Breaking through barriers to Norwegian fresh salmon trade with China by a new production technology

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Abstract

Atlantic salmon export plays an important role in the total Norwegian seafood export. EU countries are currently the main markets for Norwegian salmon export. China is one of the countries which are expected to have an increased demand for Norwegian salmon. Norwegian fresh salmon exporters are currently facing the trade barriers with respect to new inspection regime and high transportation costs when they export fresh salmon to China. This study is investigating whether Coolnova salmon, fresh frozen salmon using proton magnetic freezing technology, may break the trade barriers of Norwegian fresh salmon export to Mainland China. Firstly is the meaning of preferred fresh quality of Norwegian Atlantic salmon and secondly is the potential market value of the Coolnova salmon for the wholesalers and the supermarket in Hong Kong estimated. A sample of fresh chilled, Coolnova and frozen salmon fillets were tested by wholesalers and supermarket managers who gave their quality judgement recorded in a questionnaire. Different perceptions and attitudes were expressed related to both quality factors like fatness and colour influenced by the different fish feeding, sizes and fillet cuts of the tested salmon samples as well as factors related to the application of novel freezing and thawing technologies where Coolnova salmon has its advantage. The results show that freshness is a preferred product attribute of salmon characterized by appearance as a distinctive orange colour, clear white oil lines and a hard texture and smooth and juicy taste. The results indicate that Coolnova salmon after fresh-frozen and thawed, may satisfy the markets requirements for freshness and furthermore gain a cost advantage by the opportunity to move distribution from an expensive fresh airfreight to a low cost frozen sea freight. Frozen salmon can be kept in freezers for a long time without quality degradation and would thereby not be affected by the new quality inspection regime which hampers the fresh fish import to China. Coolnova salmon can thus break the trade barrier of Norwegian fresh quality salmon imposed by the Chinese government.

1. Introduction

1.1 Background and objective of the research

Norway is currently the largest producer and exporter of Atlantic salmon in the world. Atlantic salmon export represents a significant share of the total Norwegian seafood export (Sissener, 2005).According to Norwegian Seafood Export Council (2011), Norway exported 923,107 tonnes Atlantic salmon with a value of over NOK 31 billion in 2010, EU countries were the main markets for Norwegian salmon exports; and Japan was the largest importer of Norwegian Atlantic salmon in Asia.

Atlantic salmon is the first registered volume of Norwegian seafood which has been exported to China. There has been a steady increase in Norwegian salmon export to China during the past two decades. In 2010, Norway exported 29,792 tonnes Atlantic salmon to Mainland China and Hong Kong, and fresh chilled salmon was the main product (ibid). Chinese consumers' demand for Norwegian salmon will continue to grow due to income growth and improved food related health awareness.

Nowadays, there are two trade barriers hampering Norwegian fresh salmon export to China. First, fresh salmon are sent by air to Mainland China and Hong Kong and transportation costs are very high. Traditional frozen salmon are not so popular because they are not as juicy as fresh salmon, even if the transportation costs are much lower by boat compared to fresh airfreight. Secondly, China introduced a new quality inspection regime which has been a severe negative impact on the Norwegian fresh salmon entry into the Chinese markets.

A new Japanese invented proton magnetic freezing technology are now underway in the market, which make it possible to freeze and thaw fish which keeps its juice inside like fresh fish caused by prevention of ice crystallization and cell damages. Coolnova salmon is fresh frozen salmon which is produced using proton magnetic freezing technology.

More and more Chinese consumers prefer to purchase and eat fresh seafood. Consumers' purchase of seafood is influenced by their perceptions about what is fresh seafood and what is frozen seafood. The concept of freshness is broad and the word "fresh" might be interpreted in different ways by consumers in different countries with different demographic characteristics and consumption habits (Peneau, 2005).

Hong Kong is selected as the target market in this research. Hong Kong, located in the southern China, has a long tradition of consuming seafood. In 2010, Hong Kong was the second largest importer of Norwegian Atlantic salmon in Asia (NSEC, 2011). Due to over-exploitation of the local fishery, Hong Kong consumers' demand for imported seafood will continue to increase.

This research aims to identify the market opportunity for Coolnova salmon in Hong Kong by investigating purchasers' perceptions and attitudes towards freshness of salmon among the wholesalers and the supermarket in Hong Kong as well as discussing the competitive market value of Coolnova salmon in the Chinese markets.

1.2 Research Questions

What is the market opportunity for Coolnova salmon in Hong Kong?

—What are purchasers' perceptions and attitudes towards freshness of salmon among the

wholesalers and the supermarket in Hong Kong?

—Can Coolnova salmon gain a competitive market value in the Chinese markets?

Market value is the price level at which transactions actually occur between purchasers and sellers (Trondsen, 1998). Before introducing a new product into a market, marketers must study their customers' wants, perceptions and preferences in order to meet and satisfy the customers' needs and wants (Kotler, 1994). Coolnova salmon is fresh frozen salmon which is produced using the proton magnetic technology and tastes like fresh chilled salmon when thawed. In this research, it is expected to identify the market opportunity for Coolnova salmon in Hong Kong.

Hong Kong people have strong preference for fresh seafood. Purchase and consumption of seafood is greatly influenced by their perceptions of what is fresh seafood and what is frozen seafood. Thus, the first step is to investigate purchasers' perceptions and attitudes towards salmon freshness among the wholesalers and the supermarket in Hong Kong. Freshness of seafood is closely related to the quality which is dependent on the sensory attributes of seafood. Colour, juicy, fat, taste and texture are perceived to be the important sensory attributes of Atlantic salmon. The perception of these quality clues will be clarified in a

sample test where Coolnova salmon is tasted by experienced fish buyers in Hong Kong market and observation in the supermarket places. Competitive market value of Coolnova salmon will be discussed by comparing transportation cost differentials and trading margin differentials between fresh salmon and frozen salmon along the salmon value chain.

1.3 Structure of the research

Chapter 1 introduces background and objective of the research and puts forward the research questions.

Chapter 2 gives a general overview with respect to Norwegian salmon fishery, China's economy, Mainland China and Hong Kong fisheries and seafood markets, the Norwegian-Chinese salmon trade, and trade barriers hindering Norwegian fresh salmon export to China. All the information show the market growth potential of Norwegian salmon in China and necessity to introduce Coolnova salmon which is expected to break through the barriers to the Norwegian-Chinese salmon trade.

Chapter 3 is the literature review regarding the meaning of freshness, trade barriers and drivers of trade.

Chapter 4 illustrates the materials and method used in the research. Expert interview was used to investigate the purchasers' attitudes and perceptions towards salmon freshness among the wholesalers and the supermarket in Hong Kong.

Chapter 5 presents the results of the research.

Chapter 6 focuses on the discussion of the results derived from the interviews.

Chapter 7 makes a conclusion.

2. General overview

This chapter contains a general overview of Norwegian salmon industry, China's economy, Mainland China and Hong Kong fisheries and seafood markets, the Norwegian- Chinese salmon trade as well as trade barriers hindering Norwegian fresh salmon export to China. The market growth potential of Norwegian salmon in China and trade barriers hindering Norwegian fresh salmon export to China are the main motives to introduce Coolnova salmon in the Chinese markets.

2.1 Norwegian salmon industry

Norway is currently the largest producer and exporter of Atlantic salmon in the world. Farmed Atlantic salmon ranks the fourth largest export commodity (Statistics Norway; Liu *et al*. 2010). In 2010, Norway exported 923,107 tonnes salmon with a value of over NOK 31 billion to 101 countries, whereas 90% was exported to 19 countries (NSEC, 2011). The five largest markets for Norwegian salmon export in 2010 were France, Poland, Russia, Denmark and the United States. In Asia, Japan was the largest importer of Norwegian farmed Atlantic salmon in 2010, followed by Hong Kong and Mainland China (ibid).

2.2 China's economy

Starting in 1978, China pursued the policy of opening to the outside world and initiated a series of economic reforms, transforming from a centralized planned economy into a decentralized, market-oriented economy. Over years, China has experienced rapid economic growth, and become one of the fastest-growing countries in the world. Based on the official Chinese government data, the Economist Intelligence Unit and the IMF, China's average annual real GDP grew by nearly 10% from 1979 up to present. This has meant that China has been able to double in real terms the size of its economy in real terms every eight years (Morrison, 2011).

China's strong economic growth depends greatly on the external demand and foreign direct investment. China is the world's factory and "made in China" products have been exported to all over the world. China's export had been increasing greatly during the past years until the global financial crisis broke out in 2008. From then on, China's export has experienced a very slow growth due to decrease of external demand. In order to fuel economic growth, China is currently transforming from an export-oriented economy into an economy driven by

domestic demand. Chinese government has taken various measures to stimulate residents' consumption and increase domestic demand, of which increase in residents' disposable income is the most important. In September of 2011, the government raised the personal income tax floor by 75 percent to RMB 3,500 per month, reducing the number of tax payers by 60 million based on the government estimates (Ruan, 2011). Continuous appreciation of Chinese currency RMB following exchange rate system reform in 2005 has directly led to increase in imports. China's trade surplus dropped from a peak of nearly US$300 billion in 2008 to US$150 billion in 2011(Li and Ruan, 2011).

Over the past years, Chinese consumers' purchasing power has greatly increased thanks to strong economic growth. China has become a large market for various kinds of imported goods and services and provides great opportunities for all the traders in the world.

2.3 Mainland China fishery and seafood market

China is one of the seafood superpowers in the world. It is the world's largest producer, importer and exporter of seafood, representing approximately 35 percent of total global production. Based on the data from Chinese Ministry of Agriculture (MOA), China's annual aquatic production is approximately 60 million tonnes (Redfern Associates, 2010).

Nowadays, China is playing an increasingly important role in the international seafood trade. Its seafood exports are increasing every year thanks to the country's steady economic growth. According to the statistic data from World Trade Atlas (WTA), China had the total fish and seafood export value of US$6.81 billion in 2009, an increase of 31 percent from US$5.18 billion in 2008. At the same time, China is also a large fish and seafood import country. Based on WTA data, Chinese imports of fish and seafood were valued at US$3.60 billion in 2009, down from US$3.65billion in 2008. However, imports are expected to increase together with the consumer purchasing power in 2010 (Redfern Associates, 2010). Part of imported fish and seafood are processed in China and re-exported to other countries for local consumption.

Chinese people's love of seafood has deeply rooted in the long history and rich culinary culture. In Chinese, the pronunciation of fish is the same as that of "surplus", thus eating fish means bringing good luck and more money year after year. Apart from this special culinary culture, most of Chinese people consume seafood due to its delicacy and nutrition.

Driven by increased disposable income, Chinese people's demand for seafood has been rising steadily over the past years. However, China's seafood industry has become exhausted due to over-exploitation and contaminated waters. In an attempt to control the deterioration of the fisheries, the Chinese government issued a new regulation in 2006, stating that the total number of fishing boats would be capped at 30,000. This creates great business opportunities and higher profit margins for imported seafood. Demand for imported seafood products in the Chinese market will continue to increase due to income growth and improved health awareness (Seafood export profiles China).

China has gradually reduced its tariff since its accession to World Trade Organization (WTO) in 2001. The official tariff on Atlantic salmon in Mainland China is 40 percent; while the favourable tariff on Atlantic salmon is 10 percent. The favourable tariff is granted to the members of WTO. Norway, as a member of WTO, enjoys the favourable tariff. In addition, there is a 13 percent of value-added tax (VAT) imposed on fresh and frozen Atlantic salmon (China Customs, 2011).

2.4 Hong Kong fishery and seafood market

Hong Kong is among the most competitive fish and seafood markets in the world because of a traditional love for seafood and the presence of a large number of seafood importers and traders. There is a relatively transparent and open market system in Hong Kong (Chan, 2009).

Hong Kong local fisheries consist of capture fisheries and aquaculture fisheries. According to Agriculture, Fishery & Conservation Department (AFCD, 2011), capture and aquaculture fisheries make an important contribution to Hong Kong by maintaining a steady supply of fresh fish to local consumers. The total capture fisheries and marine fish culture production is equivalent to about 21 percent of seafood consumed in Hong Kong, while pond fish farmers produced about four percent of the freshwater fish eaten. In 2009, the estimated production of capture fisheries amounted to about 159,000 tonnes, valued at HK$2 billion. Total marine fish culture production was about 1,437 tonnes, valued at HK$92 billion. Total fish pond production in 2009 amounted to 2,105 tonnes, valued at HK$35 million.

Hong Kong is a free market with zero tariffs and zero taxes for seafood imports. This favourable trading environment provides great opportunities for seafood traders from all over the world. Different kinds of seafood are imported to Hong Kong from high value dried

seafood products like dried abalone to low value fish and seafood products such as freshwater species (Chan, 2009). Part of imported seafood is re-exported to other countries and regions as Hong Kong maintains an important role serving as a re-export centre for seafood products (Yuen, 2010).

Figure 1 shows Hong Kong's total import value and re-export value of fish and seafood from 2006 to 2010. According to statistical data from Hong Kong Census & Statistics Department, in 2010, Hong Kong's imports of fish and seafood valued HK$21.23 billion, an increase of 48 percent from 2006 when the imports was HK$14.35 billion. Mainland China was the major supplier and accounted for approximately 13 percent of Hong Kong seafood imports with the value of HK$2.76 billion in 2010, a rise of 80 percent from HK$1.54 billion in 2006. Seafood re-exports value constituted 15 percent of Hong Kong's total seafood import value in 2010. Imported seafood for local consumption increased by 50 percent from the HK$12.09 billion in 2006 to HK$18.13 billion in 2010.
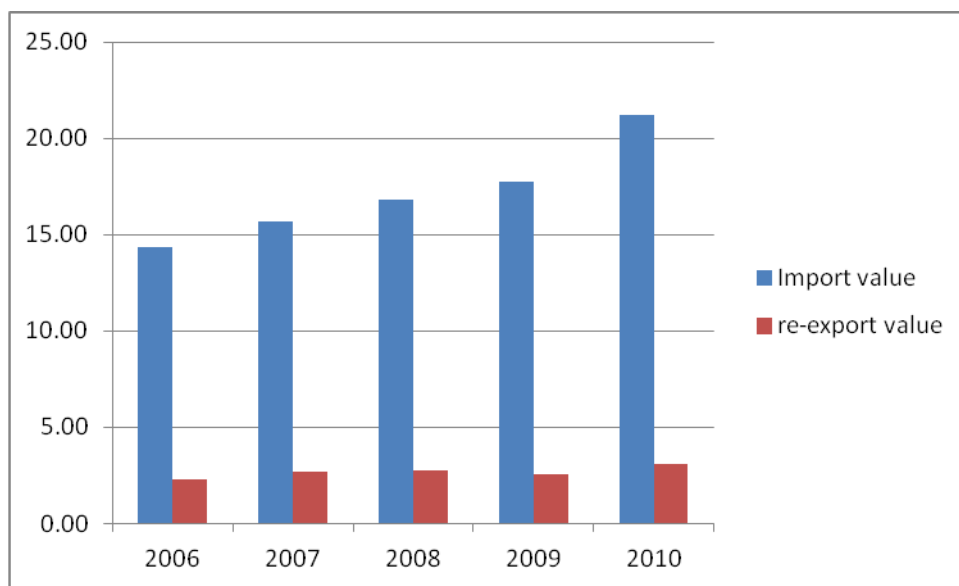

Figure 1. Hong Kong's import and re-export value of fish and seafood from 2006-2010 in HK$ billion (Source: Hong Kong Census & Statistics Department)

Hong Kong's exports of local fish and seafood decreased for the past years due to over-exploitation in the local fisheries. Hong Kong's exports of local fish and seafood valued HK$9.36 million in 2010, down from HK$30.15 million in 2006, according to the data from Hong Kong Census & Statistics Department.

Based on the survey findings at the Asian Seafood Exposition 2010, food safety, freshness and price are key drivers for seafood consumption in Hong Kong. Higher income groups consume seafood more than lower income groups. For consumers preparing seafood at home, 48 percent will buy in wet market, 30 percent in fish shops and 23 percent in supermarkets (Yuen, 2010).

2.5 The Norwegian -Chinese salmon trade

According to NESC (2011), Norwegian seafood has been sold in the Chinese markets for over 20 years. During the past decade, the seafood export from Norway to Mainland China grew gradually from 51,872 tonnes in 2001 to 152, 071 tonnes in 2010. Mackerel and Atlantic salmon were the main species. Mackerel was mainly processed in Mainland China and re-exported to Japan while imported Atlantic salmon were destined for domestic consumption.

Deeply influenced by Japanese culinary culture, more and more Chinese consumers have preference for sashimi and sushi. Norwegian Atlantic salmon holds a unique position in the minds of Chinese consumers as being very well suited for raw consumption as sashimi or the main ingredient of sushi. It is perceived as a high end seafood which they can entertain their family members and friends (NESC, 2011).

Norwegian fresh salmon dominates the total salmon export to China. In 2010, the export volume of Norwegian salmon to Mainland China amounted to 12,407 tonnes, of which fresh salmon accounted for about 79 percent. Norwegian fresh Atlantic salmon occupied about 91 percent of total fresh salmon imports in Mainland China. Hong Kong was the second largest importer of Norwegian Atlantic salmon in the Asian markets, next to Japan. In 2010, Norway exported 17,385 tonnes Atlantic salmon to Hong Kong, of which about 88 percent were fresh salmon. Norwegian fresh Atlantic salmon occupied about 92 percent of total fresh salmon imports in Hong Kong (NESC, 2011).

Despite the high market share of Norwegian salmon in China, Norwegian salmon exports to China was only 3.01% of its total production and total export value to Chinese markets were quite small in 2010. China is among the group of countries that will have a great potential for growth and will be an important market due to its increased demand. The increased demand

is based on increased purchasing power among Chinese consumers and increased distribution of salmon in hypermarkets and restaurants particularly Japanese restaurants (NESC, 2011).

2.6 Trade barriers hindering the Norwegian salmon export to China

Despite an increased demand for Norwegian Atlantic salmon in the Chinese markets, there are two trade barriers hampering salmon export to Mainland China and Hong Kong.

First, in February 2011, China introduced a new inspection regime which has a severe negative impact on all the imported farmed salmon. According to the regulation released by General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ), farmed salmon are prohibited from entry into Mainland China unless a quarantine licence for animals and plants has been applied for and obtained in advance. Wild salmon are regarded as farmed salmon unless a written statement with details about the vessel number and harvest area of wild salmon is issued by the official authority of exporting country. The new inspection regime specially emphasizes that the Entry-Exit inspection and quarantine agencies should strengthen the on-spot inspection and quarantine on fresh chilled salmon. Fresh salmon are prohibited from entry into China in case of non-compliance with the stipulations of official sanitary certificate, or non-compliance between the goods and required documents. Fresh salmon are released upon the approval from the inspection authority (personal information from Guoqing Zhang at Ministry of Commerce of the People's Republic of China).

The shelf life of fresh chilled salmon is 10 to 15 days if it is kept at 0+°C. After the new inspection regime became effective, it usually takes about five days to complete the procedures of inspection and quarantine before farmed salmon is released, two days longer than before. The new quality inspection regime shortens the shell life of fresh salmon along the distribution chain.

Fresh salmon with limited shelf-life requires fast distribution till to end consumers in order to guarantee the quality. As China covers large area and there are few distribution systems for Norwegian salmon in tier 2 and tier 3 cities in Mainland China (NSEC, 2011), it takes longer time to distribute fresh salmon to end consumers than in EU countries. After the new inspection regime became effective, some fresh salmon get rotten along the distribution chain before they come to end consumers.

As Norway is the leading supplier of Atlantic salmon in Mainland China and fresh salmon dominates Norwegian salmon export to Mainland China, the new inspection regime has resulted in sharp decrease in the export volume of Norwegian fresh salmon to Mainland China. Based on the statistical data from NSEC (2011), the export volume of Norwegian salmon to Mainland China dropped dramatically from 12,555 tonnes in the first 11 months of 2010 to 6,618 tonnes in the same period of 2011.

As the Special Administrative Zone (SAR) of China, Hong Kong has its own food and agricultural import regulations. Up to now, no similar inspection regime is imposed on the Hong Kong salmon imports. If Hong Kong traders import farmed salmon from Norway first and re-export to Mainland China, they are facing the same barrier as traders in Mainland China who import farmed salmon directly from Norway.

Secondly, high transportation cost hampers Norwegian fresh salmon export to China as fresh salmon are transported by air to the Chinese markets. Although Chinese residents' disposable income has been increasing over the past years, Norwegian Atlantic salmon is still a luxury in Mainland China. Price is the main factor when Chinese consumers purchase and eat Norwegian salmon. When the price and supply of Norwegian salmon are not satisfactory, Chinese importers will search for other substitutions (Chan, 2009).

Summary of the chapter

This chapter shows that the Chinese economy is increasingly transforming from a sole export-orientation and into an economy driven by the domestic demand. The increasing disposable income among the residents and the appreciation of Chinese currency RMB following exchange rate reform in 2005 have resulted in sharp increase in the imports. China is currently on the way from a large exporter to a large importer. Chinese people have strong preference for seafood. The demand for imported seafood will continue to increase due to the limited domestic supply from the over-exploited local fisheries, the income growth and improved food related health awareness. Fresh salmon is a dominating product in the salmon trade between Norway and China. High transportation costs and strict inspection regime are limiting the import of fresh fish and have become important trade barriers hampering Norwegian salmon export to China.

In order to identify new opportunities for an increasing salmon trade between Norway and China, several questions will be discussed in the following chapters: What is the market perception of freshness? Is it possible to get around these import barriers? Are the transportation cost differentials between fresh and frozen salmon a possible trade driver in the Chinese markets?

3. Literature review and conceptual framework

In this chapter, the meaning of freshness and meaning of fresh and frozen seafood is illustrated first in order to understand the perception as trade barrier.

3.1 The meaning of freshness

According to Cardello and Schutz (2003), the definition and meaning of the word "fresh" is complex and challenging and depends on the professional area considered. An overview of different current meanings of the word "fresh" together with the examples from different English dictionaries is listed as Table 1(Duden, 1999; Guibert, *et al*.1976; Merriam-Webster, 1986; Rey, 2001; Simpson and Weiner, 1989; Sinclair, 2000; Peneau 2005)

Table 1. Meanings with their examples of the word "fresh"

Meaning	Example
Recent, not old or stale,	fresh product
Not preserved, processed or matured	fresh peas
Not affected by time, reactivated	fresh memory
New, good as new, make better	fresh paint
Bright, with colour	fresh white
Not tired, renew energy	fresh mind
Youth, health, purity, vitality, innocence	fresh face
Pure and wholesome	fresh smell
Blowing	fresh wind
Cool, make some, something cool	fresh air
Something or someone clean	fresh towel
Not salty	fresh water

Pleasantly different, novel	fresh ideas
Without experience	freshman
Additional, replacement	fresh ink in the pen
Impertinent, rude	fresh behaviour
Give birth, come into milk	fresh cow
A flood, pool, stream	fresh water
With regard to drunkenness	to be fresh

From table 1, we can see that various definitions clearly show different possible uses of the word "fresh". The definitions associated with food are "Recent, not old or stale,"; "Not preserved, processed or matured"; "Bright, with colour" "Not salty" etc. What is the meaning of "fresh" seafood?

3.2 The meaning of fresh seafood versus frozen seafood

As indicated by Dore (1984), "fresh" means two things in the seafood business. First it means "not frozen" and secondly it means "not stale". When things such as food are stale, they are old and, if not preserved, no longer fresh or good to eat or use. "Not stale" seafood should be good to eat. It may or may not be frozen, which accounts for the phrase "fresh frozen" that is sometimes used. "Not frozen" is self explanatory. However, a fresh fish, not frozen, can also be stale.

Based on the views from biologists and fishery professionals, seafood may be classified as live, fresh chilled, fresh frozen and old frozen seafood (personal information from Professor Ragnar L. Olsen at University of Tromsø).

Live seafood is self explanatory; seafood keeps alive from the moment of being harvested till to the end consumers.

Fresh chilled seafood has never been frozen; it is slaughtered, gutted and put the ice on the top of and under seafood within several hours (usually three hours, before rigor mortis

happen) after being harvested, and maintained at 0--4˚C during storage, transportation and sale. The storage time may be up to 16-18 days after being slaughtered (Doyle, 1989).

Fresh frozen seafood is seafood which is slaughtered, gutted and frozen within rigor mortis happen (the time dependent of the storage temperature) after being harvested and maintained at or below -18/20˚C during freezing, storage, transportation and sale. Seafood is "fresh" before being frozen. Storage time is usually several months depending on the species of seafood (Ronsivalli and Baker II, 1981).

Old or stale frozen seafood implies that seafood is caught, slaughtered, gutted and kept unfrozen as long as the quality has deteriorated before being frozen later at or below -18/20˚C. If the temperature is high, the deterioration process happens after few hours. If the fish is kept in ice at -3 to 0 degree C, this process can be delayed and the fresh quality of the fish may be maintained from 4-5 to 12-15 days depending on the fish species.

Today modern freezing techniques have been used in the fisheries. It can provide excellent freezing equipments, freeze and store seafood without deterioration of seafood quality. Thus, seafood could not be simply classified as "fresh" and "frozen". A more scientific classification with regards to seafood would be "fresh frozen" "fresh unfrozen", "stale frozen" and "stale unfrozen" as shown in table 2. This suggests that consumers should purchase and eat seafood based on the quality, not on whether it is unfrozen seafood.

Table 2. Scientific classification of seafood

	Fresh	Stale
Frozen	Fresh frozen	Stale frozen
Un-frozen	Fresh un-frozen	Stale un-frozen

When consumers taste a food product in a real-life situation, their perception of the product is not only based on the sensory characteristics of the product itself. Product perception is usually biased by preconceived ideas about product properties and is affected by the consumers' judgmental frame of reference (Schifferstein, 2001). It is least known and most challenging to perceive the definition and understanding of freshness from a consumer

perspective (Peneau, 2005), as the purchase of seafood is greatly influenced by consumers' attitudes and perceptions about what is fresh seafood and what is frozen seafood. Thus it is important to ascertain consumers' perception and attitudes towards fresh and frozen seafood.

Chinese consumers have strong preference for fresh seafood and have negative perception and attitudes towards traditional frozen seafood due to their experience about frozen seafood which may cover bad pre-frozen quality. As mentioned by an experienced respondent in this research, in the minds of Chinese consumers, traditional frozen seafood is not "fresh". When consumers purchase fresh seafood in the supermarket or wet markets, they can look at the seafood, smell and make judgement of what they see. With respect to frozen seafood, consumers can not check the quality when they purchase owing to thick ice around it. After being thawed and cooked, seafood may taste awful due to the degradation of seafood quality before being frozen. It means garbage in= garbage out (Tijskens *et. al*, 2001). Consumers are reluctant to take the risk to purchase traditional frozen seafood because of variation in the quality of frozen seafood.

These informal conventions[1] negative to traditional supplied frozen foods becomes also a barrier of trade which marketers have to deal with…...

3.3 Trade barriers

Trade barriers are also related to legal conventions. Trade barriers is defined by the National Trade Estimate Report On Foreign Trade Barriers (NTE), issued by the United States Trade Representative, as "government laws, regulations, policies, or practices that either protect domestic producers from foreign competition or artificially stimulate exports of particular domestic products"(Onkvisit and Shaw, 2004).

The most important type of trade barriers has historically been the tariff. A tariff is a tax or duty imposed on the traded commodity as it crosses a national boundary. The importance of nontariff trade barriers was greatly increased as tariffs were negotiated down after the World War Two. A quota is the most important nontariff trade barrier. It is a direct quantitative restriction on the amount of a commodity which is allowed to be imported or exported. Other trade barriers include voluntary export restraints and technical, administrative and other

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[1] A convention is here defined as "an accepted way of doing things" which is informal or formal controlled in the social or institutional settings where it is operated.

regulations. Technical, administrative and other regulations include safety regulations for automobile and electrical equipment, health regulations for the hygienic production and packaging of imported food products as well as labelling requirement indicating origin and contents. Trade barriers also result from the existence of international cartels and from dumping and export subsidies. During the past two decades, these nontariff barriers have become more important than tariffs as obstructions to the flow of international trade and represent a main threat to the world trading system (Salvatore, 2011).

Traditionally, people define trade barriers as tariffs and transportation costs which are important obstacles, accounting for from zero to 30 percent of the sales value in the various markets, and they are relatively easy to quantity. Nowadays, people have become more aware of the informal trade barriers, i.e. lack of market information, customer networks and experience. Informal trade barriers are more difficult to estimate, both because of their complexity and due to the variety of barriers in the different markets (Medin and Melchior, 2002; Sissener, 2005).

In the previous overview, trade barriers are identified in the Norwegian salmon export to China. Is high transportation cost a trade barrier for Norwegian fresh salmon export to China?

3.4 Drivers of trade

According to Cateora (1987), in addition to the existence of demand, the following conditions may be necessary before trade would take place.

1. The gains of production must be greater than the costs of trading and shipping.

2. Regardless of national origin, products must be identical or equally acceptable in the minds of middlemen and consumers.

3. There must be a sufficiently effective market information network so that traders are conscious of cost differentials.

4. The differential must be sufficient to interest an entrepreneur in trading, i.e. provide a profit.

5. Tariff must not exceed the difference in costs after transportation and profit are considered.

6. No other governmental or financial restrictions must hamper the products and trading of those products.

In order to identify the opportunities for salmon trade between Norway and China, the following questions must be answered: Are the frozen and fresh salmon products regarded as identical or equally acceptable in the minds of middlemen and consumer? Are the gains greater than the costs of trading and shipping of traditional frozen salmon? Is there a sufficiently effective market information network so that traders in both countries are conscious of cost and quality differentials? Should the differential be sufficient to interest entrepreneurs in trading?

These questions will be investigated in the following chapters.

3.5 Analytical perspective

The first step in this research is to investigate the perception of salmon freshness among the wholesalers and supermarket in Hong Kong by comparing the product quality of Coolnova salmon to those of fresh and frozen salmon available in the market and the traders perception of the market value of Coolnova salmon which break trade barriers of Norwegian fresh salmon export to China.

The definition and meaning of freshness is as I have shown, complex and challenging. However, it may well be argued that the only meaning of freshness which matters is the one used by consumers. In a real sense, the consumers are the ultimate judge of what constitutes freshness in a food product, as it is only their interpretation of freshness that influences purchase behaviour. This primacy of consumer opinion is reflected in the fact that all physicochemical measures of freshness rely for their validity on the fact that they correlate with some change in appearance, taste or texture that consumers associate with "loss of freshness". Given the importance of the consumers' perspective on what constitutes freshness of a food, people really want to know how the consumers perceive the freshness in association to food (Cardello and Schutz, 2003).

Consumer's perception of freshness in association to food relies on the total impression of quality which can be described by the sensory characteristics of the food. Sensory perception of foods plays a key role in whether they are selected for consumption (Shepherd and Farleigh, 1989). This research focuses on the most distinctive sensory attributes of Atlantic

salmon, which are colour, juicy, fat or oil lines, taste and texture (chewing resistance) to present the perception of freshness in association to Atlantic salmon among Hong Kong wholesalers and supermarket.

One definition of the word "fresh" in association to food is the appearance of "bright, with colour" (Duden, 1999; Guibert, *et al*.1976; Merriam-Webster, 1986; Rey, 2001; Simpson and Weiner, 1989; Sinclair, 2000; Peneau 2005). Appearance is important because it represents the first clue the consumers have to evaluate before purchasing and tasting. People first eat food with eyes, thus colour is an important element (clue) influencing perception of the meaning of freshness from the consumers' perspective, because stale fish tends to be dehydrated and gets a bleak appearance.

Fresh seafood is characterized by the degree the juice is not leaked from the flesh. Juicy is another sensory attribute used to judge the fresh fish which can be evaluated when the consumers actually taste the products. Stale seafood tends to lose juice under storage as a result of both dehydration and microbiological decomposition.

Juiciness and texture are both regarded as sensory attributes of fresh seafood because seafood deteriorated in the freezing process by ice crystallization and microbiological decomposition destroys and softening the fish muscle and loses juice (Nevin, 2003).

Loss of juices does also influence the taste.

Shepherd and Farleigh (1989) believed that the sense of taste is probably the most important in determining selection of food. Thus, taste is perceived as another important sensory attribute which determine the freshness of salmon, because important taste elements are soluble and lost when the juices are leaking out of the product. The microbiological decomposition of the proteins and the fat when turned rancid do also change the taste.

In meat or flesh, the apparent amount of fat may be an important determinant of choice, especially in view of consumers concern of the amount and quality (like Omega 3) of fat intake (Fallows, 1986; Shepherd and Farleigh, 1989).

The perception of these quality clues will all be clarified in a test where the Coolnova salmon is tasted by experienced fish buyers in the Hong Kong market and observation in the supermarket places.

The cost differences between fresh transported by airplane and frozen salmon transported in frozen containers are significant. Who get the benefit of these cost differences, the suppliers or the consumers? With respect to transportation cost differentials as well as gross profit differentials fresh and Coolnova salmon are compared as salmon trade drivers in the Chinese markets

Fresh seafood is highly perishable food. The shelf life of imported fresh salmon is only 10 to 15 days if it keeps at +0˚C, therefore, there is strict time constraint for fresh imported salmon before it becomes stale. In order to keep freshness of salmon till the end consumers, all the participants in the value chain try to shorten the transaction time of fresh salmon. While the importer cannot control the time spent on the customs clearance, any delay in the process of customs clearance will result in the deterioration of fresh salmon before it comes to the end users.

According to FAO corporate document repository, quality control is defined as "the operational techniques and activities that are used to fulfil requirements for quality" (ISO 8402). There are stricter quality control procedures for fresh chilled seafood than the frozen seafood. Fresh chilled seafood is under the quality control during the whole process from catch handling, chilling, processing and storing in order to avoid the growth of bacteria. [2]

Figure 1 summarizes the analytical perspective applied in this study. The trade opportunities will be studied as a function of trade drivers influenced by the demand and perception of the fresh salmon qualities and the trade barriers.
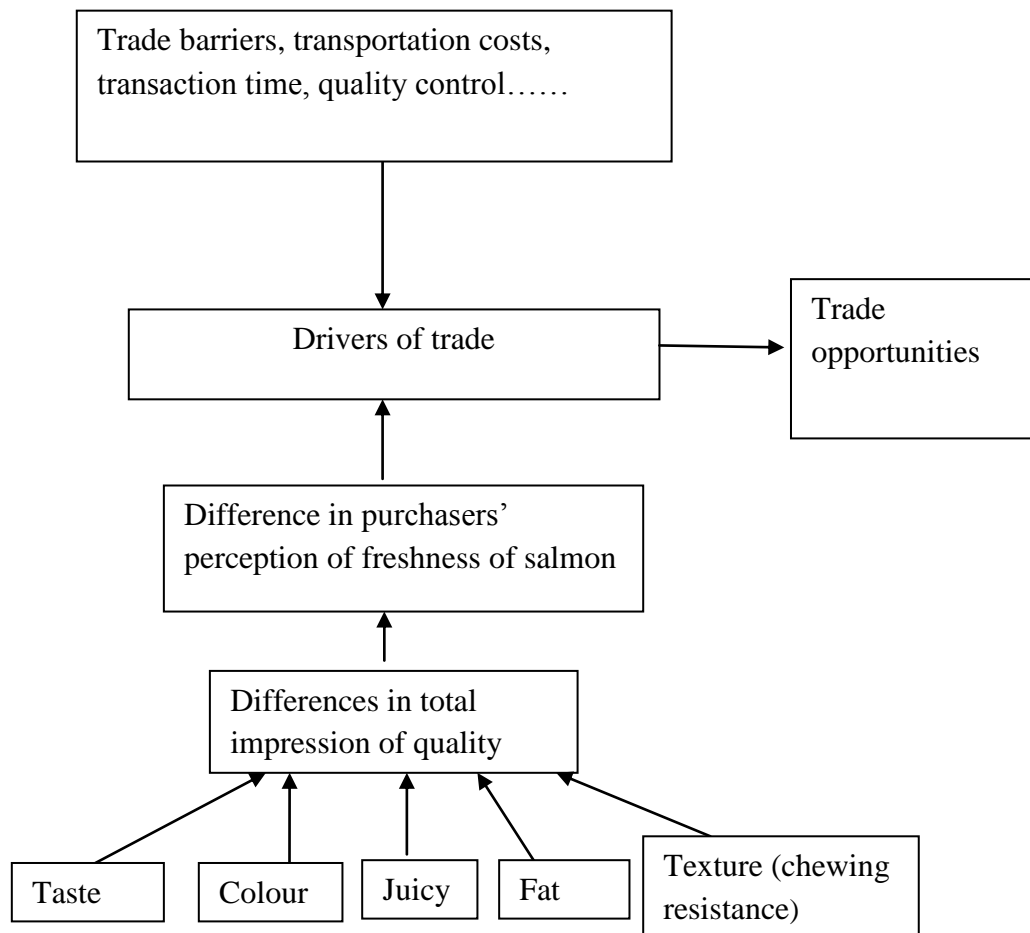
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[2] http://www.fao.org/docrep/V7180E/v7180e10.htm

Figure 1.Analytical model

Summary of the chapter

In this chapter, the meaning of fresh and frozen seafood is defined. Instead of traditional classification of fresh and frozen seafood, seafood may be classified into four categories, fresh frozen; fresh unfrozen; stale fresh and stale unfrozen. Trade barriers and drivers of trade are discussed in order to identify the market opportunity for Norwegian and Chinese salmon trade.

In the next chapter, I will start with the concept of Coolnova salmon, and then describe how the three salmon samples are prepared before testing, how the data are collected as well as how the research is designed.

4. Materials and method

This chapter mainly describes what Coolnova salmon means, how the three different salmon samples are prepared before testing, how the data are collected as well as how the research is designed.

The following pictures are the pictures of the three salmon samples which were used in this research.

Picture 1. Raw Norwegian fresh chilled salmon fillets

Picture 2. Raw Coolnova salmon fillets

Picture 3. RawNorwegian frozen salmon fillets

Picture 4.Raw and cooked Norwegian fresh chilled salmon fillets

Picture 5.Raw and cooked Coolnova salmon fillets

Picture 6.Raw and cooked Norwegian frozen salmon fillets

4.1 What is Coolnova salmon?

Coolnova salmon is fresh frozen salmon using a new Japanese invented proton magnetic freezing technology where the fresh salmon is frozen in a proton magnetic field which protects against ice crystallization, cell damages and juice leakage.

In freezing operation, freezing speed and freezing temperature have great impact on the quality of thawed fish fillets. Freezing at the fastest possible speed in freezing chambers with temperature of below -18/20 ˚C gives the best quality of frozen seafood.

To produce Coolnova salmon, fresh salmon fillets are packed in vacuum bags, which are protecting against dehydration. The vacuum packed fresh salmon fillets for testing were put in the proton freezing equipment which was set at -40˚C with air circulation 7 or air speed of 3m/sec air. A temperature measurement probe is inserted in the salmon fillets so that the temperature could be checked during the freezing process. With the proton magnetic freezing technology, the salmon samples are frozen much faster than conventionally frozen fish.

Coolnova salmon, frozen at the fastest possible speed in the proton freezing equipment set at an air temperature below -40˚C, protects against ice crystallization, cell damages and juice leakage which improves the quality when thawed.

The proton magnetic freezing technology is underway in the market. The advantage for the wholesalers and supermarket chain is the opportunity to import and keep frozen fish in storages and later thaw and distribute it as chilled fish (0-4˚C) like of fresh quality. Such logistics open up distribution by boat and trucks which are significant cheaper than importing fresh fish by airplanes that will be analysed in chapter 6. The question here is whether the Coolnova frozen fish after thawing can be considered comparable with ordinary fresh salmon airborne to Hong Kong from Norway.

4.2 Data collection

4.2.1 Three salmon samples

4.2.1.1 Coolnova salmon samples

Fresh chilled Norwegian salmons weighing about 3 kg were bought at the fishmongers in Spain on the 29th December 2010. The salmon were expected to be about 5-7 days after slaughtered in Norway. They were processed into fillets and vacuum packed, frozen in proton magnetic freezing equipment. On the 5th January 2011, they were taken out of the freezer and sent to an influential salmon distributor in Hong Kong by air and kept in the freezer upon receipt. The investigation was conducted from 8th January to 14th January 2011. Before the salmon sample tests were presented to the distributors and the face to face interviews were conducted, the Coolnova salmon was taken out of the freezer, and thawed overnight at +4˚C.

4.2.1.2 Fresh Chilled salmon samples

Norwegian fresh salmon fillets were purchased in the nearest large supermarket in Hong Kong the same day the interview was conducted. It took about 5-7 days from slaughtering the fresh salmon till to the respondents tasted them.

4.2.1.3 Frozen salmon samples

The influential salmon importer and wholesaler, the Hong Kong branch of Japanese corporation, also imported the whole frozen salmon from the Norwegian salmon exporter directly. This salmon is normally frozen a few hours after slaughter. The traditional frozen salmon were put in the freezer. One day before the interview was conducted; the whole frozen salmon was taken out of the freezer and thawed overnight at +4˚C, then processed into fillets in the warehouse processing house and used as test samples.

4.2.2 Primary and secondary data collection

Before going to Hong Kong to conduct the interviews, relevant secondary data and information were collected in the publications, periodicals and unpublished materials. Those second data and information gave me some knowledge of seafood markets and consumption preference in Mainland China and Hong Kong, the Norwegian-Chinese salmon trade, the barriers hampering the Norwegian-Chinese fresh salmon trade. All these information arouse me the interest to do the diploma work and provided the basis for the research.

With the help of my supervisor, an influential Norwegian salmon importer and wholesaler, the Hong Kong branch of a Japanese corporation, was approached by the telephone with the introduction of the research in advance. The questionnaire was sent by e-mail to them for their improvement based on their knowledge and experience in seafood marketing and local consumer preference. This Japanese corporation is a global company which has affiliates all over the world. Seafood business has been playing an important role in the whole business. Having been in the Norwegian salmon trade for many years, Hong Kong branch of the Japanese corporation is a key importer and wholesaler of Norwegian salmon which supply salmon to the influential and other medium-sized supermarkets in Hong Kong.

General Manager and Sales & Marketing manager in Foodstuffs Department were involved in the whole process of the interviews. A list of respondents which consisted of their important customers and other salmon wholesalers were sent by e-mail before I went to Hong Kong.

The product tests of three salmon fillets as raw and cooked salmon were conducted separately. For raw salmon, salmon samples were taken to the office of the respondents. At the beginning of the interview, three different salmon fillets were put on the table and an introduction of the research was given to help the respondents understand the aim of the interview. Two respondents from the Hong Kong branch of Japanese corporation indicated which was Coolnova salmon and which was frozen salmon. Norwegian fresh salmon, which had a label on the top of plastic film, was recognized easily. The respondents looked at the colour of three salmon fillets first, and then tasted them to judge the difference with regard to colour, juiciness, taste, fat or oil lines and texture. After tasting three salmon samples, they were asked to judge the product quality and product value of Coolnova salmon compared to the fresh and frozen salmon based on the questionnaire. Five respondents tasted three raw

salmon fillets and one respondent only tasted raw fresh salmon and raw Coolnova salmon fillets. Due to time limitation, only three respondents tasted cooked Coolnova salmon as well as cooked fresh and frozen salmon. They were also asked to judge the product quality and quality value among three samples.

During the interviews, only two respondents filled in the questionnaire, others excused themselves for several reasons (Table 3). However, all of the respondents who tasted different salmon fillets gave their opinions about the product quality and product value between different salmon samples. Based on their experience in the salmon trade, they perceived the meaning of salmon freshness, the market potential of Coolnova salmon in China and the estimated price of Coolnova salmon. They also mentioned Hong Kong consumers' perception and attitudes towards salmon freshness. I tried to record all the information which would help me in the research. The descriptions of profile of respondents and their businesses are presented in Table 4.

Table 3. Profile of the respondents who tasted salmon fillets and filled in the questionnaire

Respondent	Tasted raw samples and gave opinions based on the questionnaire			Tasted cooked samples and gave opinions based on questionnaire			Filled in the Relevant questionnaire
	Fresh	Coolnova	Frozen	Fresh	Coolnova	Frozen	
Number 1	X	X	X	X	X	X	
Number 2	X	X	X	X	X	X	
Number 3	X	X	X	X	X	X	
Number 4	X	X					X
Number 5	X	X	X				X
Number 6	X	X	X				

Table 4.Descriptions of profile of the respondents and their business

Number	Position of respondent	Sex	Length in business	Business reference	Business position in value chain	Business Function
1	General Manager, Foodstuffs Dept	Male	5 years	Hong Kong branch of Japanese corporation	Importer & wholesaler	Distributor
2	Sales & Marketing Manager, Foodstuffs Dept	Male	5 years	ditto	ditto	ditto
3	Commercial Manager	Male	20 years	Hong Kong supermarket	Retailer	Supermarket(selling to end consumers)
4	Food Department Merchandiser	Male	7 years	Japanese company	Wholesaler	Distributor
5	Assistant Manager	Male	10 years	Japanese company	Importer & wholesaler	Distributor
6	Newly – employed staff	Female	1 month	Hong Kong company	Wholesaler	Distributor

Number 1 was General Manager in Foodstuffs Department in the Hong Kong branch of Japanese corporation. Having been in seafood business for five years, he acquired much knowledge of Norwegian salmon products and obtained wide experience in the seafood industry and marketing.

The Hong Kong branch of Japanese corporation is the main Norwegian salmon importer and wholesaler in Hong Kong. It is the key supplier to local large and medium-sized supermarkets. They imported both fresh whole salmon and frozen whole salmon directly from Norway and sold to the supermarkets.

Number 2 worked in the same corporation as Number 1. As Sales & Marketing manager, he was mainly in charge of importing Norwegian Atlantic salmon to Hong Kong. Having been in salmon trade for five years, he not only acquired good knowledge of Norwegian fresh and frozen salmon, and gross profit differentials between two salmon products, but also obtained substantial experience regarding salmon freshness.

As the main customer of Hong Kong branch of Japanese corporation, Number 3 was Commercial Manager in the second largest supermarket in Hong Kong. The supermarket chains had more than 240 stores in Hong Kong, Macau and Mainland China. They had their own processing house where fresh whole and frozen whole salmon were processed into fillets and sent to the stores as soon as needed. Through twenty years of dealing with Norwegian salmon, he not only had acquired better knowledge of Norwegian salmon products, but obtained in-depth understanding of salmon freshness. Moreover, he understood consumers' perception of salmon freshness by keeping close contact with the seafood assistants in stores.

As Food Department Merchandiser in a Japanese corporation, Number 4 imported Norwegian fresh salmon and sold to its own 9 stores in the Japanese supermarket chain. Each store was supplied with 30 Norwegian fresh whole salmon every day. Through seven years of dealing with fresh chilled salmon, he had better understanding of the concept and meaning of salmon freshness.

Number 5 was responsible for importing frozen whole trout from Chile. Frozen whole trout were first transported from Chile to Thailand by ship and processed into fillets there, and then trout fillets were transported to Japan and sold to Japanese sushi restaurants. He had better knowledge about the consumption preferences of Japanese consumers and Chinese consumers as well as the perception of the meaning of freshness in association to seafood.

Number 6 was the only female respondent in the research. She was newly employed by a Hong Kong foodstuff wholesaler and had little knowledge and experience in the seafood marketing.

4.3 Research design for distributor quality perception

Thanks to time limitation, it was difficult to use the quantitative research in this research, as quantitative research involves a large number of randomly selected respondents and the use of structured questions where the fixed response options have been pre-specified. The qualitative research which uses unstructured questions and involves collecting, recording, interpreting and analyzing the data by observing what people say and do is used to achieve the aim of the research (Wang, 2006).

A questionnaire was designed based on the objective of the research and research questions. It tried to perceive the meaning of freshness in association to salmon by judging the product quality of Coolnova salmon compared to fresh and frozen salmon. It also aimed to unveil the perceived product value of Coolnova salmon among the wholesalers and supermarkets in Hong Kong in order to understand whether Coolnova salmon had any advantages that can break the trade barriers of Norwegian fresh salmon in the Chinese markets. The interviews were face to face in-depth interviews of 30 minutes each. The majority of respondents had been in the salmon distribution chain for years and not only had obtained expert knowledge of fresh and frozen salmon products, but also had acquired substantial experience in seafood marketing.

The questionnaire consisted of the following questions: (1) How do you judge the product quality of the Coolnova sample you have received *compared to the fresh and frozen salmon* you at present are distributing? The respondents were asked to judge the quality of raw Coolnova salmon compared to raw fresh and raw frozen salmon and the quality of the cooked Coolnova salmon compared to cooked fresh and cooked frozen salmon separately and asked to give comments in five categories from "much lower", "lower", "same", "better" to "much better". (2) How do you judge the product value of the Coolnova salmon sample you have received *compared to the present Norwegian salmon fillets* you are distributing? Respondents were asked to judge the product value of raw Coolnova salmon compared to raw fresh and raw frozen salmon and the product value of cooked Coolnova salmon compared to the cooked fresh and cooked frozen salmon separately, give comments in seven categories. It ranged from perceived product value of Coolnova salmon less than 70 percent and up to 121-130 percent of the prices of fresh or frozen salmon. Other relative questions included the logistic cost reduction of the Coolnova salmon compared to the cost of fresh salmon

distribution imported from Norway, package size preference, freezing storage preference and purchase intention of Coolnova salmon.

4.4 Expert interview

According to Kotler (1994), various forecasts can be obtained from experts. Experts include dealers, distributors, suppliers, marketing consultants, and trade associations. Many companies buy economic and industry forecasts from well-known economic-forecasting firms, such as Data Resources, Wharton Econometric, and Chase Econometric. These forecasting specialists are able to prepare better economic forecasts than the company because they have more data available and more forecasting expertise. Occasionally, a group of experts will be invited by companies to prepare a forecast. The experts exchange views and produce a group of estimate (group-discussion methods). Or they supply their estimates individually, and the analyst combines them in a single estimate (pooling of individual estimates). Or they supply individual estimates and assumptions that are reviewed by the company, revised, and followed by further rounds of estimating (Delphi method).

Expert interview was used to perceive the meaning of salmon freshness and market value of Coolnova salmon among the wholesalers and supermarket in Hong Kong. Respondents except Number 6 had been in the salmon value chain for many years, and had acquired substantial knowledge and experience about what they have worked. They were the experts in the seafood marketing, especially in salmon marketing. Since they put their broad knowledge and valuable experience in the test, their expressions and opinions were believed to be valid and trustworthy for the general opinion of salmon traders in Hong Kong.

4.5 Validity and reliability.

This research is subject to several limitations. First, blind tests were not used in this research. Thus, the respondents' preoccupied ideas and attitudes towards fresh and frozen salmon might lead to conscious or subconscious bias on the test results. Secondly, the research design is qualitative and questionnaire consists of unstructured questions; face to face interviews involve communication and interpretation between the interviewer and the respondents, thus misunderstanding or errors could occur when the interviewer obtained and interpreted the information, thus test results might be biased. Thirdly, there were only a limited number of

respondents interviewed. If there were more respondents, the results might show differences from the results derived from this research.

However, expert interview was used in this research, majority of the respondents were in salmon value chain for years and obtained good knowledge and substantial experience of salmon industry and marketing during the work. Since they put their knowledge and experience in the sample test, their expressions and opinions were believed to be valid and trustworthy for the general opinion of salmon traders in Hong Kong.

Summary of the chapter

This chapter mainly describes the concept of Coolnova salmon, the preparation of salmon samples before test, collection of primary and secondary data as well as research design for distributor quality perception.

In the next chapter, I will present the results regarding the perceived product quality and product value of Coolnova salmon compared to fresh and frozen salmon.

5. Results

In this chapter I will unveil the perceived product quality and the product value of raw Coolnova salmon compared to raw fresh and frozen salmon as well as the perceived product quality and quality value of cooked Coolnova salmon compared to cooked fresh salmon and frozen salmon

5.1The perceived product quality of Coolnova salmon

Table 5. The perception of the number of respondents' regarding of product quality of raw Coolnova salmon compared to raw fresh and frozen salmon (N=6 for fresh salmon and Coolnova salmon fillets; N=5 for frozen salmon fillets)

	Much lower	Lower	Same	Better	Much better
Fresh Norwegian salmon					
Colour		3	3		
Juicy		1	5		
Fat		5	1		
Taste		3	2	1	
Texture(chewing resistance)		3	2	1	
Total quality impression		5	1		
Frozen Norwegian salmon					
Colour		3		2	
Juicy			4	1	

	Much lower	Lower	Same	Better	Much better
Fat		3	1	1	
Taste		3		2	
Texture (chewing resistance)		2	2	1	
Total quality impression		2	1	2	

Table 6. The perception of the number of respondents' regarding of product quality of cooked Coolnova salmon compared to cooked fresh and frozen salmon (N=3 for fresh, Coolnova and frozen salmon fillets)

	Much lower	Lower	Same	Better	Much better
Fresh Norwegian salmon					
Colour			3		
Juicy			3		
Fat			3		
Taste			3		
Texture(chewing resistance)			3		
Total quality impression			3		
Frozen Norwegian salmon					

Colour			3		
Juicy			3		
Fat			3		
Taste			3		
Texture(chewing resistance)			3		
Total quality impression			3		

Table 5 and 6 show the perceptions of the number of respondents' regarding of product quality of raw Coolnova salmon compared to raw fresh and frozen salmon as well as cooked Coolnova salmon compared to cooked fresh and frozen salmon.

Colour

Table 5 shows that three respondents perceived colour of Coolnova salmon as less attractive and lighter than that of fresh salmon. Other three respondents perceived that Coolnova has the same bright colour as fresh salmon.

Among five respondents, three respondents perceived that Coolnova salmon looked not as attractive as frozen salmon owing to lighter colour. The other two respondents perceived that colour of Coolnova salmon was brighter than that of frozen salmon.

Juicy

Five respondents perceived that the Coolnova salmon contained the same juice as fresh salmon. One respondent showed negative attitudes and perceived that the Coolnova salmon was less juicy than fresh salmon.

Four respondents perceived that there was no much difference between Coolnova salmon and frozen salmon with respect to juice. One respondent believed that Coolnova salmon contained more juice than frozen salmon.

Fat

All the respondents perceived fat as the key characteristic of fresh salmon. Five respondents perceived that oil lines in the flesh of Coolnova salmon were not clear and wide as those in the flesh of fresh salmon. One respondent perceived the oil lines in the flesh of Coolnova as the same as those in the flesh of fresh chilled salmon.

Three respondents perceived that Coolnova salmon did not have clear oil lines as frozen salmon. One respondent believed that Coolnova salmon had clear oil lines whereas frozen salmon showed unclear oil lines in the flesh. Another respondent perceived that the Coolnova salmon had the same white and clear oil lines as frozen salmon.

Taste

Three respondents perceived that fresh salmon tasted better than Coolnova salmon as it had smooth and fatty taste with lots of white, clear oil lines. One respondent believed that Coolnova salmon had better taste than fresh salmon, while two respondents perceived that Coolnova salmon had the same taste as fresh salmon.

Three respondents perceived that frozen salmon tasted better than Coolnova salmon; while the other two respondents perceived that Coolnova salmon tasted better than frozen salmon.

Texture (chewing resistance)

Three respondents perceived the texture of Coolnova salmon as softer than that of fresh salmon and chewing strength not as good as fresh salmon. Two respondents perceived that there was no difference in texture between Coolnova salmon and fresh salmon. One respondent perceived that Coolnova salmon had harder texture and more chewing strength than fresh salmon.

Two respondents perceived that frozen salmon had harder texture and better chewing strength than Coolnova salmon. Two respondents perceived that Coolnova salmon had the same texture and chewing strength as frozen salmon. Another one showed positive attitude towards Coolnova salmon as it had harder texture than frozen salmon.

Total quality impression

Five respondents perceived that the total quality of Coolnova salmon was lower than that of fresh salmon. Only one respondent perceived that the total quality of Coolnova salmon was the same as that of fresh salmon.

Two respondents perceived that Coolnova salmon had lower quality than frozen salmon. One perceived that Coolnova salmon and frozen salmon had the same quality. The other two respondents believed that Coolnova salmon had better quality than frozen salmon.

Table 6 shows that three respondents tasted cooked fresh, cooked Coolnova and frozen salmon fillets. They perceived that there was no difference with regard to colour, juiciness, fat, taste, texture as well as the total quality.

5.2 The perceived product value of Coolnova salmon

Table 7. The perception of the number of respondents' regarding of product value of raw Coolnova salmon compared to raw fresh and frozen salmon (N=6 for Coolnova and fresh salmon, N=5 for frozen salmon)

	<70%	70-80%	81-90%	91-100%	101-110%	111-120%	121-130%
Fresh	4		1	1			
Frozen				5			

Table 8. The perception of the number of respondents' regarding of product value of cooked Coolnova salmon compared to cooked fresh and frozen salmon (N=3)

	<70%	70-80%	81-90%	91-100%	101-110%	111-120%	121-130%
Fresh				3			
Frozen				3			

As shown in table 7, with respect to the product value of raw Coolnova salmon compared to that of raw fresh salmon, four respondents perceived that the product value of raw Coolnova salmon was less than 70 percent of the price of raw fresh salmon. One respondent believed that the product value of raw Coolnova salmon is 81-90 percent of the price of raw fresh

salmon. Another one perceived that raw Coolnova salmon had almost the same value as fresh salmon.

Regarding the comparison of product value between raw Coolnova salmon and raw frozen salmon, five respondents perceived that there was no difference in the product value between two salmon samples.

Table 8 shows that three respondents perceived that cooked Coolnova salmon had the same value as the cooked fresh and cooked frozen salmon.

Summary of the chapter

The results show that there was a lot of variation and no significant results in the perceptions of raw Coolnova salmon compared to raw fresh and frozen salmon. But, the respondents did not identify any differences between the cooked samples.

In the next chapter, I will discuss the factors which influenced the perceptions of salmon freshness first, followed by the competitive market value of Coolnova salmon by transportation cost differentials and trading margin differentials compared between salmon samples.

6. Discussion

In this chapter, I will explain the factors influencing the perceptions of salmon freshness and discuss the competitive market value of Coolnova salmon by transportation cost differentials and trading margin differentials compared between fresh whole salmon, frozen whole salmon and Coolnova salmon fillets.

6.1 Perception of salmon freshness

In order to understand the results, it is important to take into account that blind tests were not used in this research. The respondents' preoccupied ideas and attitudes towards the fresh and frozen salmon might lead to conscious or subconscious bias on the test results. However, expert interview was used in this research. Majority of respondents had been in salmon trade for years and had obtained expert knowledge about fresh and frozen salmon. Since they put their knowledge, expertise and experience in the sample test, their expressions and opinions were believed to be valid and trustworthy for the general opinion of salmon traders in Hong Kong.

The results show that Hong Kong purchasers have the same perceptions towards salmon freshness like other consumers in the world. One definition of the word "fresh" in association to food is "bright, with colour" (Duden, 1999; Guibert, *et al* 1976; Merriam-Webster, 1986; Rey, 2001; Simpson and Weiner, 1989; Sinclair, 2000; Peneau 2005). People are at first eating food with their eyes, thus appearance like colour is an important clue influencing perception of the meaning of freshness from the consumers' perspective, because stale fish tends to be dehydrated and gets a bleak appearance. Atlantic salmon is renowned for its bright orange colour. The results show that fresh salmon have distinctive orange colour in the flesh whereas consumers perceive salmon with lighter colour as "not fresh" or stale.

Fresh seafood is characterized by the enough juice in the flesh. Juicy is another sensory attribute which is used to judge the fresh fish because stale seafood tends to lose juice under storage as a result of both dehydration and microbiological decomposition. The results show that fresh salmon is perceived as full of juice when tasted whereas stale salmon tastes dry, not much "water" in the flesh.

The sense of taste is probably the most important in determining selection of food (Shepherd and Farleigh, 1989). Therefore, taste is perceived as another important sensory attribute

which influences salmon freshness, because important taste elements are soluble and lost when the juices are leaking out of the product. The results show that fresh Atlantic salmon has smooth and fatty taste.

In meat or flesh, the apparent amount of fat may be an important determinant of choice, especially in view of consumers concern on fat intake (Fallows, 1986; Shepherd and Farleigh, 1989). Thus fat is a key sensory attribute which is used to judge freshness of salmon. The results show that fresh salmon is full of white, clear oil lines. Salmon with unclear oil lines or opaque oil lines is regarded as stale salmon.

Texture is regarded as another sensory attribute of fresh seafood as texture of seafood is deteriorated with the freezing process as the ice crystals physically destroys the fish muscle and loses moisture (Nevin, 2003). The results show that fresh salmon have tight and hard texture in the flesh and good chewing strength; stale salmon have softer texture and not good chewing strength.

This research also shows that respondents had both positive and negative perceptions and attitudes towards the product quality and quality value of raw Coolnova salmon compared to raw fresh salmon and frozen salmon. It may attribute to several reasons. First, salmon samples compared were of different qualities regarding fat, colour and size. The experienced respondents perceived different sizes of salmon samples compared based on salmon fillets they tasted. The size of salmon has great impact not only on the apparent amount of fat or oil lines in the flesh, but also on taste. Different portion of salmon samples compared could also lead to difference in fatness and taste. Colour difference among different salmon samples attributed to different qualities of salmon samples.

Secondly, open trial (not blind tests) in the research may have impact on the test results. The experienced respondents' preoccupied negative association with traditional frozen seafood influenced their perceptions of Coolnova salmon.

Thirdly, the samples had different age from slaughtering. The traditional frozen salmon was frozen after a few hours, while Coolnova was frozen after 5-7 days after slaughtering. If Coolnova salmon were frozen as early as the traditional frozen salmon, the results might be different.

In this research, I found that purchaser characteristics influenced their perceptions of the product quality of Coonova salmon. The female respondent had quite positive perceptions of Coolnova salmon regarding colour, juicy, fat, taste and texture. She believed that Coolnova salmon was the best among salmon samples. Male respondents' perceptions and attitudes towards Coolnova salmon were negative regarding fat, taste and colour. Age is another factor which influences respondents' perceptions. Middle-aged respondents perceived Coolnova salmon more negatively than the young respondent as their preoccupied attitudes towards traditional frozen seafood influenced the perception of Coolnova salmon. Respondents in the different positions of distribution chain showed different perceptions of Coolnova salmon. Wholesalers showed a mix of positive and negative perceptions of Coolnova salmon compared to fresh and frozen salmon samples. The supermarket gave negative perceptions of Coolnova salmon regarding fat, colour and texture.

This means that branding and market communication are important in marketing of Coolnova salmon.

6.2 Competitive Market value of Coolnova salmon

All the respondents expressed their willingness to purchase Coolnova salmon if its product quality is similar to that of fresh chilled salmon and competitive price could be offered.

Coolnova salmon may offer several competitive advantages for salmon traders along the distribution chain including getting around the trade barriers, reducing the transportation cost, reducing the risk of insufficient supplies of fresh salmon and generate high trading margin along the value chain.

Strict inspection regime imposed by China on Norwegian farmed salmon has resulted in the sharp decrease in the Norwegian salmon export to China. Coolnova salmon can break this trade barrier as it can be kept in the freezer for long time without degradation of the quality and would not be affected by the new inspection regime which hampers the fresh fish import to China.

Coolnova salmon may take the place of fresh salmon in the Chinese markets because the research paper shows that ordinary people cannot make difference between a fresh salmon fillet and a frozen/thawed fillet. According to Egeness *et.al* (2011), refresh, chilled, defrosted, fresh frozen or any other fancy name given by the marketing departments to the freezing

/thawing technique is somehow invisible to consumers. Only the most experimented of people can make the difference between a fresh fillet and a frozen/thawed fillet. Shifting from genuine fresh salmon to thawed Coolnova salmon and considering that the item will get the "fresh-fresh" price, meaning that consumers will appreciate it, would definitely generate a benefit somewhere along the salmon value chain. Thus, thawed Coolnova salmon could be sold as fresh chilled salmon.

In EU markets, the fresh/ defrosted status should, by law, appear on the labelling of seafood all along the distribution chain down to the end consumers when the fish is sold at the fish mongers or supermarkets (Egeness *et.al* 2011). Up to now, there are no such regulations in China. Absence of the similar labelling regulations in China provides the possibility and feasibility to sell thawed Coolnova salmon as the fresh chilled one.

In order to identify the competitive market value of Coolnova salmon trade between Norway and China, there must be a sufficiently effective market information network so that traders in both countries are conscious of cost differentials (Cateora, 1987). The cost differences between fresh transported by airplane and frozen salmon transported in frozen containers are significant. Table 9 presents airfreight for fresh whole salmon (without ice) and sea freight for frozen whole salmon (without ice) from Norway to Hong Kong. The data are derived from a Norwegian salmon exporter. Airfreight and sea freight may differ due to trade volumes of different Norwegian salmon exporters. As shown in Table 9, airfreight for fresh whole salmon (net weight) from the fish farms in Norway to Hong Kong is according to DHL and trucking companies US$2,5/ kg whereas the sea freight for frozen whole salmon (net weight) from the fish farm in Norway to Hong Kong is only US$ 0,44 /kg. The cost difference between fresh transported by airplane and frozen transported by ship is US$2,06/kg . In the salmon trade, importers, wholesalers and retailers should be conscious of cost differences between fresh and frozen salmon. They get the benefit of this cost differences in the value chain.

Table 9. Freight from the fish farms in Norway to Hong Kong for fresh salmon transported by airplanes and frozen salmon transported by ships

Description	Air freight (US$/kg)	Sea freight (US$/kg)
Fresh whole salmon	2,5	
Frozen whole salmon		0,44

.

In order to identify the competitive market value of Coolnova salmon trade between Norway and China, the gains must be greater than the costs of trading and shipping of fresh salmon and the differential should be sufficient to interest entrepreneurs in trading (Cateora,1987). According to data from Hong Kong customs, in 2010, the import price **(CNF)** of Norwegian fresh whole salmon was US$7.46/kg; the import price **(CNF)** of Norwegian frozen whole salmon was US$4.00/kg. While the Norwegian export statistics show the same export prices of frozen salmon (FOB) and fresh salmon were NOK42.40 (US$7.06) and NOK42.21 (US$7.03) in 2010. The import price should be equal to the export price subtracted the transportation costs; so the price differences indicate uncertainty about the prices from different sources. Different sizes of fish demand different prices, thus it may also explain the inconsistence in the prices from different sources.

 Norwegian fresh salmon is not a good profit business in Hong Kong and profit margin is quite small for the importers and wholesalers. As mentioned by the respondent in Hong Kong branch of Japanese corporation, "*90 percent of salmon market share in Hong Kong is fresh chilled salmon. Fresh salmon is not a good profit business and is not value-added product in Hong Kong. Profit margin is quite small in Hong Kong.*"

Coolnova salmon, fresh frozen salmon which is produced using a new technology, are expected by the salmon traders in Hong Kong to obtain price premium along the value chain. Table 10 shows the costs and margins of import and distribution of fresh whole salmon, frozen whole salmon and Coolnova salmon fillets in Hong Kong

Table 10 Costs and margins of import and distribution of fresh whole salmon, frozen whole salmon and Coolnova salmon fillets in Hong Kong (US$/kg)

```
                    ┌──────────┐
                    │ Fish farm│
                    └──────────┘
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	Fresh whole salmon (airfreight)	Frozen whole salmon (sea freight)	Coolnova salmon fillet (sea freight)
Raw material cost (at fish farm)	6,00	6,00	8,57
Filleting, packaging and freezing costs		0,20	2,50
Transportation from fish farms to export place	0,86	0,15	0,15
FOB price (except filleting and packaging costs and exporters margin)	6,86	6,35	11,22
Transportation costs from place of export to place of import	1,64	0,29	0,29
CNF Importer cost	8,50	6,64	11,51
Processing (filleting/choping/thawing) costs supermarket	1,00	1,00	0,20
Super markets fillet/chop costs	13,14	8,22	11,71
Consumer price for salmon fillets and chops	23,50	17,60	23,50
TRADING margin including VAT	10,36	9,38	11,79

In table 10, we assume that the raw material costs of salmon are the same in the fish farm. The sellers sell salmon products based on needs of importers. Fresh salmon are transported from the fish farm to the airport in Norway by truck, while frozen salmon are transported to the Norwegian port.

The filleting, packaging and freezing costs are assumed to US$ 2.50 per kilo[3] for fillets and freezing cost for whole salmon assumed to US$ 0.2/kg. The cost difference between fresh transported by airplane and frozen transported by ship from the fish farm to Hong Kong is US$2.06/kg. Import cost differences between the fresh salmon and frozen salmon attribute to transportation cost differences between fresh transported by air and frozen salmon by boat.

In this research, the importer is also the wholesaler; therefore the cost of importer is also the cost of wholesaler. The importer imported fresh whole and frozen whole salmon and sold to the supermarket; the supermarket processed into salmon fillets and frozen salmon chops and sold to end consumers. Recovery rate is 70% from whole salmon (head on) to fresh salmon fillets and 92% from whole salmon (head on) to frozen salmon chops. The value of by-products is not calculated. The filleting cost is assumed to 1 US$/kg. The consumer prices on fresh and frozen products are recorded are based on the information from the respondent in the supermarket.

The calculated trading margins are the total compensations to all the distributors between the fish farm and the consumers including VAT, tariffs etc., which value may be regarded as a trade driver.

Based on these assumptions and calculation, the results shows that frozen salmon chops offer the lowest trading margin of about 90% of the fresh salmon fillet margin (almost 1US$/kg) even though the transport costs is much lower than the airborne fresh salmon. The main reason for this is that the consumer price of frozen salmon is only 75% of the fresh salmon fillets. If we assume that the thawed Coolnova fillets can be sold to the same price as the fresh unfrozen fillets, the calculation shows that the trading margin can be increased by almost 14% (or US$1,43 per kilo). The results also show that the trading margin between fresh airborne salmon and frozen Coolnova salmon might be the same even if the latter is

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[3] Estimated from Bjørn Inge Bendiksen (2011): Driftsundersøkelsen for fiskeindustrien. Nofima AS, Tromsø

sold to US$1,43 less per kilo (6%), without any of the risks the imposed import restrictions for fresh salmon.

Summary of the chapter

In this chapter, it shows that freshness is a preferred product attribute of salmon characterized by appearance as a distinctive orange colour, clear white oil lines and a hard texture and smooth and juicy taste. A lot of variations and no significant results in the perception of raw Coolnova salmon compared to raw fresh and frozen salmon may attribute to several reasons. Firstly, salmon samples compared were of different qualities regarding size, colour and fatness. Secondly, blind tests were not used in the research. Experienced respondents' preoccupied negative association with traditional frozen seafood influenced their perceptions of Coolnova salmon. Thirdly, the samples had different age from slaughtering. The traditional frozen salmon was frozen after a few hours, while Coolnova was frozen after 5-7 days after slaughtering. If Coolnova salmon were frozen as early as the traditional frozen salmon, the results might be different. Respondents' demographic characteristics also influenced their perceptions of the product quality of Coonova salmon.

The transportation cost differentials and trading margin differentials are compared between fresh whole, frozen whole salmon and Coolnova salmon fillets. The results also show that costs are decreased by sending Coolnova salmon fillets by boat instead of fresh whole salmon by air from Norway to Hong Kong. Extra trading margins are obtained from Coolnova salmon fillets and shared among the participants in the value chain. Coolnova salmon have the advantage of reducing the quality risk of fresh salmon, getting around the trade barriers and decreasing the costs in the import and distribution by boat instead of fresh whole salmon by air from Norway to Hong Kong.

7. Conclusion

In this research, the market opportunity for Coolnova salmon in Hong Kong is identified by investigating purchasers' perceptions and attitudes towards salmon freshness among the wholesalers and the supermarket in Hong Kong as well as discussing the competitive market value of Coolnova salmon in the Chinese markets.

The results show that freshness is a preferred product attribute of salmon characterized by appearance as a distinctive orange colour, clear white oil lines and a hard texture and smooth and juicy taste. The results indicate that Coolnova salmon after fresh-frozen and thawed, may satisfy the markets' requirements for freshness and furthermore gain a cost advantage by the opportunity to move distribution from an expensive fresh airfreight to a low cost frozen sea freight. Frozen salmon can be kept in freezers for a long time without quality degradation and would thereby not be affected by the new quality inspection regime which hampers the fresh fish import to China. Coolnova salmon can thus break the trade barrier of Norwegian fresh quality salmon imposed by the Chinese government.

The results show that there was a lot of variation and no significant results in the perceptions of raw Coolnova salmon compared to raw fresh and frozen salmon. But the respondents did not identify any differences between the cooked salmon samples.

Large variation in the perceptions of raw Coolnova salmon compared to raw fresh and frozen salmon might attribute to several factors. First, salmon samples compared were of different qualities regarding size, colour and fatness. Secondly, blind tests were not used in the research. The purchasers' preoccupied negative attitudes towards traditional frozen seafood influenced the perceptions of Coolnova salmon, which also would be important when consumers purchase frozen salmon in the supermarkets. Thirdly, the samples had different age from slaughtering. The traditional frozen salmon was frozen after a few hours, while Coolnova was frozen after 5-7 days after slaughtering. If Coolnova salmon were frozen as early as the traditional frozen salmon, the results might be different.

The results show that sex, age and purchasers in different positions of the salmon value chain influenced the perceptions of salmon freshness. The female respondent had quite positive perceptions of Coolnova salmon while male respondents' perceptions and attitudes towards Coolnova salmon were negative. Middle-aged respondents perceived Coolnova salmon more

negatively than the young respondent as experience played a very important role in the perceptions of salmon freshness. Respondents in the different positions of value chain had different perceptions of Coolnova salmon. Wholesalers showed a mix of positive and negative perceptions of Coolnova salmon compared to fresh and frozen salmon samples. The supermarket gave negative perceptions of Coolnova salmon regarding fat, colour and texture. This means that branding and market communication are important in marketing of Coolnova salmon.

The results also show that costs are decreased by sending Coolnova salmon fillets by boat instead of fresh whole salmon by air from Norway to Hong Kong. Extra trading margins are obtained from Coolnova salmon fillets and shared among the participants in the value chain. Coolnova salmon have the advantage of reducing the quality risk of fresh salmon, getting around the trade barriers and decreasing the costs in the import and distribution by boat instead of fresh whole salmon by air from Norway to Hong Kong.

People buy seafood with their eyes. It is possible to bring into frozen/thawed seafood and sell at fresh one. When Coolnova is distributed as a chilled product it will be difficult to distinguish from a "fresh product". Furthermore, Coolnova frozen few hours after slaughtering at the fish farm might even be fresher after thawing compared to the 5-7 days fresh salmon airborne to Hong Kong.

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Appendix

Questionnaire

Date:

Respondent name, age and position ....

Company name...

Main business...

Category of company.. (state-owned/private/inc)

Total yearly turnover...

Number of employees in seafood trade ....

Yearly fish trade.........................tonnes,...........................value...................growth rate

Yearly frozen H&G salmon trade.................tonnes,.................value..................growth rate

Yearly fresh H&G salmon trade...................tonnes, ...value..................growth rate

Yearly fresh fillets salmon trade ....tonnes,...................value.................growth rate

Performance last year: ROC..........................Very good,................good,................bad..........

Product test

How do you judge **the product quality** of the Coolnova salmon sample you have received *compared to the fresh and frozen* salmon you at present are importing?

As raw salmon

	Much lower	Lower	Same	Better	Much better
Fresh Norwegian salmon					
Colour					
Juicy					
Fat					
Taste					
Texture (chewing resistance)					
Total quality impression					
Frozen Norwegian salmon					
Colour					
Juicy					
Fat					
Taste					
Texture (chewing strength)					
Total quality impression					

As cooked salmon

	Much lower	Lower	Same	Better	Much better
Fresh Norwegian salmon					
Colour					
Juicy					
Fat					
Taste					
Texture					
Total quality impression					
Frozen Norwegian salmon					
Colour					
Juicy					
Fat					
Taste					
Texture					
Total quality impression					

How do you judge the product value of the Coolnova salmon sample you have received *compared to the present Norwegian salmon fillets* you are distributing?

As raw salmon

	<70%	70-80%	81-90%	91-100%	101-110%	111-120%	121-130%
Fresh							
Frozen							

As cooked salmon

	<70%	70-80%	81-90%	91-100%	101-110%	111-120%	121-130%
Fresh							
Frozen							

The Coolnova fish can be imported vacuum packed frozen and thawed just-in-time for daily distribution through your chilled fish chain/counters.

How do you judge the value of **the logistic cost reduction** (HK$/RMB) of the Coolnova JIT fish concept *compared to the cost of fresh salmon distribution imported from Norway by airlines?*

	Present costs per kg	Coolnova costs reduction
Fresh gutted whole		
• Purchasing		
• Processing (cutting and packaging)		
• Distribution		
• Wastage (out of date)		
Fresh fillets		
• Purchasing		

• Processing (cutting and packaging)		
• Distribution		
• Wastage (out of date)		

Packaging

Coolnova fillets can be delivered in an oxygen permeable vacuum package approved by FDA (in USA) ready to be displayed in the chilled sales counter.

Is this packaging satisfying for you?

What package sizes do you prefer?

100 grams
150 grams
200 grams
250 grams
300 grams
350 grams
400 grams
450 grams
500 grams

Freezing storage and logistics

Do you prefer to manage yourself the freezing storage for daily delivery to your shops or do you require your supplier to offer such services?

What qualities are you normally selling weekly/monthly?

What security of supply in terms of quantities and regularity do you require from a supply contract?

Purchase intention

How do you judge all the information you have received about the Coolnova Jit fish concept?

Would you be interested to go into negotiation about a steady supply?