

Master's degree thesis

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Optimizing suggestions for *Gadus morhua* supply chain between Norway and China- base on bilateral FTA and product traceability system

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Preface

“International business and marketing” is telling the game rules and methods for global trade, for instance, evaluating customer loyalty, understanding culture differences, understanding corporate government and processing data. This thesis integrates the knowledge I learned about market regulations, supply network management and cultural communication, it will discuss the business trend between Norway and China through the analysis of *Gadus morhua* supply chain between these two countries.

During the work of last six months, I pulled through lots of problems with many people's help. I would like to thank my supervisor Prof. Trond Bjørndal, who provided suggestions and guidance for this paper with patience; thank Prof. Øyvind Helgesen, who taught me principle of business, inspired me to discover the interest of marketing and imparted knowledge in my two year study period. Really need to thank Kent Xu, the area manager of West-Norway AS China office, gave me a lot of help with interview, data and pictures, without his help, this thesis might lose case basis. Also thank my families to support me during master study life with love, and all my friends who make my life full of fun.

Abstract

The *Gadus morhua* supply chain started in Norway, processed in China and finally goes to terminal markets such as Brazil and the EU, lots of participants involved in this international supply chain. This thesis concentrates on *Gadus morhua* supply chain between Norway and China, provides optimizing suggestions to promote its profit and value.

This paper uses both of quantitative analysis and qualitative analysis for *Gadus morhua* supply chain analysis, also uses comparative analysis to compare Norway's trade index with China's, analyze competitiveness and complementary between two countries, lay the foundation of FTA effect analysis. During the case study of *Gadus morhua* processing flow in Chinese plant, we can see that the *Gadus morhua* product which captured in Norway and processed in China has matured flow in bounded area with standard system and food safety guarantee, we drew a conclusion that current *Gadus morhua* supply chain model tends to mature and stable. However, in this supply chain model, China easy to fall into "comparative advantage trap", and Norway is faced with more and more market competition in Brazil, we should consider the macroeconomic factors to stimulate its output to guide more market scale, and satisfy customer's demand to upgrade its product value, so the bilateral FTA establishment effects for *Gadus morhua* market opening and product traceability system development based on customer's value are mentioned.

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1. Introduction

1.1 Research background and significance

The objective of this thesis is clarifying and evaluating supply chain of *Gadus morhua* between Norway and China, exclude market activities after the process, provide optimized methods to promote profit and value. *Gadus morhua* is one kind of the most important export commodity of Norway, but compared with Salmon, we can hardly find out a leader enterprise which just concentrates on *Gadus morhua* product and integrate resource only for *Gadus morhua* supply chain. This is the reason for this paper to be interesting in *Gadus morhua* supply chain.

To evaluate *Gadus morhua* supply chain, we concentrate on four key points: node numbers, scales, costs and value. First of all, if the supply chain has overmuch nodes, to some extent, it means more cost and profit distribution will happen, there might have room for cost decrease, the reason should be identified and solutions should be provided; if the supply chain model tends to mature and stable, then we should consider the macroeconomic factors to stimulate its output to guide more market scale, and satisfy customer's demand to upgrade its product value.

This thesis only focuses on the *Gadus morhua* supply chain between Norway and China, excludes other markets out of these two countries. Expand to macroeconomic view, *Gadus morhua*'s trade or even aquatic food industry between Norway and China should be developed to better. In 1980, the two countries signed economic, industrial and technical cooperation agreement and the establishment of China - Norwegian economic and trade committee (later renamed the Joint Economic and Trade Commission).^[1] Since 2008, the two countries formally have eight Free Trade Agreement (FTA) negotiations, discussed details within merchandise trade, service trade and trade barriers. However, after the last negotiation in 16th September, 2010, FTA negotiation between Norway and China was stranded^[2]. Since March 23, 2015 China stopped importing whole salmon (with head) from Norway's Nantes County

(Sør-Trøndelag), Norland County (Nordland) and Trondheim Holmes County (Troms). The three counties' salmon exports accounted for one fifth of total exports of Norwegian salmon. For other parts of the Norway, China requires Norwegian authorities to add content to ensure that the salmon production is from the security area which free of infectious salmon anemia (ISA), this requirement will be effective from April 18^[3].

It is not difficult to find out that political climate is a continual influencing trade development between Norway and China. March 2014, the Norwegian Trade, Industry and Fisheries, Ms. Dilek Ayhan State secretary in Norway - the China Chamber of Commerce seminar entitled "priorities of the new government of Norway and the Norwegian trade and economic cooperation potential" speech. She said that China is one of Norway's most important trading partners in Asia, the two countries have broad prospects for economic and trade cooperation. According to the Norwegian official statistics, in 2013 China - Norway bilateral trade amounted to NOK 64 billion, accounting for 6% of Norway's total trade. China is the third largest source of imports, Norway, in 2013 exports to 48 billion Norwegian kroner. In aquaculture, China is Norwegian whitefish (cod and flatfish) and cruise fish (mackerel) is an important export market, while Norway hopes to export more to China Norwegian farmed salmon. Regrettably, in recent years, political relations between the two countries in trouble. The global economic activity center is in the East, Norway, priority must be given to sign trade agreements with these countries, the most development potential. Norway's new government will establish a good dialogue and close working relationship with China as a top priority of his administration policy to actively maintain and enhance economic and trade ties between the two countries. Finally, Ms. Ayhan said Norway hopes to resume as soon as possible bilateral FTA agreement negotiations.^[4]

If we only base on trade reality, at present, the importance of building global corporation for producing, processing and trade of aquatic product shows up. Norway is a well-known export country of ground fish like *Gadus morhua* based on the North Sea and Barents Sea fisheries, every year a large number of aquatic products sent to

the world from Norway. However, high labor cost, service cost such as transportation and material cost such as packaging will reduce the cost competitive advantage to Norway's *Gadus morhua* product.

Meanwhile, China is a main process country of aquatic product, especially for abroad sale. The huge quantity of raw material comes from China and other regional aquatic breeding, the fish caught by Chinese fishing boat in China's territorial waters, Exclusive Economic Zone (EEZ) or other ocean areas, and the import raw fish comes from other countries and areas like Norway, Russia, USA, EU and Japan. The entire fish product supply chain will start from these raw materials which from both of domestic and foreign, processing in China and export to foreign for further processing and sale. For *Gadus morhua* industry, China neither capture, nor sell domestically, raw material of China's *Gadus morhua* product is entirely from import.^[5] China's position in *Gadus morhua* industry is mentioned as famous transfer station instead of the main market in each kind of *Gadus morhua* industry reports. However, in spite of the cold diplomatic relations between China and Norway, Norwegian exporters have great expectations for Norwegian *Gadus morhua* on the Chinese market. According to an analysis undertaken by the Norwegian Seafood Council (NSC), there are about 30 million wealthy Chinese consumers that could be targeted. In addition, some 2 500 restaurants are expected to be interested in including Norwegian *Gadus morhua* on their menu. NSC expects to sell 20 000 tonnes of high quality *Gadus morhua* on the Chinese market within three to five years. NSC has already tested-marketed *Gadus morhua* in cooperation with Chinese chefs and the results are very promising^[6]. However, the high import tariff is a challenge for Norwegian *Gadus morhua* that make it to lose price advantage. China's aquatic food is labor intensive products based on advantages as low skill level and low labor cost, it is dangerous for China to fall into the trap of "law of comparative advantage", means the increase of export will lead to decrease of profit.

We believe that the Free Trade Area (FTA) establishment has strategic importance for the two countries, it can not only bring positive effects for *Gadus morhua*'s trade, but also enhance economic and trade cooperation between Norway

and China and gather FTA experience of global trade integration.

Down to microscopic view, so many companies are doing *Gadus morhua* product between Norway and China, but we can hardly find out a leader like Marine Harvest in the salmon industry. It means *Gadus morhua* industry lacks ability to integrate entire supply chain resource by one enterprise, it can only be the supply chain model that operated by lots of participants. Through case study what we will discuss in following chapter, we can conclude some characteristics of *Gadus morhua* supply chain between Norway and China: due to Norway's high cost of labor and processing material, *Gadus morhua* raw material will be sent to China and process. However, *Gadus morhua* product is not very popular in China compared with salmon, because of the substitute in variety and taste; meanwhile, according to 24% tariff of import into China, trade companies can hardly open *Gadus morhua* market in China. Therefore, Norway's *Gadus morhua* raw material should go to tariff-free zone to avoid tax, China is like a process plant instead of market. After processing product will go to the third-party markets like Brazil and American, based on the order from Norway. It is definitely "Processing on order" method. We support that this kind of "Processing on order" of *Gadus morhua*'s trade is stable, low value and tend to mature.

In conclusion, we assume initially that characteristics of *Gadus morhua* supply chain between Norway and China are:

- (1) Stable model with less cost decrease room;
- (2) China is famous as process plant instead of market.

Therefore, we draw a result that the improvement room for this supply chain are market development and value added, instead of reducing costs.

This thesis will discuss *Gadus morhua* supply chain between Norway and China in detail, include each link and its specific operation, focuses on optimization of *Gadus morhua* supply chain between Norway and China with two parts: macroscopic view of marketing development (FTA) and microscopic view of value-added (product traceability). The second chapter will focus on the evaluation of *Gadus morhua* supply chain's actuality in detail, based on a case study of West-Norway's process

plant in Qingdao, China, check if there are problems in food safety, trade documents and cost. Rest chapters will discuss optimizing suggestions' feasibility, operation and effects.

1.2 Research method and literature Review

This thesis is built on international business and supply network theory, combine with trade index and some economic models, illuminate the effects of FTA establishment and product traceability.

Main methods include: (1) quantitative analysis: consult a large number of data from aquatic organizations and articles from two countries, analyze details of current *Gadus morhua* supply chain; (2) qualitative analysis: based on quantitative analysis, expound possible optimization method for *Gadus morhua* supply chain, macro-environment effect and value-added effect for it; (3) comparative analysis: compare Norway's trade index with China's, analyze competitiveness and complementary between two countries, lay the foundation of FTA effect.

1.2.1 *Gadus morhua* supply chain

Regarding Norway's fishery and aquatic industry and management system, research in Europe has Trond Bjørndal's "Overview, Roles, and Performance of the North East Atlantic Fisheries Commission (NEAFC)" (2009), and "Cooperative and non-cooperative management of the Northeast Atlantic cod fishery" (2012) with Marko Lindroos; research in China has Liang Fang's "Norwegian fishery resource and management system" (2009), Linxiao Lu's "Analysis and research of foreign aquatic market system" (2012). All of these publications analyze natural economic and system management of Norwegian fishery and aquatic or *Gadus morhua*.

Regarding China's aquatic process and export analysis, Yuanyuan Duan uses the Constant Market Share Model (CMS) to research the increase reason of it, believes that China's advantage in aquatic export is a result of process capacity and labor cost. Qiuguang Hu uses gravity model to analyze the effect of global demand to China's

aquatic export.

For *Gadus morhua* supply chain research, we can barely find articles to support this thesis. The third part of Food and Agriculture Organization (FAO) State of World Fisheries and Aquaculture (2014) slightly describe *Gadus morhua* product variety and delivery within the Asian-Pacific region; International Institute of Sustainable Development has specific *Gadus morhua* supply chain description and analysis, includes *Gadus morhua* resource, processing in China and re-exporting to the third-party market, but its aim is a discussion for fishery sustainable development.

1.2.2 Research regards FTA

The systematic theory of regional economic integration is customs union theory, Jacob Viner describes in his “The Customs Union Issue”^[7] (1950) that The establishment of a customs union influence on the world economic welfare depends on trade creation effect and trade diversion effect, when the trade creation effect is greater than the trade diversion effect, the establishment of a customs union will produce a net increase in the welfare of the world, otherwise it will lead to reduction in benefits, which will provide theory support to our trade effect analysis of FTA establishment between Norway and China.

Jia Zhang uses CMS model and comparative advantage index to discuss the demand effect, structure effect and competitive effect of an FTA between China and Australia, Yongfeng Lang and Xiangshuo Yin use the gravity model to analyze trade effect within China-ASEAN Free Trade Area (CAFTA), which provide evidence for the effect of FTA to *Gadus morhua* supply chain.

1.2.3 Product traceability

Main references of product traceability are Europe Union (EU) standard as European Committee for Standardization (CEN) for fish, and GS1 (Globe Standard 1) technology, which provides the most advanced standard and technology for global food supply chain traceability. Norway has government implementation projects as

National Norwegian projects (pelagic and white fish) “eSporing” and several traceability research projects which led by SINTEF. China’s *Gadus morhua* product traceability now follows China Entry-Exit Inspection and Quarantine (CIQ) Healthy System, new Food Safety Law, and new catch certification scheme that recognized by the European Union Ministry of Agriculture, Bureau of Fisheries Fisheries Directorate General, and through the China Aquatic Products Processing Management Association.

1.3 Research logic and content

1.3.1 Research logic

This thesis bases with the aim of discussing the optimization of *Gadus morhua* supply chain between Norway and China, firstly investigates in the details of this supply chain to evaluate its safety, efficiency and cost, analyze the room of cost decrease and node reduction; if the supply chain is stable and no room for cost decrease or efficiency promotion, we will consider value-added based on customer expectation and the global economic trend, in this thesis, FTA establishment will be considered as external stimulate and product traceability is regarded as internal value upgrade method.

1.3.2 Research content

The first part gives a brief introduction for the thesis, aim to expound background, significance and importance of investigation of *Gadus morhua* supply chain between Norway and China, explained the logic of *Gadus morhua* supply chain evaluation-external economic environment stimulation-internal value-added increase, list theories for aquatic industry, *Gadus morhua* supply chain, FTA effect and product traceability.

The second part provides a frame of *Gadus morhua* supply chain, divides the two parts to describe the macro - environment and specific process of *Gadus morhua*

supply chain, logically investigates its operation and end with a conclusion of demand of *Gadus morhua* supply chain development.

In the third part, empirical analysis of feasibility of FTA between Norway and China will be displayed, provide implementation scheme and analyze the possible effects.

Forth part will discuss through customer orientated to illustrate Norway's and China's current product traceability, compare with global traceability experience to analyze suitable traceability systems for *Gadus morhua* product.

In the fifth part, conclusion and suggestion for entire *Gadus morhua* supply chain optimization will be provided based on the research above. Opinions on further research will also be given.

1.4 Research scope and data resources

Data collection regarding *Gadus morhua* exporting and processing case study will be based on Aalesund in Norway and Qingdao in China, the primary resource is interviewed for process plant. We can deeply understand the operation procedure and details through the interview, know well about the internal manipulation and regulation of plant. However, interview always based on the interviewee's subjective understanding, we also need statistic data and real pictures to replenish interview.

Statistic data mainly come from Norway's and China's Customs, statistical bureau, fishery and aquatic alliance, and FAO. There is a problem that Norway's statistic data cannot accord with China's, because China's Customs integrate all kinds of *Gadus morhua* in one HS Code and doesn't separate as countries of *Gadus morhua* raw resource when the processed product re-export, it is difficult to get accurate data.

The methodology will mainly use a qualitative approach for FTA establishment and product traceability, describe background, method, effect and theories of them; quantitative study of FTA feasibility analysis and logistics and process activities research such as product quantity and cost.

Through this research, we hope to describe the advantage and disadvantage of

Gadus morhua processing and find out a more effective way for *Gadus morhua* processing, the possible improvement process also be expected for this thesis. Some factors which will influence the supply chain will also be mentioned, factor of law and regulation will be the most important one of them.

2. Description of current *Gadus morhua* supply chain between Norway and China

2.1 Aquatic industry between Norway and China

Before we talk about *Gadus morhua* trade between Norway and China, we need a macroscopic view of the relationship between Norway and China. Norway recognized the new government of the People's Republic of China on January 7, 1950 and established diplomatic relations with China on October 5, 1954. In 1955, the two countries started exchange ambassadors.

The trade between Norway and China began in the early 20th century. In 1913, China and Norway opened a prelude to bilateral economic and trade exchanges. After 1954 the two countries established diplomatic relations, especially since China's reform and opening-up policy, bilateral economic relations from a simple commodity exchange to a new stage of economic development, trade, industrial and technological cooperation. China's main exports to Norway include textile and apparel products, ships, machinery and electronic products, footwear, coke, and imported crude oil, fish products, fertilizers, aluminum, steel, machinery equipment and spare parts from Norway. According the data of Country Reports from China, Norway's three main exports to China are mechanical and electrical products (28.9%), chemical product (16.8%) and fish and other aquatic invertebrates (15.4%).

Gadus morhua and haddock are important *Gadus morhua* varieties and the leading fish variety of Norway, Russia and Iceland, mainly captured from midwater in temperate marine, around North Sea and Barents Sea in Norway, is shown in Figure 1, Russia and Norway signed a bilateral fisheries agreement for 2013 in Trondheim which includes a historically high *Gadus morhua* quota for the Barents Sea of 1 million tonnes^[8].

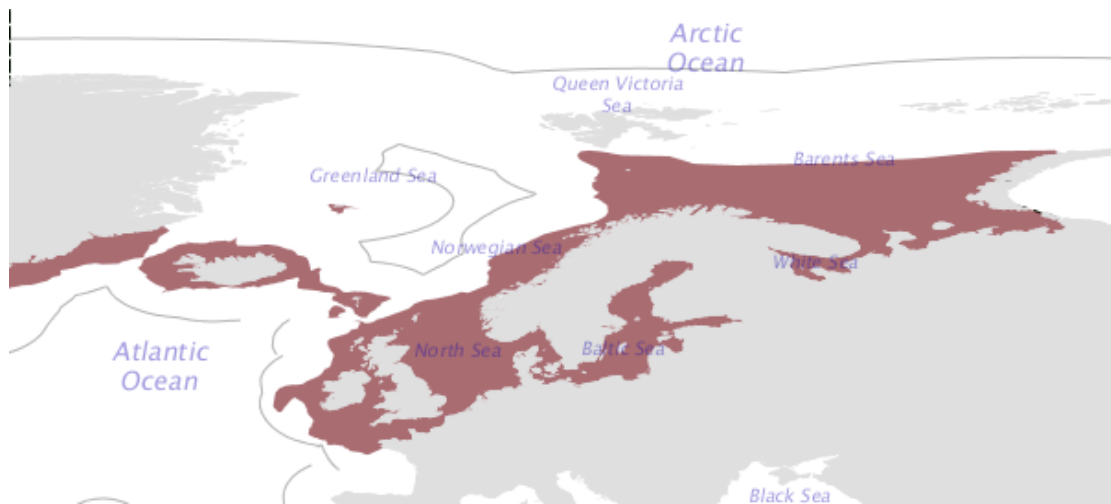


Figure 2.1 *Gadus morhua* distribution around Norway

In the year of 2011, the annual catches of Norway's *Gadus morhua* are 340100 tonnes, this figure up to 1114382 tonnes in 2012, see Figure 2, the amount of Haddock is 159500 tonnes, meanwhile, the quantity of breeding *Gadus morhua* reach 10925 tonnes in 2012^[9]. After the over capture in the 1960s, *Gadus morhua* shows resilience to some extent, but due to the breathing difficulties and catch problems, lots of evidence that the *Gadus morhua* material is falling down.

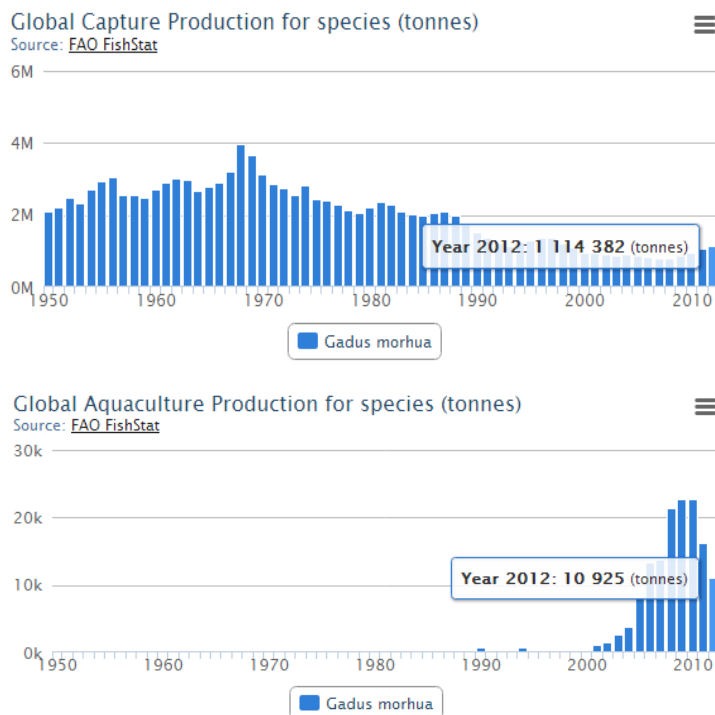


Figure 2.2 Global capture & aquaculture production for *Gadus morhua* 1950-2010

After prices plummeted in late 2013 following the announcement that Russia and Norway would share a record Barents Sea cod quota of 1 million metric tons, the

market turned around in mid of 2014, at low prices stimulated demand^[10].

Torbjorn Trondsen mentioned China's role in *Gadus morhua* supply chain in "The role of China in the whitefish market" (2010)^[11], he drew a global whitefish market structure and believed China was a processing center in it. Russia, Norway, EU and US provide each kind of cod product in China to process and re-export to EU and Brazil to sell. The structure picture is as below:

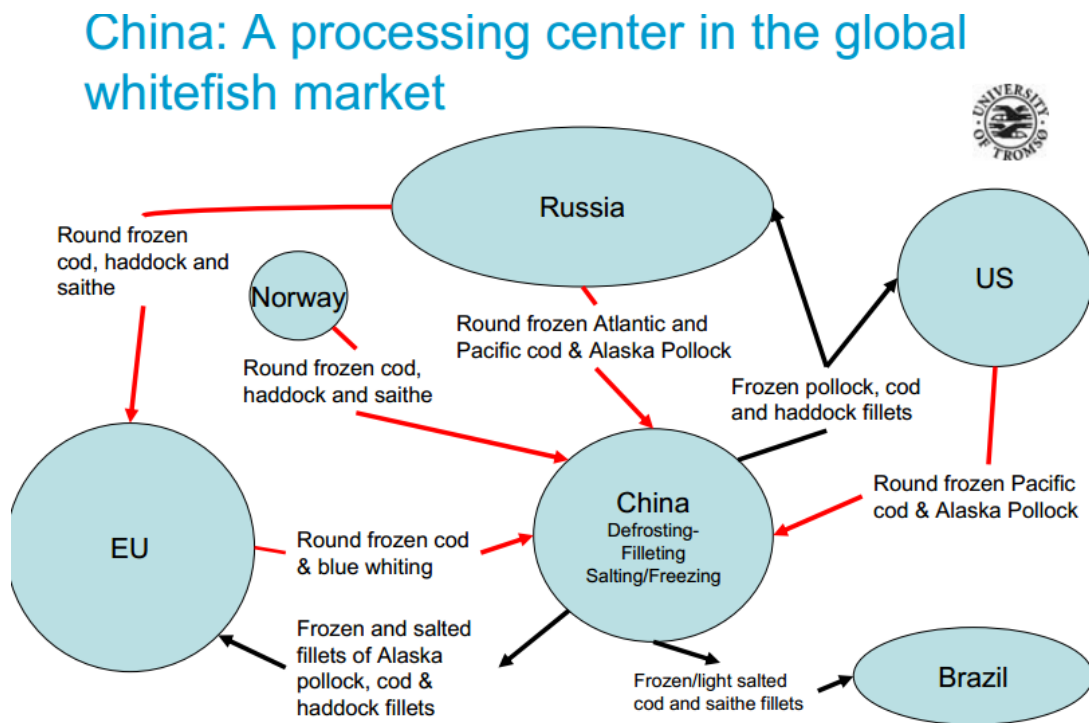


Figure 2.3 China's role in global whitefish market

We down to the specific *Gadus morhua* supply chain between Norway and China, especially processing in China, including exporting from Norway to China, transporting, tariff procedure in bounded area, warehouse management and processes, and the product distributes direction after processing, we conclude the *Gadus morhua* supply chain structure, it can be drawn as follows:



Figure 2.4 *Gadus morhua* supply chain structure between Norway and China

Gadus morhua captured by trawl, cage or trotline in Norway need primary processing on board like head cutting and gutting, and then export to China for processing, after processing, most of them will be exported again to other foreign markets like the EU and Brazil to reprocessing and sale. The materials with primary processing need to be import checks before it imported into China, and then send to agents and agents decide to process or sell, so the primary product can reach to the processor directly or after many times transferring. Processors produce different kinds of *Gadus morhua* product such as fillets and minces depend on the market demand, and the leftover material will be made into sliced fish product, The Ministry of Health of China stipulates that all fish products include the sliced fish product need to be traceable. Similarly, after processing, all products need to be checked and then export to other countries. According to China aquatic products processing and marketing alliance, the export volume of *Gadus morhua* from Norway to China in 2013 (January to September) is 390,000 tons, an increase of 24.3% compared to 2012. China's trade statistics use the same Customer Item Commodity *Gadus morhuae* for *Gadus morhua*, *Gadus microcephalus* and *Theragra chalcogramma*, it is one of data problems for this thesis.

All links of this *Gadus morhua* supply chain will be discussed, especially the processing link, it includes:

- 1) Suppliers situations: raw material resource, export limitation and preprocess;

- 2) Order process between suppliers in Norway (case study) and processor in China (case study);
- 3) Logistics processes: transportation, inbound and outbound logistics of Bound Area (involves the policies and regulations), process, packaging and distribution;
- 4) Tariff;
- 5) Distribution direction;
- 6) Regulation and limitation;

2.2 Market recognition of Norwegian *Gadus morhua* product

The market can be seemed as final result and driver of supply chain, understanding the market of *Gadus morhua* from Norway will help us to understand *Gadus morhua* supply chain, where to start, where to continue, where to end. We choose the marketing theory of the four Ps (Product, Price, Place and Promotion)^[12] model to describe this supply chain, discuss the final customer, the core product characteristics, the target market and the basic cost. Four Ps discuss four key factors which affect market around target customer, the company needs to combine these elements effectively to seek market reaction. Here we just use four Ps theory of positioning *Gadus morhua*'s product attribute, basic cost, target market and customer, and distribution level which will affect link of the supply chain. The reasons we choose four Ps model instead of four Cs (Customer, Cost, Convenience and Communication) model is that four Ps starts from internal, mainly considers the producer's subjective initiative and trade target. This thesis mainly discusses supply chain instead of the market, and we can assume that the *Gadus morhua* supply chain is hardly to say as a pull chain due to the stable market demand.

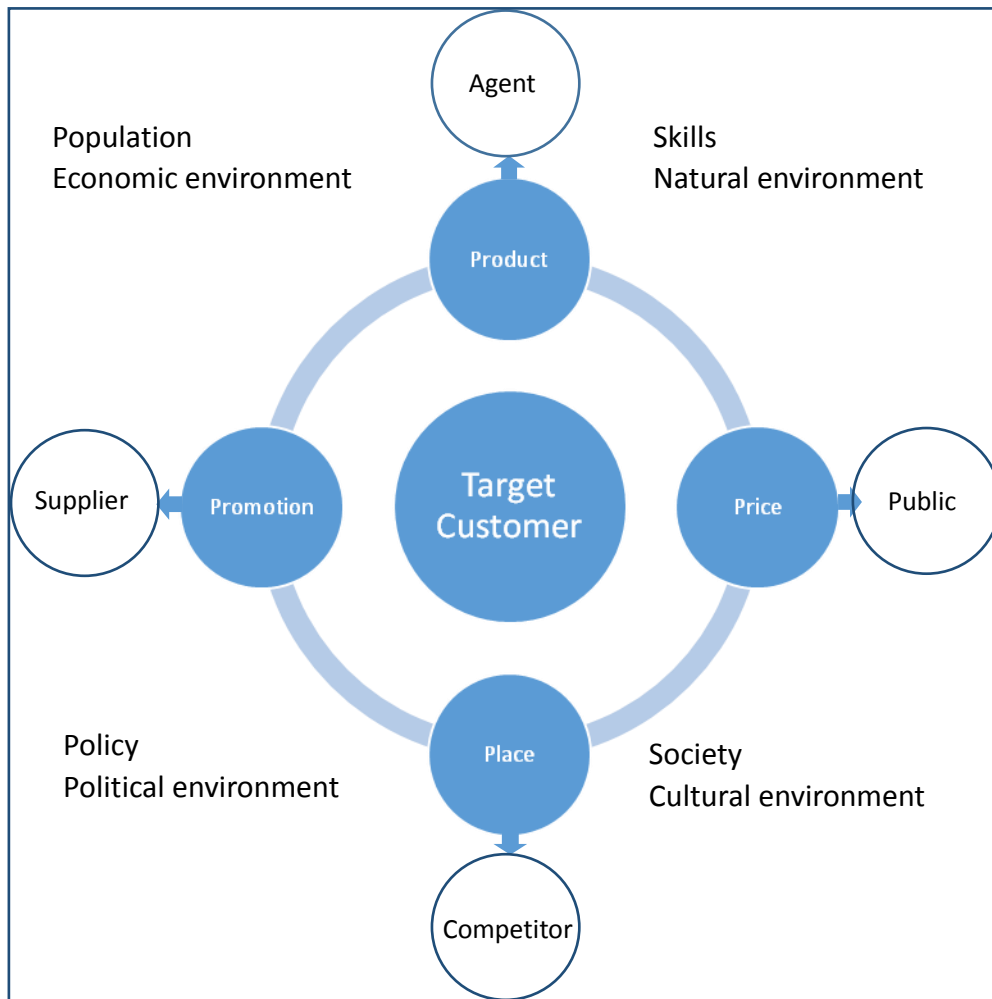


Figure 2.5 Four P's model with external factors

This thesis mainly discusses *Gadus morhua* from Norway, Bacalao as final product in Brazil market and salted & dried in the common market, which is the core product, basic characteristic includes dry or frozen, with bone or boneless. The final product has Norwegian brand guarantee and Chinese process value-add. According to West-Norway AS, China processed fish has competitive advantage in cost and skill compare with Norway traditional one. For skills, China uses manual work to boning, shelling and shredded due to the low labor charges, Norway's traditional way of processing is mechanically filled, hardly to get out all the bones so that product much wastage. According to West-Norway AS, Norway gets 55% of production in boning process, compared to 72% fish filled in China. Now Norway tends to use new technology SINTEF to develop the possibilities to fish processing. Mature machine, of course, can be an advantage for Norway's fish industry in the future, however, nowadays, the higher experimental expenses, the lower yield efficiency of used

machine are not cost-effective. Besides, China's food safety department requires traceability of all of import processing products, in order to guarantee quality of product, this measure encourage Norway companies to cooperate with China trustingly and increase customer's satisfaction. The Chinese fish product provides a convenient way for customers with skinless and boneless with lower price, that is the reason for customers to choose this kind of product and the reason for Norway companies to choose China to processing fish.

Meanwhile, we need to remember that Norwegian brand and label are the most important guarantee of customer, because it ensures the source's safety and quality. This issue is relative to ownership and packaging identification of the final product. The packaging should mark name or logo (ownership) and type (processing), also the exporter (source coming) and importer (agent). All of these identifications are relative to document legality and product traceability.

Based on the interview for West-Norway, China's processing product with shredded, small pieces, boneless and skinless, they trust the combination of Norwegian source and Chinese processing, that is also the consequence of market choice.

For price, depending on market positioning, for different pricing strategies, product pricing is based on corporate brand strategy, focusing on the value of the brand.

The important reason for processing in China is the low cost include labor, transport and equipment. According to West-Norway AS, include processing, packaging (made in China, extremely cheaper than Norway), transport from Norway to China and customs clearance, the average cost for skinless, boneless and shredded fish product is NOK 6/kg, at the same cost level Norway can use traditional method to produce 1kg fish with skin and bone, without shredded.

Companies do not directly to consumers, but to focus on the establishment of sale network and cultivation of the dealer, the connection of businesses and consumers is through distributors.

The place for final fish product will be Brazil (South American) and Europe after processing according to West-Norway, agent acts as intermediary in the sale network, agent distributes one product to a mass of distributor, sometimes one supply chain has one tier of agent, sometimes has more, it is related to supply chain level and affect pricing for final product. However, the agents have the experience and network to handle practical network corporation, it is necessary in the supply chain. For West-Norway, they deliver clip fish from China to Brazil after processing through agents, and agents sell it to different wholesalers, wholesalers distribute the fish to thousands of retailers.

However, Norwegian research institute Nofima pointed out that “reduced the market share of Norwegian bacalhau over the last five years (2007 to 2011) from 86 percent to 61 percent” in Brazil^[13], due to new fish products have steadily entered the Brazilian market, such as Chinese-produced salted Alaska pollock in smaller pieces and Portuguese-produced desalted bacalhau. Therefore, the Norwegian *Gadus morhua* product should consider and prepare to enlarge market share in new markets.

2.3 Description of *Gadus morhua* supply chain structure

Anyhow, source from Norway, processing in China, sales back to Europe or export to Brazil, such long supply chain, increase cost and risk for *Gadus morhua* product. The cost includes logistics cost such as transport and storage, tariff and profit of participants; risks include:

- 1) Transport time leads to product health problems;
- 2) Different food safety inspection among countries will increase operation leaks which might lead to food safety problems;
- 3) Different regulations among countries will mess the responsible party of product, such as product traceability problem.

So the question comes, in which way we can reduce cost and promote efficiency of *Gadus morhua* supply chain?

The main method to reduce supply chain cost is reduce participants within the supply chain, but the condition is that there should be at least one leader in supply chain to integrate each node. The first step is that we need to understand *Gadus morhua* supply chain structure and its nodes.

We divide the four parts for clip fish supply chain base on the handler or location, from raw material to final product, from capturer to the final customer. The four parts are

- 1) Capture and transport;
- 2) Processing;
- 3) Terminal and wholesale;
- 4) Retail.

Furthermore, we can sum up the processes into three points: 1) Resourcing. Source decides the original quality and reputation for final product, for instance, the customer might think salmon from Norway is better than salmon from other places because of the clean level of the ocean. For the same, *Gadus morhua* raw material from Norway has much better reputation than *Gadus morhua* from China; 2) Logistics activities. Logistics activities include trade between seafood companies and capturers, shipping, processing in China, packaging and sales in Brazil. There are lots of participants in this flow, such as freight forwarder, processor and agent, all of participants means increase in value and cost, this flow has great effect to final price; 3) Product traceability. After the logistics of supply flow, raw material becomes the final product, goes to wholesalers, to retailers, and finally reaches into customers. “You had that void and third parties became what was necessary in order for the suppliers to be able to communicate to buyers that they had the food safety controls in place”, says Robert Whitaker, chief science and technology officer at the Produce Marketing Association, a trade group.^[14] Participants include third parties for food safety controls in the supply chain will mess up source of product and increase the difficulty to find out the responsible person for quality of the final product, product traceability is important for participants to guarantee what they provide, and important for customers to know well about what they really felt.

As the analysis above, the supply chain can be concluded as follows:

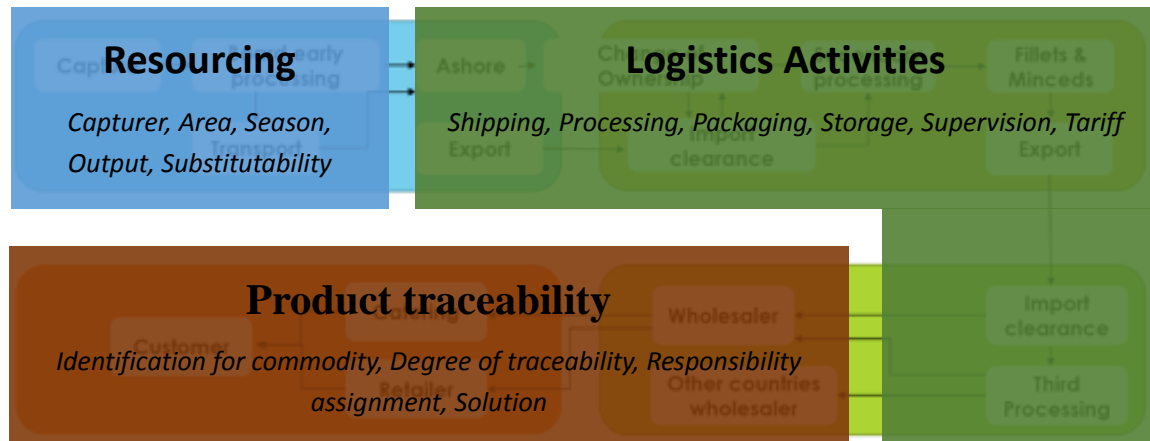


Figure 2.6 Three control parts of *Gadus morhua* supply chain

2.3.1 Resourcing

For resourcing, we need to answer three questions: the area of *Gadus morhua* comes from, the relationship between capturers and seafood companies, stability and substitutability of *Gadus morhua* source.

Gadus morhua captured by trawl, cage or trotline in Norway need primary processing on board like head cutting and gutting.

2.3.2 Logistics Activities

There are lots of steps within this process, the most important thing is how we can guarantee product quality. As same as lots of Norway seafood companies, the *Melanogrammus Aeglefinus* and *Gadus morhua* of West-Norway process at China plant, they usually set a representative office which is 100% owned by Norway company, and rent factory and production line with employees for processing. China is like a transfer station, raw material of seafood imported into China and the plants is responsible for daily communication with suppliers, product processed, quality controlled for products and exporting. We will discuss the whole process flow and focus on three points about this operation in China: quality, quantity and cost.

1) Processing

First step, raw material of *Gadus morhua* will be transported from Norway to

Qingdao, China, it usually spends 5 or 6 weeks for shipping. During shipping the temperature should be controlled at frozen. Consider that the fish material will be frozen several times, the core temperature of fish should never exceed more than 1 degree before it being frozen again, to completely eradicate bacteria. All raw materials are without head and offal, and then thawed and processing in China.



Figure 2.7 Chinese processing plant for *Gadus morhua*

Second step, after material arrives in China, representation office and plant need to check the quantity and quality. The exporting country must provide an office certificate of sanitary, plant need to pick examples to test pollution by the microbe and pollution of chemical histamine.

Third step, plant starts to processing material. The processing flow as follows:

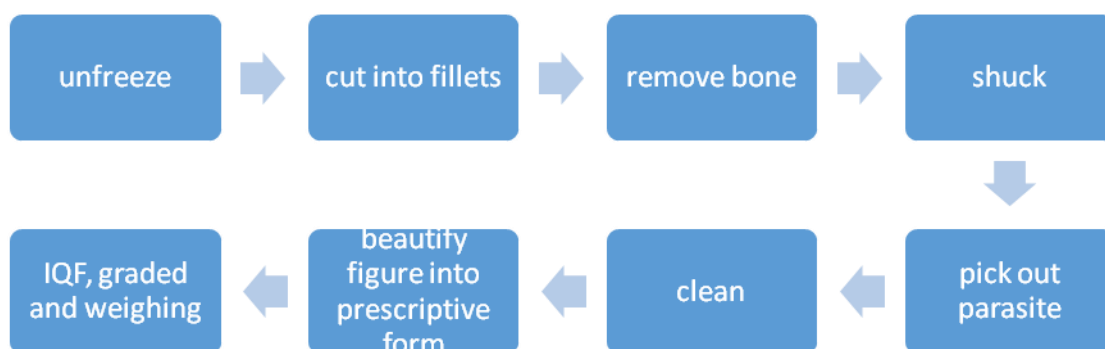


Figure 2.8 Processing flow of *Gadus morhua* in China

This is the main work and the critical control point for China plant, should be strictly ensured sanitation for everything which might contact food surface, such as plant construction, mill area, equipment and facilities include workshop, lighting service, dressing room, hand-washing facilities and toilet. Base on plant's SOP, plant should be constructed in such a manner that floors, walls, and ceilings may be

adequately cleaned and kept clean, aisles of working spaces are provided between equipment and walls are adequately unobstructed and of adequate width to permit employees to perform their duties and to protect against contaminating food of food-contact surfaces with clothing or personal contact, and should provide adequate ventilation or control equipment to minimize odors and vapors in areas where they may contaminate food, and adequate screening or other protection against pest. Mill should maintain the area in good sanitary conditions, operating system for waste treatment and disposal in an adequate manner so that they do not constitute a source of contamination, main road in the mill compound should be concrete and smooth and no seeper, the processing zone and the life zone must keep separation, keeps the completely drainage system, the rejectamenta must meet the standard of the requirement of the state. All plant equipment and utensils shall be so designed and of such material and workmanships as to be adequately cleanable, and should be properly maintained. The design, construction, and use of equipment and utensils shall preclude the adulteration of food with lubricants, fuel, metal fragments, contaminated water, or any other contaminants. All equipment should be so installed and maintained as to facilitate the cleaning of the equipment and of all adjacent spaces, equipment, containers, and utensils used to convey, hold, or store raw materials, work-in process, rework, or food shall be constructed, handled, and maintained during manufacturing or storage in a manner that protects against contamination.

For product quality consideration, processing environment has temperature and ingredient requirement. The raw material should be stored in the cold storage houses with the temperature of -18 degree or bellow, and must separate from products; the water/ice used in the processing should be in conformity to GB5749 “Quality Standard for Drinking Water”; during the steps such as washing, peeling, trimming, cutting, sorting and inspecting shall be performed so as to protect food against contamination, protection steps may be provided by adequate cleaning and sanitizing of all food-contact surfaces, and by using time and temperature controls at and between each manufacturing step; the personnel who are at thawing place should not allow to enter the processing room, and employees are forbidden flowing working at

different steps. The equipment measures shall be taken to protect finished food from contamination by raw material, refuse in the processing and other things. After all process, metal detection need to be operated to all products to check biological, chemical and physical hazard which may be appeared during process.



Figure 2.9 Processing site for *Gadus morhua*

One important reason for Norwegian seafood companies to choose China to process is manual work with low labor payment. Compared with 55% yield of skinless and boneless with machine in Norway, Chinese workers create completely boneless with hand work and plus cheaper labor charge definitely has attracted.

Unit: tonne

Year	Raw material quantity	Output quantity	Conversion rate	Dis-qualified quantity	Defective rate
2010	2500	2000	80%	20	1%
2011	3000	2100	70%	15	0.71%
2012	3700	2500	67.57%	35	1.4%
2013	4000	2700	67.5%	20	0.74%
2014	4500	3000	66.67%	50	1.67%

Table 2.1 Processing data for *Gadus morhua* product in West-Norway from 2010 to 2014

West-Norway AS China office provides quantitative data of raw material from Norway, output and dis-qualified during 2010 to 2014 as above. The average conversion rate of transferring *Gadus morhua* raw material into *Gadus morhua* product is 70.35%, average dis-qualified rate is 1.10%. Before freezing, all the processing is done manually, two reasons will result in dis-qualified product: fish raw

material are not suitable, either in size, or freshness; mistake done by workers. The average rate of dis-qualified product is less than 1%.

2) Package

After processing of material, all finished product will also be packaged in China. Packing materials come from Chinese suppliers, which are much cheaper than Norway and Europe. In the label, company in china is shown as producer, and company in Norway is shown as an exporter. This information will be helpful for product traceability.



Figure 2.10 West-Norway *Gadus morhua* product packaging

3) Storage

After packing, the products would be stored in cold storage before shipping out. The cold storage should be kept clean and sanitary, temperature for frozen fish in the storage and transporting vehicles should be constantly kept at -18 degree with anti-temperature recorder, and kept remove-frost regularly. Every piles should be with a sign which written the product name, size, net weight, lots, product date, etc. The storage condition would be minus 18 °C or below for frozen fish fillet, and 0-5 °C for salted fish fillet.

China plant has safety stock for turnover, it is insurance reserves in order to prevent uncertainty factors, such as a large number of unexpected orders, delivery sudden advance, increased use of temporary special reasons for a delay in delivery etc. Plant prepares products with temporary package and wait for urgency order. The rate of safety stock is about 10%.

4) Product traceability

The company should have organization of both production management and quality control. These organizations are responsible for the design, carrying out, supervision and inspection of this “good manufacturing practice”.The production management organization is in charge of the production of the company.

Under the direct leadership of the quality control organization director, this organization enjoys sufficient right to carry out quality control. The chief quality controller has the right to stop production or delivery.

This organization is in charge of the quality and sanitation control of the whole process of the food from raw material to frozen finish products so as to ensure the high quality and safety of the products processed in this factory.

2.3.3 Processing Cost and tariff

According to our interview for Kent Xu, principal of West-Norway for China plant, the total process cost for frozen *Gadus morhua* is USD 950/ton, include the cost of imports & export formalities in China; labor cost; electricity and water, packages, other production materials, like salt; management cost; like salary of office staff; the depreciation of the facilities; workshops; the profit of the processing factory. Through November of last year, U.S. imports of fresh Icelandic *Gadus morhua* fillets were up 27% to almost 2,500 metric tons with average imported price as \$5.40/lb, while imports of twice frozen Chinese *Gadus morhua* fillets were up almost 40% to about 40,000 metric tons with average imported price about \$2.50/lb.^[15]

According to He Cui, president of China Aquatic Products Processing and Marketing Association, fish process plants generally in accordance with the quantity and quality of production resources to pay workers a monthly salary of generally 1500-2800 yuan (equivalent to about US \$ 220-410). Torbjorn Trondsen also provides a form to show Chinese competitive labor advantage^[16]:

	Fillet processing at Pacific Andes	
	Alaska pollock	Cod
EU average import values 2008 from China €/kg	1,88	4,63
Fillet yield increase per MT H & G	150	150
Value increase from yield €/MT	282	695
Extra freight US_CN_EU €/MT	250	
Extra freight EU_CN_EU €/MT		500
Labour cost €/MT raw material	344	344
Net value increase €/MT	32	195
Yield value gain in pct of labour costs	9 %	57 %
Increased yield	15 %	
Productivity Kg/h/worker	3,14	
Labour cost RMB/h	10,68	
Labour cost €/h	1,08	

Figure 2.11 Chinese labor advantage in whitefish process

Specific figures might be changed at present, but compared with Norway, Chinese labor cost has definitely advantage and it is also the reason for Norwegian commercial companies choosing China as a processing center.

For tariff, almost all of *Gadus morhua* raw material processing model is accepted customers', refers to processing on order. Raw material goes into bounded area to be processed, after processing, these finished product or half-finished product will turn to the third market such as Brazil and Europe. For this trade model, neither of the Norwegian aquatic trade companies nor Chinese processing factory need to pay tariffs. The single processing mode will make China into a "comparative advantage trap." In addition, over the years, along with rising international prices for agricultural commodities, and rising labor costs, the appreciation of the RMB exchange rate, and the recent global economic downturn, the demand is no longer stable growth, China's fish processing industry situation even more difficult.

Less market share is a reason for high average cost, because of transit and transporting fee. Formal aquatic products processing enterprises saw a huge domestic market demand, but has been unable to really open up the domestic market, mainly because import tariffs.

Tariff number	Trade name	Preferential duty	GSP duty	VAT
03025100	Fresh/Cold Cod	12.0	40.0	13.0
03055100	Dried Cod	16.0	80.0	13.0
03047100	Frozen Cod	10.0	70.0	13.0

Table 2.2 China import tariff and VAT for *Gadus morhua*^[17]

Graph above shows import tariff of all kinds of *Gadus morhua* products, including dry, fresh and frozen material. VAT for all *Gadus morhua* is 13%, the highest import tariff is dry *Gadus morhua* is 16%, fresh or cold one is 12%, frozen is 10%, so the combined tax rate for *Gadus morhua* from Norway to enter into China is from 23% to 26%. Meanwhile, the import tariff on aquatic food in ASEAN-China FTA is 0.^[18]

2.4 Conclusions

Aim to evaluate *Gadus morhua* supply chain's cost and efficiency, we discussed around nodes and details, especially the process in China bounded area based on the interview of the case.

In this supply chain, the participants include fisherman, commercial company, shipping company, process plant, agent, dealer, etc. The fisherman is the source of raw material, commercial company responsible for international product trade, order from fisherman, order to process plant and order to shipment from process plant to agent or customers, agent is the one to communicate with the third party markets and distribution channels. For *Gadus morhua* industry, if the commercial company doesn't have the ability to integrate material resource, process plant and distribution channel together, there is not a participant can be eliminated from this supply chain.

Profit aside, the way to reduce supply chain's cost and raise its efficiency is reduced nodes or large scale, if the cost is stable, we need to consider value upgrade. Under the situation as such stable nodes in *Gadus morhua* supply chain, the way to large *Gadus morhua* product scale is opening markets, if China as the process center can be one of the main market, logistics cost should be decreased. However, product

substitutability aside, 24% import tariff makes *Gadus morhua* lose price advantage, compare with 0% import tariff for fish product from the countries which have free trade agreement with China. Therefore, the tariff is the problem, FTA establishment is the key to solve this problem.

On the other hand, based on customer's demand, *Gadus morhua* product as food product should be safe and quality guaranteed, during we investigating processing flow, we can find proof for health safety, if *Gadus morhua* supply chain need to upgrade value, product traceability that show responsible party clearly should be solved.

3. FTA's effect for *Gadus morhua* supply chain between Norway and China

FTA (Free Trade Area) is defined as two or more countries to reach some kind of agreement or treaty by the international economic integration organizations canceled tariffs and tariffs between each other and have the same effect of other measures. It has most of the characteristics in addition to a free port, but also can attract foreign investment to set up factories, development of export processing enterprises, to allow and encourage foreign investors to establish large commercial enterprises and financial institutions to promote regional economic integration, and comprehensive development^[19].

Influence of FTA on the area economy can be divided into two categories^[20]: One refers to effects due to members of the region to eliminate tariffs and trade with each other after a number of restrictive measures directly between the members of the business generated by the development, so called "Static effect"; the other means after the conclusion FTA, since the inner area of production efficiency and increase capital accumulation, leading to indirect effects of accelerating economic growth in the member, so called "Dynamic effects".

Obviously, FTA establishment will cancel import tariff of China to import *Gadus morhua* from Norway, it means *Gadus morhua* supply chain can expand and search more market share in China, instead of only processing in bounded area. Based on the stable demand from Brazil, new market in China will increase the total demand and output to *Gadus morhua*. However, as long as *Gadus morhua* product enlarges market in China, comes greater competition, even include negative competition from small, illegal seafood workshop. The substitutability of *Gadus morhua*, eating pattern difference are the threats that *Gadus morhua* supply chain should face to.

3.1 FTA's static effect analysis

Effect of "Static effect" the most representative of the so-called "trade creation effect" and "trade diversion effect". Trade creation effect refers primarily due to the decline in transaction costs and trade restrictions were lifted, leading to high costs of the domestic product is replaced by other members of the region in the past by other low-cost goods and the number of high tariffs and restrictions of their low-cost goods among members of the region to each other expansion of exports, imports and exports within the region in order to give both sides the opportunity to bring more trade and economic interests. If FTA established between Norway and China, import tariff will be cancelled, it can be imagined that *Gadus morhua* will go directly into China market after processing and not only transfer to the third market, more trade and economic interests will be created in Norway, follow the "trade creation effect".

3.1.1 Gravity model analysis

Here we use the Gravity Model to discuss bilateral trade flows, test the trade foundation between Norway and China. Gravity model of trade was established by Jan Tinbergen in 1962, to illustrate the asymmetry of trade flows in the world composed of a large number of countries, the country's trade accounts for a large proportion of GNP is less than the small countries. It also describes geographical factors and trade route has its relevance, trade between the two countries and the two countries the size of the economy (Economic size, in order to measure the output and population) is proportional to the relationship, and geographical or cultural distance between the two countries on the an inverse relationship. The fundamental formula is:

$$T_{ij} = AG_iG_j / D_{ij} \quad \text{Equation 3.1}$$

T_{ij} refers to bilateral trade volume between Country i (exporter) and Country j (importer), G_i and G_j are two countries' GDP level, D_{ij} is distance between two countries, generally use transportation cost as basis; A is constant term.

Its common logarithm is:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln G_i G_j + \beta_2 \ln D_{ij} + \mu \quad \text{Equation 3.2}$$

β_0 is constant, β_1 and β_2 are coefficients which refer to T_{ij} elasticity of $G_i G_j$ and D_{ij} .

This thesis quotes Dr. Qiuguang Hu's result in her article "China Aquatic Products Export Trade Factors and the Development Potential - Analysis Based on Gravity Model", analyze bilateral trade and trade scale between Norway and China based on aquatic market demand. The study aquatic products trade volume between China and the 32 countries of the 2006 sample data, research seafood exporters in China and its major trade flow measurement method using panel data regression results through the significant test, goodness of fit higher. In the gravity model, the dependent variable is the fish trade between China and these major exporting countries, the explanatory variable is GDP of these export countries, China's gross fisheries PRO, as well as the distance between the two sides, different studies of variable factors influence of Chinese aquatic products export trade.

Her gravity model for China aquatic products export trade through regression analysis is:

$$\ln M_{ij} = -8.77 + 1.17 \ln G_j + 1.96 \ln P_i - 1.07 \ln D_{ij} + 0.51AD^{[21]} \quad \text{Equation 3.3}$$

M_{ij} is aquatic trade volume of China and importing country, G_j is importing country's GDP, means its import demand of aquatic; D_{ij} is distance between China and importing country, represents aquatic trade's transport cost and risk; P_i is China's gross value of fishery output, represents Chinese aquatic export supply capacity; AD is dummy that whether the country is member of APEC; use μ or not for random error.

The model results show that the level of Chinese export trade and GDP seafood importing countries, China's gross fishery production positively correlated with negative from the trade between the two countries, promote the role of APEC member

countries in its seafood trade. Under other conditions the same premise, GDP is importing countries increased by 1% would boost China's seafood exports increased by 1.17%; China's gross domestic fishery production increased by 1% will promote exports of aquatic products increased 1.96%, imports States and China every 1% increase from the export of aquatic products will be reduced to its trade with China 1.07%.

Dr. Qiuguang Hu also provided analysis of GDP and distance factors effect to Norway's aquatic export trade in 2006, preliminary conclusion is:

$$\ln M_{ij} = 1.33 \ln G_j - 1.01 \ln D_{ij} \quad \text{Equation 3.4}$$

The results above showed that seafood trade between Norway and China exports will be affected by GDP and the distance of two countries, GDP increases 1% in China will contribute to the Norwegian seafood exports grew 1.33%, a 1 % increase in distance will lead to 1.01% decrease in export of Norwegian aquatic product. The result explains that, compared with China, the change in GDP in importing country will significantly impact Norwegian aquatic products' export, while distance has less relative with it.

Based on the analysis, after the establishment of FTA, Norwegian aquatic product trade will have greater development, certainly include the main aquatic product as Salmon and *Gadus morhua*. Result above shows that 1% increase in China's GDP will lead to 1.33% increase in Norway's export of aquatic products, during the China's "the Eleventh Five-Year" period (2006-2010), GDP average annual real grew by 11.2%, is one of the most increase period since the China's economic reform^[22], far higher than the average annual growth rate of the world economy. The rapid growth of China's GDP will continue to boost domestic demand, and thus play a huge role in boosting of Norwegian *Gadus morhua* product exports. For China, the GDP growth in Norway will also provide a driver for Chinese seafood export, Norway's GDP growth rate is stable, and it AGDP always occupy lead position in the world. Furthermore, an increase in China's GDP will also push the development of Chinese aquatic products export trade.

3.1.2 Import tariff cancels

The most direct impact of bilateral FTA establishment is import tariff cancels. As we mentioned in the second part, combined tax rate for *Gadus morhua* from Norway to China now is during 23% to 26%, but this rate for ASEAN-China FTA is 0.

The abyssal fish include *Gadus morhua* which China used to import is mainly from an exclusive water area of Russia, Europe, and the United States. For Chinese customer, abyssal fish is clean, nutritious, delicious and sufficient quantity, China's coastal fishery resources has a great difference not only in quantity but also in the variety. Chinese customers will appreciate if these aquatic products can import into China with lower price.

In addition to secure more aquatic resources for Chinese consumers, the establishment of the FTA will contribute to the cancellation of import duty. Processor in China also mentioned that if the abyssal fish source like *Gadus morhua* from Norway enjoy duty-free treatment, while set tariff standard for other specific freshwater fish resource from the Indian Ocean which is similar to Chinese fishery resource, might help China to balance domestic fish product in the market, protect Chinese ocean fisheries and guild Chinese customers to choose imported abyssal fish product such as *Gadus morhua*.^[23]

As a word, the cancel of Norway *Gadus morhua* and other aquatic products import tax will improve output of these kind of product, market will be expanded and profit will increase.

3.1.3 Trade creation effect

In the method of calculation of trade creation and trade diversion effects of regional economic integration, the Balassa-Samuelson model, which explains trade creation and diversion effect through the income elasticity of import under FTA establishment, is more widely used model. As used herein, the Balassa-Samuelson model has further explanation for the economic effects of static in Norwegian aquatic

trade that trade creation effect and the trade diversion effect in Norway after the establishment of FTA.

The basic principle of the model is explaining trade creation effect and the trade diversion effect of regional economic integration through the establishment of regional economic integration through calculation of the different income elasticity of demand before and after FTA establishment. Assume that the income elasticity of demand for imports is fixed prior to the implementation of regional economic integration, after the establishment of regional economic integration, if demand income elasticity of import increased in the intra-regional trade, trade creation happens; if demand income elasticity of import decreased in the intra-regional trade, which means trade diversion.^[24] The fundamental formula is:

$$M_r = aY_t b\mu \quad \text{Equation 3.5}$$

Its common logarithm is:

$$\ln M_r = a + b \ln Y_t + \mu \quad \text{Equation 3.6}$$

M_r is gross import for one country, Y_t is the country's GDP, b is income elasticity of import demand, a is constant and μ is random error.

Here thesis quotes Li Feng's result in her article "Research of the aquatic trade between China and Norway based on the bilateral FTA view", select China's GDP, China's gross import of aquatic product and China's aquatic import from Norway during 2000 to 2009. Result of Eview6 OLS calculation is:

$$\ln MT = 8.330472 + 0.006570 \ln Y_t \quad \text{Equation 3.7}$$

$$\ln MI = 0.104627 + 0.000483 \ln Y_t \quad \text{Equation 3.8}$$

Form 3.7 is China's aquatic gross import equation, MT is China's aquatic gross import. Form 3.8 is the equation of China's aquatic gross import within FTA between Norway and China, MI represents China's aquatic import from Norway. According to Li Feng's result, both of elasticity coefficients are greater than zero, means trade creation between Norway and China after FTA establishment is exist. Furthermore,

due to $b_i < b_e$, indicates the increase of economic welfare within Norway and China is less than the increase of economic welfare outside of the FTA between Norway and China, trade diversion effect will not happen. Therefore, the net trade diversion effect is produced if FTA establishment between Norway and China.

3.2 FTA's dynamic effects analysis

“Dynamic effects” including "market expansion effect" and "promoting competitive effects." The former refers to the scale with the expansion of trade, will generate economies of scale of production and circulation, and bring industrial agglomeration effect. The latter refers to the region with the formation of a unified market, will promote competition and improve production efficiency in the area of monopoly industries.

3.2.1 Economies of Scale

After the establishment of FTA between Norway and China, both tariff and non-tariff barriers aquatic related industries will be reduced or canceled, it will promote the free flow of *Gadus morhua* products between two countries, to some extent, it is conducive to the two countries to play their respective comparative advantages, improve productivity levels, thereby enhancing the professional level of aquatic products and achieve economies of scale. Aquatic production specialization and scale will help to lower production costs and improve the welfare of consumers, thus to promote bilateral economic development and welfare increases. Especially in Norway, domestic seafood market demand is limited, and China as the world's most populous developing country, exist a large potential market demand, but also with China's sustained economic development, demand for aquatic products market potential will increase. For China, the Norwegian technology and management experience in the production are worth to learn. FTA will bring the free flow of factors of production between the two countries and fisheries, such as fishery resources,

mobility of labor and capital, technology and management experience exchange, that will promote the development of bilateral aquatic industry, not only for *Gadus morhua* product, and generate economies of scale.

If we consider the re-export to the third party market like Brazil and Europe, if the capture limit is stable, Brazil also is the major market of *Gadus morhua* product, China is only a new market based on the demand compared with Brazil.

3.2.2 Competition promotion effect

According to Kent Xu, the area manager of West-Norway AS China office, the biggest challenge would be the vicious competition from other producer in China. It is not just alarmist talk. There is a mass of workshop distributed along coastal cities, some of them have not regular programming and safety guarantee, but because of bounded area's admittance, no illegal workshops existed in bounded areas. However, vast pools of cheap labor also brings competition for process plants.

After the establishment of FTA, trade liberalization will not only bring resource allocation effect, but also brings competitive effects for both Norway and China aquatic industry, and there is increased competition welfare effects because of the trade liberalization. Commercial companies and process plants will face all competitors from the two countries in the sector, it will be an unprecedented fierce competition in aquatic industry, which will promote the survival of the fittest, to stimulate enterprises to increase investment, improve technology to enhance competitiveness, thus contributing to aquatic industry specialization, to improve the overall competitiveness of the aquatic industry in the two countries. On the other hand, we should also look at the competition problem domestically. China's aquatic industry still has many problems such as low levels of aquatic products processing technology, cut-throat competition existed in process with small and medium workshops, not standardized in aquatic system construction, etc. The establishment of a bilateral FTA will bring competitions through the entrance of Norwegian competitive fishery resource and processing technologies. For long-term development, the introduction of

competition will force enterprises to make full use of existing equipment, improve production technology and promote standard and professional processing system.

Beyond that, for the product which processed in China and re-export to the third party markets, such as *Gadus morhua* product re-export to Brazil and Europe, they do not have necessary to be processed in a bounded area under the FTA regulation, commercial companies from Norway can choose process plants unlimitedly in China, and decide to sell in China or re-export to Brazil. The cost of re-export product will also be reduced due to more competition in the entire China instead of bounded area.

Therefore, the establishment of the FTA will bring positive competitive effects for all of participants in *Gadus morhua* supply chain.

3.2.3 FDI creating effect

In recent years, private investment between China and Norway are increasing. The establishment of the FTA will create a favorable environment for business investment between the two countries, and promote the exchange of Chinese and Norwegian companies and development. Although the Norwegian aquatic product processing industry is developing, due to the rising labor costs, changes in international exchange rates and the EU demanding access conditions, Norwegian aquatic product processing industry is facing greater challenges from other low-cost countries, China's abundant labor resources may be attracted to the Norwegian aquatic commercial enterprises to increase investment in China, the establishment of FTA may enable Norwegian companies to choose China as aquatic products processing base. On the other hand, as China's economic development, Chinese enterprises overseas investment capabilities continue to increase, Chinese companies may increase investments in Norway under the FTA environment, to learn from the Norwegian aquatic industry to take advantage of mature technology and aquatic equipment. In addition, it may attract other countries outside the FTA and the companies enter the market in this region, in the area of direct production and marketing.

3.3 Policy suggestion for FTA

Bilateral FTA will bring chance and challenge both in Norway and China. Even two countries have lots of political blocks, the attraction of an economic corporation cannot be resisted. Based on “resource gift theory”, Norway and China have economic complementarity, policies should guide economic corporation. On the other hand, after FTA establishment and import duty counsel, Norwegian *Gadus morhua* largely goes into a Chinese family’s dining table is just the problem of marketing.

3.3.1 Industry standards governmental support

The Norwegian Fisheries Association is well developed, there are representatives of the interests of fishermen, Norwegian Fishermen's Association (NFL), on behalf of the organization and processing of fish products marketing organization Norwegian Seafood Association (FHL), as well as the Fisheries Department provides many research institutions and administrative bodies are relevant technical and professional support. These associations, organizations and institutions for the development of the aquatic industry in Norway has made a great contribution. At present, China lags behind the development of aquatic industry in the world, the lack of standardized management within the industry is the problem urgently to be treated. First, the Chinese government should support the policy development from industry associations, gives certain ability in the aquatic industry, as well as its supervision from the legislation to better facilitate their work; support to the two countries industry associations from economies and provide basic operation of the industry for its economic foundation. As aquatic industry associations, should strengthen self-construction, improve service levels and efficiency by speeding up the construction and modernization of information, to provide a good platform for aquatic development, while establishing the anti-dumping warning system in aquatic industry, improve the international aquatic relative enterprises responding capacity safeguard the legitimate rights and interests.

Government has an important role in the development of aquatic products, in order to improve the competitiveness of the aquatic industry to resist risks after the establishment of FTA, the government should give full play to the role of guide and support the industry to create a favorable for the development. The government should consider the topics include: further strengthen the legal system for aquatic industry; establish a set of standard system of aquatic products from production to final sale with international practice; change our imperfect standards status quo; further improve the construction of aquatic product quality certification system; increase capital and scientific research; guide enterprises to complete the certification standards; strengthen safety management and supervision of aquatic products market; improve market access threshold; increase punishment to the illegal production , sale and use of drugs, clean fish market from the source to solve the problem of drug residues in aquatic products exports; guide and support the aquatic enterprises to expand financing channels; promote the establishment of order fishing venture funds; etc. Overall, the government should give full play to the role of guidance and support to improve the quality and quantity of aquatic service system.

3.3.2 Industrial structure and technology complementary

Competitive advantage of Chinese aquatic products is mainly reflected in the "quantity", while the advantage of Norwegian seafood is more reflected in the "quality", the overall competitiveness of Norwegian seafood is higher than China. But for *Gadus morhua* product, there is exactly complementary between Norwegian resource advantage and Chinese process advantage, the two countries should give full play to their strengths, take advantage of the complementarity of the two countries in aquatic field, strengthen economic and trade cooperation, expand the deep industrial division of labor, trade within the development industry, to provide a solid economy to establish a bilateral FTA foundation and protection.

Compared with the Chinese manual work for boning and shelling, Norway innovation department creates SINTEF, a filleting machine can quickly and easily

pick out the bones and the fillet. They use CT scanner and X-ray solution to learn more about how the bones of fish sit, filleting fish quickly and accurately with a powerful water jet, this means that the fish is guaranteed to be boneless, with considerably less waste than with manual filleting^[25]. China has powerful low-cost labor, to some extent, it reduces Chinese passion to create and innovate. However, China goes into economic revolution now, labor cost increasing lead to large scale transfer, lots of factories turn to south-east Asia to seek labor advantage. China needs to learn from Norway regarding the technology developed and creative spirit.

3.3.3 Market guides

Gadus morhua is not so popular as Salmon in China, primary cause might be substitutability of white fish like *Gadus morhua*. Compare with Salmon, the special red fish come from Norway can be eaten raw, *Gadus morhua* has lots alternative fish categories. Besides, high logistics cost compares with Chinese domestic fish push customers away.

FTA can solve the problem of high cost, but how to introduce *Gadus morhua* to Chinese customer need marketing efforts. *Gadus morhua* import merchants can refer to information about avocado. These two kind of food is confronted with high costs, less knowledge to customers and deviate from Chinese food culture. The market will introduce these food's nutrition with advocating a healthy life, create a high - end image and provide recipes for food ingredients collocation. The distinguishing tariff regulation we mentioned above that abyssal fish product enjoy tax free and fresh fish has limited tariff will lead to different price of import fish products, which can also guide customers to accept imported abyssal fish product like *Gadus morhua*.

4. Product traceability system for *Gadus morhua* supply chain

Product traceability is not only an afterwards solved and also a forward prevention, control and supervision of *Gadus morhua* supply chain. It emphasizes “control from boat to plate”. Under EU law, traceability means the ability to trace and follow a food, feed, food producing animal or substance through all stages of production and distribution.^[26] Every day we buy goods from the supermarket, the bar code on the goods for an account is a kind of traceability form.

According to SINTEF, the largest independent research organization in Scandinavia, two food safety oriented reasons for implementing a traceability system: ability to trace the origin, and ability to find and reduce the risk and consequences when something has gone wrong.^[27] Traceability within supply chain gives more control over food stuffs and any withdrawals of these and facilitates value adding quality labelling. Besides, there is another important reason for fish product traceability is supervising Illegal, Unreported, and Unregulated (IUU) fishing- which depletes fish stocks, destroys marine habitats, distorts competition, puts honest fishers at an unfair disadvantage, and weakens costal communities^[28]. Traceability systems can be used to document claims on certain product qualities such as a place of production and makes it easier to verify that fish have been legally caught thus constitute an important instrument in ensuring sustainable production.

In order to trace product, data record and trace is necessary, it record IDs of raw materials and ingredients entering the production, for instance, both of *Gadus morhua* materials from Norway and ingredients from China need to be recorded; store vital process data in Hazard analysis and critical control points (HACCP), quality and process control systems and link data in traceability and process systems.

In *Gadus morhua* supply chain which raw material and ownership are belong to Norway and processed in China, label of the final product should contain both of

Norway and China, even other countries who take part in this supply chain. Traceability information record is following the supply chain direction, in order to clear role and responsibility for each link, when happen of recall, it is easy and quick to find out responsible party and the risk problem.

However, there is a conundrum. Where are the traceability systems? Who will manage the database? There is a unified traceability system in this international *Gadus morhua* supply chain?

4.1 Current product traceability system in Norway and China for *Gadus morhua*

The widest method standard for global is GS1 (Globe Standard 1), both of Norway and China contain GS1 as a part of the product traceability system. The GS1 Global Identification System is standards in a global coding and data application of automatic identification, it is developed, managed and maintained by the International Article Numbering Association (EAN). It consists of three parts content: encoding system, which can automatically identify the data carriers and electronic data interchange standard protocols.^[29]

GS1 has a global labeling standard system and information exchange standard system assets to identify cross-industry products, transport units, locations and services, so that products in the world can be scanned and read. Besides, its Global Data Synchronization Network (GD-SN) ensures that the global trading partners use the correct product information, it also uses electronic Product Code (EPC) and radio frequency identification (RFID) technology to provide higher standards of supply chain operational efficiency. GS1 traceability Solutions help businesses comply with relevant international food safety regulations, to achieve security of food consumption.

The problem is, each country has its own traceability system, and the traceability system can be various.

4.1.1 Norwegian traceability system

Norway has a long history of fish industry, therefore, the industry expressed needs for traceability very early, mainly based on standard that European Committee for Standardization (CEN) which for fish and farmed fish products. Now Norway simultaneous use several implementation projects as National Norwegian projects (pelagic and white fish) “eSporing” and EU projects, and running several traceability project developments.

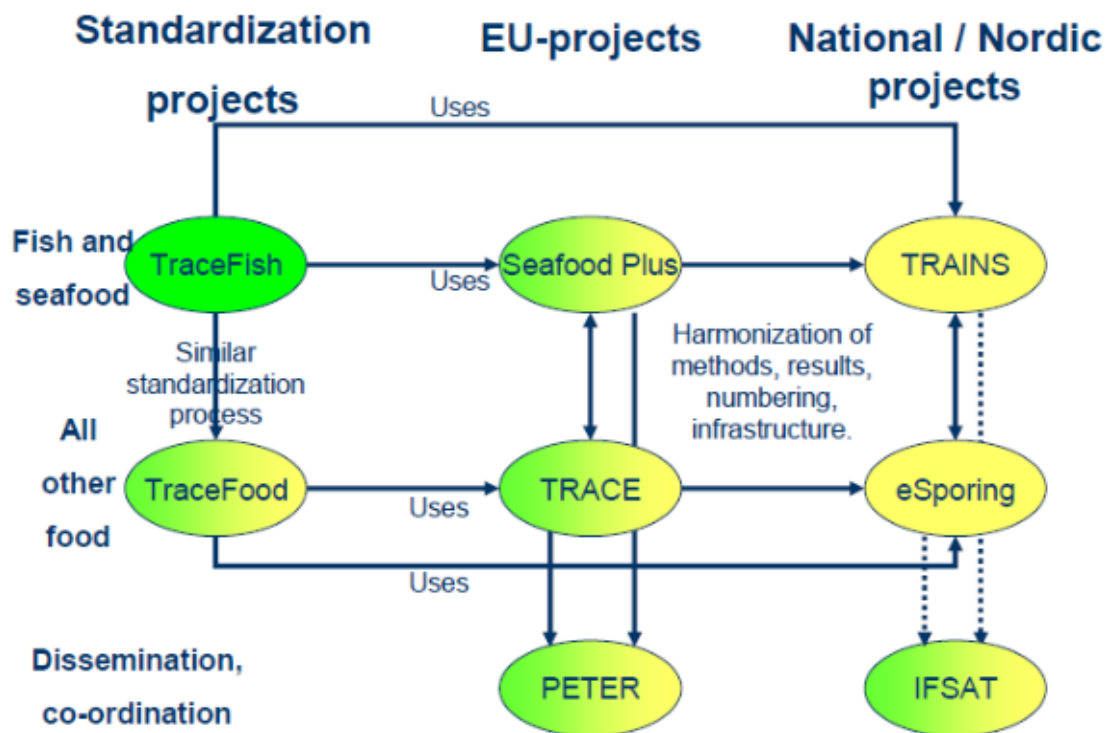


Figure 4.1 Norwegian traceability system portfolio

The foundation standard refers to as “TraceFish”, set standard for fish traceability system, requires fish product has a database since fish catch. When it exports to EU or has co-ordination with EU, EU traceability also need to be followed for some kinds of food, especial for Norwegian fish, for instance, the catch certification is required for EU export only. eSporing as national standard is a kind of harmonization and unity to provide standard for all kinds of product, whatever they are and wherever they transport. The system of eSporing is as follows:

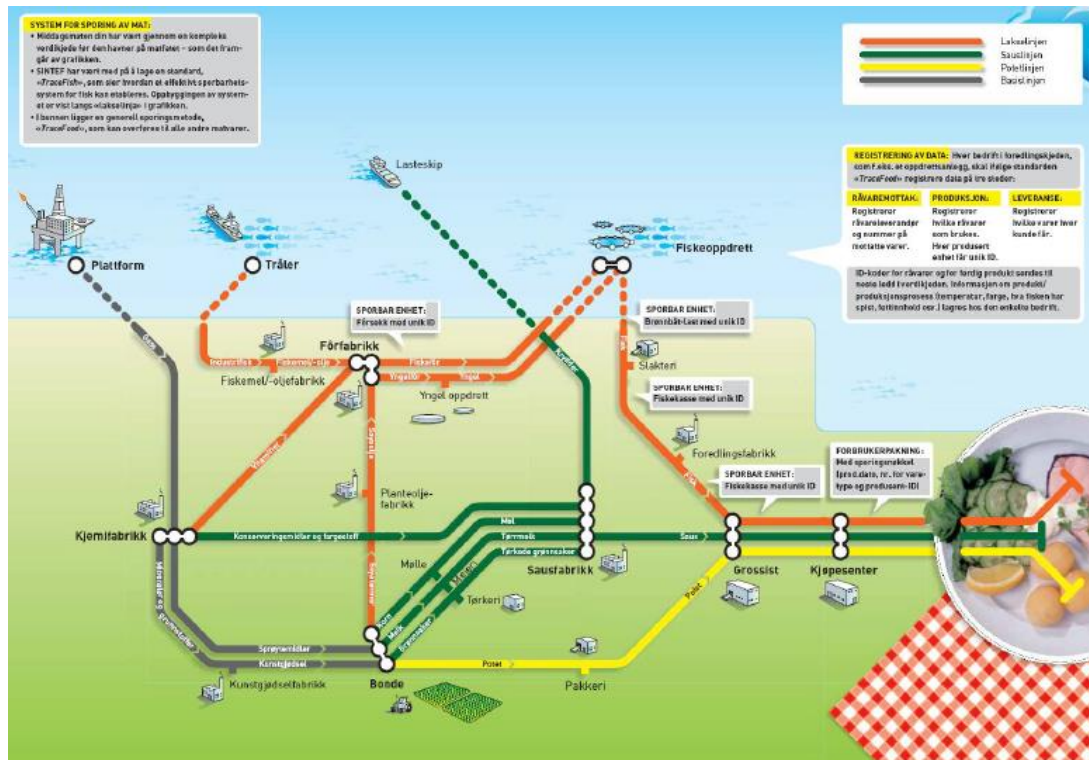


Figure 4.2 eSporing system in Norway^[30]

We focus on fish product. A host of information about the catch is entered into computers when the fish is landed, then these fish go into different farms with electronic information of species, catch time, catch area, size and even the register boat, after that, these fish will get a new unique ID base on the farm information as same as last step. In farms, even feed has traceable requiring. Then more and more ID will accumulate in fish database following slaughtering, processing, transporting and retailing, each unique ID has unique electronic information that represents the link of this supply chain, when recall happens, the electronic information will point out the responsible party rapidly.

However, the Norwegian traceability system has a common problem of a global traceability system, also happen in China: Different companies use different software and database, sometimes it means the same information will be registered many times in different way, consider the ingredients of *Gadus morhua* product, companies have to register all of combined or divided unites, the ideal traceability system will become a complex work with huge work and cost.

That is the reason for Norway to develop more traceability projects. In January

2010, the Norwegian Ministry of Fisheries and Coastal Affairs introduced a labeling requirement that includes catch and harvest date on fresh seafood.^[31] In April 2012, while the commercial system- TraceTracker AS running^[32], the Norwegian Seafood Federation, Innovation Norway, Standard Norway, the Norwegian Seafood Association and other participants launched the “Seafood with a Story” project to develop a single labeling- and coding-system of distribution and transport units for seafood products with a slogan “One code, fast traceability, safe and healthy”, the Norwegian Seafood Federation held a press conference at the European Seafood Exposition to announce the development of a new seafood identification system that will have all Norwegian seafood under one tracking label.^[33] In February 2014, Norway is cheering the committee and Standards Norway- the Norwegian member of CEN and ISO provides the secretariat, it developed ISO Technical Committee 234 (ISO/TC 234), Fisheries and aquaculture.^[34]

Norway is keeping moving on traceability system development, it believes an impeccable standard will save cost and lead to secure safe food going forward.

4.1.2 Chinese traceability actuality

The independent traceability system is running two existing Chinese. First is the CIQ health system, and the other is a new catch certification scheme that recognized by the European Union Ministry of Agriculture, Bureau of Fisheries Fisheries Directorate General, and through the China Aquatic Products Processing Management Association. China's new "Food Safety Law" implemented since June 2009, the newly adopted "Food Safety Law Implementing Regulations" clearly states that food producers and traders primarily responsible for food safety; the company should keep the record retention at least two years; the name of the food wholesale business should be the case record wholesale food purchaser's name and contact information, records, notes retention period of not less than two years^[35]. China's law and regulation on *Gadus morhua* product traceability mainly promulgated by the General Administration of Customs, including clear import certificates, customs clearance

requirements, certificates of origin, and in order to better product yield and the establishment of audit responsibility to evaluate regulations. For example, the customs requirements, in the process, if the value is greater than 40 percent, or four-digit tariff heading item changes, such products will be classified as "Made in China." However, due to hide the origin of this provision IUU fish products, causing criticism of the WTO. The new EU certification program to determine the legal origin of the product is only confirmed by a properly licensed fishing vessel. In addition to this the EU catch certification scheme, China also needs to consider the catch document scheme of regional fisheries management organizations in the traceability requirements. The key point is to import and export file link. Such as Norwegian *Gadus morhua* processing mode, because processed in the bonded area may be exempted from import duties, transit, again more to do file convergence.

At present, the China liability on traceability system is divided into different government agencies, the lack of a harmonized system, also led to a lot of loss of information.^[36] In most cases, according to the current rules of origin, all products deemed as Chinese product once to replace the four-digit customs code (for instance, replace frozen fish as 0303 to fish fillets as 0304), it is difficult to trace the true origin of the raw material of the fish product exported from China.

China also continuously develop the product traceability system. Some plants were asked to re-accept the conditions of traceability certification by China Entry-Exit Inspection and Quarantine (CIQ),^[37] even they already have certification of processing from Marine Stewardship Council (MSC), which means that although the MSC Chain of traceability standard is similar to CIQ standard, it does not reach product traceability requirements of CIQ in the development. China Customs and CIQ should strengthen the role of supervision and control to ensure product traceability in general.

4.1.3 *Gadus morhua* product traceability process

Gadus morhua raw material from Norway imported into China for processing

required to provide proof of origin and a health certificate as we mentioned in the second part of thesis regarding processing logistics activities.

FILÉ DE PEIXE CONGELADO
POLLACHIUS VIRENS

Peso Líquido **10 kg** Peso Bruto **11 kg** NÃO CONTÉM GLÚTEN

MANTENHA CONGELADO ATÉ -18°C OU MAIS FRIO
UMA VEZ DESCONGELADO, NÃO RECONGELAR

Modo de descongelamento: Descongelar em geladeira (+4°C) por 12 horas. Em caso de urgência, colocar o produto imerso em água fria por 2 horas, em sua embalagem original. Depois de descongelado, preparar no mesmo dia. Após descongelar, não congelar novamente.

Produzido por:

Autorização :
Registro no Ministério da Agricultura SIF/DIPOA sob nº

Exportado por: West-Norway As Importado por:
P.O. BOX 327 AALESUND N-6001 NORUEGA

Conservação	Doméstica	Validade
Vencimento a (-18°C)-Freezer		18 meses
Vencimento a (-4°C)-Congelador		3 dias
Vencimento a (+4°C)-Refrigerador		24 horas

Data de Fabricação:
Válido até:
LOTE:

INFORMAÇÃO NUTRICIONAL		
Porção de 100g(5 colheres de sopa)		
	Quantidade por porção	%VD
Valor Energético	76 kcal=319kJ	4%
Carboidratos	0g	0%
Proteínas	17g	23%
Gorduras Totais	0.7g	1%
Gorduras Saturadas	0g	0%
Gorduras Trans	0g	**
Fibra Alimentar	0g	0%
Sódio	80mg	3%

*Valores Diários de referência com base em uma dieta de 2.000 kcal ou 8.400kJ. Seus valores diários podem ser maiores ou menores dependendo de suas necessidades energéticas.
** Valor Diário não especificado

1 78 98111 55171 5 **INDÚSTRIA CHINESA**

BACALHAU SALGADO
Gadus macrocephalus

PEDAÇOS LOMBO

Peso Líquido **10 kg** NÃO CONTÉM GLÚTEN

Ingredientes: Bacalhau e sal
MANTENHA RESFRIADO DE 0 A 5°C

Produzido por:

Autorização :
Registro no Ministério da Agricultura SIF/DIPOA sob nº

Exportado por: West-Norway As Importado por:
P.O. BOX 327 AALESUND N-6001 NORUEGA

Distribuído por:

Data de Fabricação:
Válido até:
LOTE:

INFORMAÇÃO NUTRICIONAL		
Porção de 100g(5 colheres de sopa)		
	Quantidade por porção	%VD
Valor Energético	82 kcal=344kJ	4%
Carboidratos	0g	0%
Proteínas	18g	24%
Gorduras Totais	0,6g	1%
Gorduras Saturadas	0g	0%
Gorduras Trans	0g	**
Fibra Alimentar	0g	0%
Sódio	71mg	3%

*Valores Diários de referência com base em uma dieta de 2.000 kcal ou 8.400kJ. Seus valores diários podem ser maiores ou menores dependendo de suas necessidades energéticas.
** Valor Diário não especificado

1 78 98111 55309 2 **INDÚSTRIA CHINESA**

Produto destinado exclusivamente para fracionamento e reembalagem em estabelecimento sob inspeção.

Figure 4.3 traceability identification on *Gadus morhua* product label

Both of the interior label and external label identify the information of West-Norway AS as an exporter, and Chinese processing plant also gives clear indication of processing standard. The certificate of origin is mainly used to record the country of origin in order to determine the tariff rate, in practice does not provide the specific location of fish caught and the case. Health certificates only concerned with the health situation of raw materials, does not include fishing location, vessel number, cannot display this feed is complete or has been the primary processing of raw

materials. Once the imports of *Gadus morhua* raw materials, the China Customs and CIQ will follow this information. CIQ specifies a unique number for each boat that imported *Gadus morhua* raw materials, the process does not allow mixed with other lots. When the product is exported again, the application will be listed in imports of raw materials and imported batch application number.

4.2 Implementation suggestion for product traceability

In order to enable traceability, the ideal is a unique system with unique database should run through entire *Gadus morhua* supply chain, each link in this supply chain must register whatever the product is divided or mixed into a new product with the same database. All ingredients should be also registered as attachment of product.

Norway as the original region of product raw material, should have a stable label with electronic information on the boat and area, as the same way as eSporing in Norway. When *Gadus morhua* raw material export to China, China Customs and CIQ should require the proof of origin, health certificate, MSC certification and electronic database, process plant need to accumulate information about traceability into products, include plant and ingredients information. All participants of the supply chain need to be signed in the package.

Both of Norway and China have a feasible internal traceability system, the problem is traceability information transfer between Norway and China, and the third markets like Brazil. GS1 as a global traceable method should be considered, all of the countries in this supply chain should coordinate with GS1 global traceability consistency (GTC) certificate work.

For countries, Norway and China, even large *Gadus morhua* market like Brazil, should discuss the traceability requirement around *Gadus morhua* supply chain or fish product industry to adapt each other; Customs and inspection and quarantine bureau among countries need to communicate channel for corporations, adjust purpose of tariff control to form a comprehensive and effective transnational traceability system.

5. Conclusion and further research questions

5.1 Conclusion

To evaluate *Gadus morhua* supply chain between Norway and China, we concentrated on four key points: node numbers, scales, costs and value. If the supply chain has overmuch nodes and costs, the reason should be identified and solutions should be provided; if the supply chain model tends to mature and stable, we should consider the macroeconomic factors to stimulate its output, and satisfy customer's demand to upgrade its product value. As we discussed in the second chapter, so many commercial companies are doing *Gadus morhua* product between Norway and China, but we can hardly find out a leader like Marine Harvest in the salmon industry, it means *Gadus morhua* industry lacks ability to integrate entire supply chain resource by one enterprise, it can only be the supply chain model that operated by lots of participants. Therefore, we draw a result that the improvement room for this supply chain are market development and value added, instead of reducing costs.

After analysis and discussion of the third and fourth chapters, the main conclusions are as follows:

- 1) *Gadus morhua* supply chain between Norway and China has a model as raw material comes from Norway and processed in China, and then re-export to the third market, China is mentioned as famous *Gadus morhua* product process plant instead of the main market in each kind of *Gadus morhua* industry reports, due to high import tariff and substitutability in China. For our case interview, the interviewee doesn't have Chinese market for *Gadus morhua* products. Nofima mentioned that Norwegian bacalhau losing ground in Brazil due to new products such as Chinese-produced salted Alaska pollock in smaller pieces and Portuguese-produced desalted bacalhau, Norwegian *Gadus morhua* product should consider and prepare to enlarge market share in new markets. However, even FAO and NSC has great

expectation for Norwegian *Gadus morhua* on the Chinese market, the high import tariff should be solved;

- 2) Process in China has matured flow in bounded area with standard system and food safety guarantee;
- 3) Under the stable supply chain and complementary of market, Norway and China need to find external stimulus and internal value-added. FTA establishment and product traceability are mentioned in this thesis;
- 4) In *Gadus morhua* and entire aquatic trade with Norway, China is in a long-term deficit position. China easy to fall into “comparative advantage trap”. Based on the factor endowment advantage, there is complementary room between Norway’s resource and China’s processing, it means Norway and China have a foundation of FTA establishment; FTA establishment will have positive effect of trade between two countries;
- 5) Even both of Norway and China have feasible domestic product traceability system, but these traceability systems can hardly link together for global product like *Gadus morhua*. Governments need more communication and coordination regarding global traceability consistence, a specific traceability system for *Gadus morhua* supply chain is necessary.

As a word, the improvement for *Gadus morhua* supply chain between Norway and China should be focused on market development and value added, instead of reducing costs.

5.2 Further questions

Data collection and analysis is a large problem with this thesis. Data from different statistics department shows different results, and the limit of my data analysis restricts the result of FTA establishment's part. Furthermore, Chinese statistics department’s classification of *Gadus morhua* is too general, and doesn’t identity *Gadus morhua* product whose raw material from Norway during re-exporting, so that the thesis can hardly continue to analyze the whereabouts

after processing in China.

Another question is product traceability puzzle. Countries have domestic system, but hardly link together for global product such as *Gadus morhua*. Thesis mention out that specific traceability system for *Gadus morhua* supply chain is necessary, however, it is a huge work of governments have coordination for each industry. GS1 GTC represents a global effort in traceability field, more research is necessary for this topic.

At least, the *Gadus morhua* supply chain now has lots of participants, now we cannot find out an industry leader to integrate resource to simplify this supply chain, however, there are lots of business way to help commercial companies to communicate with customers directly, such as B2C and O2O, this kind of business is worth to discuss changing the stable agent way of international business.

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Appendix

Appendix 1

West-Norway AS

West-Norway AS established in 1957, has extensive experience, tradition and know-how in production, sourcing, product development and marketing to serve its clients in the best possible way.

West-Norway AS head office is located in Aalesund, Norway and has a subsidiary office in Qingdao, China. The company is represented in all major cities in Brazil, in the Dominican Republic, Spain and Jamaica. Other markets are served directly from the head office in Norway or from the subsidiary's office in China.

West-Norway AS Qingdao office

Address: Room 1012, Building 2, No. 61 Haier Road, 266061 Qingdao, China

Telephone: +86 532 555 76106/76107/76108

Telefax: +86 532 555 76103

Area manager: Kent Xu (Xu Jian) - Cellphone: +86 138-0896-6925

West-Norway AS website: <http://bacalanor.com/>

Interview

Date: 7th April, 2015

Interviewee: Kent Xu, area manager of West-Norway AS China office

I would like to know about process details of West-Norway's *Gadus morhua* product in China, the questions below will focus on *Gadus morhua* raw material, processing flow, plant equipments, regulations, healthy check and tariff, if you have supplements or doubts please contact me.

1. Can you please introduce Qingdao office of West-Norway in China?

West-Norway AS Qingdao office was set up in 2004, located in Qingdao, is only a representing office to communicate with our Chinese partners. Till 2015 we have 10 office staffs and 10 technicians.

Our main work scope are:

- 1) Daily communicate with our suppliers / buyers in Asia (mainly China) to smooth on-going business
- 2) Source fish and agricultural products
- 3) Quality control for products we purchased or processed
- 4) Make exporting documents
- 5) Import into china

What's the relationship between West-Norway AS and West-Norway China office?

West-Norway AS Qingdao office is 100% owned by West-Norway As, is only a

representing office.

How about the main products?

Our major products:

- 1) Seafood: frozen fish, like cod, saithe, haddock, from Norway, Pollock, herring, salmon, flounder from Alaska, etc
- 2) Agricultural products: Garlic, frozen vegetable, mushroom, beans, tomato

2. Can you please introduce in details about *Gadus morhua* process, include flow, time, healthy check, etc.

According to HACCP plan for the details of each step in processing flow, we have healthy safety guarantee for products.

How about the cost and cost components of *Gadus morhua* product?

Take frozen cod fillets as example, we are paying USD 950/ton for process. It includes:

- 1) Cost of imports and exports formalities in China;
- 2) Labor cost;
- 3) Electricity and water, etc.
- 4) Package
- 5) Other production materials, such as salt;
- 6) Management cost like salary of office staff, devaluation of the facilities, workshops;
- 7) Profit of the processing factory.

3. Is the process of *Gadus morhua* manual operation?

Before freezing of final product, all the processing are done manually.

What reasons will lead to dis-qualified product?

The dis-qualified products are mainly because of:

- A: fish raw material are not suitable, either in size, or freshness,
B: mistake done by workers

How about the rate of dis-qualified product?

It is hard to say the percentage, shall be less than 1%.

4. Are there requirements or regulations for *Gadus morhua* process environment and workers?

We have SSOP and GMP for each details for that, have enough knowledge about the workers and working environment.

5. Are the both of information of Norway and China West-Norway AS included in final *Gadus morhua* product's label? Are there some identities on the label

for traceability?

Yes, the company in China is shown as producer, and company in Norway is shown as an exporter.

For traceability, there is lot number which is traceable.

6. How do you storage the product? What are the requirements for inventory environment?

After packing, the products would be stored in cold storage before shipping out.

The storage condition for frozen fish fillet would be minus 18 °C or below.

The storage condition for salted fish fillet would be 0-5 °C.

Do you have cycle inventory for *Gadus morhua* product? What is the turnover rate?

There would be products with temporary packing, but not much, only about 10%.

7. What is the main market of *Gadus morhua* product? Where does the shipment order come from?

Main market is Brazil, export order is given by West-Norway.

8. What kind of tariff you need to pay?

If the fish to be processed are imported from another country, we could make processing license and report to Chinese customs, storing and processing under the supervision of the customs office, and no need to pay import tax and VAT

9. What advantages do you think about China's process for *Gadus morhua*, compare with process in Norway or the rest of Europe?

Since most of the processing is done by hands in China, can have a better yield rate than using machine in Europe. Also, it is much easier to process high value added products.

Such international food supply chain that crosses Norway, China and Brazil, what kinds of challenge you think it has to face to?

The biggest challenge would be the vicious competition from other producer in China.

10. Do you have any *Gadus morhua* products sell in China market? Do you think *Gadus morhua* products have market share in China?

No, we don't have sales in Chinese market... I think the *Gadus Morhua* (Atlantic cod) will have market in china, but not now... Still Chinese market is looking for cheap white fish products like Alaskan Pollock and most of people don't know how to distinguish white fish species, but as a kind of good protein resources, cod for sure will have a market share in china, it's only a matter of time.

11. Can I ask some data and pictures regarding *Gadus morhua* product and

process? Data include quantity of *Gadus morhua* raw material imported from Norway, output of *Gadus morhua* final product and the dis-qualified products from 2010 to 2014; pictures include plant external and internal area, product, package and label.

Please find the information here:

Year	raw material Quantity	finished products	non-qualified products
2010	2500	2000	20
2011	3000	2100	15
2012	3700	2500	35
2013	4000	2700	20
2014	4500	3000	50

I would search the pic and send to you later.

Thank you for providing so specific reply, I will clear up all questions and answers and send back to you to check. After your confirmation, I will premise your answer during my paper and attach original interview manuscript as an appendix.

Appendix 2

Table of hazard analysis for Gadus morhua processing flow

1	2	3	4	5	6
Components	Potential hazard	Significant	Reason for Decision-making in column	Measures to prevent from significant hazard	critical control point(y/n)
Material check before delivery	Biological hazard: Pollution by microbe	Y	The sea area may pollute the fish; The processing may pollute the fish.	The exporting country must provide government certificate of sanitary; The importing country must provide government certificate of sanitary.	Yes
	Chemical hazard: Chemical pollution	Y	The sea area may pollute the fish; The processing may pollute the fish.	The exporting country must provide government certificate of sanitary; The importing country must provide government certificate of sanitary.	
	Physical hazard: Metal	Y	Metal may do harm to consumer.	Metal detect controlled.	
Unfreeze	Biological hazard: Pollution by microbe	N	SSOP control		
	Chemical hazard: None	N		Control the time and temperature of unfreeze.	
	Physical hazard: None				
Processing: to cut into fillets, to clean, to beautify the figure into prescriptive form, and IQF	Biological hazard: Pollution by microbe	Y	SSOP control		No
	Chemical hazard: None				
	Physical hazard: Metal	Y	The knife which is using may product pieces of metal and metal may do harm to consumer.	Metal detect controlled.	

Remove the bone	Biological hazard: Pollution by microbe	N	SSOP control		Y
	Chemical hazard: None				
	Physical hazard: Hard bone	Y	The hard bone perhaps do harm to consumer.	Remove the hard bones from every pieces of fillets.	
Pick out the parasite	Biological hazard: Pollution by Microbe parasite	N	SSOP control	Parasites are died when it in the temperature of minus 18 °C for more than 24 hours, so they do not harm to customers.	N
	Chemical hazard: None				
	Physical hazard: None				
Graded	Biological hazard: Pollution by microbe	N	SSOP control		
	Chemical hazard: None				
	Physical hazard: None				
Weighing	Biological hazard: Pollution by microbe	N	SSOP control		
	Chemical hazard: None				
	Physical hazard: None				
Package	Biological hazard: Pollution by microbe	N	SSOP control		
	Chemical hazard: None				
	Physical hazard: None				

Metal detect	Biological hazard: none				Yes
	Chemical hazard: None				
	Physical hazard: Metal	Y	Metal may be product in the past processing. Metal may do harm to consumer.	Detect all the products with metal detector.	
Cold storage	Biological hazard: None				
	Chemical hazard: None				
	Physical hazard: None				

Appendix 3

SSOP for Gadus morhua processing flow

I. Safety of Processing water (running water、 sea water)

Objective: Guarantee that water (or after sterilized) for processing and ice-making meets the standard of drinking water.

- 1) All the water used in the process, the running water comes from the Tap water webs of the city and the sea water from the clean sea area, which is regularly inspected by the municipal Epidemic Prevention station twice a year. The lab of our company inspects germs、 coliform bacillus in water and offer the record.
- 2) The water system is equipped with two ClO₂ Auto Making to guarantee the safety of running water and seawater, and the Two were inspected twice per day. All exit of the pipes has its number. The water used in the workshop should be sampled daily for the inspection of its chlorine and recorded. The seawater pool was washed two times a year.
- 3) The ice slice using in the processing was made by Ice Making machine in our company and the block ice made in quick freezing room.
- 4) The company keeps the complete system for processing water and sewage release. The press of the water must remain suitable. The repairmen will promptly mend the broken or jam whenever find the defect during the processing.

II. Condition and cleanliness of Food contact surfaces

Objective: The food-touching area must be clean and sanitary.

- 1) The material, which touches the food, with smooth and lean should be non-toxic and non-absorbent and resist corrosion and inert to cleaning and sanitizing chemicals. The material should be plastic or rubber or stainless steel. Wood and cotton are forbidden using the process exclude special requirement.
- 2) In the beginning of each workday, the ground、 the stainless steel work desk、 IQF machine、 conveyer belt and all the utensils be used should be strictly observed to wash and sterilize. (The sanitizing procedure: wash-sterilize-wash; The worktop and the utensils should be sterilized in 100- 150PPM disinfectant liquid and ground with 200PPM.
- 3) The hands must treat as this procedure: Clean with tap water---wash hands with liquid

soap---clean hands---soak in 50PPM disinfectant liquid for 30 seconds---clean. The density for gumboots is 200PPM, 10-15cm deep and all this should be monitored by the person on duty and kept record.

- 4) The workers' uniform must keep clean. All the things including hands, gloves, aprons, utensil, equipment, etc. cannot connect with food if not washing –sterilize correctly.
- 5) During the processing all the desktops and ground must be sterilized every two hours, the hands schedule is one hours by the moving sterilizing tank. The utensils using around must be sterilized every turn and kept record.
- 6) Any utensil contaminated or fell on the ground must wash and sterilize.
- 7) The water in the tanks should be changed according to the germs inspected by the Lab.
- 8) After the processing a good washing—sterilizing must be take place among all the utensils, equipment, desktops, ground, etc.. The O₃ Making machine should start to work to sterilize the air during the night.
- 9) To verify above actions, the lab of the company takes inspection of the surface periodic confirmations for sanitization and report the result to HACCP team to corrective their work.

III. Prevention of Cross-contamination

Objective: to make the sanitary administration better, avoid the cross- pollution and guarantee the product quality.

- 1) Workshops are not allowed to process two kinds of different products and other no-processing things are forbidden in the workshops.
- 2) All the utensils have its own place, use at their place and not allowed mixed.
- 3) The seawater pipe and running water pipe are differentiated by sticky film of red and blue colors. Any tank has its signs in the processing room and special place for fell product.
- 4) Leading soft pipe should not allow to soak into the tank and not allow to lie on the ground too, hang on special place is acceptable. Sewage must let out immediately.
- 5) The raw material, packing material and finished products should be respectively stored in their special storehouses. All the employee should stay at his own work place and not allow to walk through. The right director of the products must flow from raw processing room to processing room to packaging room, every entrance has a obvious sign for alarm.

- 6) Employee hygiene practices: wear correctly the clothes, hairnets, caps, gloves, aprons. No one in the workshops is allowed to wear any ornaments (including finger-rings, necklaces, ear-ring) and watches as well as make-ups.
- 7) Smoking, gum-chewing and eating is prohibited in the workshops, spitting at random is also prohibited. The hands are limited to connect only hands of the body during the processing.

IV. Maintenance of hand washing, hand sanitizing and toilet facilities

Objective: Guarantee the sanitation of hands and the facilities for sanitation in a good condition.

- 1) The hands washing and sterilizing facilities should enough and should be installed in proper place. The facilities must include No-hand switch, soap liquid, disinfectant liquid and hair-sticking. Every workshops and toilets should have facilities and keep in a good condition.
- 2) Train the good habit of washing, sterilizing and being into W. C. and keep clean of the facilities and lavatory.
- 3) Special personnel should inspect the facilities and guarantee the good condition. The person on duty check the density and change the disinfectant liquid in scheduled time and keep record in Daily Sanitary Inspection.

V. Protection from Adulterants

Objective: To ensure that the food, food-packaging material; and food contact surfaces are protected from various microbiological, chemical and physical; contaminants.

- 1) Any fishery product, component and/or ingredient is deemed to be adulterated if it meets the definition of food sanitation certification, the storage for this material must dry and airiness and prevent contaminant.
- 2) The use of toxic compounds—pesticides, cleaning and sanitizing agents and lubricants—should be kept under centralized management those are frequently necessary in the seafood processing environment.
- 3) Prevent to contaminate the utensils and workshops and sterilize necessarily when the repairman maintain or lubricate the equipment.

- 4) The workshops should be airing and clean up condensate forming on insanitary surfaces and standing pools of water, prevent contamination from splashing.
- 5) The gas NH_3 used in the compressor and refrigeration must be controlled strictly of supplying and letting out, and guard against the pollution.

VI. Proper labeling, storage and use of toxic compounds

Objective: To ensure that the labeling, storage and use of toxic compounds are adequate to protect food from contamination.

- 1) The company wholly buys the cleaners, sanitizers, pesticides and so on with their certification for food. Usually these things must store in a locked room or cage, with the keys given only to necessary personnel. Cleaning chemicals should be segregated from insecticides and rodenticides to prevent accidental mixing or misuse.
- 2) The person specially assigned for receiving the compounds should take charge of that and play fixed place with signs and keep records. Not allow to contaminate the food, food contact surfaces and packaging material.
- 3) Special person needs to consider the proper storage, proper labeling, as well as proper usage of toxic compounds.

VII. Control of employee health conditions

Objective: The primary goal of monitoring employee health is to control conditions that could result in the microbiological contamination of food, food packaging material, and food contact surfaces.

- 1) All the employee must have the Health Certification issued by municipal Epidemic Prevention station once a year.
- 2) The processing personnel must be transferred out of the processing job when they have such symptom: diarrhea, fever or sore throat with fever, vomiting, jaundice (yellow skin or eyes), scar, skin disease, and they should also bear the doctor's certificate/notes before they are allowed to take up the job again after they have recovered.
- 3) The employee must be received the training schedule every year, and required being health conscious and conscientious in the protection of own health. Special person inspects the

employee by watching. The processing person mutual inspects and reports if someone does not feel himself.

VIII. Exclusion of pests

Objective: To monitor that pests are excluded from relevant areas of the plan to the extent possible and should also confirm that procedures are followed to prevent infestation.

- 1) The company should work out the pests-killing plan, and draw the rat-killing structure and layout the position, the dead rat should be buried 1 meter under the ground faraway from the company. And keep the records of exclusion of pests.
- 2) The road surface in the mill compound should be clean, smooth and without puddles and holes. Clear the debris and rubbish and the tiny environment to minimize cover for pests to approach and enter the facility. The doors and the windows seal tightly to prevent entry of pests or contaminants. Properly cleaned and sanitized the waste bins, tubs and/or dumpsters.
- 3) The every entrances should be installed fly-killing cages, and the zone of the plant, life place and garden should be sterilized according to the season.
- 4) Maintain the three phase pest control program: elimination of shelter and attractants, exclusion of pests from the food plant and extermination of those pests that gain entry.