it is recommended that the government in local area must provide vocation training to educate good local labors to develop inland waterways transport.

Would you please provide your suggestion towards financing model and funding resources for inland waterways transport in Saigon-DongNai River System?

I do not have answer for this question since I am not financial experts.

Would you please provide your suggestion towards the facilities and the infrastructure required for inland waterways transport in Saigon-DongNai River System?

In my opinion, the government of Vietnam and local government bodies in Ho Chi Minh City and Dong Nai Province must work closely to implement construction projects in which several roads and bridges must be established to connect river ports with industrial parks and other economic areas. Key roads and bridges which must be upgraded or built are Ben Luc – Long Thanh Highway, North – South Road, and Phuoc An Bridge. Other facilities and infrastructure are the inland container depots (ICDs) to support the riverports which are far away to factories and industrial parks. The development of ICDs will reduce the time and the cost to ship goods from riverports to different area since it allows the inventory setup to reduce negative impact from waiting the next schedule.