Master's degree thesis

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An empirical investigation of consumers perception of information availability in fish supply chains in Norway

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Preface

This master thesis was written during the spring of 2023 as the final part of my Master of Science in Logistics program at Molde University College. I have had two great years in Molde, living in a great city with beautiful nature but also been lucky enough to attend one of the greatest schools in logistics with highly competent lecturers. With all their knowledge they have helped me getting a higher understanding of the world of logistics and I am thanking them for the opportunities that will follow for me.

I would also like to express a huge appreciation to my supervisor, Berit Irene Helgheim, for the support and advice´s through the entire semester. Without your helpful discussions and motivational speeches this thesis would not have been the same. Also want to thank you for believing in me for this project and for the contact achieved with the Portuguese studies, wishing you all good luck with the future studies on this topic.

Last but not least, thank you to my family and friends for great support through all five years of education. I would also like to thank my lovely girlfriend for getting me up every morning to continue the work on this thesis, keeping my motivation high. Thank you all for the support and motivation to complete this final product that I am proud of.

Molde, 22.05.2023
Nichlas Huseby Botten

Summary

The fishing industry in Norway is one of the biggest industries when it comes to export and production of fish, and the goal for this paper has been an investigation of the Norwegian market. The aim for this research has been to investigate the consumers of fish products in the Norwegian market, evaluating their interest in product information about the products they buy and factors influencing this interest. In addition to that a contribution to the literature of seafood SCM and the benefits of using blockchain technology in this industry.

To complete this research, data was collected through a questionnaire answered by 200 different fish consumers living in Norway. Questions were asked about their age and county of a living, but also questions to investigate their relations with their favorite brand to understand their trust, loyalty, and word-of-mouth towards them. The dataset was used in SmartPLS to be analyzed using the method of PLS-SEM, understanding the relationships between independent and dependent variables. Where the respondents' relations to the brands and their age were the main focus towards the dependent variable of information interest.

The findings in this research reveals the huge impact trust can have on loyalty, as well as it has on interest for product information. Without trust to the brand, consumers will not achieve a loyal relationship and will not contribute to positive word-of-mouth advertising for them. The benefits of blockchain technology can prevent these damages to the buyer-supplier relationship, with transparency and non-tangible ledgers to give out trustworthy information to all stakeholders. At the top of this, a clear difference between consumer group of younger than 40 years old trusting the information more than the group of older than 40 years old, while the younger group do not show as much interest as the older group.

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1.0 Introduction

Norway is second in the world, behind China, in terms of exports of fish products and ranks among the top seven countries in the world for aquaculture production (FAO, 2021). Despite the success in the world, the consumption of fish in Norway has drastically decreased in recent years (Strøm, 2018). Considering this, the thesis aims to investigate the Norwegian market when it comes to the buying decisions of fish consumers. Exploring if more information about where the fish comes from and processes the fish has been through influences the choices taken in the grocery stores.

The degree to which information availability can affect consumers' buying decisions will be crucial for brands to understand their target market, and possibly utilize it as competitive advantage in the market towards their competitors. By knowing more about consumers in a market, brands can focus on what is expected by them to achieve high service quality towards consumers. In addition to investigating the Norwegian market, this study will also examine the potential utilization of blockchain technology within the supply chain. By adapting blockchain, it will be possible to track the fish from the point of origin to final product for the consumers. Such technology can be quite beneficial in this situation for both the brands and consumers who will obtain transparency with the products they frequently purchase.

Consumption of fish in the Norwegian market differ from high consumption in north municipalities to lower in south, while people with high salaries have higher consumption than the rest of the population (Stabel, 2017). Through this research of both the Norwegian market and blockchain technology, this study´s purpose is to showcase the factors influencing consumer behavior, consumption and identify opportunities for brands to create competitive advantage in the fish industry.

1.1 Background for the thesis

In general, many researchers have investigated consumers preferences regarding fish brands and their products (Curles, 2019; Risius et al., 2019). Others have investigated the value creation of using blockchain to trace fish products through the supply chain (Ferreira et al., 2022; Tokkozhina et al., 2022a). In Norway, the research in this field is limited. Even though research is done on labeling of crabs using QR-codes and blockchain, following the product

in the supply chain to achieve transparency (Sverd & Jebsen, 2021). While the company Lerøy, currently are testing the information sharing of their fish products in Norway. In order to inform customers about the fish origin, feeding, and the vaccinations it has received throughout the months, the concept of "Gladlaks" has been established (Lerøy, 2023).

However, these authors did not focus on the importance of information sharing in the fish industry and how the relationship towards the brand affects the interest for more information. An earlier study investigated this topic about information sharing in the fishing industry and explained the difficulties around it. Highlighted the low awareness and knowledge about fish and aquaculture from the consumer side, which have left this gap in research. Vanhonacker et al. (2011) explained that a bunch of information given to the consumers will not be beneficial before the knowledge about the industry is improved (Vanhonacker et al., 2011). This was back in 2011, more knowledge and interest around aquaculture has happened since then which is a great possibility for this thesis.

The noticeable research gap is if Norwegian fish consumers are influenced by product information about the fish and which factors that are influencing that interest in information. If that is the case, a great potential lay in a possible competitive advantage for the brands to develop their technology to suit the expectations of their consumers. All of this leads to the following research problem.

1.2 Research questions

The main purpose of this thesis is to investigate the Norwegian fish market and how information sharing influence the buying decision of the consumers. This thesis would like to fill the gap of knowledge in this field by investigating:

–   *What kind of factors do influence consumers interest of product information?*

To be able to answer the overall research question stated above, a few sub-questions are formulated to address the above-mentioned research topic and discover solutions.

1. Have trust, loyalty, and word-of-mouth an impact on information interest?
2. Are there differences in information interest depending on geographic location, gender, or age?

These research questions are addressed by collecting data, using a questionnaire, where consumers from three different locations are approached to answer the survey. PLS-SEM is used to analyze the data.

1.3 Structure of the thesis

This thesis is paper-based which means it is divided into two different parts. The first part is the introduction of the thesis, chapters included in this part following the above introduction are: literature review, methodology, conclusion, and research summary. The second part is a research paper, with the following sections: abstract, introduction, literature review, methodology, results, discussion, and conclusion.

The thesis is briefly described in the introduction of *chapter 1* above, along with the paper's background and problem statement. Next up is *chapter 2* with the literature review used in the study, which includes relevant theory from other scientific researchers to back up the findings of this study. In this case that will be information sharing, blockchain technology, fishing industry, and competitive advantage in the supply chain. Followed by *chapter 3*, hypotheses, presenting the hypotheses of the model which are backed up by theory found to understand what to expect by the model. The approach is explained in *Chapter 4*, methodology, explaining the research design and the methods used to gather data for this study. Chapter 5 and 6 goes through a conclusion and a research summary to end of the first part of the thesis.

Chapter 7 focuses exclusively on the research paper. Starting off with an *abstract* explaining the purpose of the paper while presenting the results, to engage the reader. Followed by *introduction, literature review and methodology* as in part 1 just shortened to fit the paper-based format. The main under-chapters of part 2 which are the *results and discussion* comes up next. The results of the questionnaire used on the Norwegian market and analysis done with it are explained, while they are discussed up against each other with theory found in chapter 2, at the same time answering the research questions presented in chapter 1. The *conclusion* wraps up the entire paper and provides an answer to the research problem.

2.0 Literature review

The literature relevant for this thesis will be presented in this chapter. Explaining how the supply chain is constructed, how blockchain technology can be beneficial for businesses and customers in the supply chain, the fishing industry in Norway, labeling of fish products and consumer expectations. This study wants to fill a theoretical gap in research, with this literature review the gap will be highlighted while linking relevant theory to strengthen the outcomes of this study (Barczak, 2014).

2.1 Supply Chain Management

To figure out how blockchain technology can contribute in the SCM of fishing industry, defining supply chain management is an important beginning. As Christopher (1992) says it, supply chain management is a wider concept than logistics. *Logistics* is all about the strategically managing of materials from procurement to final order, with the focus on profitability are maximized while being cost-effective. On the wider range the focus of supply chain management is the management of relationships in the whole chain to achieve profitability for all parts. Managing upstream and downstream relationships, from suppliers to customers, to deliver more value to the customers at less cost for the supply chain (Christopher, 1992).

This idea around supply chain management has evolved through the years, from a fragmented tactical view to today's vision of a strategic integrated view. The evolution of the term has its reasoning from companies outsourcing a lot more now than before, which increases the importance and the role of the supply chain. In other terms, improving the supply chain management should be looked at as a value adder rather than a source of cost. By looking at the supply chain, traditionally it has been described with three main flows (Cordón et al., 2012). As seen in the figure below, the flows are easily described with arrows from either supplier to retailer or the other way around.

Where the first flow (1) of goods begins at the supplier to manufacturer, to the distributor and finally the retailer to reach the consumers. The other flow (2) is off information and goes the opposite direction of goods, where information like order placement, forecasting, available capacity, and delivery dates move from retailer all the way back to supplier. The last of the

traditionally flows (3) is of cash, financial flows between each actor of the supply chain (Cordón et al., 2012).
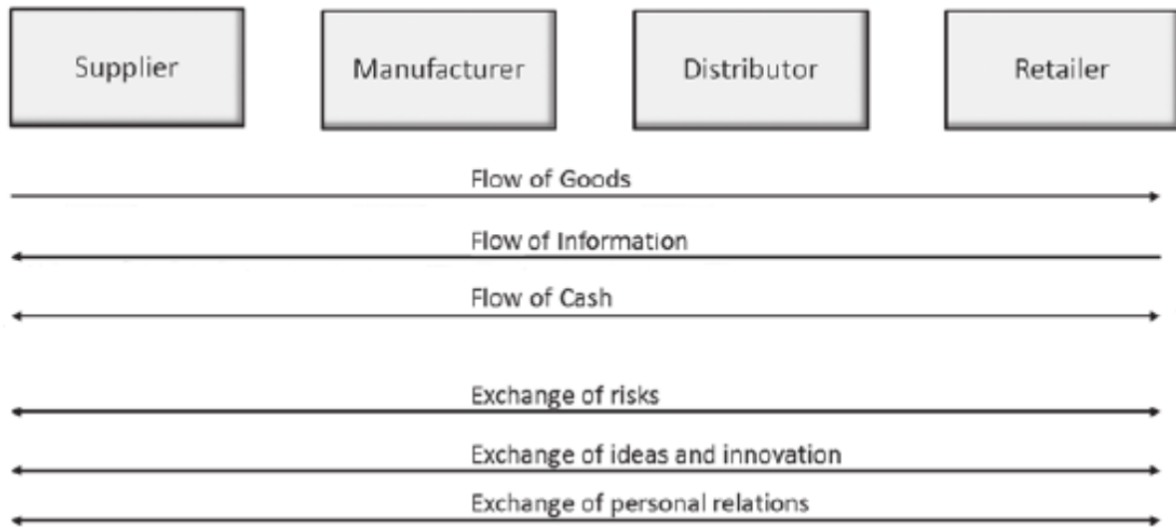
Figure 1. Supply chain flows (Cordón et al., 2012).

Equally important to these first three flows are the last three circulating in both ways. Where the first one of those is (1) the exchange of risks, aiming at all the exchanges of risk between the suppliers in the beginning until the consumers in the end. All risks cannot be transferred, but some might be specified in the contracts between each actor. Second (2) is the exchange of ideas and innovation, which focusses on how the supply chain responds to consumers wishes or suppliers innovative solutions that can be a great advantage for the supply chain. Last one is (3) the exchange of personal relations. Where actors can take advantage of great performance by evaluating each other and keeping a great relationship (Cordón et al., 2012).

2.1.1 Seafood supply chain

Food supply chain is the most complex and time-critical supply chains out there. The most important factor here is temperature control to extend the shelf-life of the products. Only a few degrees warmer can cause vitamin loss and decrease of quality, which in the end will higher the risk of food poisoning. Change in customer needs, short product life, and long complex supply chains make these tasks critical for fresh food logistics (Aung & Chang, 2014).

A type of food supply chain is the seafood supply chain, which several firms in the aquaculture industry are utilizing. In a supply chain like this a few steps are normal, although firms can have fewer or more steps depending on the suppliers they rely on for each step. Vericatch (2023) shows in figure 2 a seafood supply chain that their software navigates through. Here there are 6 steps starting with the harvesting of the fish, often out at sea or fish farming. Step 2 involves getting the raw materials to land, where it will be processed into products in step 3. Either it will be sold as a whole fish or in filets, several other steps would be added here if the fish would be used in other products. When the final products are packed and ready, they are distributed out in different cooling units. Step 4 is all about the transport of the final product, from step 3 of the processing to step 5 of the retail store. Arriving at step 5, the retail store, the products are available for consumers. This is the final stage of the supply chain, step 6, where consumers can by the products and bring it home (Vericatch, 2023).

Figure 2. Seafood supply chain (Vericatch, 2023)

Talking about a supply chain with several more steps than expected is the product of fish sticks sold by the brand Findus. Alaskan pollock, which is caught outside of Alaska and Canada, makes up 61% of the fish sticks. The raw fish are then shipped by boat from Alaska to Le Havre in France, where it gets transported in trailers to a facility in France processing the fish sticks into final products. The final products are then driven in trailers to a warehouse in Norway, where they are from there distributed out to retail stores around the country (Lysvold & Skeie, 2018).

2.1.2 Norwegian Aquaculture Industry

The Norwegian Aquaculture industry is one of the largest in the world, only behind China, when it comes to export and ranking among the top 10 in terms of production (FAO, 2021).

According to data acquired from Fiskeridirektoratet (2022), the industry in Norway produced a total of 1,67 million tons of slain fish back in 2021. This amount is estimated to be worth 80,4 billion NOK, placing Norway among the top 10 of fish producers worldwide (Fiskeridirektoratet, 2022). The majority of these 1,67 million tons of fish slaid is the species Atlantic salmon contributed with 1,56 million tons. Makes salmon the main species produced in Norway with a value of 75,7 billion NOK (Fiskeridirektoratet, 2022).

The fish production in Norway is divided between wild caught fish and farm raised fish. Farm-raised fish represent the majority of the production, 989 of these farms are located in the sea while just 58 is land-based fish farms. In total there are 1 135 licensed production facilities in the country, so the reminder 88 is wild caught fish production (Fiskeridirektoratet, 2022). Fish products have traditionally played a significant role in Norwegian food culture, and a few years ago consumption in Norwegian housing reached its peak. Starting with the peak in 2013, the consumption of fish in Norwegian homes drastically decreased with 17% in between the years of 2012 and 2017. The older generations above 34 years old maintained their consumption levels, meanwhile the younger generations below 34 years old consumed less fish for their meals (Strøm, 2018).

It can be difficult trying to understand how the different generations think when purchasing fish products, but a difference can be found. Especially the younger generations are more concerned about climate change and sustainability, which can make them more complex and demanding consumers (Gangsø et al., 2022). Offering them products with well-known information on where it comes from, low carbon footprint and local products can be important in the purchasing decisions of these products. Looking at the other range of people, the elderly, can be answering more highly on quality of the products, due to them buying more fish products than the younger adults. This can be backed up by statistics done by Stabel (2017), that figured out that 85% of people over 67 years old eat fish products more than two times a week, while only 60% do the same of the ages between 16-24. Location and salary are also important factors, people that are born and raised in the most north municipalities eat more than the southern ones, high salary also increases the percentage of eating fish products (Stabel, 2017).

2.2 Blockchain technology

When people today hear about blockchain technology, most of them will probably think of bitcoin and all the people earning a lot of money through cryptocurrency. Through bitcoin is how it all started, a fully distributed system for storing peer-to-peer network transactions. All transactions are linked, updated, and validated by parties in the network. With this system, blockchain enforces transparency and validity on a history of transactions (Queiroz et al., 2020). Using this technology for transactions, third-party actors, as banks, will not be necessary as the transactions go directly between two actors. It is built up by chronologically data blocks, which are cryptographically guaranteed unforgeable and non-tamperable decentralized ledgers (Liu & Li, 2020).

Other than transactions, the Ethereum project launched on the blockchain *smart contracts* back in 2013 with Vitalik Buterin. This enables user to create contracts that can complete any transfer and automates processes in the business (Liu & Li, 2020). This technology is highly customizable when it comes to transfers and replace third parties through the network nodes verifying the codes stated. Smart contracts are a binding agreement between two parties, where the parties have to fulfill the agreements stated in the contract for the transactions to occur automatically (Macrinici et al., 2018).

The blockchains used can be private or public. By a private blockchain means a collaboration in the supply chain, where participants must be invited and validated. Participants in the private blockchain can be any stakeholder of a company, requirements to join is set by the network initiator. Information is shared in real time and only between the parts involved in the blockchain. On the other hand, public blockchain is open to everyone. Anyone can participate in this network and information shared is open for everyone to see (Giri & Manohar, 2023). Example of this is Bitcoin, where anyone can buy and sell cryptocurrency as they like.

An example of this in real life can be a private blockchain technology to track crabs. With this technology information cannot be tampered with nor deleted, which secures high degree of credibility and securing traceability. Choosing a private blockchain for this example of tracking, is one actor the administrator of the network while allowing different actors view the information shared (Sverd & Jebsen, 2021). In this aspect, consumers can be the once

having the entrance to information about the product they are buying which can be relevant to their decision making in the buying process.

2.2.1 Impact of blockchain in supply chain management

The struggles of supply chain management, SCM, can be their tendency to extend the supply chains and therefore vulnerability will occur in terms of information sharing and trust to their management (Tokkozhina et al., 2022a). Other struggles in the SC are the poor transparency which again leads to low trust levels, where organizations struggle to meet the transparency requirements and mislabeling of fish in grocery stores are increasing. Blockchain technology is the promising solution to these challenges (Howson, 2020; Tokkozhina et al., 2022b).

According to Tokkozhina et al. (2022a) they have completed a literature review of blockchain benefits and challenges in supply chain management. Which the greatest advantages mentioned by several articles ended up being transparency and traceability, cost reduction, and trust improvement. While the disadvantages were concerns due to the technology being novel, information privacy, scalability, and low knowledge about blockchain. Often mentioned is that blockchain is costly, but the greatest cost aspect of it is to teach everyone about it. It will give cost reduction with smart contracts that execute themselves and increase of value to the firm's product. With the use of this technology a third-party actor can be removed, which has the power over prices and processes which can be manipulative. The technology does take care of this, where SCM activities and operations will be executed in a secure and transparent way. With verified transactions, traceability throughout and outside the supply chain which in all strengthens the trust between stakeholders (Tokkozhina et al., 2022a).

Another paper done by Tokkozhina et al. (2022b) interviewed several actors involved with blockchain technology and hearing their stands on how it works in their daily workdays. Similarities here as above, is the increase of trust due to secure information and digital transactions, data security, collaboration improvement through transparency and product safety with less of human errors. The most mentioned disadvantage was the lack of knowledge of the technology by workers. Here they also talk about the upfront costs being high, but the long-term benefits will outweigh the expenses over time and even give competitive advantage in terms of information availability (Tokkozhina et al., 2022b).

Those were the similarities, but the interviewees also mentioned that even though the third party is eliminated, the stakeholders still need to focus on their relationships. The technology increases the trust, but it cannot be an absolute substitute to communication and relationship-building between organizations. Blockchain technology is not for everyone, especially if the data is not needed after 4 months, the need of putting it on the chain is unnecessary. Finally, not all companies are willing to risk competitive advantage by allowing information transparency. On some occasions information shared can be utilized by competitors (Tokkozhina et al., 2022b).

2.2.2 Impact of blockchain in aquaculture SCM

A huge problem affecting the marine ecosystem is IUU, short for *illegal, unreported, or unregulated* fishing. Meaning of IUU can be several destructive methods used by fishing vessels that harms the marine ecosystem, like blast bombing and cyanide fishing damaging coral reefs while usage of prohibited gear has contributed to by-catch. By-catch in for example tuna fisheries are responsible for 40% of the turtle mortality. On the global scale IUU represents about 30% of the captured fish, which is an annual loss of 26 million tons of fish products representing an estimate between 10 and 23.5 billion US dollars (Petrossian, 2015). The economic loss is clear, but the loss of social and environmental value is also severe (Ferreira et al., 2022). The problems of IUU fishing mentioned above can possibly be solved by opening the supply chain for all stakeholders and trace the seafood from captured wildlife until final product for consumer. Blockchain technology as mentioned earlier can be the right way to solve all these problems and provide global transparency and traceability (Ferreira et al., 2022).

2.3 Labeling

Nowadays there are a bunch of brands delivering almost the same products of fish, then the importance of ethics of food has been more important than ever. Labeling of the products is decided after what the brands believe is the most important for the consumers (Curles, 2019). The focus on healthy and safe products will keep increasing with the population on earth expected to overgrow 9 billion around year 2060. Aquaculture is a sector developed faster than any others, with a weakness of 50-70% of the costs of fish production being feeding (Cortés-Quezada et al., 2022).

In the Norwegian markets today, the only mandatory information to be shared is the location of where the fish has been captured, but only if it is caught in the sea. That is the only law when it comes to labeling the products, to protect the consumers of not being misled (The Norwegian Food Safety Authority, 2023). This is the most important label that consumers care most about when purchasing fish products. After caring about where the fish is captured, sustainable production methods is a good number two of important information that leads to a consumer choosing that product. That is dependent on the consumer being sustainability oriented, for those that are not the information about production criteria and control systems are more important. Interestingly enough, the majority preferred medium or high price on their products rather than low which is a sign of quality and focus on sustainability (Risius et al., 2019). These different criterions are the main labels in other research as well, where Curles (2019) discovered the three most important labels are *country of origin*, *the way fish are raised*, and *sustainability label* in order of importance (Curles, 2019).

A great challenge for the food industry with their scientists, policy makers, and marketers, is to identify the information the consumers are interested in and how to provide it. The first aspect of the problem is identifying what the consumers care about, what exactly are they wondering about when purchasing a product. Other problem is then how much information to label on the product, including too much information can be confusing and too little can be misleading. Claims already known from consumers are that the labels should be easily understood, other information that can potentially confuse consumers can be available through codes and web links (Pieniak et al., 2013).

A Norwegian study found on labeling of crabs can be relevant, where the same methods can be used for fish products. This study went on testing different kinds of labeling and tracking of crabs, where the most effective way ended up being usage of strips or stickers to attach QR-codes to the crab. The QR-codes also have their own ID-numbers, if the codes get unreadable both number and code will lead to same place (Sverd & Jebsen, 2021).
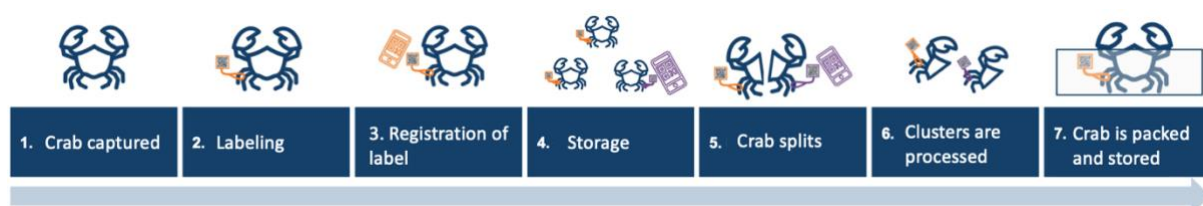

Figure 3. Crab labeling (Sverd & Jebsen, 2021).

By following the few steps above an effective way of labeling the crabs which also makes them easily trackable. Starting off by producing a closing slip for all crabs at the very moment of capture, before labeling all the possible parts of the crab that can be sold as individual parts. Following up by registration of all the labels and connecting them to the closing slip produced in step 1, information about weight, gender, and quality is noted here. Step 4 is where the crabs get stored in water, before split into different parts in step 5 depending on the final product. The products then get processed, in this case boiled and then frozen. If a label is missing, new once can be produced at any times. Last step the product is packed and stored or sold with label on (Sverd & Jebsen, 2021).

Similarities can be seen for the project Fiskeridirektoratet (2023) focus on, capturing all factors in the production of fish products with the help of "FangstID". This is a program started to secure correct registration of all food products captured at sea. With this program all fishing boats will have technology on board where they are able to connect each catch to information regarding the product, information like position, temperature in water, gender, composition, and nutrition of the fish. This technology is not only to make it easier for the actors with less work on administration and registration of the fish, but also getting better knowledge, data, and measure a more sustainable industry for the future generations of consumers. The consumers are going to care about where the fish comes from, when it is captured, and how it is captured. The information gathered and saved in an early stage is not only for the consumers, but also for the whole supply chain the product will be sent through (Fiskeridirektoratet, 2023).

2.4 ID-technology

2.4.1 QR-codes

Being able to share as much information as wanted on smallest places possible is a huge task. That is why technology like quick-response codes, QR-codes, exists. QR-codes are small bar codes that can be scanned with a smartphone and the code will take you immediately into an online information page including information about the product or place scanned. The strengths of QR-codes are that it can contain far more than regular barcodes, for instance files, app downloads and videos (Kroski & Murphy, 2012). By using QR-codes on fish products, all information regarding the product can be found by using the QR-code without all the information being placed on a small pack of salmon filets. Consumers expect different

things from their choice of products, and can then use the QR-codes can therefore be used to find information of interest (Pieniak et al., 2013).

2.4.2 RFID

Radio frequency identification, RFID, is a revolutionary data collection technology. Characteristics of this technology includes asset tracking, automatic identification, security surveillance, access control, and smart logistics. The assets that are to be tracked using RFID have a tag unit attached that sends signals to the antenna of a reader located on a different location. These signals enable sharing of data, measurement values or identity codes can be shared between the asset and the reader (Karmakar et al., 2016).

With the use of RFID companies increase efficiency while reducing costs. Which also will gain a competitive advantage through increased security or the service provided is better than others. Today RFID is frequently used and is a well-known technology. An example from daily life can be people's passports. Walking through customs the security will take a quick look at your passport. By using RFID identification numbers, they can determine if the passport is valid and if people are on any criminal charges. Other examples can be pets having implanted identification chips used to identify them if getting lost, or hotel keys can access every room in the hotel by only changing the identification numbers (Zelbst & Sower, 2016).

2.4.3 eDNA metabarcodes

Environmental DNA, eDNA, can be found in water, soil, or air. For example, fish shed cells into water in multiple ways like feces and urine, blood, skin cells or mucous. By analyzing a water sample, eDNA from all living organisms in the water can be gathered in a highly efficient and cost-effective way (USDA, 2023). To be able to capture the input data the QR-codes or RFID technology have stored for the consumers, technology like eDNA can be a solid solution. With eDNA metabarcodes, the water from the place of origin is sampled and analyzed (Frühe et al., 2021)

2.5 Service quality as competitive advantage

For the firms to be able to give out information about the product, they also need to know what the consumer expects. As mentioned by Rapert and Wren (1998), service quality does

improve performance, but what really matters is not if the firm hit their targets but rather hit what the consumers feel are important (Rapert & Wren, 1998). To keep a high service quality for the consumers, finding out what they care about is number one priority. By doing so the firm can attend satisfied customers which leads to competitive advantage, which means an extra added value of your service better than the competitors. Firms now a days needs to change quickly to stay relevant, recognize the changes fast by focusing on competition and customers to survive (StrategicDirection, 2013).

By gaining competitive advantage the brand must put out the competitive strategies into practice. The goal of each strategy is for the firm to create as much value for the buyer as possible. As of the view of Michael Porter, if adopted strategy of cost leadership the value created for the firm takes form in lower prices than competitors. Other example can be differentiation, where value created is through unique benefits (Izushi & Huggins, 2012). Each of these strategies can be set in different activities when it comes to the value chain as seen in figure 4. In the primary activities as great costumer service or being able to produce products at a lower price. Looking at support activities new technology can achieve faster and better production, while procurement section can purchase cheaper or better materials. Which all in the end can benefit the buyer and give a competitive advantage towards their competitors.
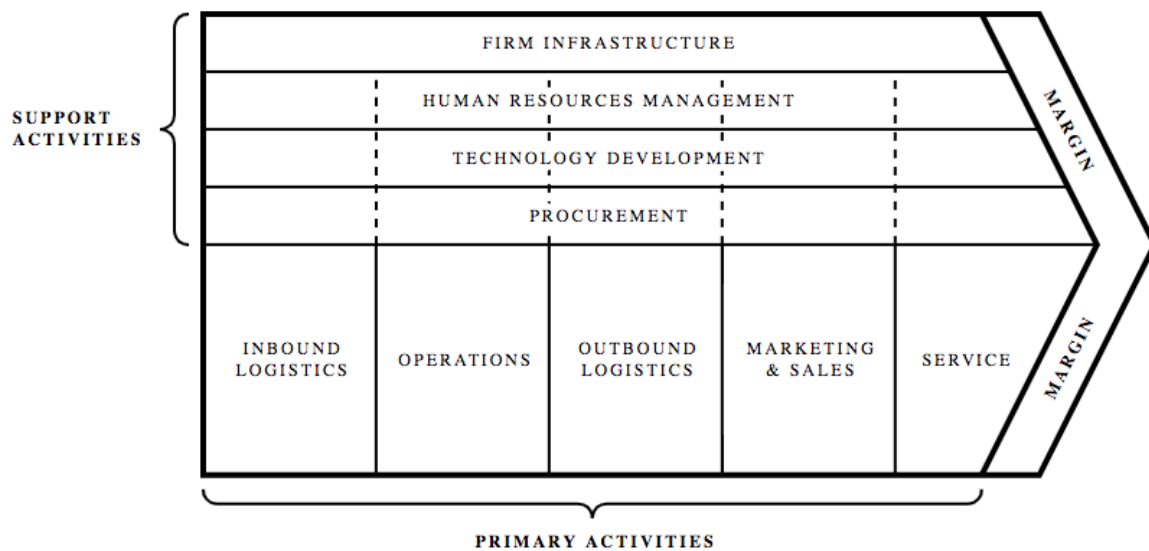

Figure 4. Value chain framework by Porter (Izushi & Huggins, 2012)

2.6 Buyer-supplier trust in supply chains

Due to environmentally friendly expectations from all angels, the firms get pressured by customers, investors and even governments. The firms must give out information that follows

the expectations of all their stakeholders, but at the same time being truthful and trusted by all of them. This constant pressure might be growing the trust of the buyers towards the suppliers due to the firms constantly striving to reach the buyers expectations to maintain the relationship. The reason behind this is because the knowledge of the buyers keep increasing and with open dialogues social improvements can occur (Gualandris & Kalchschmidt, 2016).

To be able to give the consumers information they can trust, information sharing and transparency are important terms. Information sharing will increase consumer satisfaction, where managing customer relations gives a significant effect on satisfaction and increasing the chance of the consumer to retain with the firm. Showing again that this can give increased market share (Hassan et al., 2015). The research found shows how important sharing information with consumers can affect the buying decisions. With transparency, letting the consumers being involved in the process of the products, will let them trust the information they are given and being more satisfied with it. Together with traceability where the consumers can track information about where the product comes from and where it has been (Woodcock, 2020).

2.7 Buyer-supplier loyalty in supply chains

Buyer satisfaction is important for suppliers to keep their consumers buying their products, and by keeping the buyers satisfied, the loyalty to them can rise. As Jyh-Shen et al. (2009) investigated in their research on online auctions, resulted in the overall satisfaction the consumers felt the higher the affection on loyalty between them.

Environmentally friendly expectations are on a rise and to maintain relationship with the consumers these expectations need to be fulfilled, by having this pressure the trust from consumers increases (Gualandris & Kalchschmidt, 2016). Consumer loyalty to a supplier is based on the supplier's performance, satisfaction, and attractiveness. All of these three different elements increase loyalty to the supplier, making the consumer continuing purchasing from their supplier instead of other competitors due to high level of these three (Rossmannek et al., 2022).

Generating brand loyalty involves convincing consumers the brand is reliable, building this through communication between the brand and its consumers to create trust will increase

loyalty. In other words, if the brand fails to show its care of the stakeholders the loyalty declines (Ozdemir et al., 2020).

2.8 Word-of-mouth in supply chains

Word of mouth (WOM) is in marketing an act where consumers provide information about the supplier to other consumers. Consumers sharing their reviews on goods and services provided by the supplier with others, represents a significant development when it comes to consumer behavior and affects purchasing decisions (Rosario et al., 2016). Looking into the effect of loyalty on WOM, research done by Watson et al. (2015) showed that the effect of loyalty on WOM has grown over time and maintaining a relationship with the use of attitude and behavior. As stated in their paper an increase of loyalty affects WOM positively (Watson et al., 2015). Siagian et al. (2022) continued with the more information that are shared by the brand, increases the engage of positive WOM advertising between consumers (Siagian et al., 2022).

2.9 Information interest

Article from Verbeke et al. (2007) highlights how consumers refused buying fish products due to false information given. For the brands it will be important to tackle these beliefs through communication and information sharing to build up the trust and interest for information about sustainability and ethical decisions in the fishing industry (Verbeke et al., 2007).

Three different groups of fish consumers were researched by Pieniak et al. (2007) to understand differences in trust about information given in between the different groups. The first consumer group considered of younger people with a low consumption level, but they trusted the system and by then had a low usage of information about the products. The biggest consumer group, enthusiasts, were the most interested in information and looked at all labels available. Trust was high and the group consisted of more women than men. Last group, sceptics, consisted mainly of men. This group showed a low trust and usage of information. Showed a relatively low interest in labels and then a difficult group to communicate with. This study concluded with none of the groups showing low trust levels, nor high use of information (Pieniak et al., 2007).

Satisfaction was mentioned as an important aspect to achieve loyalty between consumer and brand. A gap can occur between what the supplier´s interpretation of the value of service is to the buyer´s expectations when buying their products (Ashok et al., 2018). Research done in some of the biggest countries in Europe figured out that consumers rather pay more for wild-caught fish than farm-raised fish. This was due to the wild-caught fish being superior on taste, safety, and nutritional value, which leads to the consumers wanting to pay more for the fish when having more basic knowledge about the product. In addition to the preferences, the liking of wild fish increased when getting information about the production methods the fish has been through. The products in this case doing the best had eco-friendly and healthy related labels, but for this to work the consumers need enough information and trust the systems that are in use (Menozzi et al., 2020).

According to Siagian et al. (2022) on the topic of WOM and loyalty when it comes to information sharing, a final result here told that an increase of information sharing had a positive reaction on loyalty (Siagian et al., 2022). Which also is backed up by other research pointing out how information sharing from brands influences the customer loyalty in a positive way (Hannan et al., 2017).

3.0 Hypotheses

Based on the theory proposed above, five hypotheses are developed as showed in table 1.

	Hypothesis
H1	There is a positive relationship between consumer trust and their level of loyalty towards the brand
H2	Higher levels of loyalty towards the brand positively influence the engage in positive word-of-mouth advertising for the brand
H3	There is an association between trust the consumer has in the information provided by the brand and their interest of consuming more information
H4	Greater consumer loyalty towards the brand is positively associated with their interest in information related to the brand´s products
H5	The higher the level of positive word-of-mouth advertising related to the brand is positively associated with interest in product information

Table 1. Hypotheses

The hypotheses are the basis for the research model, which will be represented in figure 5. The figure illustrates the relationships between the independent variables as well as the relationships between the independent variables towards the dependent variable of information interest. A positive relation indicates a positive effect on each other. While a negative relation means a negative effect on the other variable. No sign means an association will be noticed between them.
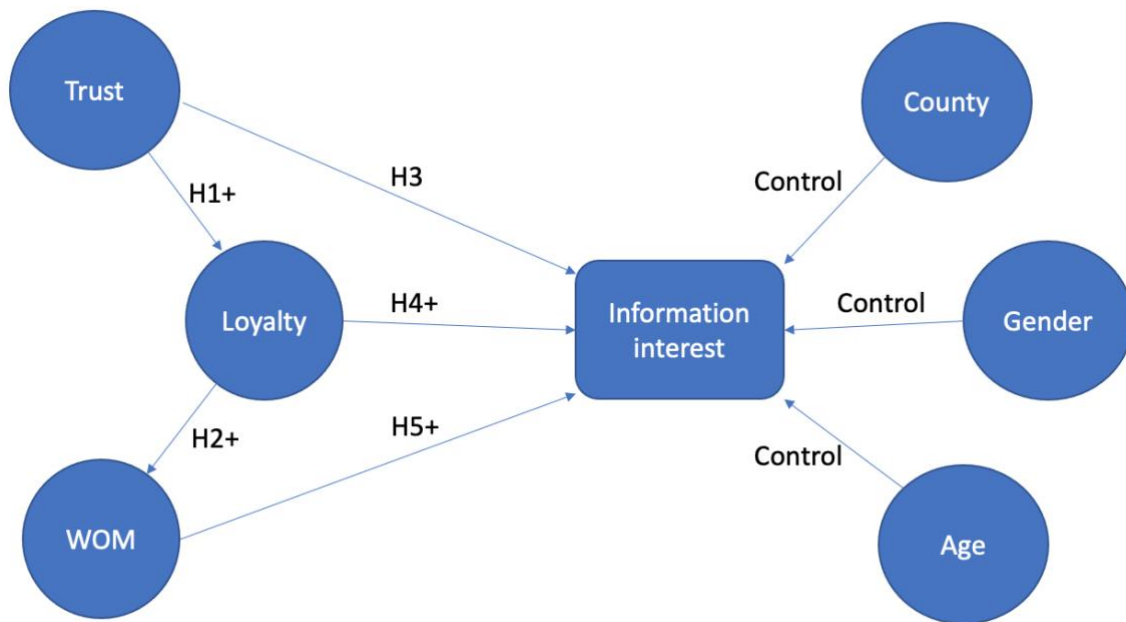
Figure 5. Relationships between variables

To understand the variables shown in the illustration an operationalization of the construct and variables are provided in table 2. The indicators reflect on the questions used to measure each construct and variable, they are designed to capture relevance and allow for analysis later.

Construct	Abbreviation	Indicators
Trust	Trust_1	The information tells where the fish comes from
	Trust_2	The information is correct
	Trust_3	The information is authentic, not falsified in any way
Loyalty	Loyalty_1	I consider myself loyal to the brand

	Loyalty_2	This brand is my first choice when buying fish products
	Loyalty_3	I am not going to buy fish products from other brands, when I can buy the same product from my brand
Word-of-Mouth	WOM_1	I will mention positive experiences about the brand to friends and relatives
	WOM_2	I will recommend the brand to others
	WOM_3	I will encourage friends and relatives to buy products from this brand
	WOM_4	I will make sure others know I rely on the brand when buying fish products
Information Interest	Interest_1	Are you interested in having information about the origin and processing stages of fish products
	Interest_2	How would the availability of information impact your purchasing decision
County	County	County the respondent lives in
Gender	Gender	Gender of the respondent
Age	Age	Age of the respondent

Table 2. Operationalization of constructs and variables

4.0 Methodology

The following under-chapters provide further information on the specifics of the research design, participants, data collecting, and analyzing methods utilized to be able to answer the research problem. To end of the chapter, the quality of the research is investigated to ensure the research data is valid and reliable for the study.

4.1 Research design

A research design explains the overall plan for the study, showing how data is collected and analyzed (Churchill, 1999). Different research designs answer different questions and serving different purposes, the important object is to apply studies as they are designed to utilize their strengths. The designs mainly used are qualitative and quantitative research, where

qualitative research explores non-quantitative data typically as word phrases rather than statistics. Quantitative research is the opposite and explores statistics and gather quantifiable data (Cook & Cook, 2016).

This study will investigate *qualitative* variables as trust, loyalty, word-of-mouth, and information interest which are non-quantifiable variables. With the method of a questionnaire, using the research technique of measuring the participants opinion on a scale from 1-7, enabling a *quantitative* approach. Quantitative research is testing theories by measuring the relationship between variables, with survey research design that will be possible in this case. Survey research is here used to study the opinions of a sample of the people in Norway to generalize the population. The method used as previously mentioned is a questionnaire to collect data, this dataset will be analyzed and interpreted utilizing an experimental approach (Creswell, 2014).

Exploratory, descriptive, and causal research are research designs also worth considering. Exploratory research discovers ideas and insights, descriptive research determine the frequency which something occurs, while causal research determines cause-and-effect relationships (Churchill, 1999). The primary focus will be exploratory research, using hypotheses to break down the broad problem statement into smaller and more precise statements. Using this design to figure out ideas or just to clarify expected measurements (Churchill, 1999).

4.2 Data collection and methods

Data collection for this paper can be divided into primary and secondary data. Primary data involves data gathered by the researchers themselves, like interviews, analysis, or observation of people. In this study, primary data collection method is a questionnaire with an aim of gathering information directly from consumers. Other collection of data is secondary, where other researchers have gathered primary data for their own research. Finding such data can be relevant and time-efficient for our own study, but since secondary data is often collected for other purposes the importance of being critical is high (Gripsrud et al., 2016).

4.2.1 Survey design

This paper aims at analyzing the Norwegian market when it comes to purchasing decisions of fish products and the significance of product information. Primary data was collected using a quantitative approach through a questionnaire. The questionnaire is based on a study done in Portugal (Tokkozhina et al., 2023), but adjusted for the Norwegian market. Prices are adjusted with the consumer price index to be relevant for Norwegian fish products. Portuguese prices are multiplied by 1,5 to fit the Norwegian market which is an increase of 50% (Statistisk Sentralbyrå, 2022). The questionnaire is made for the respondents to be anonymous, but questions about age and county the person lives in were added to be able to analyze the market and identify differences between age groups and geographical locations in Norway.

The Portuguese questionnaire focused heavily on the grocery stores the respondents' bought products from, and their level of trust towards the information given and their loyalty towards the store. In Norway, even the most competing grocery stores often sell the same fish products from the same brands. Where information about where the fish comes from is solely the responsibility of the brands and not the grocery stores. Which means the questions asked had to be changed from focusing on the loyalty, trust and WOM of the grocery stores to the loyalty, trust and WOM towards the information shared by the brands the respondents most often buy their products from.

To be able to measure qualitative terms like loyalty, trust, and WOM towards the fish brands in a quantitative way, a seven-point Likert scale was used to measure the respondent's opinions about the brand. Which is a scale from 1-7 on how much the respondents agree or disagree with the statements presented (Tullis & Albert, 2013). The larger scale allows for greater variation in analysis. At the same time, a larger scale makes the questions more uninteresting responding to. Therefore, finding the middle ground was crucial, achieved by having three to four questions per variable with a seven-point Likert scale to suit both the interest of the respondents but also the accuracy of analysis (Mwesiumo, 2022).

In quantitative research when applying a questionnaire, changes cannot be made when the questionnaire is public to avoid invalid answers. Therefore, taking it through a pilot study was vital to seek for adjustments. Five people were asked to answer it to search for improvements. Following the pilot study was the official collection of data, where the goal

was to travel to three different malls located in Molde, Oslo, and Ski. To be able to collect answers from all different ages while being able to analyze differences between the locations later. This was quite time-consuming, so an online questionnaire was also created to reach the goal of 200 respondents. Answers from all over Norway were received and could focus more on differences between counties instead of the three malls as planned. The respondents wanted for this study were fish consumers in all ages living in Norway, which was achievable with a usable amount from each age group and several counties.

4.3 Data Analysis

The dataset collected with the help of the questionnaire will be analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The program SmartPLS was downloaded to be able to analyze the dataset using the 4th version of the program (SmartPLS, 2023). PLS-SEM is a statistical modeling technique often used to create theories in exploratory research. Another type of SEM is the covariance-based (CB-SEM) primarily used to confirm or reject theories, which contrasts from PLS developing theories (Hair et al., 2016). PLS-SEM requires also a smaller sample size than CB-SEM, and became the natural choice for this thesis with dataset of 200 respondents (Henseler et al., 2009).

The two consisting elements of a PLS path model is the structural and measurement model, also called inner and outer model. Where the structural model is based on the construct in the inner section of the model, representing the paths between each of them. The second element, measurement model, which displays the outer relationships with the constructs (circles) and the indicator variables (rectangles) (Hair et al., 2016). To simplify for this thesis, the indicators are questions the respondents answered in the questionnaire. Similar indicators are grouped to create the three different independent variables: trust, loyalty, and word-of-mouth. In the inner model these three have all paths in-between themselves but also to the dependent variable, information interest. The goal of the paths is to figure out the relationships between the constructs and if they have any significant effect on each other.
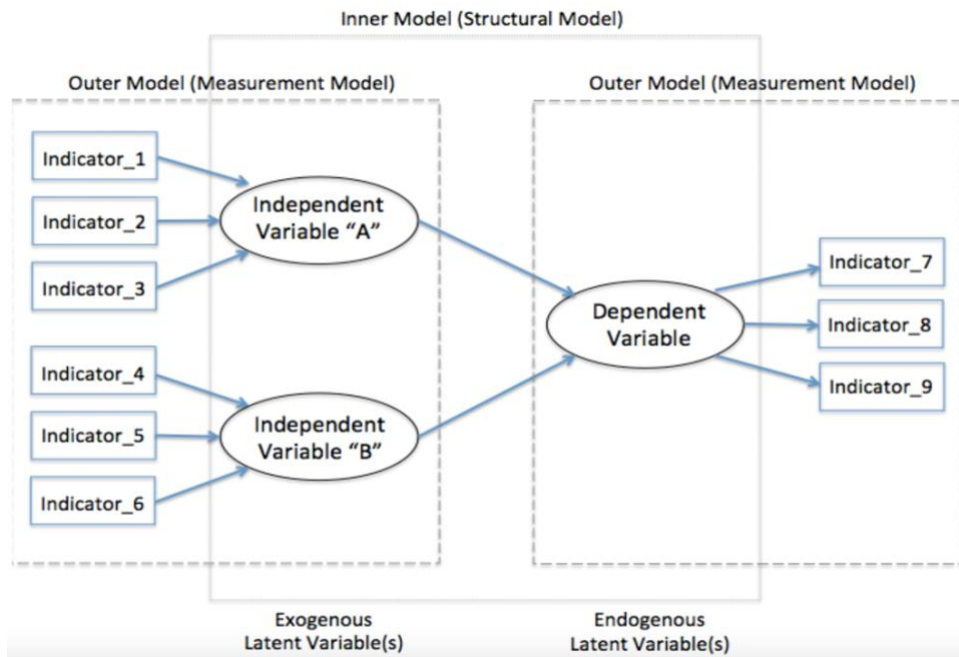
Figure 6. Inner vs Outer model PLS-SEM (Kante et al., 2018).

Assessing the measurement model is the next important step, to investigate if the dataset and model are valid. Using different fit indices and measurements to have less of a chance of measurement errors, important to find to account for errors in the findings of the research (Hair et al., 2016). Cronbach´s alpha is used to measure internal consistency reliability and values above 0,7 are recommended to fulfill the reliability in the model. Cronbach's alpha comes with limitations and are often sensitive to number of items which brings composite reliability as an alternative method. Composite reliability often over estimates, the true internal consistency reliability lies usually between these measurements (Hair et al., 2016).

To understand the variance of the model, convergent validity using the measurement of average variance extracted (AVE). With an AVE above 0,5 will show that the constructs explain more than half of the variance. Discriminant validity is next and investigates to which extent a construct is different from the others in the model (Hair et al., 2016). Measurement for discriminant validity is hetertrait-monotrait ratio of correlation (HTMT) and should be less than 0,85 to be unique and not represented by other constructs (Mwesiumo et al., 2021). Checking the model for a possible collinearity problem is variance inflation factor (VIF) a useful measurement. Value should be less than 5, a collinearity problem will occur if any factors are over this level. If the VIF indicators are less than the recommended 5, 80% of the indicators variance is accounted for by the rest of the indicators (Hair et al., 2016).

The final two last criterions for assessing the structural model are the coefficient of determination (R2) and effect size (f2). R2 is the most common measurement for evaluation, and it calculates the squared correlation between the actual and predicted values of a construct. An R2 under 0,19 is not accepted and the higher it is the better prediction of the dependent variable is achieved (Kassem et al., 2020). Effect size is great to use to investigate the change in R2 value when different constructs are taken out of the model. This way an understanding of the impact the construct has on the model is achieved (Hair et al., 2016). The realistic requirements are 0,005, 0,01, and 0,025 for small, medium and strong effect size (Kenny, 2018). Due to Aguinis et al. (2005) conducting a review of average effect size over 30-years and turned out to only be 0,009. Which meant the effect sizes of 0,02, 0,15, and 0,35 as small, medium, strong were too optimistic.

To resample the data a method used in SmartPLS is bootstrapping, the probability values of each coefficient will through this method be revealed. A setting of 5000 bootstrap samples is used, meaning 5000 random samples get repeated with replacement from the original sample. This way the standard error and standard deviation of the estimated coefficients are determined. Most common significance level used for p-values is 5%, which means the p-value has to be smaller than 0,05 to consider the coefficient to be significant (Hair et al., 2016).

4.4 Changes in dataset

To be able to achieve the best possible model, a few adjustments had to be done to optimize the dataset. Firstly, the respondents had to state their age where a group of 80 years and above were an opportunity to answer. However, the number of respondents in this age group were low and to address this issue the group was removed. The respondents in the removed age group were merged with the 70–79-year-olds group. As a result, the new age group, 70+, included all aged 70 and above.

The next adjustment involved the variable of county of residence. 6 of the 11 possible counties had a sufficient number of respondents, while the last 5 had a low number of respondents. The solution was to assign the respondents from low-response counties to the nearest of the 6 usable counties. The variable county had to be made ordinal, which means the counties could be put in an order. The counties were assigned a number from 1 to 6

depending on their positioning from east to west. This was based on Stabel (2017) investigation on consumption patterns between north and south municipalities in Norway, and exploring the differences in east and west were a gap in research.

5.0 Conclusion

This paper wants to answer the research questions aiming at the factors affecting the interest in product information of fish products and if interest for information vary depending on geographical location, gender, or age of the consumers. The possible motivations for adopting blockchain technology in the seafood supply chain management will also be an important topic of this paper.

Literature is gathered about the supply chain management and the seafood supply chain to build a higher understanding, addition to articles about blockchain technology to suit the SCM. Other literature focusing on the relationship between consumer and brand in the SCM is also investigated to be applied to the findings of this study. Based on the secondary data, eight hypotheses were created to guide the analysis of primary data. Questionnaire was used to gather primary data, where the primary targets of respondents were fish consumers in the Norwegian market. 200 random respondents were able to answer, and the dataset will be analyzed using PLS-SEM tool. Different fit indices will be used to check for validity and reliability in the dataset and analysis.

Limitations for this research is the number of respondents. It could have strengthened the research with getting a larger number of respondents to answer the questionnaire, with a wider reach of ages and counties the respondents live in. Anyway, the research gathered a reasonable amount and sufficient findings to answer the research problem.

6.0 Research summary

6.1 Implications

With the findings done in this research, firms should be looking into the use of blockchain technology and understand the benefits that comes with it. Having the transparency through the whole supply chain will benefit the consumers but also the firm itself, also the trust

between the stakeholders will arise and strengthen the firm in many sectors. Trust also strengthens the loyalty, which is important for any firm. By looking at how all the three variables affect each other but also the interest in information shows what a great competitive advantage this can achieve.

It is also important to understand the differences in different market sectors in Norway. While age groups as well differ from each other. The believe of younger adults caring much about the environment and what products they buy, this belief is not as expected when fish products is the subject. The environmental impacts of long traveled fish products should therefore be more highlighted. This could have given the younger generations an eye-opening for important information when it comes to the products they buy.

6.2 Further research

With this research the impact of product information about fish products and the factors affecting the interest in information are understood. Further research on this topic should be to analyze the market of other countries opening the possibilities of understanding differences in Europe while comparing different markets up against each other. This can achieve new knowledge about fish consumers worldwide and beneficial information for fish producers.

7.0 Research paper

An empirical investigation of consumers perception of information availability in fish supply chains in Norway

Abstract

This study explores the relationship between seafood supply chain management, blockchain technology, and how information sharing possibly affect the buying decision of Norwegian fish consumers. The purpose is to understand how different connections to the brand, such as trust, loyalty, and word-of-mouth affect the interest for more information about the products the consumers buy. The data used for this paper is a questionnaire responded by 200 fish consumers in the Norwegian market and PLS-SEM used as analyzing tool. The results display that trust is positively associated with loyalty to a brand, the same goes for loyalty towards word-of-mouth. Loyalty and word-of-mouth have positive impact on interest for product information. However, trust has a negative impact on interest. This means consumers need more information when the trust is low, and caring less about information when trust is high. Another result revealed that fish consumers older than 40 years old have a strong interest of consuming information about fish products, but also doubts the information they are given by the producer. The respondents younger than 40 tend to trust the information more but shows relatively lower interest in product information. Blockchain technology is a beneficial tool for increasing the trust through transparency and non-tangible ledgers.

7.1 Introduction

The fish and aquaculture industry plays a vital role in Norway´s economy, ranking second in the world for exports of fish products (FAO, 2021). With a production valued to 80,4 billion NOK (Fiskeridirektoratet, 2022), the industry holds significant importance in the country´s food supply chains. However, managing the fish supply chains allocating sensitive foods with short shelf-life poses challenges (Aung & Chang, 2014). While consumers are demanding more to satisfy their nutrition and environmental sustainability requirements (Sacchettini et al., 2021).

Information availability about fish products is not as accessible, and the interest in information has been regulated by the rules set for producers. The only requirement from the Norwegian Food Safety Authority the producers have to follow is the information about the origin of the fish (The Norwegian Food Safety Authority, 2023). While the regulations are not very comprehensive, the consumers have a greater interest for more. Researchers regarding consumer interest in supply chains are mixed regarding the interest for traceability, however the interest for origin and production methods seems to be of some importance (Jin & Zhou, 2014).

To address these challenges and meet consumer demands, blockchain technology has emerged as a promising solution. Blockchain offers to solve traceability issues while also being transparent with information sharing, open to all stakeholders in the supply chain (Tokkozhina et al., 2022b). The information fish consumers prioritize is the origin of the fish, sustainable production methods, handling practices, nutritional health, and environmental impact (Curles, 2019; Risius et al., 2019; Sacchettini et al., 2021). For brands, efficient and detailed information sharing is crucial to ensure health and safety for the consumers (Tokkozhina et al., 2023). Implementation of new technology is associated with cost and the question whether the industry is willing to invest. It is therefore interesting for the producers to have knowledge about the consumers´ need or interest for product information, while understanding the implementation on technology is not only about costs but a potential value adder (Cordón et al., 2012).

However, these researchers have not investigated the impact of different factors on consumers interest for product information. This paper will investigate several different

factors which may have an influence on information interest from a consumer's perspective. More specific the overall research question in this paper is:

- *What kind of factors do influence consumers interest of product information?*

To investigate this research question, the following sub-questions are created:

- Have trust, loyalty, and word-of-mouth an impact on information interest?
- Are there differences in information interest depending on geographic location, gender, and age?

To address these questions a questionnaire is created and collected 200 answers from different fish consumers across Norway, the respondents age groups differ from 18 year to 70 and above. The data will be analyzed using SmartPLS and the method of PLS-SEM. By filling the gap of knowledge about the consumer market in Norway, which is to understand the relevance of information about fish products and factors impacting the interest. In doing so, potential benefits for the final consumer will be highlighted with the potential use of traceability technology.

With the sections as follows this paper will answer the mentioned questions: section 2 is a literature review, aiming at understanding the seafood SCM, information availability, blockchain technology, while also understanding the relations between brands and consumers in today's market. This section forms the basis for the development of hypotheses for the model. Section 3 is the methodology, outlines the data collection and the quality of data. While section 4 provides the findings and 5 discusses these findings. Finally, section 6 concludes the paper and summarizing the contributions.

7.2 Literature review

The seafood supply chain spans from the capture of fish to the available final product in consumer stores. Following the harvesting of fish, either from the sea or fish farming, the catch is brought to land for processing. The product is processed and packed before distributed out to stores locally and world-wide (Vericatch, 2023). The complexity of a supply chain depends on the final product, the different stages to transform raw material into the final product. An example of an extended supply chain is fish sticks produced by Findus, containing 61% Alaskan pollock. This fish is harvested from Alaska or Canada is transported by ships to France to be processed into fish sticks. After that transported in trailers to a

warehouse in Norway, where it is distributed out to various retail stores (Lysvold & Skeie, 2018).

Gualandris and Kalchschmidt (2016) highlight the escalation of expectations from stakeholders within the logistics industry, with a constant pressure of improving sustainable solutions and maintain consumer relationships. The sustainable requirements are strict from consumers, amongst emphasis on nutritional aspects of the products (Sacchettini et al., 2021). The struggles of SCM like information sharing and trust has the potential to be addressed with blockchain technology, offering benefits as transparency and traceability, cost reduction, and trust improvement (Tokkozhina et al., 2022a). The technology is commonly utilized for transactions between two parties, eliminating third parties. It is built up by chronologically data blocks, which are cryptographically guaranteed unforgeable and non-tamperable decentralized ledgers (Liu & Li, 2020).

Combining QR-codes with RFID enables a label easily trackable, like the study done on crabs. Where QR-codes attached to the crabs facilitating tracking each step of the supply chain, new information added to the bar code along the way (Sverd & Jebsen, 2021). QR-codes are small bar codes scannable by smartphones, accessible to online information about the product (Kroski & Murphy, 2012). Radio frequency identification, RFID, which is technology specified for asset tracking, identification, security, access control, and smart logistics (Karmakar et al., 2016). However, implementation of new technology is associated with cost and there will be hesitation whether the industry is willing to invest in it. The driver for if the industry will invest in new technology is normally the potential for saving costs and increasing efficiency, in addition to monitoring the potential increase of value (Hangl et al., 2022). Implementation of blockchain is costly, but the biggest cost aspect is to teach everyone about it due to the knowledge being low. Other than that will the costs reduce with smart contracts automatically activating themselves (Tokkozhina et al., 2022a). In the end the implementation will rather be a value adder than a cost aspect (Cordón et al., 2012)

7.2.1 Theoretical background for hypotheses

Hypotheses are derived from previous research related to trust, loyalty, word-of-mouth, and information interest. A structural and confirmative model is developed for testing the data by using PLS-SEM. The rest of this section is outlining the literature and creating hypotheses. In

exploratory research like this creating several hypotheses is important for breaking down the overall problem statement into several smaller subproblem statements (Churchill, 1999).

Consumers trust, loyalty, and Word-of-Mouth

Suppliers are under constant pressure growing trust of the buyers. As environmentally friendly expectations continue to rise, maintaining consumer relationship requires fulfilling these requirements and the pressure benefit increasing the trust (Gualandris & Kalchschmidt, 2016). Consumer loyalty to a supplier is based on the supplier's performance, satisfaction, and attractiveness. All of these three different elements increase loyalty to the supplier, making the consumer continuing purchasing from a particular supplier instead of other competitors (Rossmannek et al., 2022).

Generating brand loyalty involves convincing consumers the brand is reliable, and building this through effective communication can result in higher trust that will increase loyalty. In other words, if the brand fails to show its care of the stakeholders the loyalty declines (Ozdemir et al., 2020). Based on these different theories *hypothesis 1* is then as follows:

- **H1***: There is a positive relationship between consumer trust and their level of loyalty towards the brand.*

Word of mouth (WOM) is in marketing an act where consumers provide information about the supplier to other consumers. Consumers sharing their satisfaction with others about the goods and services provided by the supplier, represents a significant development when it comes to consumer behavior and influence purchasing decision (Rosario et al., 2016). Some researchers have investigated the impact of loyalty and WOM. Watson et al. (2015) presented that the effect of loyalty on WOM has grown over time and maintaining a relationship with the use of attitude and behavior. According to theses authors an increase of loyalty affects WOM positively (Watson et al., 2015). Following these theories *hypothesis 2* was derived:

- **H2***: Higher levels of loyalty towards the brand positively influence the engage in positive WOM advertising the brand.*

Information interest

Pieniak et al. (2007) conducted research on three different groups of fish consumers, investigating their trust levels in the information they were given. The first consumer group

considered of younger people with a low consumption level, they trusted the system and by then had a low usage of information about the products. The largest consumer group, enthusiasts, displayed the highest interest in information and examining all available labels. Trust levels in this group was high and the group consisted of more women than men. Last group, sceptics, consisted mainly of men. This group showed low trust levels and low interest in information (Pieniak et al., 2007). This research shows that the interest in information may be divided, but still present for consumers regarding fish product. With that in mind, *hypothesis 3* was created:

- **H3***: There is an association between trust the consumer has in the information provided by the brand and their interest of consuming more information.*

According to Siagian et al. (2022) investigating the influence of loyalty and information sharing, indicated loyalty had a positive relationship with information sharing, and the other way around. Further claims that an increase of information also increased loyalty (Siagian et al., 2022). This finding is supported by other research, pointing out how information sharing from brands influences the customer loyalty in a positive way (Hannan et al., 2017). Which brings us the *hypothesis 4* as follows:

- **H4***: Greater consumer loyalty towards the brand is positively associated with their interest in information related to the brand´s products.*

Siagian et al. (2022) also explored the impact of WOM on information sharing towards consumers. They concluded that the more information distributed by the brand leads to higher engagement in positive word-of-mouth advertising (Siagian et al., 2022). From this, *hypothesis 5* is derived:

- **H5***: The higher the level of positive word-of-mouth advertising related to the brand is positively associated with interest in product information.*

Geographic location and consumers income may impact the consumption of fish products. A higher percentage of fish consumer lives in northern municipalities and consume more fish compared to the those living in southern regions of Norway (Stabel, 2017). Other factors as income and socializing patterns may also vary depending on the geographical location of the respondent. Statistically in Norway, counties with big cities tend to have higher salaries. Oslo with an average of 62 000 NOK a month while a county like Møre og Romsdal has an average of 50 320 NOK a month (Statistisk Sentralbyrå, 2023). In contrast, rural areas experience lower social interactions and have little contact with others compared to urban

regions. Oslo reported 37% of individuals not knowing any of their neighbors, while 30% answer the same at Vestlandet (Statistisk Sentralbyrå, 2020). These differences may lead to variation in information interest.

Pieniak et al. (2007) researched the trust levels of consumers regarding product labeling. Their results indicated that the group they called enthusiasts had the highest trust and it consisted of mainly female respondents. The other group was called sceptics and consisted mainly of men. These respondents showed low trust but also low usage of information (Pieniak et al., 2007). The younger generations is increasingly concerned about climate change and sustainability, which may make them demanding consumers (Gangsø et al., 2022). Even though their concerns are high, Pieniak et al. (2007) concluded with the consumer group of younger people cared less about labels than others. Which means that elderly may focus more on the quality of the product, due to them buying more fish products than the younger generations. The majority of consumers prefer to pay medium or high prices rather than low which is a sign of quality and focus on sustainability (Menozzi et al., 2020; Risius et al., 2019). According to Stabel (2017), 85% of people over 67 years old consume fish more than two times a week, while only 60% do the same of the ones aged between 16-24. County, gender, and age are all control variables in the model. Based on theory proposed above, it is interesting to investigate the association between geographic location, gender, and age on information interest.
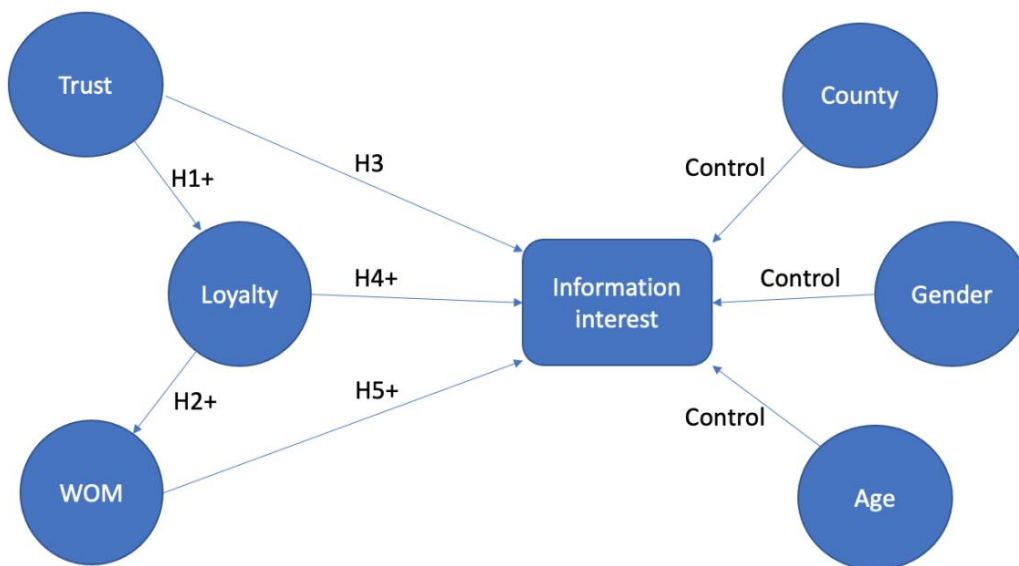

Figure 7. Focal constructs and hypotheses

Focal constructs and control variables are shown in figure 7, to demonstrate the relationships between them. Due to the hypotheses created, the relationships are highlighted as positive or negative effects on each other. In table 3 is an operationalization of the focal and control variables. Except for the control variables of county, gender, and age were all the indicators for the other variables measured on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7).

Construct	Abbreviation	Indicators
Trust	Trust_1	The information tells where the fish comes from
	Trust_2	The information is correct
	Trust_3	The information is authentic, not falsified in any way
Loyalty	Loyalty_1	I consider myself loyal to the brand
	Loyalty_2	This brand is my first choice when buying fish products
	Loyalty_3	I am not going to buy fish products from other brands, when I can buy the same product from my brand
Word-of-Mouth	WOM_1	I will mention positive experiences about the brand to friends and relatives
	WOM_2	I will recommend the brand to others
	WOM_3	I will encourage friends and relatives to buy products from this brand
	WOM_4	I will make sure others know I rely on the brand when buying fish products
Information Interest	Interest_1	Are you interested in having information about the origin and processing stages of fish products
	Interest_2	How would the availability of information impact your purchasing decision
County	County	County the respondent lives in
Gender	Gender	Gender of the respondent

Age	Age	Age of the respondent

Table 3. Operationalization of focal constructs and control variables

7.3 Research methodology

To investigate the dimensions, a survey was conducted for this paper. The questionnaire is based on a similar study conducted in Portugal by Tokkozhina et al. (2023). The measurement in the questionnaire is a Likert scale from 1-7. A total of 200 answers were collected from random fish consumers in the time of December 2022 and January 2023. The data collection method involved approaching people at three different malls located in Molde, Oslo, and Ski to complete the survey. A diverse sample of respondents were the target for the choices of malls. The data was later investigated and tested by using PLS-SEM and the analyzes were performed in the SmartPLS software, to investigate the relationships between the variables.

A multigroup analysis will figure out if the pre-defined data groups have significant differences in their parameter estimates (Ringle et al., 2022). The respondents are distributed in seven age groups and for analytical purposes they are merged into two groups: <40 years old and >40 years old. These two groups are based on initial analysis using PLS-SEM, where the first group <40 years old had negative impact on information interest, while >40 years old had a positive impact. The result of this analysis is presented in appendix 4.

7.3.1 Analysis

The assessment of the measurement model is a starting point to understand if the data fits the model and are valid. Several fit indices were used to test the model, including internal consistency reliability, convergent validity, and discriminant validity (Henseler et al., 2016). These indices help to make sure the model is accurate, and the more items used the less chance of measurement error. Finding potential errors is important to be able to account for it in the research findings. The difference between the true value and the value obtained by a measurement is the measurement error (Hair et al., 2016).

The two terms *validity and reliability* are crucial aspects of evaluating the quality of the research. The two terms mainly focus on how accurately the study have been measured.

Where validity aims at how well the variables are measured, while reliability involves the trustworthiness of the results (Gripsrud et al., 2016).

7.3.1.1 Internal consistency reliability and convergent validity

The measurement of *internal consistency reliability* begins with the most traditional criterion using *Cronbach´s alpha*. This criterion estimates the reliability but has limitations with assuming indicators are equally reliable and are sensitive to number of items. That is why *composite reliability* is also measured, which tends to overestimate compared to Cronbach´s alpha. Measuring both criterions are important when the internal consistency reliability usually lies between these two. Values above 0,7 are recommended, to fulfill reliability in the model (Hair et al., 2016).

	Cronbach´s alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Information interest	0.892	0.892	0.949
Loyalty	0.850	0.903	0.907
Trust	0.887	0.920	0.929
Word-of-mouth	0.939	0.941	0.956

Table 4. Cronbach´s alpha and composite reliability

Table 4 presents the measurements of Cronbach´s alpha and composite reliability in the model. The composite reliability measurements are higher than the Cronbach´s alpha. Indicating that the internal consistency reliability of the model lies between these two, but all the values are above 0,7 as recommended and the reliability of the model is then fulfilled.

Convergent validity was evaluated using average variance extracted (AVE) measurement. The value set for this criterion is recommended to be 0,5 or higher. With a measurement of AVE > 0,5 indicates that the construct explains more than half of the variance (Hair et al., 2016). As shown in table 5 the criterions are followed being above 0,5, which means the constructs explains more than half of the variance.

	Average variance extracted (AVE)
Information interest	0.902
Loyalty	0.765

Trust	0.814
Word-of-mouth	0.846

Table 5. Average variance extracted

7.3.1.2 Discriminant validity

Discriminant validity investigates to which extent a construct is different from the other constructs in the model. Which means it is not represented by other constructs and it is unique (Hair et al., 2016). To determine discriminant validity the measurement hetertrait-monotrait ratio of correlations (HTMT) is recommended. The threshold for HTMT is less than 0,85 to assess the best discriminant validity (Mwesiumo et al., 2021). Table 6 presents the HTMT measurements, all of which are less than the recommended 0,85 and the constructs are then unique and not represented by other constructs.

	Age	County	Gender	Information Interest	Loyalty	Trust
Age						
County	0.045					
Gender	0.131	0.022				
Information interest	0.274	0.062	0.078			
Loyalty	0.086	0.093	0.028	0.491		
Trust	0.114	0.110	0.042	0.091	0.280	
Word-of-mouth	0.184	0.028	0.113	0.449	0.639	0.244

Table 6. Discriminant validity

7.3.1.3 Multicollinearity

Variance inflation factor (VIF) was used to measure collinearity in the model. A VIF value less than 5 indicates that the model does not have a collinearity problem. If the model follows the recommended VIF, it implies that 80% of the indicators variance is accounted for by the rest of the indicators that are related to the same construct (Hair et al., 2016). As for this model, the VIF measurements are followed as seen in table 7.

	VIF
Age	1.000
County	1.000
Gender	1.000
Interest_1	2.833
Interest_2	2.833
Loyalty_1	2.364
Loyalty_2	2.404
Loyalty_3	1.768
Trust_1	1.887
Trust_2	4.479
Trust_3	3.937
WOM_1	4.518
WOM_2	4.603
WOM_3	4.281
WOM_4	2.936

Table 7. Variance inflation factor

7.3.2 Hypothesis testing

The past subchapters focused on the vital measurements when it comes to model metrics for PLS-SEM. For the structural model, the important structural metrics are R^2 (explained variance), f^2 (effect size), and significance of the coefficients (Hair et al., 2016). Having established the reliability and validity of the construct measures, this sub-chapter examines the capabilities of the model and its results.

7.3.2.1 Coefficient of determination

The coefficient of determination, also known as R-squared (R^2), is an important criterion for assessing the structural model. R^2 calculates the squared correlation between the actual and predicted values of a construct. While acceptable levels of R^2 are dependent on research context, a general guideline considers below 0.19 as unacceptable (Kassem et al., 2020). This model is then accepted with a R-squared equal to 0.312, where 31,2% of the variable "Information interest" is explained by the other constructs in the model. Higher values of R^2 indicates better prediction of the dependent variable (Hair, 2010).

7.3.2.2 Effect size

Effect size f^2 measures the change in R^2 value when different constructs are taken out of the model, understanding the impact it has. To understand the level of impact the construct has

these different levels are recommended; 0.02, 0.15, and 0.35 as small, medium, and strong effect sizes. Values below 0.02 indicates no effect (Hair et al., 2016). As seen in table 8 the measurements for this model are struggling to fulfill a medium effect size, except for loyalty towards word-of-mouth.

	Age	County	Gender	Information Interest	Loyalty	Trust	Word-of-mouth
Age				0.048			
County				0.008			
Gender				0.002			
Information interest							
Loyalty				0.129			0.533
Trust				0.024	0.073		
Word-of-mouth				0.029			

Table 8. Effect size F²

Some researchers mention that these requirements to effect sizes are way too high for what is normally achieved through this kind of analysis. A review by Aguinis et al. (2005) found that the average effect size over 30 years was only 0.009 (Aguinis et al., 2005). Kenny (2018) proposed more realistic requirements of 0.005, 0.01, and 0.025 for small, medium, and strong effect sizes (Kenny, 2018). Which means the constructs of age, loyalty and word-of-mouth do all have a high impact on information interest, with trust also being close to the requirement. Gender and county on the other hand struggles to even fulfill small effect size requirements and are not statistically significant as further discussed in the next subchapter.

7.3.2.3 Bootstrapping

Bootstrapping is a method used to investigate the significance of the different coefficients in the model. Typically, 5000 bootstrap samples are used to estimate the model. When running the model on 5000 samples a random sampling gets repeated with replacement from original sample, to determine standard error and standard deviation of the estimated coefficients (Hair et al., 2016).

In PLS-SEM software the bootstrapping reveals the *probability values* (p-value) for each coefficient. In research the most common significance level used when it comes to p-value is 5%, which means the p-value must be smaller than 0,05 to consider the coefficient to be significant (Hair et al., 2016).

	P values
Age -> Information interest	0.002**
County -> Information interest	0.239
Gender -> Information interest	0.477
Loyalty -> Information interest	0.000**
Loyalty -> Word-of-mouth	0.000**
Trust -> Information interest	0.040*
Trust -> Loyalty	0.000**
Word-of-mouth -> Information interest	0.036*
P-values: **< 0,01 *<0,05	

Table 9. Bootstrapping

Table 9 displays the results of bootstrapping, and most off the mentioned p-values are smaller than a significance level of 0,05. Indicating that the values are all significant and the correlations between the variables are accurate and reliable. County and gender are the only two variables that are not significant, recommending that the values related to these variables in the model may lack accuracy. Figure 8 visualizes the bootstrapping model providing an improved view of the p-values between the coefficients.
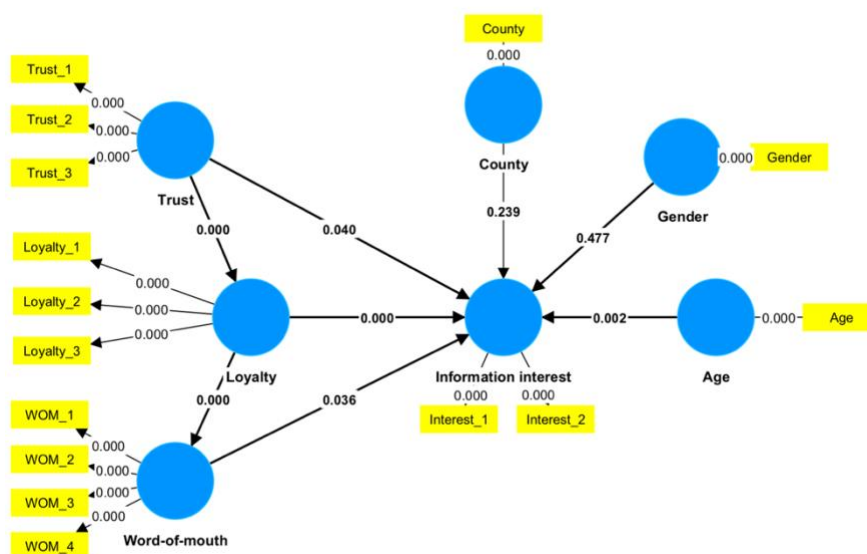

Figure 8. Bootstrapping

7.4 Results

This chapter presents the results from analyzing the responses from the questionnaire conducted by 200 respondents in the Norwegian market. It collected insights into the respondents' trust, loyalty, and word-of-mouth behavior towards their favorite brand, in addition to their interest in information about the fish products they usually buy. The analysis explores the relevance of the different variables and their interdependence.

7.4.1 Results of the structural model estimation

The questionnaire was directed at the Norwegian market, wanting to capture fish consumers´ opinions regarding trust, loyalty, and word-of-mouth towards their favorite brand. Additionally, the respondents were asked about their interest in receiving information about origin and processing stages of the fish they purchase. The survey received data from respondents of various age groups and from different regions all around Norway.

The data collected through the questionnaire is analyzed using PLS-SEM. This section describes the findings of the analysis and explore the relationships between the focal variables presented in the PLS-SEM model in figure 9.
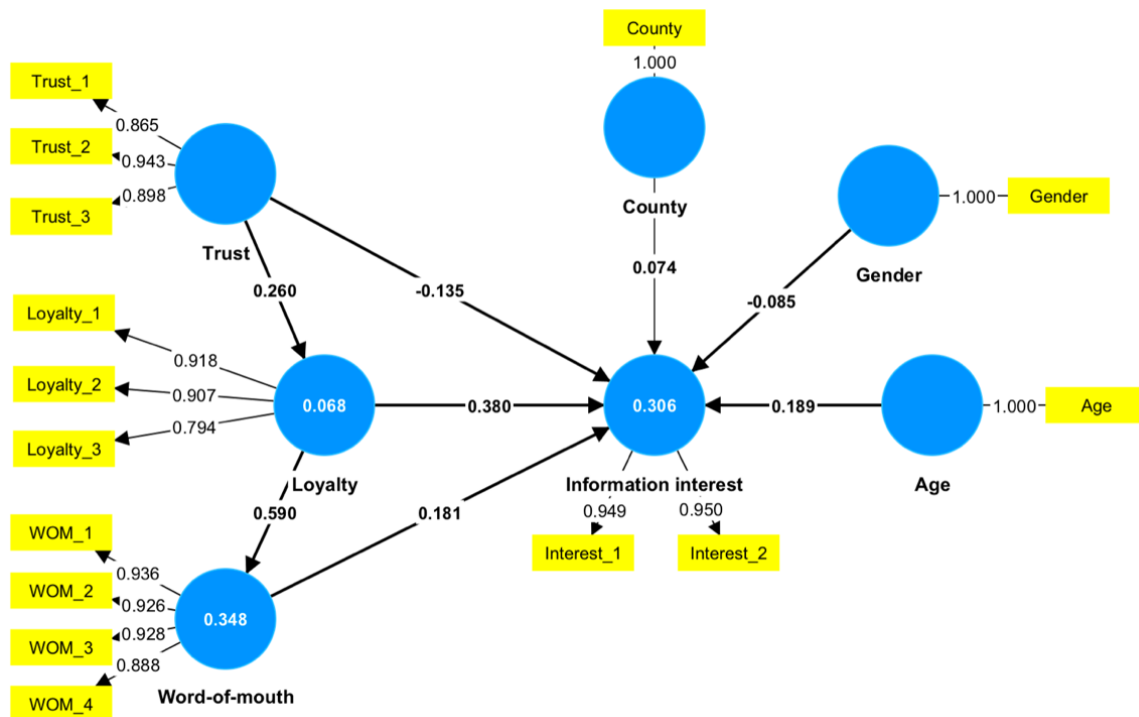

Figure 9. PLS-SEM model

The hypotheses created shows the potential relationships between the focal variables. To support these hypotheses assessing the significance of the path coefficients are checked, where the path coefficient has a significant level of less than 0,05 are significant and the hypothesis is supported.

The first hypothesis (H1) proposing that an increase of consumer trust have a positive relationship with the level of loyalty towards the brand. This hypothesis is supported as the path coefficient is positive (0,260) and significance level at $p \leq 0,01$. This indicates an increase of 1 in trust between the two parts leads to a 26% increase in loyalty. The next hypothesis (H2) suggested that stronger loyalty the consumer has to the brand results in increased positive word-of-mouth advertising for the brand. This hypothesis is also supported when the path coefficient is positive (0,590) and significance level also here of $p \leq 0,01$. An increase of loyalty will then have a positive impact on WOM with 59%.

The hypotheses concerning information interest, hypothesis 3 (H3) explains that there is an association between trust and information interest. H3 is supported and the path coefficient is negative (-0,135) and significant with $p \leq 0,05$. This is indicating that an increase of trust between consumer and brand, decreases the interest in information about the product by 13,5%. Hypothesis 4 (H4) proposed that greater loyalty would lead to higher interest in information related to the products. The path coefficient between these two is positive (0,380), $p \leq 0,01$, supports this hypothesis. Therefore, loyalty is affecting information interest positively by 38%. Hypothesis (H5) explains the effect of word-of-mouth towards information interest. The path coefficient shows a positive path coefficient (0,181) while the significance level a $p \leq 0,05$. Supports the hypothesis indicating a higher word-of-mouth advertising corresponds with increase of information interest.

In addition to the focal variables, three control variables were added to the model to see the potential effect towards information interest. First is county, representing the county the respondent lives. Aiming to investigate differences between area of living in Norway and the importance of information about the fish. Even though the analysis shows a positive path coefficient (0,074) it is not supported as the effect is not significant. Second control variable is gender, having a negative path coefficient (-0,085) suggesting male consumers are less

interested information. This effect is neither supported when the effect is not significant, showing that gender does not have a significant effect on information interest.

The third control variable is age, categorizes respondents in age groups reaching from 18-29 to 70 and older. The analysis expresses a trend of increasing interest for information with age, as the coefficient shows is positive (0,189), $p \leq 0,01$, meets the requirements supporting that age influences information interest.

Hypothesis	Relationship	Path coefficient	P-value	Conclusion
H1	Trust ->Loyalty	0,260	0,000	Supported**
H2	Loyalty -> WOM	0,590	0,000	Supported**
H3	Trust -> Info interest	-0,135	0,044	Supported*
H4	Loyalty -> Info interest	0,380	0,000	Supported**
H5	WOM -> Info interest	0,181	0,024	Supported*
	County -> Info interest	0,074	0,239	Not supported
	Gender -> Info interest	-0,085	0,477	Not supported
	Age -> Info interest	0,189	0,002	Supported**
P-values: **< 0,01 *<0,05				

Table 10. Test of hypothesis

7.4.3 Multigroup analysis

This analysis examines the impact each of the age groups in the model has on the dependent variable, information interest. Analyzing each group as a binary variable and their corresponding path coefficients towards information interest. The two groups, <40 years old and >40 years old, are tested regarding information interest, the variables of trust and word-of-mouth have a noticeable change between the two groups. While the invariant connection shows no difference from either of the groups, which means loyalty and information interest as shown in table 13, does not differ significantly between the age groups. Correlation between trust and information interest for older_40 group is significant with a negative coefficient (-0,234), while the coefficient for younger_40 is also negative (-0,046) but not significant.

The correlation of word-of-mouth with information interest shows the opposite compared to the trust variable. The younger_40 group has a positive path coefficient (0,257) and significant p≤0,05. The older_40 group shows a positive path coefficient (0,161) as well but is not significant.

	Original (Younger_40)	P-value (Younger_40)	Original (Older_40)	P-value (Older_40)
Age -> Information interest	0.033	0.737	-0.009	0.922
County -> Information interest	-0.085	0.345	0.244	0.009**
Gender -> Information interest	-0.208	0.201	0.045	0.808
Loyalty -> Information interest	0.328	0.001**	0.434	0.001**
Loyalty -> Word-of-mouth	0.632	0.000**	0.546	0.000**
Trust -> Information interest	-0.046	0.633	-0.234	0.020*
Trust -> Loyalty	0.374	0.000**	0.131	0.392
Word-of-mouth -> Information interest	0.257	0.020*	0.161	0.272
P-values: **< 0,01 *<0,05				

Table 11. Multigroup analysis

The multigroup analysis identified no differences among the age groups in terms of the relationship between loyalty and information interest. Loyalty indicated a consistent effect on information interest regardless of age. However, examining the influence of trust and WOM revealed differences between the groups. Group 1 consisting of respondents younger than 40 years old had significantly higher effect of word-of-mouth towards information interest, while the second group consisting of older than 40 had significant higher negative effect of trust towards information interest.

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7.5 Discussion

This paper aims to investigate the level of interest in information sharing related to fish products in the Norwegian market. This can be used as an indicator for company´s if they should adopt blockchain technology. The research was investigated in the context of Norwegian fish consumers, and the next under-chapters discuss the hypotheses presented previously, the multigroup analysis investigating the differences in age, and the possible adaptation of blockchain technology.

7.5.1 Theoretical contributions

7.5.1.1 Factors influencing consumers interest of product information.

The findings of this study support several of the hypotheses created. The results confirmed the hypothesis that increased trust of the consumer is positively associated with the loyalty towards the brand. In other words, if the brand can give out trustworthy information to consumers they continue purchasing from the brand. The result is supported by Rossmannek et al. (2022) who concluded that consumer loyalty is based on the supplier´s performance, satisfaction, and attractiveness. High level of these three make the consumer come back to the supplier instead of other competitors (Rossmannek et al., 2022). Also Ozdemir et al. (2020) highlighted in their study that the generating of brand loyalty is convincing the consumers that the brand is reliable, building that through communication and trust is the best way of increasing that (Ozdemir et al., 2020).

Second hypothesis supported by the results suggests that higher consumer loyalty leads to an increase of advertising to their friends and family about their satisfaction of the brand´s goods and services. The trend has grown over time, highlighted by Watson et al. (2015) that the use of attitude and behavior to maintain a relationship is more important than ever (Watson et al., 2015). The high focus on climate and choosing sustainable solutions, consumers take pride in choosing environmentally friendly solutions like high quality local fish and express their satisfaction easily with others (Menozzi et al., 2020; Risius et al., 2019). Third hypothesis supported indicates how an increase of trust will have a negative effect on interest for more information. Which can be explained by having a high trust to the brand, the need for more information is not needed. Having a low trust to the brand, the need for more information becomes significant. Pieniak et al. (2007) stated the same when investigating a consumer

group of younger people, realized they had a low consumption level of information due to them trusting the system.

Next supported hypothesis implies that loyalty is positively correlated with information interest. This means that the more loyal customers are to the brand, the more they care about the information given to them. Which is also supported by Siagian et al. (2022) who concluded with increased information sharing strengthen the loyalty (Siagian et al., 2022). Last hypothesis supported was the more information that are shared the higher change for people to talk about it to others. Suits research Siagian et al. (2022) where more information that are shared to the consumers, increases the engage of positive word-of-mouth advertising (Siagian et al., 2022).

The last significant investigation was the effect of age on information interest, where the older the respondent was the higher interest in product information. Which is also supported by Pieniak et al. (2007) that the consumer group considering mainly younger people trusted the system, so their interest and usage of information and labels were on the low (Pieniak et al., 2007). Some interesting statistics on this topic is also captured by Stabel (2017), that shows the amount of people above 67 years old eating more fish than the generations of younger than 24 (Stabel, 2017). The older generations above 34 years old have maintained their consumptions levels while the younger generations below 34 years old consumed less fish for their meals, 17% decrease of fish consumption in Norwegian homes between 2012 and 2017 (Strøm, 2018).

7.5.1.2 Does interest for product information vary depending on age?

The population of Norway older than 67 years old have a significant higher consumption of fish products compared to the generations below the age of 24 (Stabel, 2017). While younger generations tend to prioritize sustainability (Gangsø et al., 2022), the older generations may show greater care for product quality due to their consumption levels. The results revealed differences between the interest in information between respondents younger than 40 years old and those aged 40 years old and above. Also, along with differences in how the variables like trust, loyalty, and word-of-mouth influence their interest in product information.

Firstly, the findings found a difference between the age groups of younger and older than the age of 40. Previous studies investigated what information that are most relevant different generations and their preferences (Curles, 2019; Risius et al., 2019). However, no research examined the level of interest in product information and which age groups caring more than others. In our study the findings showed that individuals below the age of 40 had a negative impact on information interest compared to the older age group which showed a positive impact in interest of product information. This can be explained by reflecting on recent events. The past few years with covid-19 and war between Russia and Ukraine in Europe, today´s younger generation may have faced their first economic crisis. As a result, from December 2021 to December 2022 the prices for food and drinks raised with 11,5% (Bråthen, 2023). The younger generation were forced to prioritize price when it comes to food products and therefore diminishing their interest in product information. People in this age groups are unable to afford sustainable and local products, since it often comes at a higher price. On the other hand, for the second group, above 40 years old, it is reasonable to believe that the majority can afford to pay more for food including fish products. Paying more is often a sign of quality and focus on sustainability (Risius et al., 2019). For this reason, they will have more interest in information concerning the product they buy (Menozzi et al., 2020).

Secondly, the results found out the age groups got affected differently by trust, loyalty, and WOM towards the interest of product information. Previous studies as mentioned investigated preferences of different generations (Curles, 2019; Risius et al., 2019). However, no research showed the relationship of trust, loyalty, and WOM towards information interest and how it affects the age groups differently. In our study the results confirm loyalty towards information interest is invariant, which means there were close to no change in the correlation between the two age groups and are consistent. As consumers tend to continue purchasing from their favorite brand regardless of their age.

Trust and word-of-mouth are not invariant where the two age groups have a different outcome between each of the variables. The variable trust had a significant negative impact on interest in product information for the group of older than the age of 40. Close to 20% difference to the other group, lower negative effect of trust on interest of product information. The results show that younger generations have greater faith in information they are given compared to the older generations. These results align with research by Pieniak et al. (2007), suggesting that the customer group consisting of mostly younger generations trusted the

system needing less information. The older on the other hand have more difficulty trusting the information. Research from Verbeke et al. (2007) explained that several consumers refused buying fish products due to false information being shared by the brands, which can explain the low trust from the older generations.

The findings found of the variable word-of-mouth had a different effect between the two groups. Where the younger age group (below 40) had a significant positive effect of WOM towards interest for product information, whereas the older group (above 40) had less of an effect of WOM towards interest for product information. Earlier studies have conducted research on the effect of genders towards WOM (Lee & Workman, 2021), while none have investigated the activeness of age groups when marketing for their favorite brands, especially not towards product information. Younger generations are striving to be labeled as sustainable, motivated to advocate for products they buy to others. Older generations have likely been purchasing the same products for years, may not promote them as actively.

7.5.2 Managerial implications for seafood SCM producers

Based on the quantitative results this study has highlighted some implications in the seafood supply chain management. Notable implication is the low level of trust shown by the older generations, which through the multigroup analysis trusted the information far less than the younger generations. Given that the older generations are the biggest consumer group of consumption of fish products in Norway, the lack of trust should be addressed by the brands. Increasing trust among older consumers can offer an important competitive advantage. Previous studies investigate the usage of blockchain in SCM, benefits like improvement speed such as efficiency and minimizing human error (Tokkozhina et al., 2022b). When focusing on seafood SCM, it is crucial to concentrate on products having short shelf-life by utilizing fast processes and rapid delivery of fresh fish.

Traceability and visibility may be a competitive advantage for the seafood producers. Blockchain is one of the technologies which is focused on because it is making it possible for consumers to have information about the product. All information available are in the blockchain system, this information will be stored in immutable and tamper-proof manner. By having this type of information accessible to the public, brands are incentivized to higher their performance standards, prioritize fish welfare, and pursue sustainable solution. The

brands can in this way not get away with illegal, unreported, or unregulated fishing (IUU), which is destructive fishing methods causing by-catch and loss of environmental value (Ferreira et al., 2022; Petrossian, 2015). However, implementation of new technology is associated with cost and a question whether the industry is willing to invest in it. The driver for if the industry will invest in new technology is normally the potential for saving costs and increasing efficiency, in addition to monitoring the potential increase of value (Hangl et al., 2022). This solution is costly, but increase of value through unique benefits for consumers and brand (Izushi & Huggins, 2012).

There are examples showing that labeling countries does not indicate the correct origin of the product (Lysvold & Skeie, 2018). The investigation in this paper shows that the information of fish products is significant, which means it can be used by the producers as competitive advantage. With the implementation of blockchain, the brands will not be able to hide potential negative information related to the product, such as the actual origin, sickness, warm temperature transportation nor processing in other countries. This will again improve the performance of the brands and their suppliers, while also increasing the trust to their consumers. The brands must perform better than their competitors by prioritizing transparency to earn the trust and loyalty of the consumers wanting their final products.

7.6 Conclusion

This paper has investigated the factors that are influencing consumers interest in product information about fish products, factors like trust, loyalty, and word-of-mouth. In addition to investigating if the interest is dependent on geographic location, gender, or age. The findings indicates that trust, loyalty, and word-of-mouth are having an impact on the interest of product information. Trust has been found to have a negative impact on information interest, meaning when the trust is accomplished the consumers require less information. Otherwise, loyalty and WOM showed to increase the interest for more information. Moreover, the results revealed that consumers above the age of 40 shows the most interest in information regarding the fish they buy, possibly driven by the economic circumstances. The younger than the age of 40 express a higher trust to the information they receive and like to share their experiences about the brand to their friends and family more compared to the older group. The implications for the producers can give brands a competitive advantage in the seafood SCM,

contributing to consumer satisfaction with information sharing, transparency and increase of trust between the parts with the use of blockchain technology in the fish supply chain.

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Appendix 1

Informasjon om fiskeprodukter

`0 %`

Obligatoriske felter er merket med stjerne *

Spørreundersøkelse

Denne spørreundersøkelsen er en del av min masteroppgave ved Høgskolen i Molde. Spørreundersøkelsen dreier seg om hvor viktig informasjon er for kundene, ved kjøp av fiskeprodukter.
Informasjonen det er snakk om her er hvor fisken kommer fra og hvordan den er behandlet før den blir lagt frem til deg som vare.

Ved å svare på denne spørreundersøkelsen over nettet, vil IP-adresse bli kjent. Ved å svare på denne undersøkelsen godtar du at IP-adressen din blir kjent. I min masteroppgave er den helt irrelevant, så skal ikke brukes til noe. Men om du angrer på å ha svart på spørreundersøkelsen etter levert besvarelse, ta kontakt på nichlas.h.botten@himolde.no så kan den bli fjernet.

Neste side

Informasjon om fiskeprodukter

`33 %`

Obligatoriske felter er merket med stjerne *

Del 1. Generell informasjon

1. Hvor besvares undersøkelsen? *

○ Nettundersøkelse

○ Kjøpesenter i Oslo

○ Kjøpesenter i Ski

○ Kjøpesenter i Molde

2. Kjønn *

○ Kvinne

○ Mann

○ Ikke-binær

3. Alder *

- ○ 18-29
- ○ 30-39
- ○ 40-49
- ○ 50-59
- ○ 60-69
- ○ 70-79
- ○ 80 eller eldre

4. Hvilket fylke bor du i? *

Velg ... ⌄

5. Høyest fullført utdanning *

- ○ Videregående skole
- ○ Bachelor (1-3 år)
- ○ Master (5 år)
- ○ Doktorgrad
- ○ Yrkesfaglig utdanning/Fagskole
- ○ Ingen av de nevnte

6. Når du kjøper fiskeprodukter, kjøper du mest fersk eller frossen fisk? *

- ○ Kun fersk fisk, aldri frossen
- ○ Cirka 75% fersk fisk og 25% frossen fisk
- ○ Cirka 50% fersk fisk og 50% frossen fisk
- ○ Cirka 25% fersk fisk og 75% frossen fisk
- ○ Kun frossen fisk, aldri fersk

7. Når du kjøper fiskeprodukter, hvor mange personer kjøper du vanligvis produkter til? *

- ○ 1-2 personer
- ○ 3-4 personer
- ○ 5-6 personer
- ○ 7 eller flere personer

8. I gjennomsnitt, hvor mye penger bruker du på fiskeprodukter i måneden? *

- ○ 0-299 kroner
- ○ 300-599 kroner
- ○ 600-899 kroner
- ○ 900-1 199 kroner
- ○ 1 200-1 499 kroner
- ○ 1 500 kroner eller mer

9. Hvor kjøper du vanligvis fiskeprodukter? (Velg butikken du oftest bruker) *

Velg ... ⌄

10. Fra hvilket fiskemerke kjøper du vanligvis produkter fra? *

Velg ... ⌄

11. I hvor stor grad er du interessert i informasjon om hvor fisken kommer fra, og hvordan den er behandlet? *

Ikke interessert						Veldig interessert
1	2	3	4	5	6	7

Verdi [⇕]

12. I hvor stor grad påvirker informasjonen om hvor fisken kommer fra kjøpet ditt? *
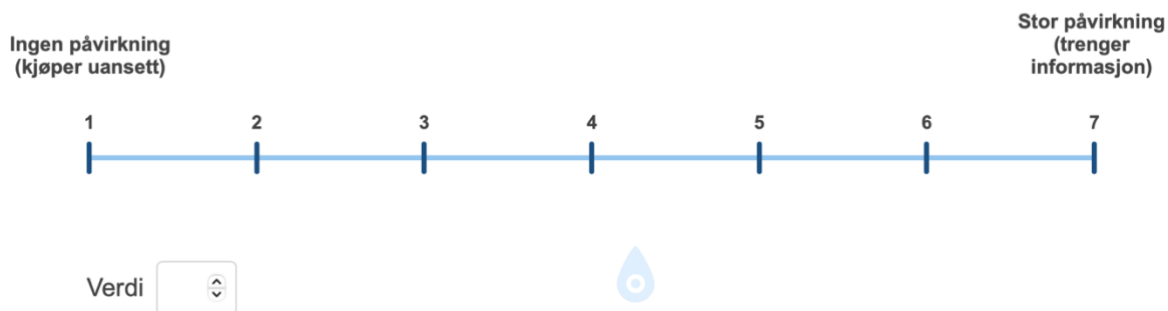
Ingen påvirkning (kjøper uansett)						Stor påvirkning (trenger informasjon)
1	2	3	4	5	6	7

Verdi [⇳]

Del 2. Tillit

De neste spørsmålene skal besvares med henhold til merket du vanligvis kjøper fiskeprodukter fra, og hvor vidt de gir ut informasjon om fiskens opprinnelse og hvordan den er behandlet. Svar med 1 (helt uenig) til 7 (helt enig) på følgende påstander:

13. Jeg stoler på at merket gir ut informasjon om fiskeproduktene og at...

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
13.1 informasjonen forteller hvor fisken er fisket *	○	○	○	○	○	○	○
13.2 informasjonen er korrekt *	○	○	○	○	○	○	○
13.3 informasjonen er autentisk, ikke forfalsket på noen måte *	○	○	○	○	○	○	○

Del 3. Egne opplevelser

14. Hvis merket gir ut informasjon om hvor fisken kommer fra og hvordan den er behandlet, svar på hvor enig/uenig du er med påstandene under:

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
14.1 Jeg vil fortelle om mine positive opplevelser om merket til venner og familie *	○	○	○	○	○	○	○
14.2 Jeg vil anbefale merket til andre *	○	○	○	○	○	○	○
14.3 Jeg vil oppmuntre familie og venner til å handle produkter fra dette merket *	○	○	○	○	○	○	○
14.4 Jeg vil fortelle andre at jeg stoler på merket når det kommer til informasjonen de gir ut *	○	○	○	○	○	○	○

Del 4. Lojalitet

15. Hvis merket gir ut informasjon om hvor fisken kommer fra og hvordan den er behandlet, svar på hvor enig/uenig du er med påstandene under:

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
15.1 Jeg vil være lojal og for det meste handle produkter fra dette merket *	○	○	○	○	○	○	○
15.2 Merket er mitt førstevalg når det kommer til kjøp av fiskeprodukter *	○	○	○	○	○	○	○
15.3 Jeg vil ikke kjøpe fiskeprodukter fra andre merker hvis jeg kan kjøpe samme produkt hos mitt valgte merket *	○	○	○	○	○	○	○

Forrige side   Send

60

Appendix 2

– Answers to the questionnaire

Rapport fra «Informasjon om fiskeprodukter»

Innhentede svar pr. 7. februar 2023 13:19

Leverte svar: **200**

Påbegynte svar: **0**

Antall invitasjoner sendt: **0**

Del 1. Generell informasjon
1. Hvor besvares undersøkelsen? *

Svar	Antall	Prosent
Nettundersøkelse	190	95 %
Kjøpesenter i Oslo	2	1 %
Kjøpesenter i Ski	4	2 %
Kjøpesenter i Molde	4	2 %

2. Kjønn *

Svar	Antall	Prosent
Kvinne	117	58,5 %
Mann	83	41,5 %
Ikke-binær	0	0 %

3. Alder *

Svar	Antall	Prosent
18-29	93	46,5 %
30-39	18	9 %
40-49	25	12,5 %
50-59	36	18 %
60-69	13	6,5 %
70-79	12	6 %
80 eller eldre	3	1,5 %

4. Hvilket fylke bor du i? *

Svar	Antall	Prosent
Oslo	18	9 %
Viken	87	43,5 %
Møre og Romsdal	33	16,5 %
Rogaland	21	10,5 %
Vestland	17	8,5 %
Innlandet	5	2,5 %
Agder	2	1 %
Vestfold og Telemark	4	2 %
Trøndelag	12	6 %
Nordland	1	0,5 %
Troms og Finnmark	0	0 %

5. Høyest fullført utdanning *

Svar	Antall	Prosent
Videregående skole	40	20 %
Bachelor (1-3 år)	87	43,5 %
Master (5 år)	44	22 %
Doktorgrad	0	0 %
Yrkesfaglig utdanning/Fagskole	24	12 %
Ingen av de nevnte	5	2,5 %

6. Når du kjøper fiskeprodukter, kjøper du mest fersk eller frossen fisk? *

Svar	Antall	Prosent
Kun fersk fisk, aldri frossen	29	14,5 %
Cirka 75% fersk fisk og 25% frossen fisk	46	23 %
Cirka 50% fersk fisk og 50% frossen fisk	44	22 %
Cirka 25% fersk fisk og 75% frossen fisk	57	28,5 %
Kun frossen fisk, aldri fersk	24	12 %

7. Når du kjøper fiskeprodukter, hvor mange personer kjøper du vanligvis produkter til? *

Svar	Antall	Prosent
1-2 personer	123	61,5 %
3-4 personer	65	32,5 %
5-6 personer	10	5 %
7 eller flere personer	2	1 %

8. I gjennomsnitt, hvor mye penger bruker du på fiskeprodukter i måneden? *

Svar	Antall	Prosent
0-299 kroner	85	42,5 %
300-599 kroner	71	35,5 %
600-899 kroner	32	16 %
900-1 199 kroner	10	5 %
1 200-1 499 kroner	1	0,5 %
1 500 kroner eller mer	1	0,5 %

9. Hvor kjøper du vanligvis fiskeprodukter? (Velg butikken du oftest bruker) *

Svar	Antall	Prosent
Bunnpris	9	4,5 %
Kiwi	55	27,5 %
Rema 1000	55	27,5 %
Meny	28	14 %
Coop Mega	5	2,5 %
Coop Extra	33	16,5 %
Coop Prix	0	0 %
Joker	0	0 %
Eurospar	2	1 %
Rett fra fiskebåt/bil	2	1 %
Rett fra fiskebod/butikk	5	2,5 %
Andre	6	3 %

10. Fra hvilket fiskemerke kjøper du vanligvis produkter fra? *

Svar	Antall	Prosent
Lerøy	42	21 %
Findus	29	14,5 %
Lofoten	19	9,5 %
Salma	31	15,5 %
Fiskemannen	5	2,5 %
Fiskeriet (Rema1000)	25	12,5 %
Bjellands	0	0 %
Coop	10	5 %
Xtra	7	3,5 %
First Price	13	6,5 %
Andre	19	9,5 %

Hvilket merke kjøper du om ingen alternativer over passet deg?

- Billig middag fra Bunnpris
- Icelandic cod
- Findus
- Karmøy
- Salma
- Vet ikke
- REMA 1000 Prima
- Fiskehuset på Kolbotn
- Kjøper sushi fra restaurant
- Fiskefilet fra lokale fiskebåter.
- Rørvik
- Mange forskjellige
- Vet ikke
- IA
- Norsk Sjømat fra Oda
- Varierer
- Troll
- Fersk fisk
- Fra fidkedisken

All the answers from question 11 and 12 were listed up with all 200 answers, had to make own table for these myself:

11. I hvor stor grad er du interessert i informasjon om hvor fisken kommer fra, og hvordan den er behandlet? *

Rating	1	2	3	4	5	6	7
Amount	10	19	26	41	54	29	21
Percent	5%	9,5%	13%	20,5%	27%	14,5%	10,5%

12. I hvor stor grad påvirker informasjonen om hvor fisken kommer fra kjøpet ditt? *

Rating	1	2	3	4	5	6	7
Amount	13	23	31	51	40	27	15
Percent	6,5%	11,5%	15,5%	25,5%	20%	13,5%	7,5%

Del 2. Tillit

De neste spørsmålene skal besvares med henhold til merket du vanligvis kjøper fiskeprodukter fra, og hvor vidt de gir ut informasjon om fiskens opprinnelse og hvordan den er behandlet. Svar med 1 (helt uenig) til 7 (helt enig) på følgende påstander:

13. Jeg stoler på at merket gir ut informasjon om fiskeproduktene og at...

Svar fordelt på antall

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
13.1 informasjonen forteller hvor fisken er fisket *	4	4	15	47	54	39	37
13.2 informasjonen er korrekt *	3	2	11	30	47	38	69
13.3 informasjonen er autentisk, ikke forfalsket på noen måte *	3	3	14	31	36	43	70

Svar fordelt på prosent

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
13.1 informasjonen forteller hvor fisken er fisket *	2 %	2 %	7,5 %	23,5 %	27 %	19,5 %	18,5 %
13.2 informasjonen er korrekt *	1,5 %	1 %	5,5 %	15 %	23,5 %	19 %	34,5 %
13.3 informasjonen er autentisk, ikke forfalsket på noen måte *	1,5 %	1,5 %	7 %	15,5 %	18 %	21,5 %	35 %

Del 3. Egne opplevelser

14. Hvis merket gir ut informasjon om hvor fisken kommer fra og hvordan den er behandlet, svar på hvor enig/uenig du er med påstandene under:

Svar fordelt på antall

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
14.1 Jeg vil fortelle om mine positive opplevelser om merket til venner og familie *	19	19	23	40	47	26	26
14.2 Jeg vil anbefale merket til andre *	15	9	19	36	52	39	30
14.3 Jeg vil oppmuntre familie og venner til å handle produkter fra dette merket *	16	15	27	30	49	32	31
14.4 Jeg vil fortelle andre at jeg stoler på merket når det kommer til informasjonen de gir ut *	18	13	23	44	47	25	30

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
14.1 Jeg vil fortelle om mine positive opplevelser om merket til venner og familie *	9,5 %	9,5 %	11,5 %	20 %	23,5 %	13 %	13 %
14.2 Jeg vil anbefale merket til andre *	7,5 %	4,5 %	9,5 %	18 %	26 %	19,5 %	15 %
14.3 Jeg vil oppmuntre familie og venner til å handle produkter fra dette merket *	8 %	7,5 %	13,5 %	15 %	24,5 %	16 %	15,5 %
14.4 Jeg vil fortelle andre at jeg stoler på merket når det kommer til informasjonen de gir ut *	9 %	6,5 %	11,5 %	22 %	23,5 %	12,5 %	15 %

Del 4. Lojalitet

15. Hvis merket gir ut informasjon om hvor fisken kommer fra og hvordan den er behandlet, svar på hvor enig/uenig du er med påstandene under:

Svar fordelt på antall

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
15.1 Jeg vil være lojal og for det meste handle produkter fra dette merket *	16	12	25	53	40	28	26
15.2 Merket er mitt førstevalg når det kommer til kjøp av fiskeprodukter *	13	15	18	51	47	34	22
15.3 Jeg vil ikke kjøpe fiskeprodukter fra andre merker hvis jeg kan kjøpe samme produkt hos mitt valgte merket *	26	19	37	39	40	21	18

Svar fordelt på prosent

	1 (helt uenig)	2	3	4	5	6	7 (helt enig)
15.1 Jeg vil være lojal og for det meste handle produkter fra dette merket *	8 %	6 %	12,5 %	26,5 %	20 %	14 %	13 %
15.2 Merket er mitt førstevalg når det kommer til kjøp av fiskeprodukter *	6,5 %	7,5 %	9 %	25,5 %	23,5 %	17 %	11 %
15.3 Jeg vil ikke kjøpe fiskeprodukter fra andre merker hvis jeg kan kjøpe samme produkt hos mitt valgte merket *	13 %	9,5 %	18,5 %	19,5 %	20 %	10,5 %	9 %

Appendix 3
– Different age groups effect on information interest
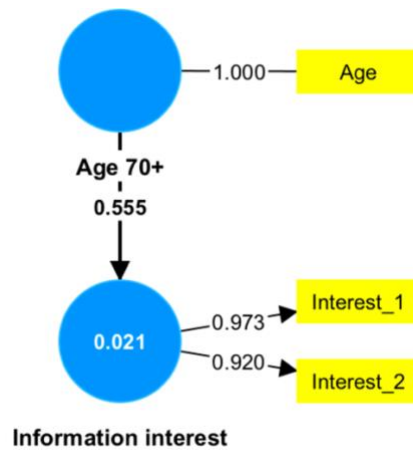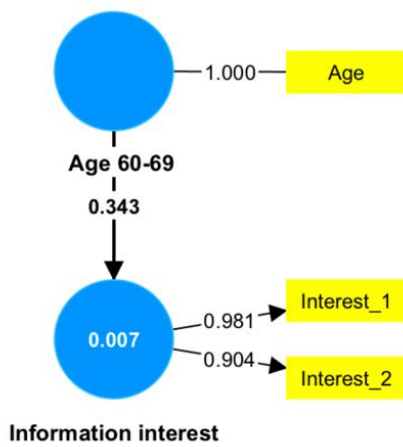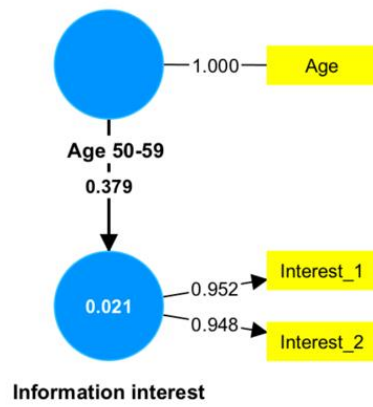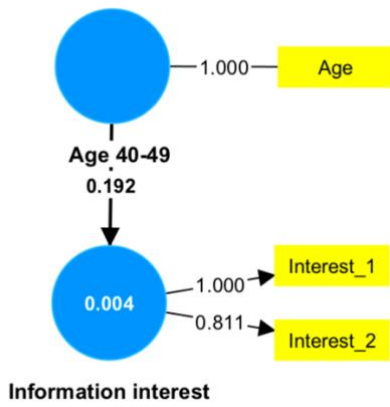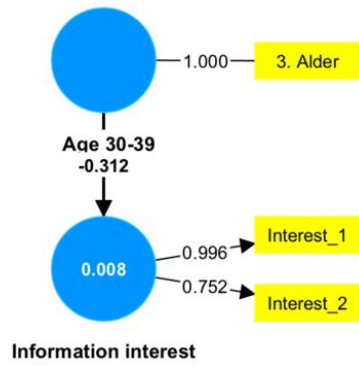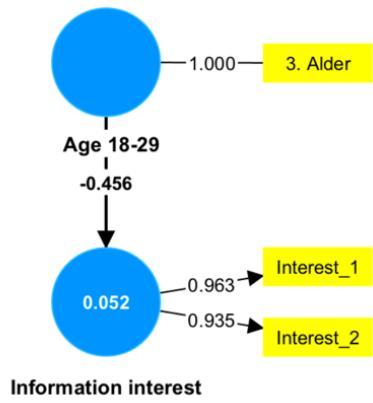
Appendix 4

Age group	Coefficient
18-29	-0,456*
30-39	-0,312
40-49	0,192
50-59	0,379*
60-69	0,343
70+	0,555*

(*= p-value 0.05)

The results indicate a transition between group 2 and 3, where group 2 represents respondents aged 30-39 and group 3 represents those aged 40-49. First two groups have a negative effect on interest for information while the remaining groups have a positive correlation towards it. To investigate this further, two groups are formed: group 1 contains respondents younger than 40 years old, and group 2 containing respondents older than 40 years old. Completing the multigroup analysis with these two groups, allows for an examination of the variables that depend on respondents´ age.