

Czech University of Life Sciences Prague
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Diploma Thesis

Value chain analysis of Vietnam pangasius aquaculture

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Thesis title

Value chain analysis of Vietnam pangasius aquaculture

Objectives of thesis

First of all, the strengths and weaknesses that the Vietnam pangasius fisheries and aquaculture segment has in hand would be taken into account. The thesis will also focus on the challenges and obstacles that the Vietnamese pangasius farming sector is encountering. The main part would be about the value chain of Vietnam pangasius production from the stage of purchasing and processing live fish, including the inputs of the final products' value.

Base on the mentioned goals, the hereunder research questions are selected in order to centralize and reach for the objectives:

- What are the strengths and weaknesses that the sector currently has?
- What are the challenges that the sector is encountering?
- What is the current situation of pangasius of Vietnam's value chain?

Methodology

The first and second research questions would be discussed in the Literature Review section, where the relevant data would be collected and reconciled from academic and reliable resources.

The practical part would analyse of data of the followings:

- Value of Vietnam pangasius export (USD)
- Total export value of Vietnam (USD)
- Value of World pangasius export (USD)
- Total export value of the World (USD)

which are used to identify the Revealed Competitive Advantage (RCA) index. The Mekong River Delta of Vietnam is the main area from which the secondary data set was collected, which would also clarify the third research question.

All the information and data used in the making of the thesis were extracted from resources such as Food and Agriculture Organization of the United Nations (FAO), Policy Department for Structural and Cohesion

Policies of European Parliament, Vietnam Association of Seafood Exporters and Producers (VASEP)... and other sufficiently helpful articles and papers.



The proposed extent of the thesis

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Keywords

Vietnam, pangasius value chain, pangasius fisheries and aquaculture, Vietnam fishery and aquaculture

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Khoi Doan. (2015). Description of the Pangasius Value Chain in Vietnam

Porter, M. E. (1985). Competitive Advantage – Creating and Sustaining Superior Performance

Raikes, P., Jensen, M. F., & Fonte, S. (2000). Global commodity chain analysis and the French Filiere approach: Comparison and critique. CDR Working Paper, 0(3), 1–26

Subramanian, U., Paludetto, M., & Yee, P. (2007). Moving Toward Competitiveness : A Value Chain Approach

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Declaration

I declare that I have worked on my diploma thesis titled "Fish Value Chain in Vietnam" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 31.03.2021

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I would like to express my deepest gratitude to my supervisor Ing. Pavel Kotyza, Ph.D. for his tremendous and wonderful supports. He has encouraged me to explore and implement new ideas, and constantly return with helpful feedbacks and suggestions.

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Value chain analysis of Vietnam pangasius aquaculture

Abstract

Global fisheries and aquaculture production have for long been the main source of export and import income of the world, especially for countries that have the geographic advantages like long coastlines as Vietnam. Vietnamese government has assessed the great potential of this sector to the post-war recovery and development of the national economy, and continue to exploit it until now. As a result, in 2016, Viet Nam was the World's fourth major producer of fishery and aquaculture, with a total production of 6.4 million tonnes, and created employment of more than 4 million workers.

This thesis drew attention to the value chain of Vietnam pangasius, the largest aquaculture sector of Vietnam that has dominated global market for many years. However, over the years, pangasius farmers in the MRD have had to engage with volatile production cost and market buying prices, along with the frequent decline in both local and international markets. This has resulted in their demotivation to keep up with their aquaculture business, not to mention costly upfront expenses for their pangasius farming. 90 percent of pangasius produced is to serve exporting purpose, therefore any challenges or obstacles from foreign markets would tremendously affect the price and export volume of Vietnam pangasius. The negative effect of the pandemic in 2020 has also added up to the decline of this sector.

Furthermore, the RCA index implementation was done in order to ensure the competitive advantage of Vietnam pangasius production and exportation. However, it has also given evidence that there are lots of challenges coming Vietnam's way of maintain its rank, which comes from the difficult regulations, tariffs, higher demands... from US and EU markets, including other competitors. Along with stating in-time solutions from Vietnamese Government and agriculture associations, the thesis also has some recommendations and suggestions for the improvement of the sector.

Keywords: Vietnam, Vietnam pangasius value chain, Vietnam pangasius fishery and aquaculture, Vietnam fishery and aquaculture

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List of abbreviations

ASC: Aquaculture Stewardship Council
ASEAN: Association of Southeast Asian Nations
BAP: Best Aquaculture Practices
DoC: Department of Commerce
EU: European Union
EVFTA: EU-Vietnam Free Trade Agreement
FAO: Food and Agriculture Organization
FIAS: Foreign Investment Advisory Service
FSIS: Food Safety and Inspection Service
GAP: Good Agricultural Practice
GCC: Global Commodity Chain
MARD: Ministry of Agriculture and Rural Development
MoIT: Ministry of Industry and Trade
MPI: Ministry of Planning and Investment
MRD: Mekong River Delta
NAFIQAD: National Agro-Forestry-Fisheries Quality Assurance Department
PoR: Period of Review
RCA: Revealed Comparative Advantage
SCOR: Supply Chain Operations Reference
USDA: United States Department of Agriculture
VASEP: Vietnam Association of Seafood Exporter and Producer
VCA: Value chain Analysis
VND: Vietnam Dong
WTO: World Trade Organization

I. Introduction

Vietnam is a nation with the coastline of over 3,260 km and has more than 3,000 islands, where the border of the country is 4,639km. Thanks to their significantly long coastline, Vietnam's fish production wins among the top ten products with highest export value, which accounts for about 4-5% of Gross Domestic Product ('GDP') and approximately 9-10% of national export revenue, and provides jobs for about 4 million people. In the economic sectors of Vietnam, the export value of the fisheries sector ranks 3rd, and is also the 3rd major exporter of the world's fish and fishery products, with exports valued at USD 8.5 billion in 2017.

Among the popular fish products that contribute galore to the fish yield and export volume and value, Vietnam pangasius stands out to be the key export products. It has been bringing billions of dollar to the annual export income of Vietnam since the 2000, and proudly become the dominant country in producing and exporting pangasius. The Mekong River Delta is the major areas for the farming of pangasius thanks to the rich supply of fresh water there, and largest markets of Vietnam pangasius are China, the US, the EU, ASEAN... Pangasius aquaculture has become the main sector for farmers there, and national agriculture organizations such as VASEP or NAFIQAD always support the farming procedure there with training programs, technology advancement and information enrichment. The value chain of Pangasius products is studied and analyzed, including their Revealed Competitive Advantage index, with the purpose of identifying the status of Vietnam Pangasius, its dominance in the World's aquaculture sector and relevant challenges.

II. Objectives and Methodology

2.1. Objectives

First of all, the strengths and weaknesses that the Vietnam pangasius fisheries and aquaculture segment has in hand would be taken into account. The thesis will also focus on the challenges and obstacles that the Vietnamese pangasius farming sector is encountering. The main part would be about the value chain of Vietnam pangasius production from the stage of purchasing and processing live fish, including the inputs of the final products' value. Based on the mentioned goals, the hereunder research questions are selected in order to centralize and reach for the objectives:

- What are the strengths and weaknesses that the sector currently has?
- What are the challenges that the sector is encountering?
- What is the current situation of pangasius of Vietnam's value chain?

2.2. Methodology

The research questions would be discussed by focusing on the dominance of Vietnam pangasius in the world, its flow and value of trades, the status of the sector to clarify its strengths and weaknesses. This part would also mention the challenges the sector is facing and their impacts.

Data collection

The pangasius value chain to be investigated in the time series 10 years, **from 2009 to 2018**. The thesis uses secondary data from the database of United Nation Comtrade with HS code **030462 - Fish fillets; frozen, catfish (Pangasius spp., Silurus spp., Clarias spp., Ictalurus spp.**, capturing data of:

x_{ij} : export value of pangasius of Vietnam (USD)

X_{it} : total value of Vietnam export (all commodities) (USD)

x_{wi} : the export value of pangasius of the World (USD)

X_{wt} : is the total value of World export (all commodities) (USD)

Data analysis

To analyse the value chain, the **Revealed Competitive Advantage (RCA)** index is chosen to perform the analysis:

The RCA proposed by B. Balassa in 1965, whose aim was to define the country's products trade and their relative advantage or disadvantage evidenced by trade flows. „The RCA is defined as the ratio of two shares. The numerator is the share of a country's total exports of the commodity of interest in its total exports, and the denominator is share of world exports of the same commodity in total world exports.“ (Dinda Soumyananda, 2015).

According to Assessment of Comparative advantage in aquaculture (Junning Cai et al., 2009) The Standard RCA index is where X_{ij} represents country i's export of product j:

- $RCA_{ij} > 1$ indicates country i has a comparative advantage in production of j; the greater the index, the stronger the advantage.
- $RCA_{ij} < 1$ indicates that country i has a comparative disadvantage in production of j; the smaller the index, the greater the disadvantage.

The RCA, within the scope of this thesis, will be used to indentify Vietnam's pangasius comparative advantage, initiated as below:

$$RCA_{ij} = \frac{\frac{x_{ij}}{X_{it}}}{\frac{x_{wi}}{X_{wt}}}$$

All other information and data used in the making of the thesis were extracted from resources such as Food and Agriculture Organization of the United Nations (FAO), Policy Department for Structural and Cohesion Policies of European Parliament, Vietnam Association of Seafood Exporters and Producers (VASEP)... and other sufficiently helpful articles and papers.

Besides, the flows of pangasius exporting to top destinations of Vietnam pangasius, such as China, the USA, Singapore, the UK and Mexico will also be analysed.

The **average export price** of pangasius to these destinations will also be taken into account, formulated as below:

$$\frac{\sum \text{value of export}}{\sum \text{volume of export}}$$

III. Literature Review

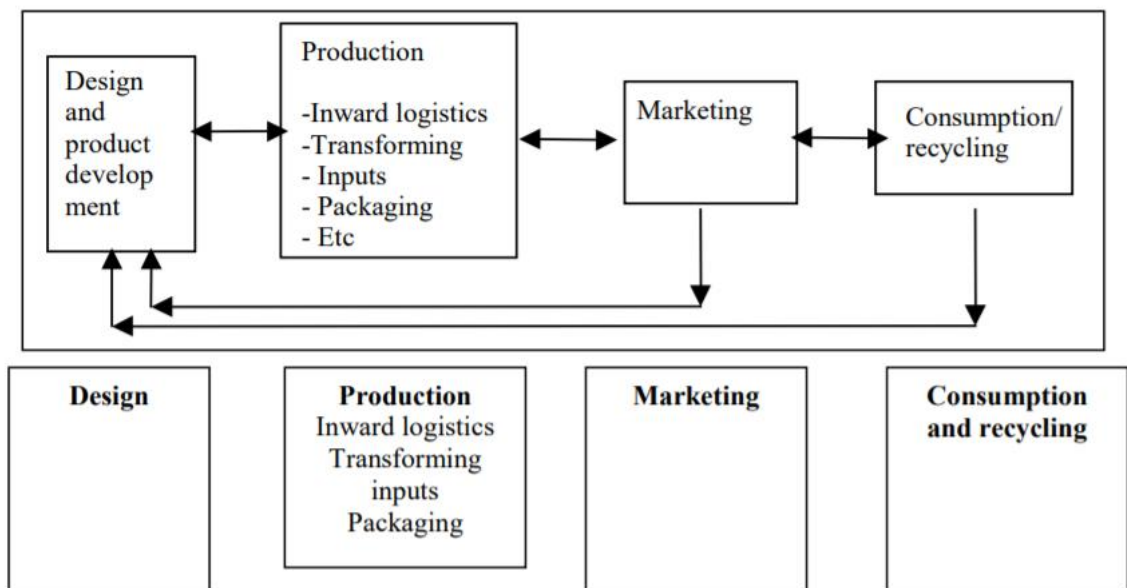
3.1. Overview of value chain analysis

3.1.1. Definition of value chain and value chain analysis

a) Definition of value chain

In „A Handbook for Value Chain Research“ (Kaplinsky & Morris, 2001), a simple value chain has the purpose of bringing a product or service from conception through other different phases of production (involving a combination of physical transformation and the input of various producer services), and describing a full range of required activities performed to deliver to final consumers, as well as after-used final disposal. Figure 1 represents the general form of a simple value chain.

Figure 1: A simple value chain



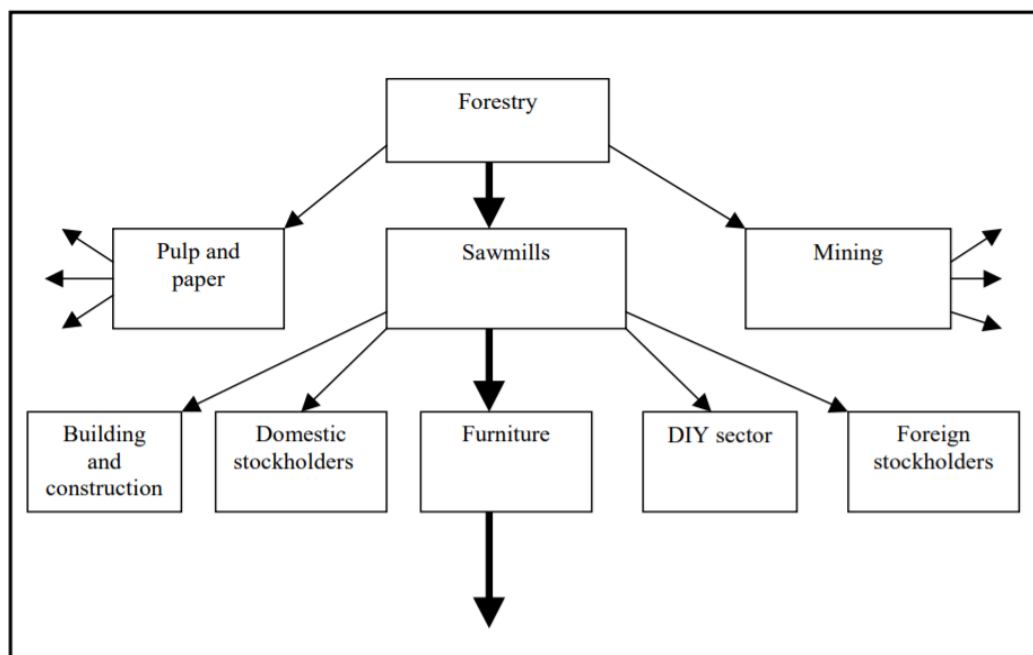
Source: Kaplinsky & Morris (2001)

As we can study from Figure 1, production per se is only a part of value added links. Besides, there are other ranges of different activities within each link of the chain. The graph can be seen as a vertical chain, but the intra-chain linkages are most of a two-way nature – for example, design and product development both influence the nature of production process, and is also influenced by other segments inside the chain.

In addition to the simple value chain, an extended value chain depicts a more complex picture, which could be understood that there are many more links in the latter compared to the former, and is more related to „the real world“.

For one thing, also in the real world, a value chains could also feed into a number of different value chains, depending on the complexity of the whole range or the connection of one value chain to another. Figure 2 represents an instance of a „One or many value chain?“ (a complex value chain).

Figure 2: One or many value chains?



Source: Kaplinsky & Morris (2001)

b) Concepts of value chain analysis

What is value chain analysis?

According to the definition from Moving Forward a Competitiveness „Value chain analysis (VCA) is a method for accounting and presenting the value that is created in a product or service as it is transformed from raw inputs to a final product consumed by end users“. (Subramanian et al., 2007)

For the last decades, the concept of value chain was subject to different objectives and influences.

In the 1960s, the '**filière concept**' (whose meaning in French is literally "thread") was developed at the Centre Internationale en Recherche Agronomique pour le Développement (CIRAD) and the Institut National de la Recherche Agronomique (INRA) as an examining tool for experimental agricultural research. The concept was studied to gain a better understanding of the processes of the economics within agricultural commodities' production and distribution systems (Raikes et al., 2000). The general filiere analysis has been applied to the domestic value chain stopping at national boundaries (Kaplinsky & Morris, 2001)

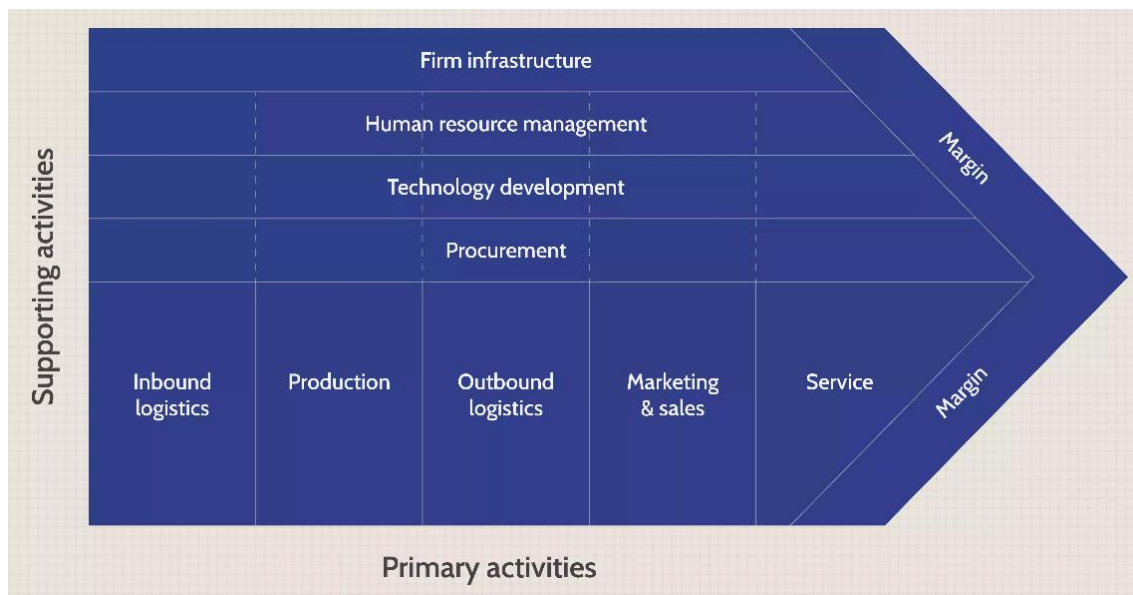
In addition, in the 1970s, the concept of **commodity chains** was developed by (Wallerstein, 1974), where it is used to discuss a diversity of international chains for agricultural (and timber) products in the beginning of the modern era. It aims for the explanation of the dynamic distribution of value chain and its activities in the world's capitalist economy. The crucial orientation is the international division labor in different regions because of the variety of labor-intensities of production and manufacturing exercises within a chain.

From these two concepts, a couple of derivatives have come up. One of the most well knowns are Michael Porter's concept of the value chain in the mid 1980s. There are two other concepts, the global commodity chain from Gereffi Gary in 1994, and Messner's world economic triangle in 2002, which were both joined the concept of the global value chain.

During the 1980s, Porter (1985) developed the concept of the **value chain** in the context of his work on competitive advantages. He built up his concept to inspect particular activities through which specific companies may generate value by determining their activities into links in the chain of value-added. Porter drew the distinction between two essential value-adding exercises of a company: primary activities (inbound logistics, operations, outbound logistics, marketing, and sales) and support activities (strategic planning, human resource management, technology development, and procurement) (Porter, 1985)

Figure 3 illustrates the elements in Porter's value chain with mentioned exercises of a company.

Figure 3: Elements in Porter's value chain



Source: Investopedia (2020)

In the 1990s, Gary Gereffi and Miguel Korzeniewicz (1994) developed the **global commodity chain (GCC)**.

Gereffi set up four key elements (Kaplinsky & Morris, 2001):

- (a) input-output structure
- (b) territorial (international) structure
- (c) institutional framework
- (d) governance structure.

The institutional mechanisms and inter-firm relationships were the main focus that the governance referred to. Attention was paid to the balance of the power embedment in the coordination of global production systems (fragemented yet interlinked). Gereffi drew the conclusion that many chains are made up from some major elements, which decides the overall characteristics of the chain. These elements are responsible for the possibilities upgrading, knowledge transferring, and interaction coordinating within the value chain.

In 2002, the concept of the **world economic triangle** was developed by Messner based on Gereffi's GCC. Messner's concept was based on the theoretical consumption that actors,

governance and regulation systems establish the scope of action in the world commodity chains.

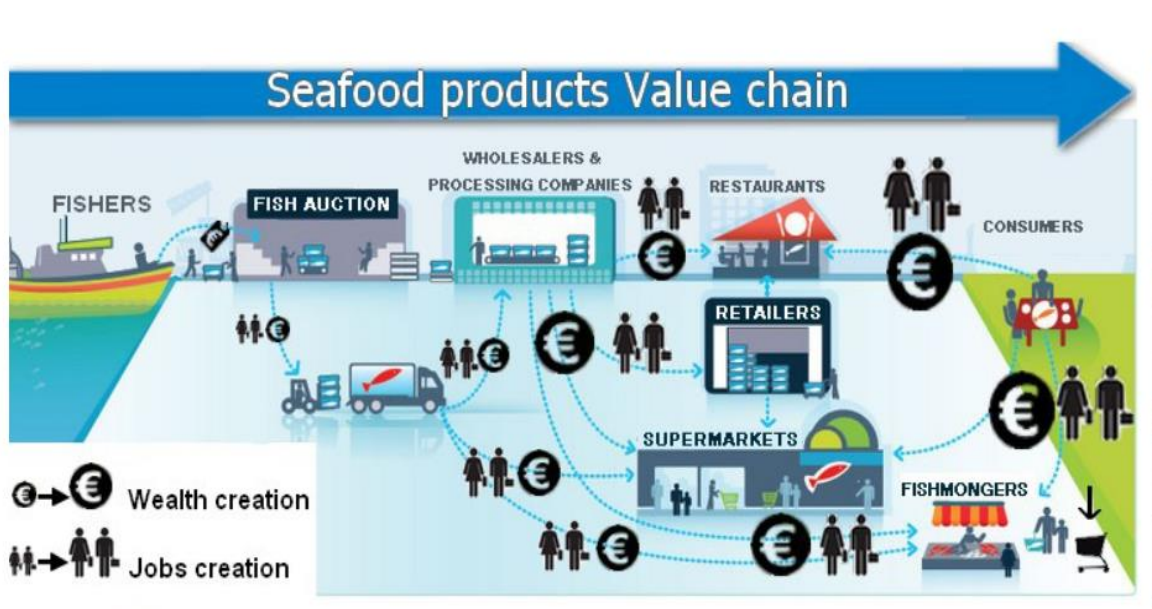
3.1.2. Value chain analysis framework

a) Basic Framework

The value chain analysis (VCA) framework centralizes the three main segments that describe each production link in the value chain: **Source**, **Make**, and **Deliver**. This was adapted from the **Supply Chain Operations Reference (SCOR)**. Figure 4 is an example of an extended value chain of Seafood products. Each of the activities displayed in the diagram can be represented by a cost breakdown. For instance, the seafood industry is a multistage system of production, and from a supply chain perspective, it is linked to other segments such as fish wholesalers, restaurants, retailers... The fish could be branched off to higher value-added ones as frozen fillets, or dishes in restaurants. The length of the chain in practice shall depend on the objectives and scope of the project with the client. (Subramanian et al., 2007)

Figure 4 shows the extended value chain of Seafood products, where each of the link in the chain shall contribute in the creations of weath and jobs for the involved.

Figure 4: The extended value chain of Seafood products



Source: SUCCESS (2020)

- **Source**

To **source** is to process goods and services that are required as inputs in the process of producing a product. There shall be two plans for the product: whether it will become an intermediate input in the following production stage, or it will be the final product and sold to consumers.

- **Make**

The process that transforms raw inputs (materials) into a complete product is to **make**. The complete product would later become an intermediate product that would be further processed (e.g., cement, which is used in infrastructure construction), or a finished product that is ready for consumption/purchases (e.g., apparel, footwear).

VCA shall include the primary factors listed below as its „make phrase“ include monetary value and time activities: (1) Cost and quality of utilities, which includes the telecommunications, power, fuel, water, etc.; (2) Capital charges including returns to capital, depreciation, and interest charges; (3) Administrative overhead, which consists of telecommunications, unofficial charges, other overhead charges... (4) Equipment, including repair and maintenance; (5) Land; (6) Labor

- **Deliver**

The deliver phrase of VCA investigates the trend of finished products/services to either the following production exercise (e.g., paper printed into book) or to the final purchase (e.g., paper block), which consists of the hereunder activities:

- Preparing for outbound shipping
- Inspecting pre-shipment
- Clearing export border
- Handling port and terminal
- Transporting outbound line-haul
- Transiting capital carrying charges
- Storing/Transiting shelf loss
- Wastage, returns, price markdowns

- Emergency shipment

The monetary value and time of the value chain is measured for the quantification of the value chain, and undertaken along the Source-Make-Deliver construct of each production activity. The cost and time is classified to compare varied production activities, and the result of the measured monetary value and time classification will be further analysed and transformed to value added and productivity. The performance gaps from there will be identified, which lead to the firm-level performance, and the established benchmarks will be used to against competitors.

A typical value chain framework will require below key steps:

- Choose the sector(s);
- Study the market;
- Map the value chain;
- Measure the performance and establish benchmark;
- Investigate the performance gaps

3.1.3. The role of value chain analysis

The three main sets of reasons explain the importance of value chain analysis during the current era of globalization are:

- a) The division of labour and the global production components and systemic competitiveness are growing and becoming significantly important*

Value chain analysis plays a key role in understanding the need and scope for systemic competitiveness. Economist Aadam Smith observed that labour division was established depending on the extent of the market. This could be interpreted that small scale markets shall require little specialization – entrepreneurs only need a small number of employees, e.g. one position could handle multi-tasks to make the final product. When the market expanded, the specialization shall be executed by employees since it becomes profitable. This would lead to the effectiveness as employees would have the chance to concentrate and develop their specific skills.

Sometimes it was important to tolerate “inefficiency” at a particular point in the production line to achieve plant-efficiency (Kaplinsky & Morris, 2001). The example of this

could be the objective of the scarcity of inventories: workers should only continue working if they are aware that there are sufficient materials for the next stage of production process; if not, the act of „pushing“ additional work onto the next would only lead to the redundancy of work-in-progress.

Therefore, value chain analysis plays a key role in the systemic competitiveness understanding. The deep acknowledgement in the flow of inputs of goods and services in the production chain will help the firm to determine the exact role of each individual in the making of its success.

b) Production's efficiency is necessary but yet a successful condition for penetrating global market

Value chain analysis is important because it helps understanding the strengths and weaknesses by analysing the whole cycle of production of firms or countries. Next, the force of the VCA shows the reason why the producers are strongly connected to the final markets and how it influences their potential to gain by studying the participating factors of the production link.

c) The best of globalization in global market allowing sustain income growth requires the knowledge about value chain factors

VCA is imperative since it helps to explain the distribution of particularly benefits and income to those participating in the world economy.

Definition of globalization: the pervasive decline in barriers to the global flow of information, ideas, factors, technology and goods.

The key matter is the engagement of the firms, regions or countries while part in the global market. The risk of them failing at it would initiate a „race to the bottom“, reduce their chance to compete in bigger competition and even reduce incomes. VCA offers the key entry into this analysis and the policy implications.

- VCA contributes its value to the competitiveness, and to the raise the sights from individual to interconnected firms
- All the links in the chain and activities are focused on, so they can identify which specific activities would be subject to the increase or decrease of returns

- Policy makers therefore will assist in regulating appropriate policies to protect particular links or upgrade other links
- Even though competitiveness may have been achieved, macro policies and institutional linkages will require different policies to deliver firm-level competitiveness
- Income growth may not be sustained over time, regardless how competitive firm's participation in global markets. Thus, VCA would allow the understanding of the determinants of income distribution
- By participating in the global markets, the VCA would help to determine the gains from globalization. It can also be used to understand the income distribution in large economies

3.2. Overview of fisheries sector

3.2.1. Global fisheries sector historical background

Since the area of the World ocean covers approximately about 70.9% of the surface of the Earth, humankind for long has acknowledged and taken advantage of the marine rich biodiversity. The global fisheries and aquaculture was subsequently developed in order to serve the seafood consumption of human and also for other non-food uses.

Global fish production was estimated to have reached around 179 million tonnes, valued at approximately USD 401 billion USD in 2018, with aquaculture production amounting to nearly 82 million tonnes, valued at 250 billion USD. This has given the sector of fish and seafood to be one of the most traded food commodities (FAO, 2020)

Of the overall total, human consumption accounted for 156 million tonnes, equivalent to an estimated annual 20.5 kg per capita. Fish product and its safe and sustainable production, thus, has become a crucial component to serve the the world's population that was expected to reach 9.7 billion in 2050 because preserving food security has for long been recognized as one of the main challenges in the global fora. (FISHER, 2020)

There are more people than ever rely on the fisheries and aquaculture for both sources of food and income. The sector of fisheries and aquaculture contribute livelihoods, income and employment for particularly people in coastal communities in developing countries. The

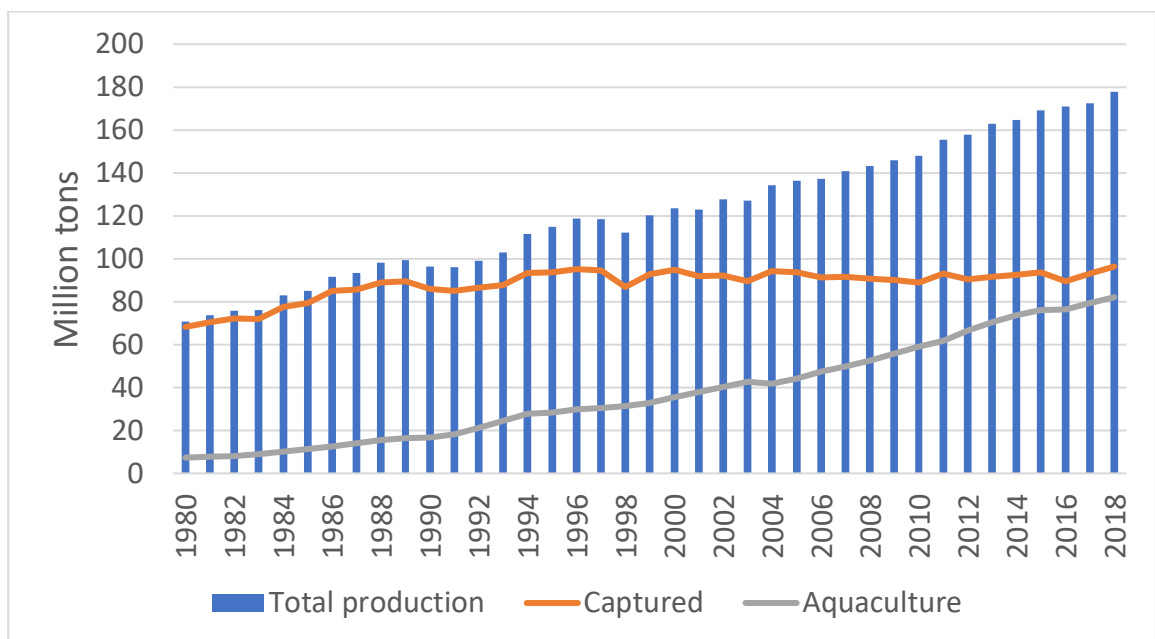
livelihoods of approximately 10-12 percent of the world population was supported by fisheries and aquaculture. The employment in fisheries and aquaculture has grown faster than employments in traditional agriculture.

Hereunder figure 5 is used to represent the global fish production from 2000 to 2018, where both the data of captured and aquaculture were also mentioned to make comparison between their volumes. It could be observed that whilst global fish production grew over time, aquaculture as well has significantly increased, whilst captured fish production has very moderate fluctuation.

From 1980 to 2018, the global fish production volume soared from 70.78 to 177.7 million tons, whilst aquaculture production has skyrocketed from 7,35 million tons to 82.1 million tons. As the long-term trend in the world's capture fisheries has been stable since the late-1980s, with catches relatively fluctuated around 86 and 93 million tonnes per year, the fisheries and aquaculture seems to have taken their leap to differentiate it from more traditional agriculture production.

According to the latest data reported from FAO (2018) was the year the global fishery industry reached the highest level ever recorded at both capture fisheries production and aquaculture production.

Figure 5: Global fish production from 2000 to 2018



Source: FAO (2018) and compiled by author

The total global capture fisheries production was 96.4 million tonnes in 2018, which was mostly driven by marine capture – increase from 81.2 million tonnes in 2017 to 84.4 million tonnes in 2018. The top seven capture fishery producers (Table 1), including Vietnam, accounted for almost 50 percent of the the global capture production, and China, the World’s top capture producer, accounted for 15 percent.

Table 1: Marine capture production: major producing countries and territories

| Countries or territories | Production (million tonnes) | | | | Percentage of total, 2018 |
|---|------------------------------------|-------------|-------------|-------------|--|
| | 2015 | 2016 | 2017 | 2018 | |
| China | 14.39 | 13.78 | 13.19 | 12.68 | 15 |
| Peru | 4.79 | 3.77 | 4.13 | 7.15 | 8 |
| Indonesia | 6.22 | 6.11 | 6.31 | 6.71 | 8 |
| Russian Federation | 4.17 | 4.47 | 4.59 | 4.84 | 6 |
| The USA | 5.02 | 4.88 | 5.02 | 4.72 | 6 |
| India | 3.5 | 3.71 | 3.94 | 3.62 | 4 |
| Vietnam | 2.71 | 2.93 | 3.15 | 3.19 | 4 |

Source: FAO (2020) and complied by author

Whilst China remains the world’s top producer of capture fish production, its still experienced decline from 13.8 to 12.7 million tonnes between 2015 and 2018. This was the partial result of the Thirteenth Five-Year plan of China (2016-2020), which aimed to provide policy protecting the marine ecosystems and restoring capture fishery within the exclusive economic zone of China, and this catch reduction is expected to result in further decreases in upcoming years.

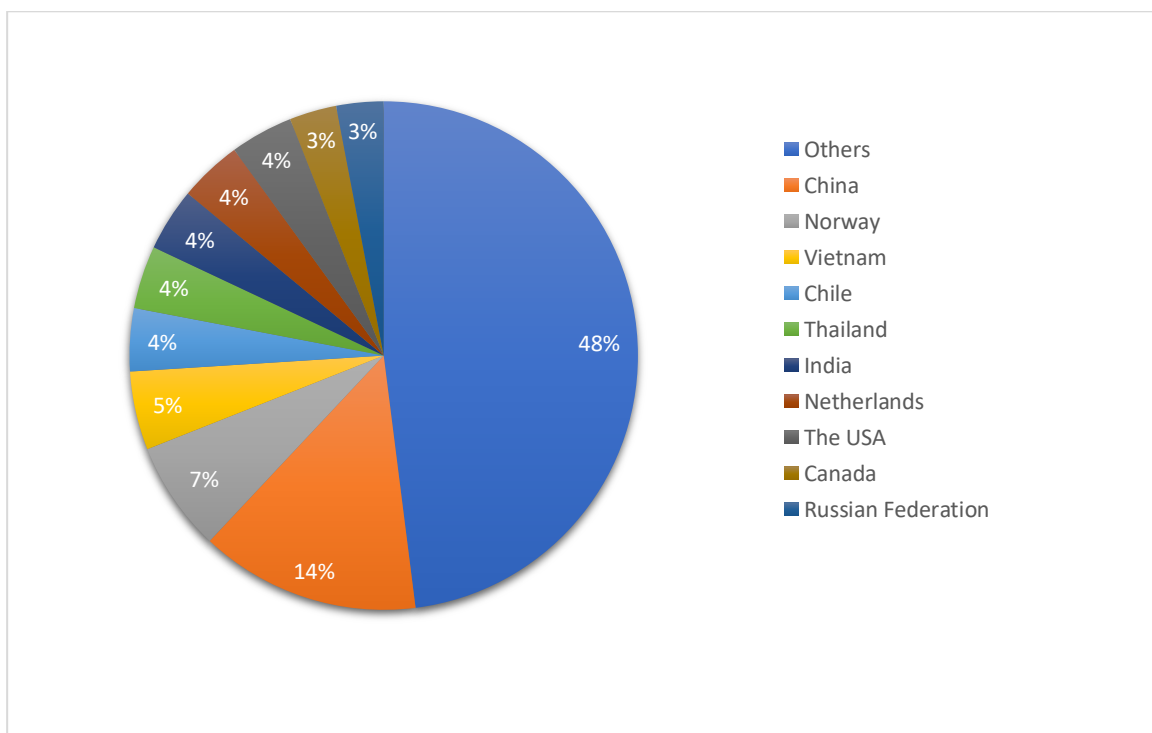
In some countries, inland water captures are more focused than marine captures, and Brazil, Thailand and Vietnam in particular, were those whose national or regional diets take inland water captures as locally important food sources. In 2018, there were 16 countries produced approximately 80 percent of total inland captures, while there were 25 countries took part in marine capture. Asia has consistently contributed two-thirds of global inland

water production since the mid-2000s, followed by Africa with 25 percent, and Europe and the USA accounted for 9 percent.

Based on the data of major groups of fish species, it could be seen that the world aquaculture production has surpassed capture fisheries production. The motto „farming more than catch“ has created relevant milestones for different groups of fish species (diadromous fishes, crustaceans, aquatic algae, freshwater fishes, molluscs,) from 1970 to 2014. However, even though the output from global aquaculture is increasing, farming of marine fishes would not be likely to overtake marine capture production in the future.

Figure 6 illustrates the World's top exporters of fish products in term of value. From observation, China is the world's largest fish and fish products exporter, which accounts for 14 percent of the total value.. That of Norway is 7 percent, and Vietnam is the third in place with 5 percent.

Figure 6: Top exporters of fish and fish products in term of value



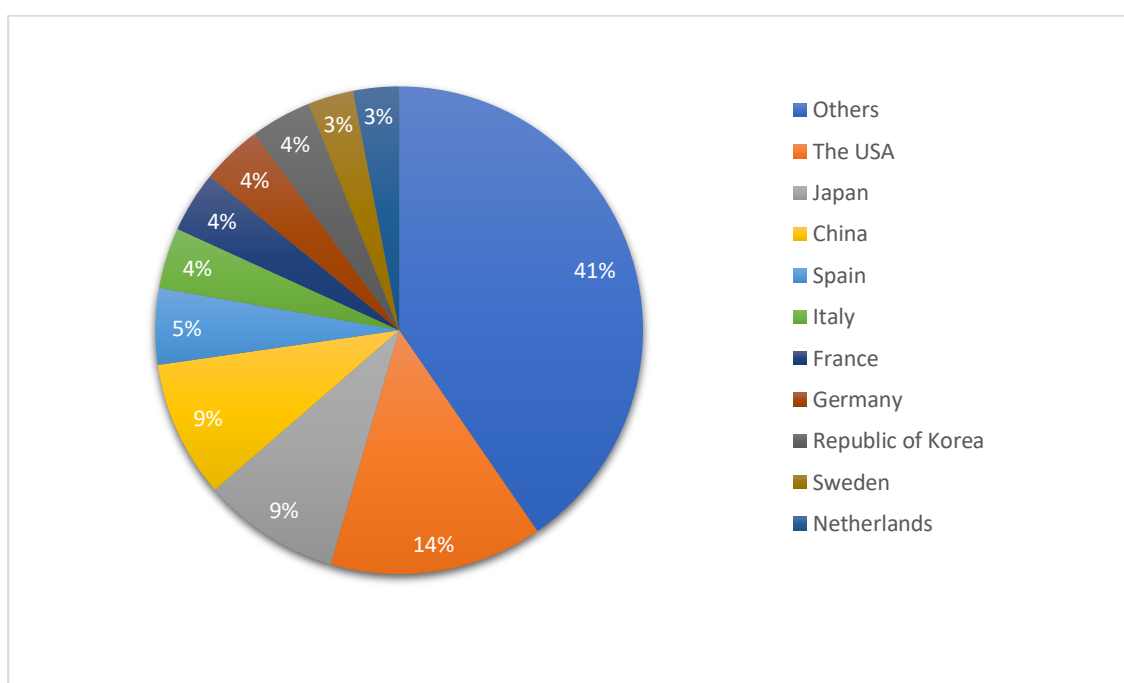
Source: FAO (2020) and complied by author

Inland aquaculture produces aquatic animal in freshwater mainly, that is why it is called fresh aquaculture in most countries. Besides, there are various farming systems with different methods, practices, facilities and integration, still fish culture remains an important traditional area and is expanding rapidly, specially in Asia. In recent years, inland aquaculture

farming systems has been significantly advanced and improved, which resulted in not only higher productivity and more efficient resource-use, but also reduced environment impacts. In inland aquaculture, the dominance of finfish reduced gradually during 2000 and 2018, reflecting the growth of other species groups as crustacean, including shrimps, crayfish and crabs.

Figure 7 represents the World's top importers of fish products in term of value. The USA is the world's largest importers fish and fish products with 14 percent of the total value, which is understandable since they are in the third place of the world population. The second runner up is Japan and China with 9 percent, followed by Spain with 5 percent.

Figure 7: Top importers of fish and fish products in term of value



Source: FAO (2020) and compiled by author

67 million tons of fish were traded internationally in 2018, equating to approximately 38% of globally caught and farmed fish. From 1976 to 2018, the annual increase rate value of global export of fish was 8 percent and 4 percent in nominal term and in real term respectively. The Covid-19 pandemic has strongly and negatively impacted the export and import between countries in 2020. China, being both the major fish exporter and importer of the world since 2002, still stands their ground in 2018. Also since 2002, Norway and Vietnam have been the second and third major exporter of fish. It could be clear that developed markets

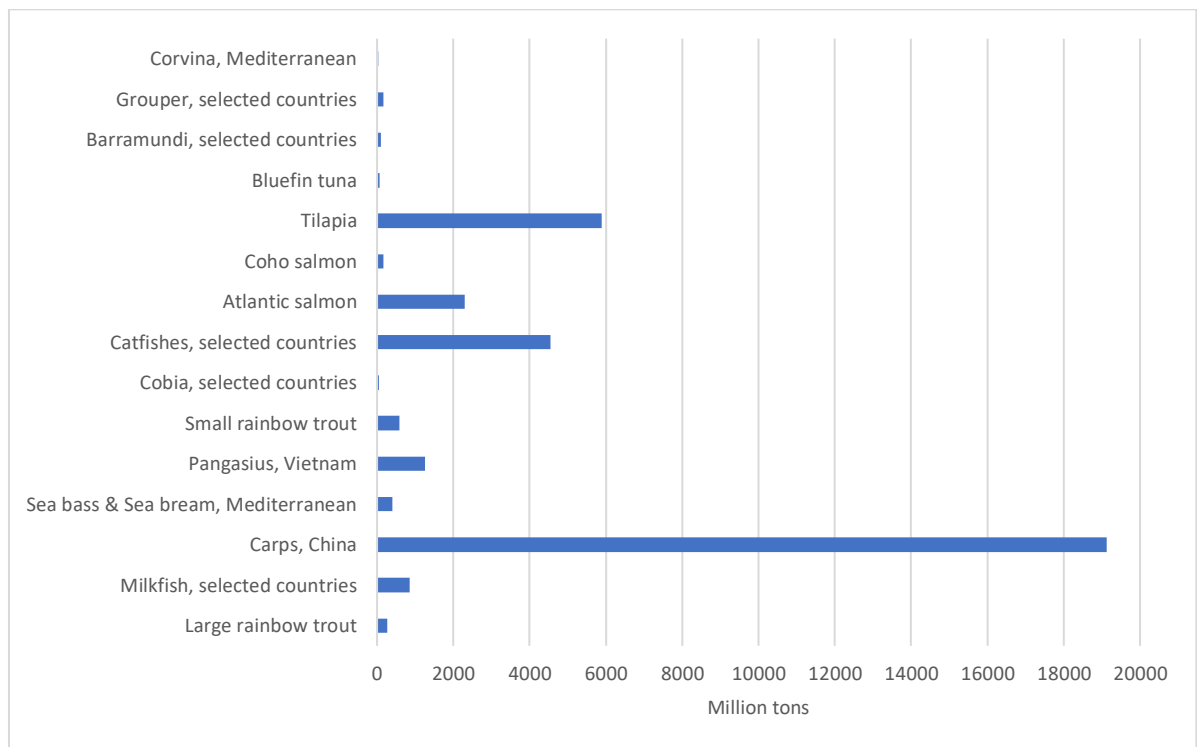
still have dominance over others, such as the European Union (the EU), the USA or Japan. However, the importance of developing countries being both consumers and producers of fish and fish products has been steadily growing. In 2018, 31 percent of fish import by value and 49 percent by quantity was from developing countries.

3.2.2. Global finfish production background

Regarding key finfish species given in the given chart, there are some individual species and trends shall be analysed, e.g. the top five of World's finfish in production as Carps (China), Tilapia, Catfishes, Atlantic salmon and Pangasius (Vietnam):

- Tilapia – the most diversified fish species, continues to grow in production. In the first half of 2019, its representative price (US import price) was 3.80\$ per kg. The price was around 5\$ perkg in 2008, and fluctuated in a downward trend since 2014. China has been the leading tilapia producer, and Egypt and Indonesia were the runner-ups.

Figure 8: 15 major species and regions in finfish production



Source: Global Aquaculture Alliance (2019) and complied by author

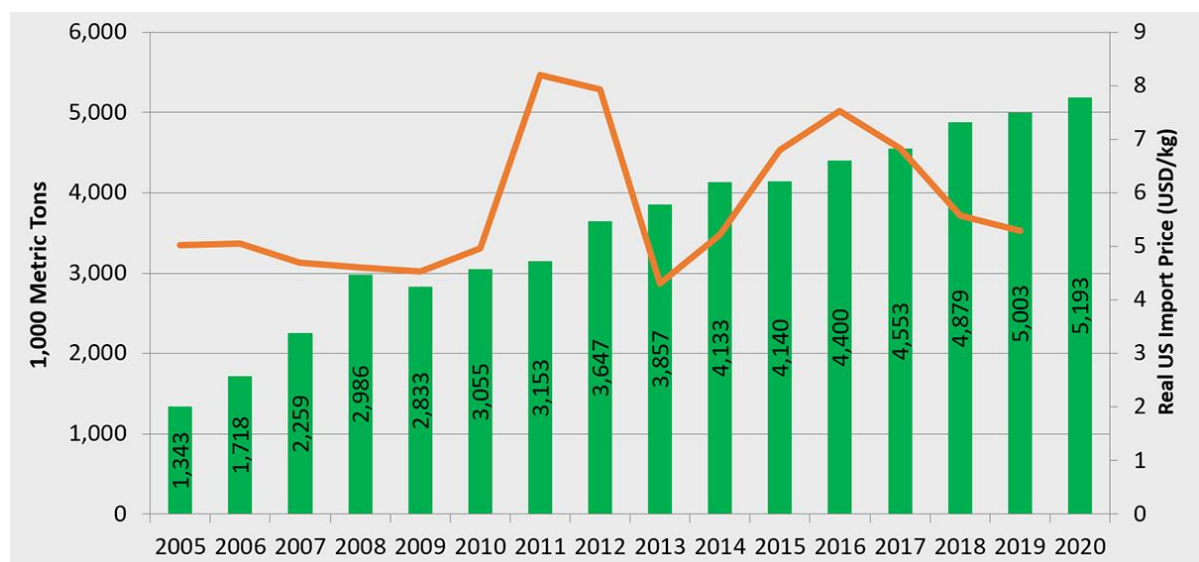
- Carps are mainly produced in China and for domestic markets. China was as well the dominant carp producer, and India also produces significant amount of carp species.

- The main producer of Atlantic salmon is Norway, and Chile was the second-largest producer. Prices of salmon in the US was 11.9\$ per kg and around 7.3\$ per kg in the EU market. (Tveteras et al., 2019)
- The total production of catfish species (including pangasius) of largest producers of catfish (China, Vietnam, Indonesia, Bangladesh and India) reached 5 million tonnes in 2018, and is expected to increase by 4 percent in 2020. Vietnam's pangasius was estimated to increase by 3 percent in 2019, and another 3 percent in 2020

Among the whole species of finfish and regions, the top 15 of major species and regions of finfish production will be introduced in Figure 7.

Figure 8 shows the total production of catfish species in million metric tons from 2005 to 2020, including the US import price in USD per kg

Figure 9: Total production of catfish species from 2005 to 2020



Sources: Kontali, et al.

Pangasius is a type of catfish species with low to medium fat content and high level of protein, which is native to fresh water in South and Southeast Asia. So far, Vietnam is the World's largest pangasius producer and exporter. As mentioned in the above statistics, it is undeniable that pangasius aquaculture has for long been the strong contribution of export products income of Vietnam. The analysis of Vietnam pangasius production and the value chain of pangasius are in the next section of the thesis.

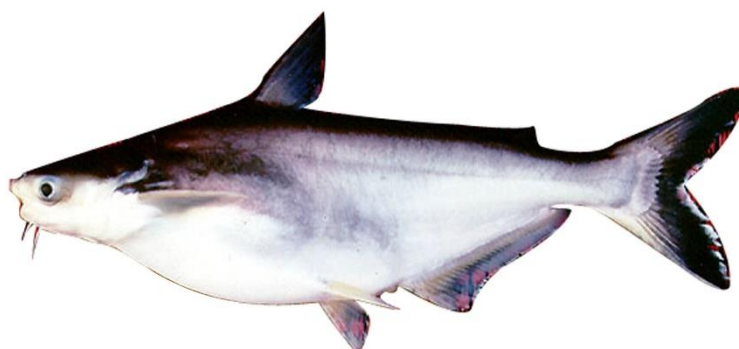
3.3. Overview of Vietnam pangasius production aquaculture

Table 2: Types of pangasiu related to the research

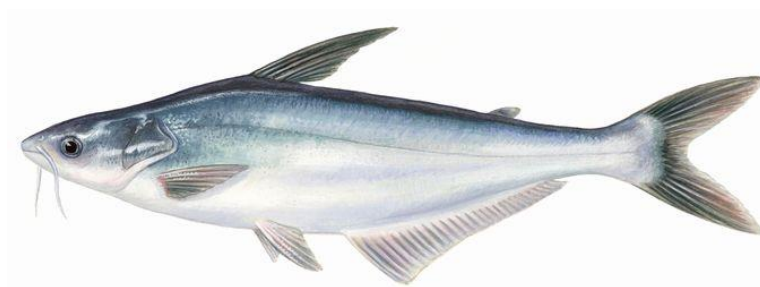
| Scientific Name | English name | Vietnamese name |
|-------------------------|----------------|-----------------|
| Pangasius bocourti | Basa Pangasius | Ca Ba sa |
| Pangasius hypophthalmus | Tra Pangasius | Ca Tra |

Source: Khoi (2007) and complied by author

Figure 10: Pangasius bocourti and Pangasius hypophthalmus



Pangasius bocourti - Basa Pangasius

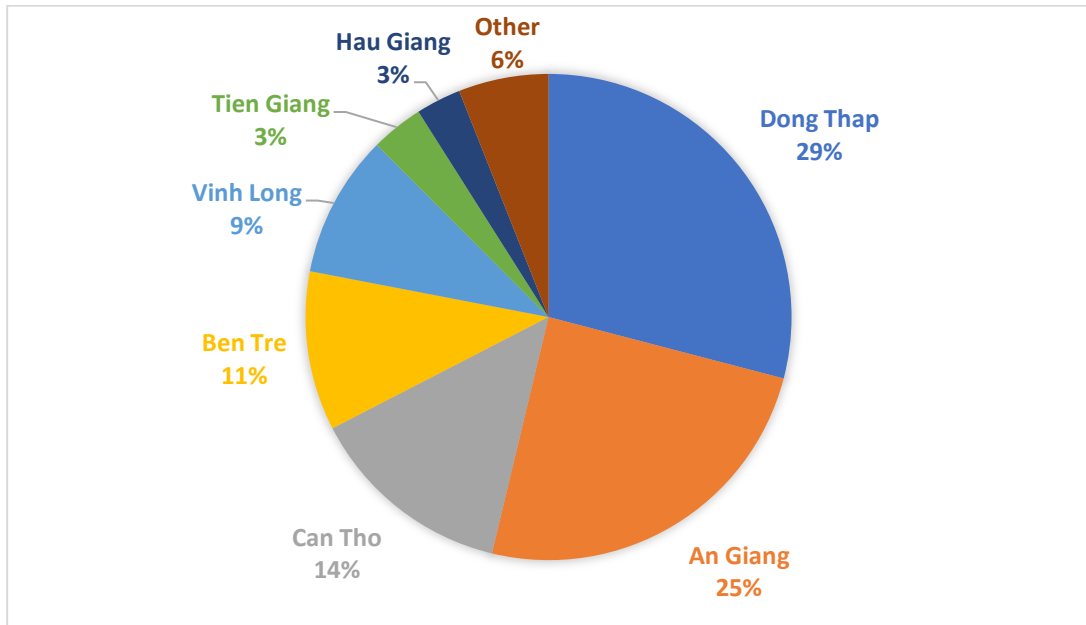


Pangasius hypophthalmus - Tra Pangasius

Source: The WWF Seafood guide, 2010

Figure 11 gives information and statistics of main areas that specialized in farming pangasius in the Vietnam.

Figure 11: Main regions of Pangasius farming in Vietnam

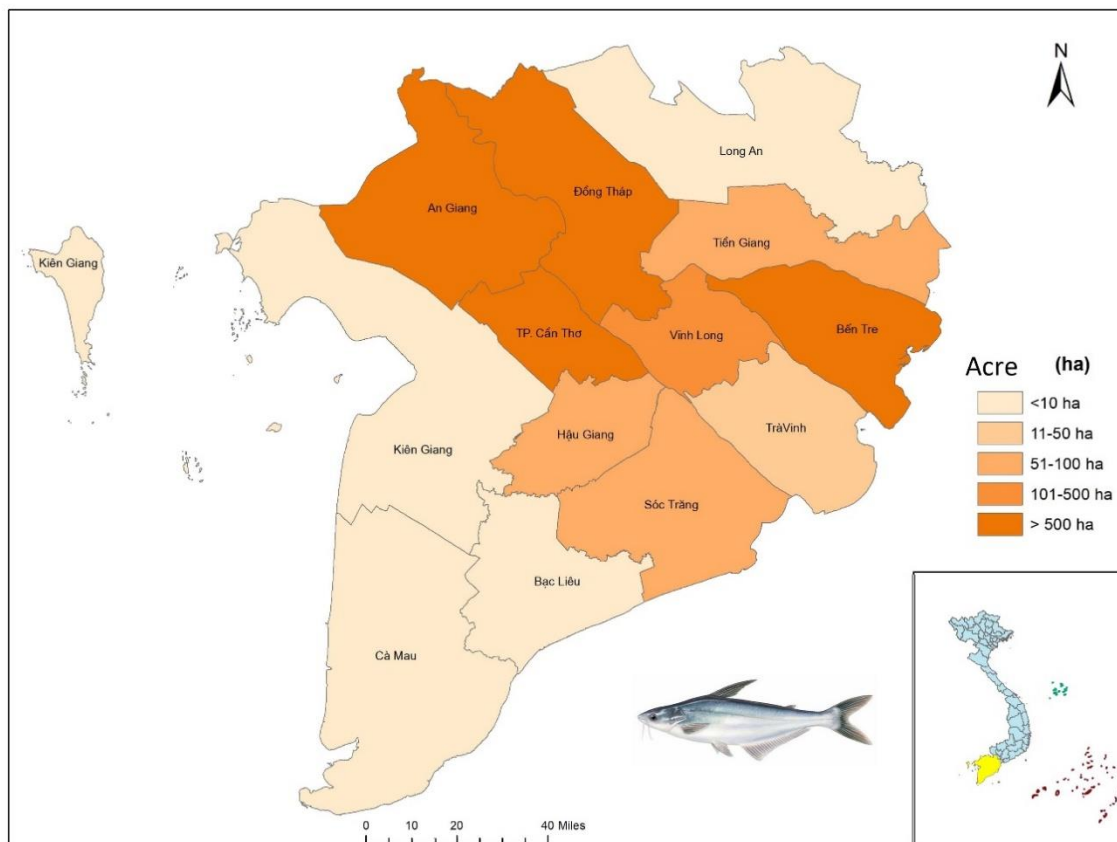


Source: VASEP (2019) and compiled by author

The Mekong River Delta (MRD) of Vietnam is the prime hub for pangasius aquaculture due to its great supply of water. Aquaculture area of the MRD accounts for 70.6% of the country's aquaculture area, and the two main aquaculture species in MRD are pangasius and shrimp. Pangasius farming areas are centralized in provinces such as Dong Thap, An Giang, Can Tho, Ben Tre, Vinh Long, Tien Giang, Hau Giang, Soc Trang, Tra Vinh, Kien Giang and two provinces (Tay Ninh and Quang Nam), with a total cultivated area of 6600 ha in 2019.(Thuan & Danh, 2014)

Dong Thap, An Giang, Can Tho, Ben Tre accounts for more than 75% of the whole country's total pangasius production volume. The fish and fish products are manufactured in compliance with strict international quality management and food safety standards such as Global G.A.P ASC and BAP. In 2019, Vietnam exported pangasius to 131 markets, whose the top 8 main markets are China - Hong Kong, USA, EU, ASEAN, Mexico, Brazil, Colombia and Japan. The export value reached 1.77 billion USD in 2017, accounted for 80.4% of country export value. There are about 100 manufacturing factories of pangasius in Vietnam, located mainly in the MRD. Most factories are equipped with advanced technologies, allowing the automation of most stages of the production line. Figure 10 represents the major pangasius farming areas in the MRD in 2019, where the coastlines and great supply of water have contributed galore to the volume of pangasius harvest.

Figure 12: The farming areas of pangasius in the MRD in first quarter of 2019



Source: infodata.vn (2019)

Table 3: Pangasius acres and yields in the MRD in first quarter of 2019

| | Acre (Ha) | Yield (Tonnes) |
|------------|------------------|-----------------------|
| Viet Nam | 3934 | 644,623 |
| Tien Giang | 61 | 14,580 |
| Ben Tre | 600 | 88,000 |
| Tra Vinh | 20 | 4,171 |
| Vinh Long | 454 | 42,545 |
| Dong Thap | 1,171 | 204,900 |
| An Giang | 883 | 175,430 |
| Can Tho | 593 | 87,900 |
| Hau Giang | 95 | 21,280 |
| Soc Trang | 57 | 5,817 |

Source: infodata.vn (2019) and complied by author

It is undeniable that this aquaculture commodity plays an important role in the economic development of many localities in MRD. The reason is the high demand of the world market as Vietnam pangasius fillet has built a prestigious brand image in international markets. The Government and the Ministry of Agriculture and Rural Development (MARD) is acting on the strategies to improve the situation of Vietnam pangasius aquaculture, particularly from well-known challenges as climate changes, natural aquatic resources, to more recent ones as international anti-dumping tariffs from the US, or the catfish inspection program.

Figure 13: Pangasius fillets



Source: Alan's Market, 2010

In the value chain of Vietnam pangasius, fish farmers would be the most vulnerable link. Therefore, the VCA of pangasius production would be used to evaluate the levels of difficulties fish farmers are facing, so relevant strategies and policies shall be drawn accordingly to shape a stabler development for the sector. Additionally, the results shall also inform fish farmers and enterprises to find out appropriate business decisions.

3.3.1. Strengths and weaknesses of Vietnam pangasius

a) Strengths

- Vietnam has a **very long coastline** and its Southwest area has a generous supply of freshwater from the Mekong River. Thanks to the natural geographic advantage, the MRD and its several inter connecting canals and smaller rivers have primarily contributed to the development of Pangasius aquaculture for almost 50 years.

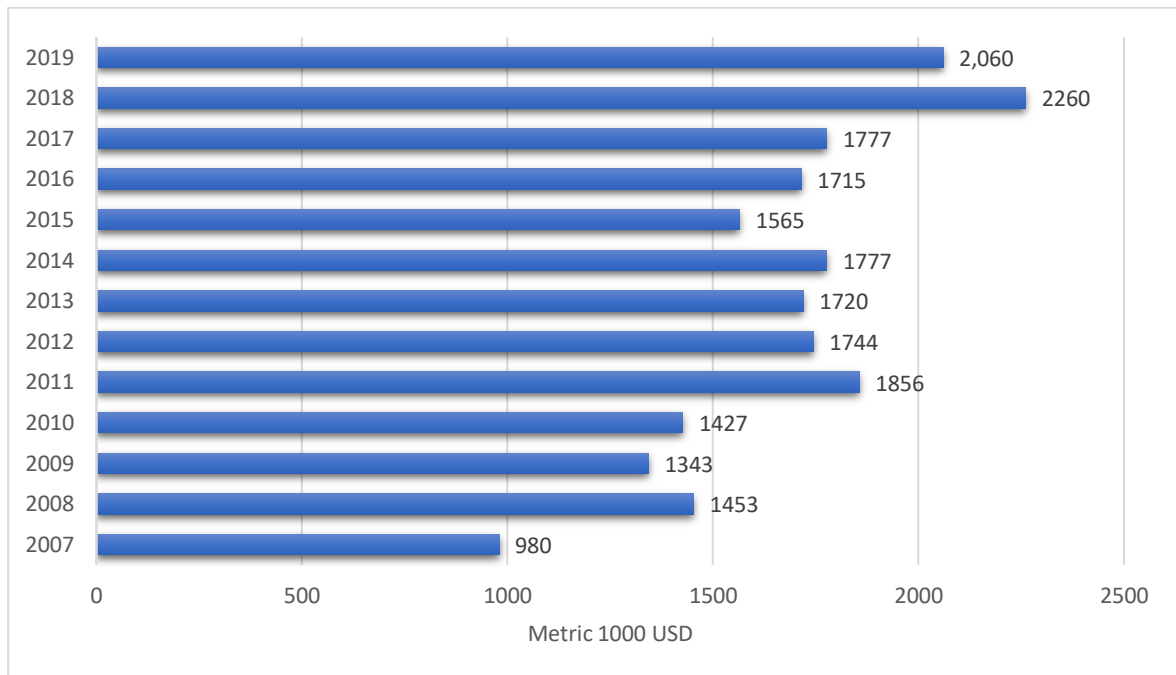
- The **advanced technologies** applied in the field of pangasius production have reduced both processing time and labour cost, which results in the decline in the cost of the whole progress.
- The Vietnamese government has brought out the **sustainable plan** for growing high-quality fish and also minimizing the environmental impact due to Pangasius farming activities. Various standards such as ASC, GLOBALG.A.P., VietGAP, BAP etc. were also implied by the government in order to gain consumer trust and confidence in the export market. As a result, certified hatcheries, farming practices and processes also proposed great contribution to the growth of the Vietnam Pangasius industry.
- Moreover, the **increasing demand** from China, United States and Europe, along with the expansion of product capacities, the initiation of production sustainability are driving the growth of the markets of seafoods and pangasius

(Vietnam Pangasius Market Strengths, Weaknesses & Opportunities During the Forecast Period, 2019-2025, 2020)

- Pangasius farmers are to receive the support from the national Departments and Associations in the transfer of science and technology. As fish farmers are well-informed and trained to gain experience in fish farming, the farming process is also mechanized and proactively controlled to maintain the quality of pangasius supply
- Planned by MARD, the National Aquaculture Development Plan in 2020 creates opportunities for processing companies to develop value-added products, exploit new markets, increase output and be able to invest, improve processes and advance machinery (Thuan & Danh, 2014)

Figure 13 illustrates the value of pangasius export from 2007 to 2017. From 2011 to 2017, the fluctuation of value was around 1.5 – 1.7 million USD, but it peaked in 2018 with all-time-high at 2.26 million USD.

Figure 14: Vietnam pangasius export value from 2007 to 2019



Source: VASEP (2019) and compiled by author

b) Weaknesses

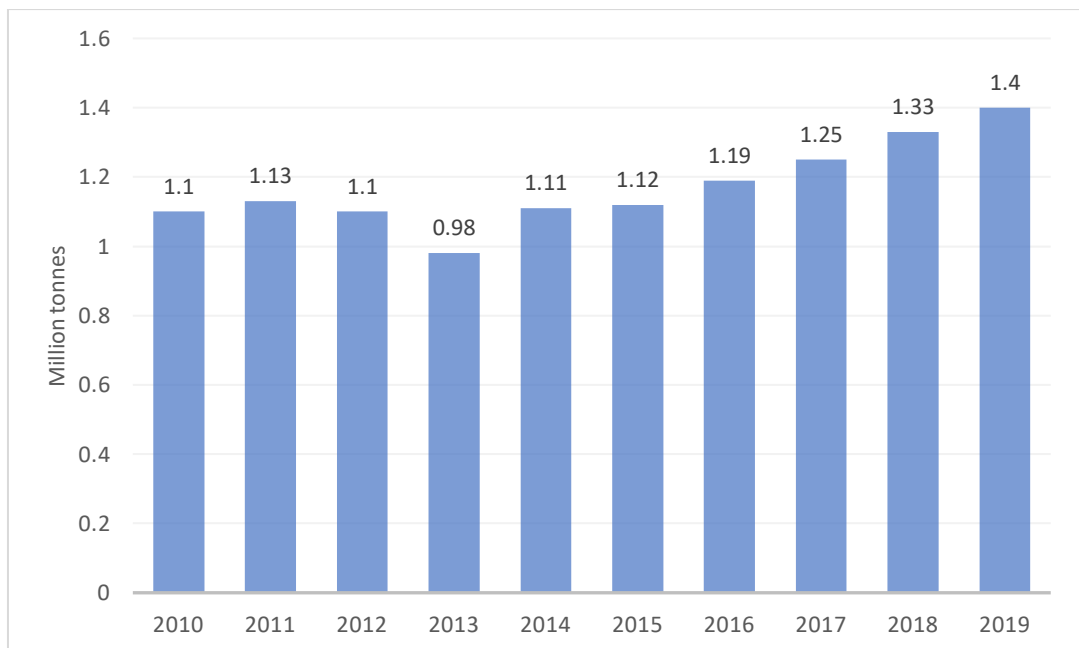
- Pangasius industry is a **profitable yet risky** sector as pangasius farmers have to bear the significant fluctuation of input and output prices, especially for small, household-sized enterprises. (Thuan & Danh, 2014)
- Vietnam and 26 other countries are entitled as **vulnerable to climate change**, and its consequences such as global warming or sea level rise would negatively affect their fishing and aquaculture sectors. Recently, great losses to fish farming that are ready for harvesting were greatly caused by heavy rains and floodings. (“Export Guide: Vietnam,” 2018)
- The **lacks** of extension channel of **marketing and services**
- The **awareness of farmers** and processors regarding to hygienic standards, high-quality tools and chemical monitoring was **low and inadequate**. Particularly, high high levels of toxic residues (i.e. antibiotic, heavy metal contents...) and the exceeding of maximum residue levels of Chlorine were common problems. (Son & Trung, 2019)
- As mentioned, the **input and out prices** of pangasius have large volatility, consider unstable, therefore the material supply is as well unstable. Fish farmers could not control the quality of inputs and the farming process is not fully complied with certain

quality standards. For this, the products of pangasius processing company is low in price competence.

- The **production entities** are **small and fragmented**; the market information system is insufficient
- **Farming density** is too thick (50 – 70 fish/m²) leading to the increase in production costs

Figure 12 has given information about the pangasius production volume from 2010 to 2019. It could be understood that in 2019, the production volume was higher than that of 2018 thanks to the success of outstanding export outcome of 2018, but since the demands from the US, the second biggest market of Vietnam decreased, it also dragged down the export value of Vietnam.

Figure 15: Vietnam pangasius production volume from 2010 to 2019



Source: groundfishforum.com (2019) and compiled by author

Table 3 below introduces the name of policies, both from national and international sources, and projects regarding to pangasius and aquaculture of Vietnam with the aim of improve and develop the agriculture and aquaculture of Vietnam in upcoming years.

Table 4: The available policies and projects regarding to pangasius and aquaculture of Vietnam

| Aim of the policy/project | Name of the policy/project | Effective date | Description |
|--|---|----------------|--|
| Effective export of agriculture products to EU | The EU-Vietnam Free Trade Agreement (EVFTA) | 2020 | <p>With EVFTA, Vietnamese goods, including agricultural products, are expected to enter EU market quickly and effectively. Effective From August 1, 2020, EVFTA has considered Vietnam agricultural exports as the sector that shall leverage on great and favourable conditions of preferential tariffs. This would especially apply to agricultural products that are the strengths and carry competitive advantages of Vietnam, such as seafood, vegetables and fruits, rice, coffee, pepper and wooden products.</p> <p>However, advantages such as tariff reduction, or non-restriction on agricultural products in terms of commodities and turnover shall be greeted with a strategic preparation instead of celebration, as there would be more technical barriers than before from the import market. The EU is one of the most selective markets in the world with world standards requirements, and simultaneously, is also a leading market in combating illegal natural resources</p> |

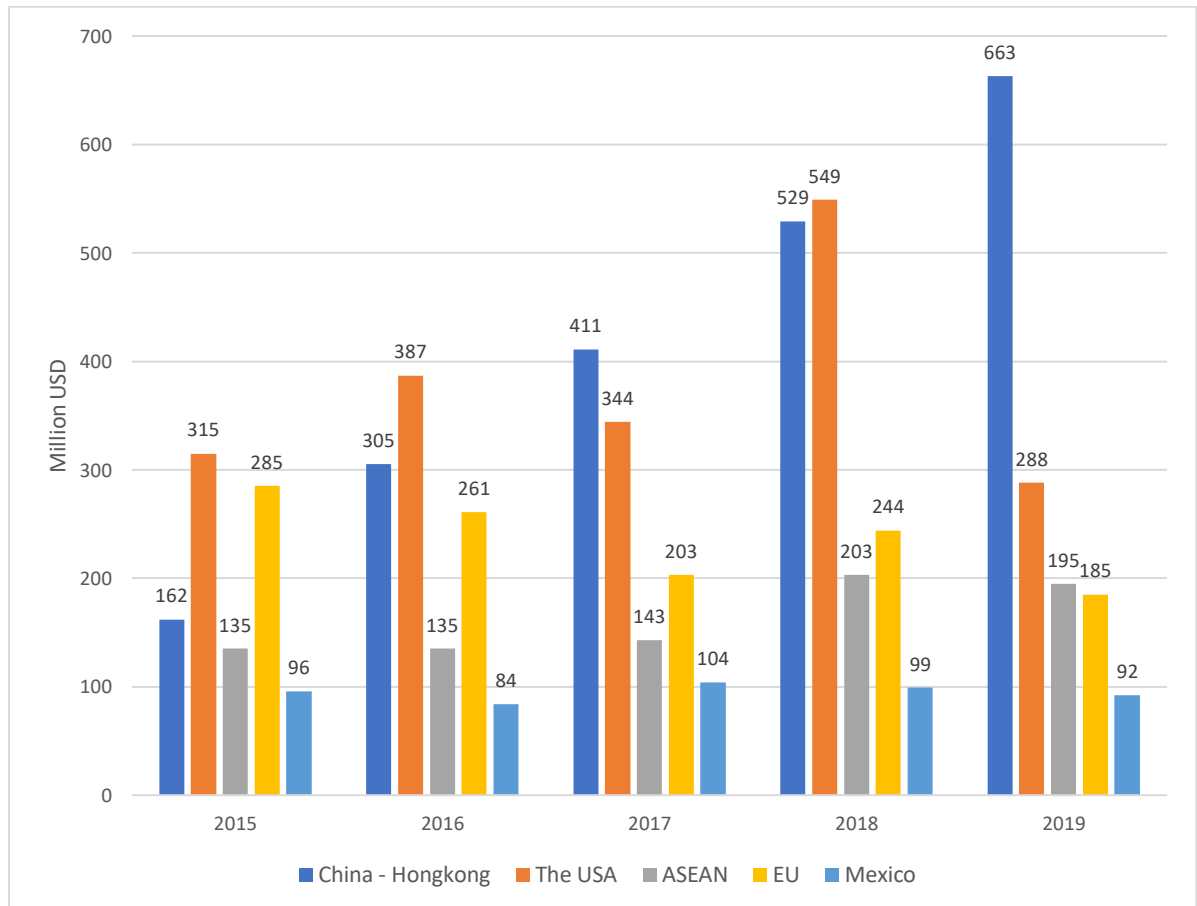
| | | | |
|--|---|-------------|--|
| | | | exploitation and enhancing high-quality original goods. (<i>Vietnamese Agricultural Products En Route on EVFTA “Highway,”</i> 2020) |
| Organic agriculture products enhancement | Organic Agriculture Development Project | 2020 - 2030 | The Organic Agriculture Development Project for 2020-2030 was signed by Vietnam Deputy Prime Minister, in hopes of seizing the perks of organic agriculture production. As the government plans to convert lands to organic production ones, organic aquaculture’s is hoped to account for 0.5 – 1.5 percent of the total aquaculture areas by 2030. Organic products will also be improved with the efficiency of organic production across all sectors, and organic cultivation is expected to result in product value per one hectare 1.3 – 1.5 times higher than that of non-organic production. (<i>Vietnam to Ramp up Organic Aquaculture Production before 2025,</i> 2020) |
| Technical standard for aquaculture | Circular No. 16/2015/TT-BNNPTNT | 2015 | The MARD has issued Circular No. 16/2015/TT-BNNPTNT, which regulated the national technical standards on aquaculture conditions. (<i>National Regulation on Aquaculture Conditions in Vietnam,</i> 2015) |

3.3.2. Challenges of Vietnam pangasius aquaculture

a) Anti-dumping tariff from the US

US market has applied the anti-dumping tariffs that to Vietnamese pangasius export since 2003, and the applied tariffs rates shall be reviewed annually by the Department of Commerce (DOC) of the US. On April 20, 2020, upon the 15th period of review (POR 15), the DOC issued the final duty imposed on enterprises that took the questionnaire and partnered DoC, which was 0.15\$ per kg (equivalent to 3.8 percent of the exporting price). Those that were not partnered DoC were imposed 2.38\$ per kg, and most big Vietnamese pangasius exporters benefited the duty of 0%. (Phuong, 2020)

Figure 16: Top export countries/territories of Vietnam’s pangasius from 2015 to 2019



Source: VASEP (2019) and compiled by author

The DOC has aimed to encourage the partnerships with Vietnamese enterprises by reducing the tariffs for those that have been their partners. However, the tariff was believed to be „improbably high“, and would create barriers for Vietnamese enterprises to enter this

market. To clarify, as the imposed tariff of 2.38\$ to non-partnered enterprises, it proportionated 60% on the US market price per kg of pangasius. High tariffs and the POR review periods had as well slowed down the export value to the US market by 22% in 2019, comparing to term-end of 2018.

The challenge from the US market upon the anti-dumping tariffs was believed to be resolved if the tariffs were imposed at 0% for all current enterprises. (Anh, 2019)

b) USDA Catfish Inspection Program

The Agricultural Act 2014, concretized by the USDA's catfish inspection program issued in March 2016, stated that in order to continue exporting catfish (mainly pangasius) to the US, Vietnam must build and organize a food safety control system equivalent to the US in three groups of criteria:

- the legal system in quality control, food safety;
- law enforcement capacity of the authorities;
- the assurance of hygiene and food safety in the whole process of fingerlings producing, farming, transporting, preliminary processing, processing, and exporting pangasius to the US.

NAFIQAD shall request businesses to review and improve food safety and hygiene conditions, take part in quality management programs and records in the entire process of production, transportation, and records. processing and processing catfish for US market export.

Enterprises shall actively assign staffs to coordinate with the local aquaculture management agency to review the conditions to ensure food hygiene and safety, and the legal documents of fish farms that serve the supply of processing factories. (Ky, 2020)

c) The impacts of the Covid-19 pandemic on the drops of demands on pangasius products

According to Vietnam Pangasius Association, in 2019, the country's pangasius export turnover reached more than 2 billion USD, down by 11.4% comparing to the last term-end. The farming areas in the MRD increased, but the export market experienced downhill tendency, which led to the decrease in the country's turnover value.

From the beginning of 2020, pangasius exports have faced a new challenge when the Covid-19 epidemic broke out and spread rapidly in many countries around the world. As Asia, Europe, America, big export markets of Vietnam, were all negatively impacted by the global pandemic... the Vietnamese pangasius industry subsequently went through a lot of pressure. In the first three months of 2019, the total pangasius export value only reached 334 million USD, down 29.3% over the same period in the previous year.

For the past year, Covid-19 outbreak has caused many difficulties for Pangasius processing and exporting enterprises, since almost all trading activities of businesses have been delayed. In the difficult situation of the epidemic, businesses have to spend a lot of money to maintain their operation. For example, for household-sized businesses raising fingerlings, the price of fingerlings fluctuated between 1.8USD and 2.7USD per kg in the past, now it is only 0.8USD per kg. The longer the pandemic lasts, the heavier the losses will enterprises will have to endure.

Recently, the Vietnam Government has been rescheduling, debt freezing, debt restructuring, corporate income tax collecting... towards pangasius farmers. These solutions have created favorable and timely conditions and supported businesses consolidate and develop in the coming period. (Ly, 2020)

d) Smearing media in the EU

In Romania in 2018, many online newspapers published false information about Vietnam's pangasius industry. In 2017, Vietnamese pangasius was also attacked with inaccurate information in a TV program in Spain... VASEP has repeatedly requested information correction, as well as the provision of clear and accurate information about the processing and exporting situation of Vietnamese pangasius to European countries.

e) Farmbill barrier

After the transition period of the Catfish Inspection Program ended, since August 2, 2017, FSIS has conducted a food safety inspection and packaging all pangasius exports to the US at the I-house. On February 23, 2018, USDA announced that Vietnam had completed and achieved compliance in terms of records under the US Catfish Inspection Act. After the acceptance in terms of records, FSIS conducts a field inspection (an important and decisive

step to determine compliance) to determine which businesses are eligible to continue exporting pangasius to the US.

In coherence with its efforts to gain equivalent recognition, Vietnam has now filed a complaint against the catfish inspection program and requested consultations from the WTO.

f) Growing numbers of other pangasius producers and exporters

Vietnam holds the dominant position in Pangasius export market for many years. However, new and strong competitors are entering the market every year: India has achieved production of 650 thousand tons of pangasius per year, and Bangladesh has produced 450 thousand tons/year. Moreover, China is reported to have successfully applied new technologies to raise and grow pangasius.

For the time being, new competitors yet to be able to dominate the pangasius export market. However, in the long term, the impact is inevitable, especially once China invests in farming pangasius in Hainan with moder aquaculture technology. In order to maintain its position and compete huge competitive pressure, Vietnam is to change drastically its pangasius exportation in the near future, and focus on quality instead of quantity.

g) Vietnam' big import markets of pangasius are shrinking in importing power

As of March 2019, there are 20 pangasius processing factories in China with a production capacity of about 30,000 tons / year. This shows that China can become a major rival of Vietnam in the pangasius industry in the near future. (VNS, 2019).

Nonetheless, it is a fact that in accordance to VASEP's 2020 report, Vietnam' big import markets of pangasius are shrinking in importing power:

- The total export value of pangasius to China-Hong Kong market was down by 20.6 percent compared to the same period of 2019. Although the value decreased, but the proportion of exports to this market accounted for 34.4 percent of the total export value of pangasius to other markets.
- The US is also one of the key markets for Vietnamese pangasius. Also in 2020, pangasius export value to this market decreased slightly by 4.8 percent compared to the same period in 2019. This year is the year when both the US economy and politics are much volatile, so the seafood supply sources for this market were not expected to have a sudden growth.

- In ASEAN, although they were not severely affected by the Covid-19 epidemic, ASEAN's demand for white fish imports from February has been slow. In many countries, pangasius importation are lower than the same period in 2019, such as Thailand, Singapore and Malaysia

IV. Practical Part

4.2. Pangasius aquaculture value chain of Vietnam

There are three main processes of pangasius production:

- (1) raising broodstock into fingerlings
- (2) farming fingerlings into grow-out sized pangasius
- (3) processing pangasius into products, i.e., frozen fillets, for local consumption or export.

Based on the theory of Porter's value chain concept (1985), and within the scope of this thesis, this part would further explore the second process, which is processing pangasius into products, for local consumption or export, because this one direct to the value chain of Vietnam pangasius.

a) Primary activities

- Inbound logistics

Companies would buy raw fish materials from farmers or traders, or some processing companies would culture their own fish. This could support them to depend less on external suppliers. The raw materials shall go through inspection upon arrival and be approved by the Quality Inspection Team before entering the processing area.

- Operations

The most important material used in the processing of frozen pangasius such as Tra fish and Basa fish fillets is live fish. The live fish, after purchasing, is washed, gutted, filleted, skinned and trimmed. After the fillets are sized and classified, they will go through quality inspection. Once they pass it, they shall be frozen, packaged and exported or sold to local market. The fish waste as head, tail, skin... will be processed into fish food or fish oil, which aims to recover some costs during the whole process. Generally, fillets account for 30-40 percent of the fish, hence, for example, 3.9 kg of live pangasius will produce 1 kg of fillet. The most common form of fish product is the frozen one, followed by dried products, and fish sauce or paste. High value-added products are fillets, ready-made or surimi.

- Outbound logistics are integrated with marketing and sales

The MRD area, near the fish villages, is the main area fish processing plants most located in, as it is more convenient for companies to purchase pangasius. The processing/export companies' agents will collect fish, and if companies require larger volumes of fish, they will link up with larger farms to secure the volume and profit. The HACCP and EU code requirements will be applied to the increasing capital intensive production.

The companies export by selling seafood products to importers, and they know and partner with potential importers via international trade fairs. This is the best way to make contact with business partners for importers and exporters of fishery production. From the exporter's perspective, the buying price will be set depending on import market price, and the selling price shall be considered with the inclusion of utilities, worker wages, loan interest, value-added tax (VAT), waste.... and minimum 20 percent of profit. The reversible calculation of the price level of the purchase from farmers shall be done subsequently.

Table 5: Marketing channels of Vietnam pangasius to EU market

| Marketing channels | Methods | Outcomes |
|--|---|---|
| Direct mail | Forms of a letter (post, fax or e-mail) and send to EU importers Products and price list should be added to the email so importers will know clearly the offer | Common responses from most companies: - Not interested - Already carry another line - No responses |
| Indirectly through company website | A professional website with company's products, vision and address | |
| Personal visits | Plan a trip to the market | Often will be profitable |
| Visit invitation to processing factory | Invite EU importers/potential business partners to visit the processing factory | |
| Networking | Build a network in order to extend the contacts. | Simple to execute |

| | | |
|---------------------------------|---|---|
| Visit international trade fairs | <p>The most relevant fairs:</p> <ul style="list-style-type: none"> - European Seafood Exposition - Seafood Processing Europe, held once a year in Brussels, Belgium | <ul style="list-style-type: none"> - Find customers - Advertise one's fish products. |
| Set a price | <p>For overseas price establishment, following factors should be considered:</p> <ul style="list-style-type: none"> - Competition - Costs (production, packaging, transportation and handling, promotion and selling expenses) - Demand for a product and the maximum price the market is willing to pay | |
| Terms of payment | A letter of credit is a preference | |
| Terms of sale | <p>Free on Board (FOB) terms for exporters:</p> <ul style="list-style-type: none"> - The price for goods includes the cost of loading at the port of departure. - The buyer bears the cost of sea transport and insurance | |
| Sales promotion | | <ul style="list-style-type: none"> - Fulfill customer requirements - Maintain a good customer relationship with the European business partners. - Increase sales |

Source: Khoi Doan (2007) and complied by author

- Services

There are some popular customer services provided by pangasius processing companies

- Supply credit (about 40%) to fish farmers who have a good relationship with companies
- Offer support programs for the fishermen about breeding, which aims to eliminate the usage of the inimical chemicals and to prioritize clean products.
- Set up fishery clubs in major provinces like Dong Thap, An Giang, Can Tho.
- Operate technical service enterprise, specialized in designing and installing fishing equipment

b) Support activities

- Procurement and technology development

The processing factories/companies are equipped with advanced and modern equipment chains. Management systems has been applied, like HACCP, ISO 9001:2000 and SQF 2000 to guarantee the best quality for the products and serve market demands, or the EU code that to make it easier for product to enter EU market.

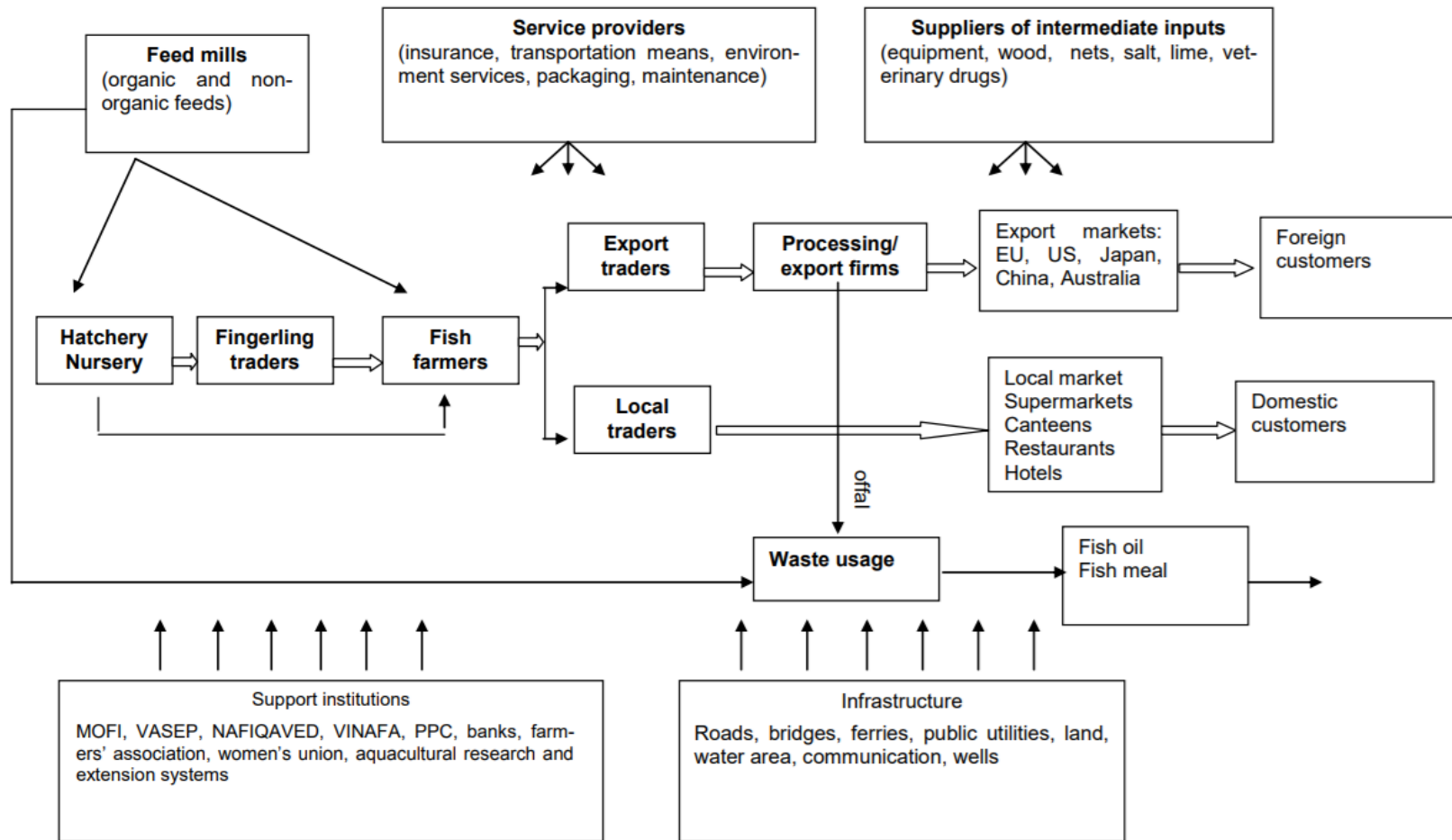
- Human resource management

There are minimum 1000 employees in most processing companies in the MRD area, in which they can attend training courses on management and work skills.

- Firm infrastructure

Most companies/factories comply with strict hygiene rules in the EU market, therefore almost all export companies have trace system establishment that can inform the exact factory, production unit and material supplier. Long-term farming contract will also be signed between export companies and farmers in order to main the stable raw materials of fish. (Khoi Doan, 2007)

Figure 17: Pangasius production process in the MRD



Source: Khoi Doan (2007)

The Vietnam pangasius value chain analysis will initially be based on the production cost breakdowns presented in Table 6.

Table 6: Cost of Pangasius production

| | | |
|--|---|----------------------|
| Size of raising cage (14 x 7 x 5 m) | | |
| Average price of breed | VND 2,520 a piece | |
| Average price for feed | VND 3,240 per kg | |
| Raising duration | 8 months | |
| Output | 40 tonnes | |
| Production costs | | |
| Breed cost | 40,000 pcs x 2,520 VND per piece | 100,800,000 |
| Feeding cost | (40,000 kg - 3,000 kg) x 3 x 3,240 VND per kg | 359,640,000 |
| Cage depreciation | 220,000,000 VND x 10% | 22,000,000 |
| Labourer wage | 5,000,000 VND/month x 2 labourers x 8 months | 80,000,000 |
| Fuel cost | 20 lit x 40 t x 16,000 VND | 12,800,000 |
| Disease prevention and treatment cost | | 20,000,000 |
| Fixed asset depreciation (equipment, machines) and other costs | | 10,000,000 |
| Bank interest: | 220,000,000 VND x 70% x 1% x 8 months | 12,320,000 |
| Business registration tax and other fees | | 1,800,000 |
| Total cost | | 616,360,000 |
| Production cost excluding wastes | 670,720,000 VND per 40,000 kg | 15,409 VND/kg |
| Cost of waste | (40,000 kg x 10%) x 15,409 VND | 61,636,000 |
| Production cost | (616,360,000VND + 61,636,000)/40,000 | 16,950 VND/kg |

Thus, the **production cost** of a pangasius raised in a cage is **16,950 VND per kg**.

The minimum price that processing companies to buy based on the consumption contracts must be: **16,950 VND + 20% of 16,950 = 20,340 VND per kg**.

Source: Khoi Doan (2007) and complied by author

Table 6's cost breakdown was extracted from the research Description of the Pangasius Value Chain in Vietnam (Khoi Doan, 2007), but the cost values of the research were collected in 2004. Hence, the cost breakdown is now theoretically replaced by author based on the Vietnamese aquaculture recent updates, i.e. the buying price of companies/traders from 21,000 to 22,000 VND. (Mi, 2020), fuel price from 13,000 to 19,000 VND/lit (Nguyen Nga, 2021), or labourer wage in pangasius farm approximately 5mil VND/month (MPI, 2016)...

As the result, **the average and updated Value-Adding** and benefit of fish farmers would be:

$$20,340 - 16,950 = \mathbf{3,390 \text{ VND}}$$

For better comparison, Table 7 illustrates the value-adding of pangasius value chain in 2010.

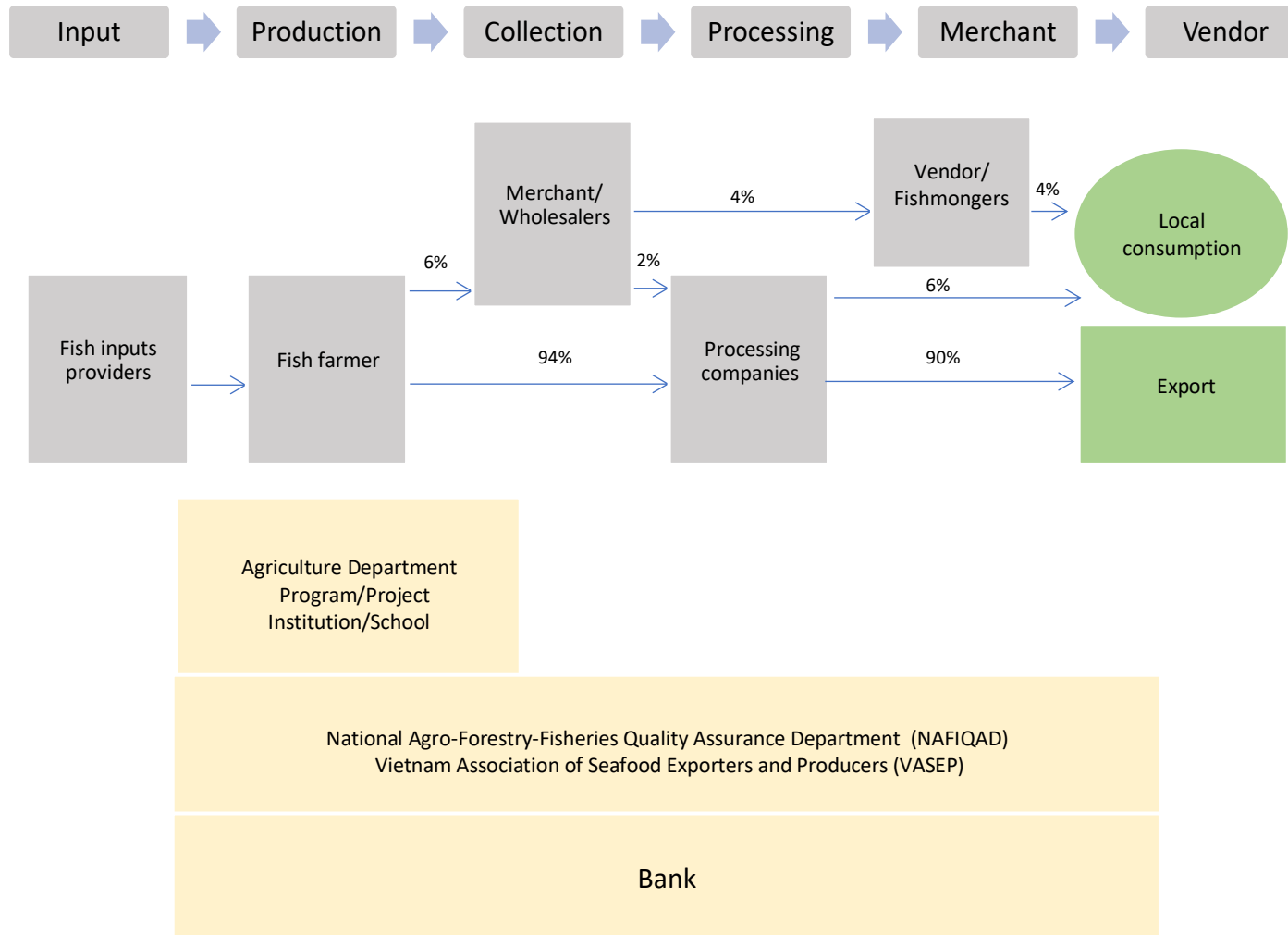
Table 7: Value-adding and benefit analysis in pangasius value chain in 2010

| Value chain actors | Value-Adding (VA) | | Net Value-Adding (NVA) | |
|----------------------|-------------------|----------------|------------------------|----------------|
| | Value (VND) | Percentage (%) | Value (VND) | Percentage (%) |
| | 8.775 | 100.0 | 3.485 | 100.0 |
| Pangasius farm | 2,683 | 30.6 | 1,936 | 55.5 |
| Processing companies | 6,093 | 69.4 | 1,550 | 44.5 |

Source: N. Thuan & Danh (2014)

Over the years, the average VA of pangasius farmers has increased about 21 percent comparing to that of 2010 (from 2,683 to 3,390VND).

Figure 18: Mapping of pangasius value chain in the MRD



Source: N. Thuan & Danh (2014) and complied by author

In the main market channel of the value chain, besides raw pangasius purchased from farmers (94 percent), the processing company purchases an additional amount of raw materials from traders (2 percent), then they export directly to overseas buyers (90% of the value chain output).

- Fish farmers

In 2010, fish farmers sold fish directly to the company at an average price of 18,314 VND/kg, with an average intermediate consumption of 15,631 VND/kg. Therefore, the added value and profit gained by the producer and the factory per kg of raw fish are nearly 2,700 VND and 2,000 VND per kg, respectively, accounting for 30.6% and 55.5% of the total VA and profit of the chain (Table 7).

- Export processing company

Processing companies buy fish mainly from fish farmers and produce fish fillets mainly, with an average processing rate of 0.35 (1 kg of raw pangasius generates 0.35 kg of fish fillet). The data in Table 1 show that the percentage of VA distribution for this agent is much higher than that of pangasius farming households.

Table 8: Fillet production cost structure

| | Value (VND) | Net price share |
|---|--------------------|------------------------|
| Net price per kg of fillets (Export price of pangasius in 2020 = 2.7USD) (1 USD = 23,000VND) | 62,100 | |
| Cost of live pangasius (at company gate) | 20,340 | |
| Processing ratio (1 kg live pangasius = 0.35kg fillet) | 2.8 | |
| Cost of live pangasius fillets (20,340VND * 2.8) | 58,114 | |
| Waste recovery | 4,621 | |
| Cost of structure | | |
| Net cost of live pangasius (58,114VND - 4,621VND) | 53,493 | 81.86% |
| Labor | 4,226 | 7.90% |
| Utilities (electricity, chemicals, packing...) | 738 | 1.38% |
| Rent | 80 | 0.15% |
| Depreciation | 455 | 0.85% |
| Interests | 562 | 1.05% |
| Tax | 1,353 | 2.53% |
| Profits | 2,289 | 4.28% |

Source: Agifish company (2002) and complied by author

The production cost breakdown in Table 8 was extracted from the paperwork Vietnam Pangasius market: value chain income distribution – Production cost per unit – Industry development solutions (Thuan & Danh, 2014), and reconciled by author with updated pangasius export price (from 2.6 – 2.7USD per kg) (Anh, 2020), and the calculated average cost of pangasius at company gate.

As of 2020, the production and export value of pangasius in the MRD of Vietnam encountered negative impacts due to the global epidemic and decrease in demands of big export markets. In the second half of 2020, the Pangasius material price in Can Tho reached its bottom: the price of material pangasius was from 17,000-19,500 VND/kg. At the same time, fingerlings pangasius was priced at only about 20,000 VND/kg. With this price, fish farmers suffer a loss of 3,000-4,000 VND/kg compared to production costs. Farmers had to sell their fish with very low

price to compensate their cost of production, since the longer they wait, the larger the losses of fish food expenses. (VOV, 2020)

In absolute terms, pangasius farming has a large profit margin compared to other agricultural sectors in the MRD region, especially when compared with rice production. However, in terms of investment efficiency, the return is not high, only about 10%, within the first period of 6-8 months. Besides, the investment efficiency on the amount of inputs is very low, only 1.1 times (spend 1 VND to invest in materials, only get 1.1 VND profit). However, the investment efficiency per employee is relatively good at 6.8 times. With a quite large investment capital in the beginning, and not high investment rate, catfish farming is only suitable for farmers with good financial capacity and risk tolerance.

4.2. Revealed Comparative Advantage (RCA)

The RCA, within the scope of this thesis, will be used to identify Vietnam's pangasius comparative advantage, initiated as below:

$$RCA_{ij} = \frac{\frac{x_{ij}}{X_{it}}}{\frac{x_{wi}}{X_{wt}}}$$

In which:

x_{ij} is the export value of pangasius of Vietnam (USD)

X_{it} is the total value of Vietnam export (all commodities) (USD)

x_{wi} is the export value of pangasius of the World (USD)

X_{wt} is the total value of World export (all commodities) (USD)

From personal observation of Table 9, the export of pangasius of Vietnam has for years dominant the pangasius market as it was statically reported by VASEP to take up to 72 percent of the global pangasius yield. These gap was gradually shortened down from 2017-2018, around 52 percent and 53 percent (Nhan, 2019), as of the countries like Malaysia, Indonesia, Bangladesh or India have aggressively grown their pangasius production. China has also boosted their pangasius production but mainly to serve local demands.

Table 9: Data table for RCA calculation of Vietnam pangasius from 2009 to 2019

| Year | Export value of pangasius of Vietnam (USD) | Total value of Vietnam export (USD) | Export value of pangasius of the World (USD) | Total value of World export (USD) |
|------|--|-------------------------------------|--|-----------------------------------|
| | x_{ij} | X_{it} | x_{wi} | X_{wt} |
| 2009 | 1,343,000,000 | 57,096,274,457 | 1,865,277,778 | 12,556,200,000,000 |
| 2010 | 1,427,000,000 | 72,236,665,000 | 1,981,944,444 | 15,302,680,000,000 |
| 2011 | 1,856,000,000 | 96,905,673,959 | 2,577,777,778 | 18,339,800,000,000 |
| 2012 | 1,744,000,000 | 114,529,170,983 | 2,422,222,222 | 18,513,190,000,000 |
| 2013 | 1,720,000,000 | 132,032,853,998 | 2,388,888,889 | 18,950,640,000,000 |
| 2014 | 1,777,000,000 | 150,217,138,752 | 2,468,055,556 | 19,007,210,000,000 |
| 2015 | 1,565,000,000 | 162,016,742,480 | 2,173,611,111 | 16,555,700,000,000 |
| 2016 | 1,715,000,000 | 176,580,786,634 | 2,381,944,444 | 16,043,200,000,000 |
| 2017 | 1,788,000,000 | 215,118,606,999 | 3,438,461,538 | 17,737,660,000,000 |
| 2018 | 2,261,000,000 | 243,698,698,324 | 4,348,076,923 | 19,468,140,000,000 |
| 2019 | 2,060,000,000 | 264,610,322,649.00 | 3,886,792,452.83 | 18,888,800,000,000 |

Source: UN Comtrade Database (2021) and compiled by author

The RCA index calculation in 2009 shall be performed as:

$$RCA_{ij} = \frac{\frac{1343000000}{57096274457}}{\frac{1865277778}{12556200000000}}$$

$$= 158.34$$

Based on same calculation method, Table 11 will be about the RCA index of Malaysia pangasius from 2009 to 2019.

Table 10: RCA index of Vietnam pangasius from 2009 to 2019

| Year | RCA_{ij} |
|-------------|------------------------------|
| 2009 | 158.34 |
| 2010 | 152.53 |
| 2011 | 136.26 |
| 2012 | 116.39 |
| 2013 | 103.34 |
| 2014 | 91.10 |
| 2015 | 73.57 |
| 2016 | 65.42 |
| 2017 | 42.88 |
| 2018 | 41.54 |
| 2019 | 37.83 |

Source: Compiled by author (2021)

In order to emphasize the dominance of Vietnam in the export market of pangasius, another World's large pangasius producer and exporter, Malaysia, has been selected to initiate comparison. The RCA index will be used to indentify Malaysia 's pangasius comparative advantage, within time serie from 2013 to 2019. That before 2013 was not as remarkable since around the year 2010, Vietnam accounted for 95 percent market share of the World's export market.

Table 11: Data table for RCA calculation of Malaysia pangasius from 2013 to 2019

| Year | Export value of pangasius of Malay (USD) | Total value of Malay export (USD) | Export value of pangasius of the World (USD) | Total value of World export (USD) |
|------|--|-----------------------------------|--|-----------------------------------|
| | xij | Xit | xwi | Xwt |
| 2013 | 57,469 | 228,316,000,000 | 2,388,888,889 | 18,950,640,000,000 |
| 2014 | 141,752 | 234,135,000,000 | 2,468,055,556 | 19,007,210,000,000 |
| 2015 | 87,945 | 200,211,000,000 | 2,173,611,111 | 16,555,700,000,000 |
| 2016 | 524,254 | 189,414,073,154 | 2,381,944,444 | 16,043,200,000,000 |
| 2017 | 339,705 | 217,722,507,482 | 3,438,461,538 | 17,737,660,000,000 |
| 2018 | 1,123,419 | 247,323,665,356 | 4,348,076,923 | 19,468,140,000,000 |
| 2019 | 6,234,945 | 238,088,652,110 | 3,886,792,453 | 18,888,800,000,000 |

Source: UN Comtrade Database (2021) and compiled by author

Based on same calculation method, Table 12 will be about the RCA index of Malaysia pangasius from 2009 to 2019.

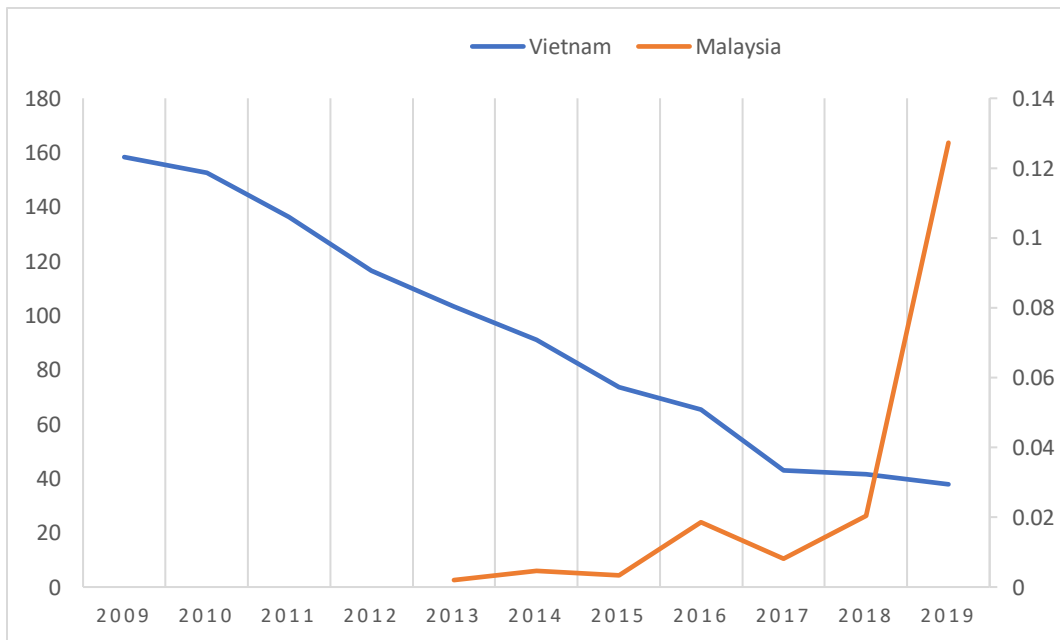
$$\begin{aligned}
 RCA_{ij}^1 &= \frac{\left(\frac{157,469}{228,316,000,000}\right)}{\left(\frac{2,388,888,889}{118,950,640,000,000}\right)} \\
 &= 0.0020
 \end{aligned}$$

Table 12: RCA index of Malaysia pangasius from 2013 to 2019

| Year | RCA_{ij}^1 |
|------|--------------|
| 2013 | 0.0020 |
| 2014 | 0.0047 |
| 2015 | 0.0033 |
| 2016 | 0.0186 |
| 2017 | 0.0080 |
| 2018 | 0.0203 |
| 2019 | 0.1026 |

Source: Compiled by author (2021)

Figure 19: RCA index comparison between Vietnam (2009 – 2019) and Malaysia (2013 – 2019) pangasius export volume



Source: Compiled by author (2021)

Figure 19 has once again guaranteed Vietnam’s pangasius competitive advantage, as the index is magnificiently higher than 1. However, the value of RCA index has decreased over time,

which created an absolute downtrend pattern during the whole examined period (Figure 17). From observation, the trend dropped strongly in 2012, 2015 and 2017, but in practice, Vietnam still maintained their World's highest rank in the pangasius production and export market during those years. The reasons for these negative trends in 2018, for example, might due to the impose of anti-dumping tariff from the USA, and simultaneously many major import markets such as EU, Brazil levelled off, UK, Germany and Belgium continued to decline deeply. The RCA index fluctuation from 2017 to 2019 is quite moderate, which could be seen as a positive sign.

The comparison also shown that that Malaysia 's RCA index value of pangasius resulted in competitive disadvantage ($RCA_{ij}^1 < 1$), but it is obvious that it has been gradually increasing over time. Even though Vietnam totally trumped over Malaysia in the export of pangasius during the examined time period, Malaysia is still one of the countries that has very high potential in intensifying the production and exportation of pangasius, among Indonesia, India or Bangladesh. The reason for this is because of the strategies that Malaysia, India, Bangladesh, Indonesia ... are applying: They will not compete directly with Vietnam pangasius in markets where Vietnam's pangasius industry has its advantage as of the cheap export price (currently only 1 USD / kg), especially the US and China markets. However, these countries will boost exports to markets where Vietnam's pangasius industry is facing technical barriers and is losing market share, particularly the Middle East and EU markets. If their strategies work well in these two markets, their influence can significantly reduce Vietnam's pangasius market share in the global market.

**Table 13: Data of trade volume and trade value of Vietnam pangasius exporting to large importing destinations
from 2015 to 2019**

| | 2015 | 2016 | 2017 | 2018 | 2019 |
|-----------------------|-------------|-------------|-------------|-------------|-------------|
| China | | | | | |
| Trade volume (tonnes) | 101,327,775 | 137,898,298 | 118,257,493 | 162,663,005 | 90,687,193 |
| Trade value (USD) | 320,246,859 | 386,374,485 | 340,503,062 | 556,283,084 | 288,228,077 |
| USA | | | | | |
| Trade volume (tonnes) | 32,798,439 | 74,629,530 | 98,445,316 | 112,298,910 | 163,487,784 |
| Trade value (USD) | 103,659,605 | 209,102,989 | 283,457,147 | 384,045,433 | 519,607,763 |
| Singapore | | | | | |
| Trade volume (tonnes) | 29,553,803 | 28,861,920 | 34,799,905 | 27,642,378 | 27,762,041 |
| Trade value (USD) | 93,404,920 | 80,867,639 | 100,200,622 | 94,532,788 | 88,235,169 |
| Mexico | | | | | |
| Trade volume (tonnes) | 10,121,551 | 12,022,024 | 11,701,669 | 11,680,818 | 10,566,656 |
| Trade value (USD) | 31,989,205 | 33,684,270 | 33,693,037 | 39,946,647 | 33,583,652 |
| UK | | | | | |
| Trade volume (tonnes) | 13,517,007 | 14,869,234 | 14,952,254 | 13,219,233 | 14,870,403 |
| Trade value (USD) | 42,720,556 | 41,661,809 | 43,052,566 | 45,207,795 | 47,262,106 |

Source: UN Comtrade Database (2021) and compiled by author

Table 14: The average export price per kg of Vietnam pangasius from 2015 - 2019

| | Export volume (kg) | Export value (USD) | Average export price (USD/kg) |
|-------------|---------------------------|---------------------------|--------------------------------------|
| 2015 | 450,089,148 | 1,565,000,000 | 3.48 |
| 2016 | 546,129,460 | 1,715,000,000 | 3.14 |
| 2017 | 545,604,886 | 1,788,000,000 | 3.28 |
| 2018 | 577,135,769 | 2,261,000,000 | 3.92 |
| 2019 | 541,599,895 | 2,060,000,000 | 3.80 |

The average price of Vietnam pangasius in Table 14 would explain the sector's competitive advantage in cheap export price. As mentioned earlier, the export price offering to markets like China or the USA has helped Vietnam to dominate these markets. However, they are raising the bar of demands on the quality of Vietnam pangasius, including tariff application. China is on its way to have pangasius locally produced and consumed, which also create a barrier to Vietnam fish export.

V. Conclusion and Recommendations

Overall, it can be agreed that there are more and more obstacles influencing the dominance of Vietnam pangasius export values and their value chain:

- Particular regulations related matters from importers, such as the Anti-dumping tariff from the US, the USDA Catfish Inspection Program or the Farmbill barrier
- Objective worldwide matter such as the impacts of the Covid-19 pandemic. In the first half of 2020, Vietnam pangasius farmers had been awfully damaged as the selling price at some points cannot compensate the production price for fish farmers due to the low demands of market and the redundancy of pangasius supplies
- Smearing media in the EU
- Vietnam' big import markets of pangasius are shrinking in importing power, for instance China-Hong Kong (20.6 percent down), The US (4.8 percent down), Thailand (25.6 percent down), Singapore (49 percent down) and Malaysia (28 percent down) compared to the same period of 2019
- Most of all, the main growing numbers of other pangasius producers and exporters is the main reason for the fall of Vietnam RCA index of pangasius export :Vietnam holds the dominant position in Pangasius export market for many years. However, new and strong competitors are entering the market every year: India has achieved production of 650 thousand tons of pangasius per year, and Bangladesh has produced 450 thousand tons/year.
- China, one of the biggest importers of Vietnam pangasius, is reported to have successfully applied new technologies to raise and grow pangasius for their national consumption, which could result in the reduction in importing pangasius products from Vietnam. However, Vietnam still stands on a stronger ground thanks to the quality of pangasius fillet comparing to that produced in China.

For the time being, new competitors yet to be able to dominate the pangasius export market. However, in the long term, the impact is inevitable, especially once China invests in farming pangasius in Hainan with moder aquaculture technology. In order to maintain its position and compete huge competitive pressure, Vietnam is to change drastically its pangasius exportation in the near future:

- The MARD to continue the project of Three-level Fingerling production of pangasius in the MRD to meet the demand for high quality breeds, stabilize the supply and demand of fish breeding performanc. From there, the quality and quanti of broodstocks and fingerlings would contribute to the sustainable development of pangasius and meet the requirements of domestic and international markets.
- The Government to cooperate with MARD, VASEP to promote the image of Vietnam Pangasius in international markets. Aparting from traditional marketing channels, exhibitions or fairs of Vietnam Pangasius can be organized for the locals and overseas for foreign consumers to promote the image and brand, and later the consumption of pangasius products. This could be very effective for local consumption and buying power in China.
- The strong consumption of Vietnamese pangasius in many markets has created a positive growth for a key export industry. However, in order to sustain that growth rate, farmers in MRD shall be encouraged to re-plan production from raising fingerlings, fish feeding, enhancing the application of advanced science and technology, prioritizing product diversification, investment in value added for products.

Singapore and the UK are two special markets because during the pandemic, while most major export markets were negatively affected, these two markets performed outstandingly in importing value. The first half of 2020, the export value of pangasius to Singapore, the second largest export market of Vietnamese pangasius in was up 5.7 percent, and that of UK market was up 7.1 percent over the same period in 2019. Therefore, the exploration of new potential markets would as well contribute tot he development of Vietnam pangasius.

Nevertheless, Vietnam pangasius still has in hand their weapons: high quality pangasius products (white fish with no fish smell, which is different from pangasius grew in China), the MRD with rich supply of fresh water resources, experienced pangasius farmers... With supports from the Governments on the obstacles coming from international markets, the existing strengths would create the needed difference and changes to the sector in the future, and help maintaining their dominance in the global market.

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VII. Appendix

Appendix 1: Growing pangasius fingerlings in cage in the MRD



Source: GlobalAquacultureAlliance, 2019

Appendix 2: Pangasius processing line in Vietnam



Source: Fish Information and Services, 2019