MARKET RESEARCH AND ENTRY STRATEGY FOR CLEANTECH INNOVATION IN MARITIME INDUSTRY

Lappeenranta–Lahti University of Technology LUT

Master's programme in International Business and Entrepreneurship, Master's thesis

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Examiners: Professor Liisa-Maija Sainio

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ABSTRACT

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Market research and entry strategy for cleantech innovation in maritime industry

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Keywords: Five Forces, Business model, Product-Service System, PSS, maritime industry, cleantech, BWTS, ballast water treatment system, market entry, B2B

The environmental issues that ships' ballast water is causing to ocean waters have gained attention in recent years. Unloading unmanaged ballast water to oceans can transfer invasive species and affect the biodiversity. Tightening regulations about ballast water management from IMO and USCG are striving for better environmental protection. Most ballast water treatment systems (BWTS) are installed to ships which causes costs, and the devices are large. This research is made for port-based mobile BWTS that LUT University has been developing as an alternative to ship-based device. This study aims to conduct market analysis for port-based BWTS and to identify a product-market fit. Based on the results of these actions market entry strategy is created.

Market analysis was conducted based on Porter's Five Forces framework. Business model planning is focusing on product-service system (PSS) as a promising model. The research is qualitative research and potential customers, and partners were interviewed to collect primary data. According to this research there is no superior business model as it depends a lot on the type of the product and to who it is offered to. Maritime industry is complex and causes challenges but the atmosphere towards port-based BWTS is positive and there are multiple potential BWT service providers. In a nascent BWT industry there are still many uncertainties but also opportunities to research. The most potential and interested BWT service provider that came out in this research is a company working circular economy services. Other potential entry strategies are researching more port operators, port service providers and opportunities in other industries. One option is to sell the product to some other company. Findings indicate that the mobile BWTS has potential in the market, but during the research many new research topics arose.

TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT

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Anniina Pasi

Markkinatutkimus ja strategia markkinoille menoon cleantech-innovaatiolle meriteollisuudessa

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Avainsanat: Viisi kilpailuvoimaa, Liiketoimintamalli, Product-Service System, PSS, meriteollisuus, cleantech, BWTS, painolastiveden käsittelyjärjestelmä, markkinoille meno, B2B

Viime vuosina laivojen painolastivesien merivesille aiheuttamat ongelmat ovat herättäneet huomiota. Käsittelemättömän painolastiveden päästäminen veteen voi kuljettaa invasiivisia lajeja mukanaan ja vaikuttaa vesistön biodiversiteettiin. IMO ja USCG ovat tiukentaneet määräyksiä painolastiveden käsittelystä tavoitteenaan parempi ympäristönsuojelu. Useimmat painolastiveden käsittelyjärjestelmät asennetaan laivoihin, mikä aiheuttaa kustannuksia ja vie tilaa laivoista. Tämä tutkimus keskittyy satamissa toimivaan liikuteltavaan painolastiveden käsittelyjärjestelmään, jota LUT Yliopisto on kehittänyt vaihtoehdoksi laivoihin asennettaville järjestelmille. Tutkimuksen tavoitteena on tehdä markkina-analyysi satamassa toimivalle käsittelyjärjestelmälle ja tunnistaa tuote-markkina yhteensopivuus. Näiden tuloksien pohjalta luodaan strategia markkinoille menoon.

Markkina-analyysi on tehty hyödyntäen Porterin viiden kilpailuvoiman mallia. Liiketoimintamallin suunnittelussa lupaavimpana keskitytään PSS-malliin. Tutkimus on laadullinen tutkimus ja potentiaalisia asiakkaita ja kumppaneita on haastateltu primääridatan keräämiseksi. Tutkimuksen perusteella ei ole olemassa yhtä ylivoimaista liiketoimintamallia, vaan se riippuu tuotteen tyypistä ja siitä, kenelle sitä tarjotaan. Monimutkainen meriteollisuus aiheuttaa haasteita, mutta ilmapiiri painolastiveden käsittelyjärjestelmää kohtaan on positiivinen ja mahdollisia käsittelypalvelun tarjoajia on useita. Kehittyvässä painolastiveden käsittely teollisuudessa on edelleen monia epävarmuustekijöitä, mutta myös paljon tutkittavia mahdollisuuksia. Potentiaalisin tutkimuksessa ilmi tullut palveluntarjoaja painolastiveden käsittelylle, on kiertotalouden palveluihin keskittyvä yritys. Muita mahdollisia markkinoille meno strategioita ovat satamaoperaattoreiden, satamapalvelujen tarjoajien ja muiden toimialojen mahdollisuuksien tutkiminen. Yksi vaihtoehto on myydä tuote jollekin toiselle yritykselle. Havainnot osoittavat, että liikuteltavalla painolastiveden käsittelyjärjestelmällä on potentiaalia markkinoilla, mutta tutkimuksen aikana nousi esiin myös monia uusia tutkimusaiheita.

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Towards new challenges!

Kotka, June 19th 2022

Anniina Pasi

SYMBOLS AND ABBREVIATIONS

B2B - business-to-business

BM - business model

BWM - ballast water management

BWTS - ballast water treatment system

IMO - International Maritime Organization

USCG - United States Coast Guard

PSS - Product-service system

PS - Product-service

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1 Introduction

Ballast water is used in ships to maintain the stability (GEF-UNDP-IMO GloBallast Partnerships Programme and WMU 2013; Gollasch & David 2018). Ballast water is seawater that is loaded to the vessel's tanks in other port and then unloaded in another port. Even though ballast water is necessary for ships to guarantee the security it is causing problems for the environment. Transportation of ballast water carries invasive marine species with it to new environments which creates serious problems (Gollasch & David 2018). For example, that can affect the biodiversity of oceans and coastal waters, spread pollution and damage ecological balance (Sayinli, Dong, Park, Bhatnagar & Sillanpää 2021; Rignault & Chevallier 2012; Ruiz & Backer 2014). Even though there is evidence about the threat that ballast water is causing to the environment sea transportation is maintaining its popularity. It is one of the main forms of cargo and at the moment approximately 80% of the world cargo is transferred by ships and number is continuously increasing (Lakshmi, Pria & Achari 2021).

To protect the ocean waters International Maritime Organization (IMO) and United States Coast Guard (USCG) have made ballast water management mandatory for vessels. New regulations order that every ship must manage its ballast water in U.S. Waters by 2012 and IMO has given the deadline for new vessels to manage their ballast water by 2017 and existing vessels by 2019. There is still five years' time to complete the retrofitting for old vessels from 2019. (Sayinli et al. 2021) Even though it is necessary to protect the environment the new regulations cause headache for the maritime industry. There is uncertainty about the regulations and about the possible ways to manage the ballast water. Ballast water treatment systems are large and expensive to install and that causes problems especially for small and old ships. LUT University has created a new kind of mobile BWTS that aims to create a solution for this problem. The aim is that ballast water treatment could be offered as a service for ships in ports with mobile BWTS.

This research focuses on creating a market entry strategy for mobile BWTS where ports and port operators are target customers. Also, other possible service providers are interviewed in order to get comprehensive understanding about the industry and to identify other potential service providers for BWT than ports and port operators. This study is topical and important to conduct now when there is still time to create innovative solutions for ballast

water management from regulations perspective. Also, as amount of cargo freight is increasing the environmental issues and harms are increasing too. The market needs innovative solutions to this problem as it is not possible for all to invest in BWTS. It is necessary that all companies in the industry contribute and make their effort to protect the environment. To be able to do so it should be made easy for them to contribute and secure the wellbeing of environment. This mobile BWTS is one option and attempt to make ballast water treatment accessible for every ship so that the threat to ocean and coastal waters could be minimized.

1.1 Research gap

The industries that this research is focusing are maritime industry and cleantech industry. In versatile Finnish maritime industry, there are around 1100 companies working, 25 000 employees, turnover of 7,7 billion euros and over 90% export which makes it significant industry to Finland (Meriteollisuus 2022). In Finland's shipyards have been built large luxury cruise ships, ice-going vessels, and icebreakers. Marine system supplier and subcontractor networks are large in Finland as well. Delivering environmentally friendly high-tech maritime solutions have a long history in Finland and expertise reaches offshore solutions and port technology in addition to shipbuilding. (Business Finland 2022)

Cleantech is another industry that this research is focusing on and in Finland cleantech industry has high goals and government has its strategy to promote cleantech business (Työ- ja elinkeinoministeriö 2014). In 2017 Global Cleantech Innovation Index Finland was ranked second and creation of early-stage innovation was seen as the main strength of Finland. (WWF 2017) One ambitious goal of Finland is to be carbon neutral in 2035 and to achieve that it is necessary to invest in cleantech (CTC 2022).

This thesis combines two important industries in Finland, maritime and cleantech, and focuses on creating an entry strategy for cleantech innovation that offers solution to topical environmental issue. There is no similar product in Finnish market which makes this research unique and valuable. It is a challenge to create an entry strategy for a product that hasn't been previously existing and therefore this thesis acts as an example case for future innovations in these industries. Considering the topicality of this issue the solutions to BWT

in the market are quite similar and it is important to try to create alternatives to existing solutions. That way it is possible to create competition and development in the market. It is important also to understand that industries can evolve all the time (de Reuver, Sørensen & Basole 2018; Gawer 2014). In nascent industry the atmosphere and structures are constantly evolving, and changes can be rapid as it is still uncertain who are the participants and what are their relationships (Shi, Li & Chumnumpan 2021). That requires continuous attention from companies aiming to that industry. In this research the focus is on understanding the market and its structures and that way filling the gap between existing literature about the subject and current reality.

Porter's Five Forces was formed by Michael E. Porter in 1979 in Harvard Business School. It is a tool for industry analysis and business strategy development. (Wu et al. 2012) It was created to understand the competitive forces of the industry which determine the industry's profitability. By understanding those it is possible to anticipate for competition and gain long term profitability. (Porter 2008) Creation of successful strategy begins with market research and critical analysis. During its existence Porter's model has been thoroughly studied and the studies have shown the model to be still applicable and effective tool for market analysis even after industry structure change (Dälken 2014). For this study it was chosen because of its possibility to create comprehensive understanding about the market. That fosters the creation of effective market entry strategy which is the aim of this research. In previous literature Five Forces has not been used for market analysis of maritime industry from the perspective of cleantech product. Therefore, it creates valuable information to practical implementation while contributes to theoretical literature by adding a new context and filling that gap.

Another key theory in this research is business model. Choosing business model is one part in market entry strategy planning. Business model has been studied a lot in previous literature, but this research focuses on Product-Service System as a business model which is a less studied concept (DaSilva & Trkman 2014). PSS is one form of business model, and it gives the possibility to offer services such as guidance for the use of product or recycling, in addition to product, which may be valuable when offering new and complex products. That way it is easier for potential customers to purchase the product when they rely on supporting services and there is less risk for them when product and service provider carries part of the risk. (Meier, Roy & Seliger 2010) Recently there have been interest in PSS in

shipbuilding companies as way of gaining competitive advantage (Norden, Hribernik, Ghrairi, Thoben & Fuggini 2013). Otherwise, PSS is still rather little used model in complex maritime industry and brings fresh perspective to business model planning in that context. This research aims to create information about the characteristics of B2B business environment in maritime industry that foster or hinder the implementation of PSS business model. That information can benefit the further research about PSS as well as facilitate the market research and business model planning of other companies aiming to that market.

Even though these two main theories that are Porter's Five Forces and business model are popular in previous studies there is no literature or very little studies that combine these to find the product-market fit. This research contributes to theoretical literature by increasing the understanding of how these theories can be utilized in order to find the product-market fit. This also further increases the awareness of using these theories in different contexts. With the information provided in this research it is more convenient for researchers to understand the suitability of PSS to complex port environment.

1.2 Research questions

The main research question underlines the purpose of this study which is to create effective and efficient entry strategy for cleantech innovation. Before being able to do that product-market fit is necessary to identify. The complex nature of the industry affects the process of identifying the product-market fit and makes it more challenging. Nonetheless it makes it even more important to understand who the possible customers are and what do they need. Regulation-driven market is somewhat limiting and guides the development of product. Nascent B2B market gives its own spice to the study as the nature of the industry needs to be considered when planning the interviews and entry strategy. This thesis focuses on answering the question:

"How to identify a product-market fit and create entry strategy for a cleantech innovation in a nascent and regulation-driven B2B market?"

To support the wide main question three sub-questions were created. With them it is possible to answer more comprehensively to main question. The first sub-question takes the industry into account and the aim is to find out the special factors and characteristics of it. By identifying the special characteristics of the market, it is possible to create entry strategy for the innovation. The first sub-question is:

"What are common characteristics of this nascent and regulation-driven B2B market?"

The second sub-question focuses on business model selection. Besides traditional product and service there are different kind of combinations of these and multiple options to implement the business. Selecting a business model is a part of planning the entry strategy and it can be challenging. Thus, the second sub-question is:

"How to identify the best business model?"

The third sub-question is created to understand who the potential customers and partners in complex industry are. To find the most potential and right customers for the product is crucial to succeed. The strategies for entry and marketing cannot be done if it is not clear to whom those are targeted. In a market like this there is also potential option to enter the market together with a partner. Finding a partner together with whom to collaborate towards common goals is one objective in this research. Thus, the third sub-question is:

"How to identify product-customer fit and decide on most suitable customer and partner?"

1.3 Theoretical framework

Theoretical framework introduces the main topic of the thesis which is cleantech innovation in maritime industry. The studied phenomenon focuses on B2B market in maritime industry

and theories of Five Forces and PSS are applied in that business environment to find the product-market fit for the cleantech innovation.

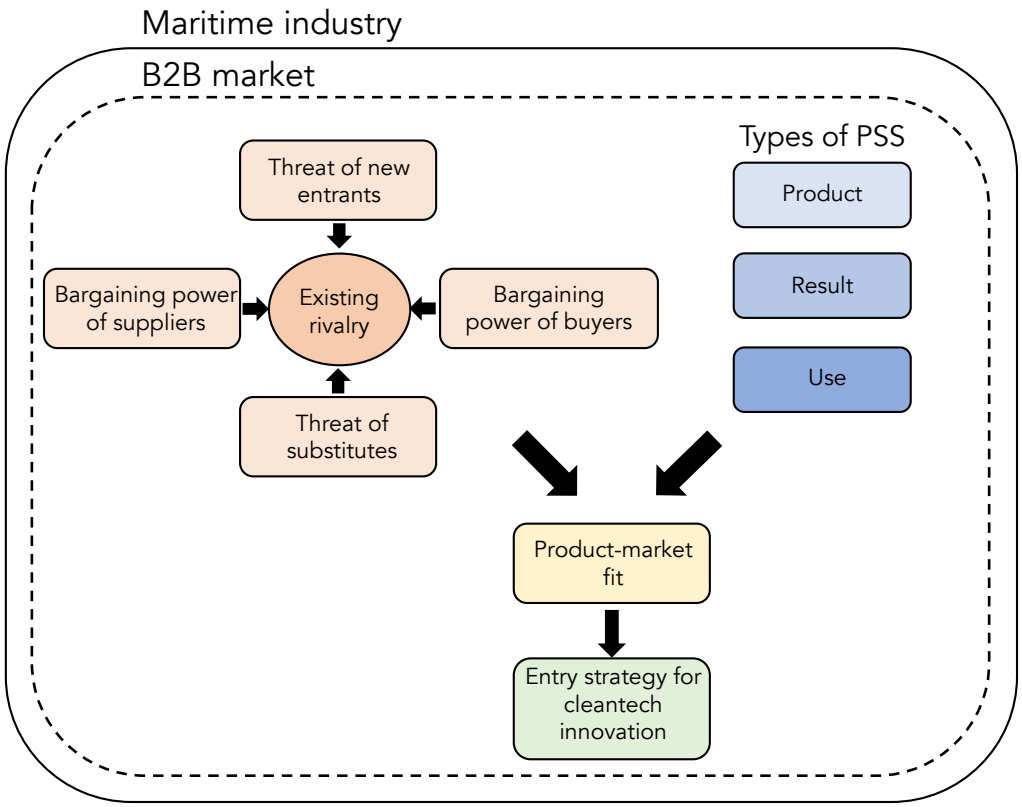

Figure 1 Theoretical framework

Illustration of theoretical framework can be seen in Figure 1 and it introduces the relations of the themes and theories used in this thesis. There are two frameworks used in this research. The first one is Porter's Five Forces which is utilized for market research from the perspective of cleantech innovation in maritime industry. Another framework is PSS and that is used to identify the potential business models for the same cleantech innovation. Together with these two frameworks the aim is to identify the product-market fit that is necessary to find before planning an entry strategy.

1.4 Definitions

Ballast water (BW) is used in vessels to balance them (Gollasch and David 2018). Even though it is necessary for ships to have ballast water it carries multiple marine species along

with it (IMO 2022a). That causes a threat to environment when the water is transported to new environment and then unloaded to ocean and at the same time indigenous species are transported to place with different biotope (Rata et al. 2018; Ruiz and Backer 2014). That might change the biodiversity of oceans. In addition, the movement of organic and inorganic waste as well as sediment in ballast water is a major contributor to pollution and ecological imbalance (Rignault and Chevallier 2012; Ruiz and Backer 2014).

Ballast water treatment system (BWTS)

In 2004 BWM Convention was introduced to control the movement of invasive species. Ballast water must be treated and disinfected in compliance with current legislation to remove pollutants from it. Ballast water management is now obligatory in ships because of these regulations. (IMO 2022b) The techniques used to treat ballast water should be chosen based on the location, biota, and indigenous organisms (Wang, Cheng, Xue, Xiao & Wu 2020). Common method for ballast water management is mid-sea exchange but that should be combined with ballast water treatment to avoid transfer of invasive organisms. Filtration is effective pre-treatment method, and the actual treatment is done as mechanical treatment, such as ultra violet radiation, or as chemical treatment, such as chlorine biocide for example. There are multiple ballast water treatment options in the market. (Lakshmi, Priya & Achari 2021)

Maritime industry can be divided into four main categories which are Shipping, Marine industry, Ports industry and Marine business services industry. All categories consist of multiple different activities. (Career Transition Partnership 2022) Maritime industry connects the world via seas and carries over 90% of world trade in volume (IMO 2022c). Transportation via seas is one of the cheapest ways to transport cargo and it is also one of the most polluting industry (Czachorowski, Solesvik & Kondratenko 2019). On the other hand, when looking from productive value point of view it is the least environmentally harmful transporting mode (IMO 2022c).

Product-Service System (PSS) can be defined as *"a marketable set of products and services capable of jointly fulfilling a user's need. The product/service ratio in this set can vary, either in terms of function fulfilment or economic value"* (Goedkoop, van Halen, te Riele & Rommens 1999, 20). In PSS dematerialized services can complete the product and cover

the needs of consumers and also, ownership structure can be different from traditional (Mont 2002).

Product-market fit means that product has demand on the market and customers are willing to pay for it. To achieve product-market fit the target market should be properly analyzed and customer needs identified. (Mailchimp 2022)

Porter's Five Forces is a framework which helps to understand the forces shaping industry. With the Five Forces it is possible to get comprehensive understanding about the industry and create strategy that leads to long-term profits. The forces are established rivals, customers, suppliers, new entrants, and substitute offerings. (Porter 2008)

1.5 Delimitations

This study has delimitations as it focuses only on Finnish market and one specific industry which is maritime industry and new cleantech innovation in that market. The market that this study is focusing on is B2B market as this product is not targeted to B2C consumers. The market analysis and entry strategy are created for that market and product only and cannot be generalized. This is a case study focusing on creating strategy for specific project and specific timing and this research doesn't aim to generalize the results. Even though this study is delimited, and results are not generalizable it can still give value to other companies. For example, even for companies operating internationally because the maritime industry is very international, and findings can be relevant in other countries as well.

1.6 Research methodology

This research is qualitative research, and the primary data was collected through interviews. Qualitative research method was chosen because the aim was to get deeper understanding about the phenomena. According to Tuomi & Sarajärvi (2003) qualitative research method is suitable for that and it enables understanding and interpreting of a specific phenomenon.

Interviews were semi-structured and focusing on key themes to cover the research questions. Interviews were chosen for data collection methods because with those it is possible to ask additional questions when those arise during the conversation and that way get deeper understanding of interviewee's thoughts. Chosen interviewees are representatives of potential customer or partner companies such as ports and port operators and other companies working in port environment. They were chosen with elite sampling which means that they are expected to know the most about the interview themes (Tuomi & Sarajärvi 2003, 88). That should ensure that information gained from the interviews is applicable. Ports and port operators were chosen for interviews because at this point of the university's project they were considered as the most promising and potential customers for the innovation. Other companies arose in the conversations when considering other possibilities for BWTS service providers. With this research it was possible to study the potential customer groups more closely and give a deeper look whether that information is correct, and they indeed are potential customers.

For the market analysis the data was collected through secondary sources such as websites, Internet statistics, articles and information gathered for the project. After the data collection it was transcribed and then analyzed with content analysis.

1.7 Structure of the study

This study consists of theoretical part and empirical part. The structure of the study is presented in the Figure 2 below. The study begins with introducing the topic, some previous literature about it and justifying this research based on the gap in literature and topicality. Also, the research questions are introduced in the first chapter.

The second chapter focuses on market research. Porter's Five Forces is introduced as it is the main theory in this part. It includes also views about the framework from other researchers and criticism towards it. Then some examples about the use of framework in different industries is presented. Finally, this chapter explains the concept of product-market fit and presents ideas about customer acquisition through partnership. Third chapter belongs to theoretical part as well and that is focusing on business model. Introduction of business model as a concept is the first part of the chapter. Then more specifically PSS business

model and previous literature about it is introduced. After that, theories about PSS are applied to BWTS industry.

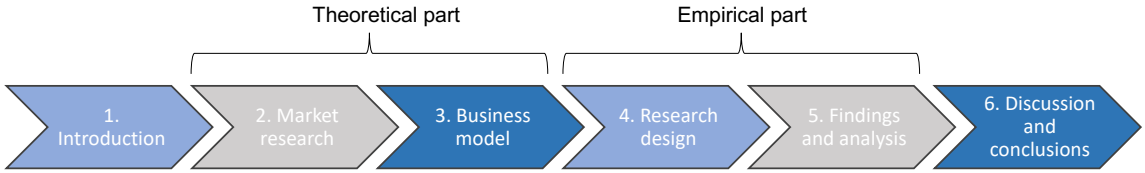

Figure 2 Structure of the study

From the fourth chapter begins the empirical part. The fourth chapter introduces the methods used, case selection, data collection and data analysis. The fifth chapter focuses on findings. It begins with market analysis that is done by utilizing the Five Forces. Then the findings from the interviews are discussed and analyzed. Finally, the sixth chapter concludes the research.

2 Market research

This chapter focuses on presenting Porter's Five Forces and previous literature about it. In this research it is crucial to understand the target market and its features. Five Forces has been chosen to be analysis tool because with it it's possible to get comprehensive understanding about the industry. That is necessary in order to achieve product-market fit. After Five Forces this chapter presents product-market fit. Finally, the importance of customer acquisition and partnership is introduced.

2.1 Porter's Five Forces

Five Forces from Michael E. Porter was published in 1979 in Harvard Business Review. It is a model that describes the forces that shape the industry, and it helps managers to see competition as widely as it truly occurs. Often competition is seen only from direct competitors. To be able to create long-term profitability and effective strategy it is necessary to understand the competitive arena and parties in it. Five competitive forces introduced by Porter are established rivals, customers, suppliers, new players and substitutes. (Porter 2008) Figure 3 below illustrates the forces.

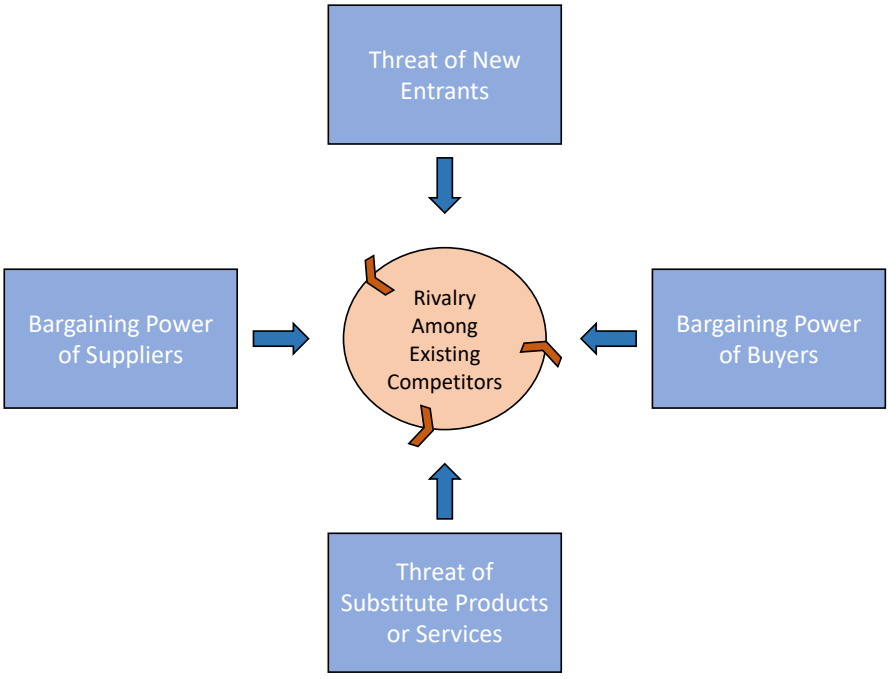

Figure 3 Porter's Five Forces, adopted from Porter (2008)

The most familiar form of competing is rivalry among existing competitors. The ways of competing are price discounts, new products, advertising, and improvements in services. Rivalry between companies can be divided according to its intensity and competing basis. Competition is usually intensive when there are multiple competitors, or they are approximately same size and have equal amount of power. When the industry growth is slow there is intensive rivalry. High exit barriers are one thing increasing intensity of rivalry. When the leadership is the goal of companies, and they are committed to business the competition intensity increases. What affects the rivalry in addition to intensity of competition is dimensions where the companies are competing and whether they compete in same or different dimensions. Competition in prices is easy to see and that leads often to decrease of profits when companies align their prices with their competitors. Other possible dimensions to compete are for example delivery time, product features and support services. Competition in these kinds of dimensions can lead to increase of profits because customers get more value which leads to increase of prices. When competing companies are using different dimensions the competition can actually increase their profitability. They are serving different customer segments and it means that there are more customer groups whose needs are met and that develops and widens the industry. (Porter 2008)

Another competitive force is bargaining power of buyers. When buyers have bargaining power, they can force decrease of the prices and require better quality of products and services. Usually when there are only few buyers, or one buys significant volume of products the customer has negotiating power. (Porter 2008) As the buyers' means of negotiation get stronger and persuasive, the earnings of the industry get lower (Hungenberg 2014). Also, when the products are quite standard buyers can choose the vendor and when there are no switching costs it is easy. Sometimes when the profit of vendor increases too much, buyers can threaten to produce the product themselves. (Porter 2008)

The next introduced force is bargaining power of suppliers. Power of suppliers can decrease profit of industry. They can do it by increasing prices, offering only limited amount of quality or services and transferring costs to industry participants. The power of suppliers depends on many things. If the industry the suppliers are selling to is less concentrated than suppliers' group, it makes suppliers powerful. Also, if suppliers have many customer groups from different industries it makes them powerful, and they can charge the maximum profits. If

changing supplier creates costs for companies it increases the power of supplier. These kind of switching costs appear when companies have for example aligned their production location near to supplier's facilities or invested in specialized equipment. Suppliers get more bargaining power by offering differentiated products that companies are dependent on. When there are no substitutes available it forces companies to use the same suppliers regardless of their prices. Suppliers have also the possibility of threatening industry participants that they will enter the market themselves if the profit of the companies gets too high. (Porter 2008)

Threat of new entrants forces existing companies to keep their prices low in order to retain the market share. New entrants are eager to gain market share and they have new capacity in use. (Porter 2008) The motivation of new entrants' is the economic success that incumbents have gained (Barney 2011). Incumbents must make investments and stay aware of market situation if they want to compete against new entrants. Market entry barriers define the threat of new entrants. The seven major sources of barriers are supply-side economics of scale, demand-side benefits of scale, customer switching costs, capital requirements, incumbency advantages independent of size, unequal access to distribution channels and restrictive government policy. Market entry barriers favour incumbents compared to new entrants. (Porter 2008)

Substitute means a product or service that has function similar to industry's product. It can be implemented by different means, but it can replace the industry's product. Having high threat of substitutes is harmful for the industry as its profitability decreases and growth potential is limited when the prices cannot increase tremendously. There is a high threat of substitutes if their products are attractive to customers and can serve same or better value than industry's product. It is important not to ignore changes in industry that make it attractive to substitutes. Buyers usually don't have switching costs, or they are low, and that way industry profitability can have huge impacts when the industry is attractive substitutes. (Porter 2008)

2.1.1 Advantages and criticism towards Five Forces

With Porter's Five Forces it is possible to identify the reasons behind the industry's profitability. With the model company can compare itself to other operators in the market and by doing so create an effective and profitable strategy. (Porter 2008) Even though Porter's Five Forces have been recognized as a useful tool for industry analysis it has its critics. (Bruijl 2018) Aktouf (2005, 92) has criticized the framework that it *"justifies and legitimizes three common trends fundamental to the dominant financial capitalism, (a) domination by large organizations, (b) the concentration of capital, and (c) excessive hierarchization centralization"*. The framework has also been criticized for not taking small actors into account (Aktouf 2005). Brandenburg (2002) on the other hand has stated that in many industries large organizations have the control of the industry and Porter's framework focusing on that is making the model realistic. Another thing that the framework has been criticized for is that it is assuming the market structure quite static and not taking strategic alliances into account (Indiatsy 2014; Recklies 2015). What limits the Porter's framework is that value chains of the industries can be oversimplified. One difficulty is that companies have little impact on the five forces and the framework is not linked directly to management's actions. Also, the industry in the model is seen as independent entity and there is no specific relation to 'PEST' factors. (Grundy 2006)

According to Johnson, Scholes & Whittington (2008, 60) the framework is a *"useful starting point for strategic analysis even where profit criteria may not apply"*. In different industries the forces that shape the industry might be various and therefore considering only factors that affect all companies in that particular industry might be wise thing to do (Dälken 2014). There have also been discussions whether the model is still applicable in modern digital and global world. The model doesn't take 'digitalization', 'globalization' and 'deregulation' into account and has been criticized for it because these were some of the factors influencing the change of industry structures in the past decade (Flower 2004; Downes 1997). Even though globalization, digitalization and deregulation affect the markets they don't need to be new forces since they are affecting the existing forces and companies need to take that into account. That makes Five Forces still relevant model, but these new factors need to be taken into account since they have an impact on industry attractiveness and structure. (Dälken 2014) Even though there have been critics about focusing only on large corporations the model has its benefits for SME's as well. According to Bruijl (2018) the framework is useful for SMEs' when they need to find their superior capacities compared to competitors

and establish a competitive advantage. Among many scholars and practitioners Porter's Five Forces is considered as significant and steady framework for organizational competitiveness and balance of power analysis in the industry (Cunningham & Hamey 2012). With the framework managers can analyze the industry and its returns in long term. Framework also highlights market attractiveness and negotiating power as important determinant. (Grundy 2006)

2.1.2 Examples from different industries

A number of industries have been studied through Porter's Five Forces. For example, hotel business (Cheng 2013), emergency medicine (Pines 2006), railway industry (Wellner & Lakotta 2020) and shale gas industry (Yunna & Yisheng 2014). Yunna and Yisheng (2014) have successfully used Porter's Five Forces to analyze shale gas industry in China. They were able to determine the most influential force factors in the industry and create scenarios about future trends. They found out how the competition will change in the future, what are the main barriers even after changes in the industry and what are most probable substitutes. With these findings they were able to form suggestions for the industry about future actions. (Yunna & Yisheng 2014) Wellner and Lakotta (2020) used Porter's framework to analyze German railway industry. In their research they extended the original Five Forces framework by adding the role of governmental interventions and complementary goods to the analysis to get an updated model. What they found out was that power of buyers influences the profitability remarkably. Also, the strong economies of scale effect and cost advantages of incumbents are affecting threat of entry. Main finding however is that the profitability in German railway industry is in a low level. (Wellner & Lakotta 2020) Pines (2006) used Five Forces to research Emergency Departments' (ED) role in health care system. He was able to determine that suppliers have significant role in the industry because drugs have an important role and nursing shortage was worsening. Also, huge entry barriers, such as costs of establishing an emergency care centre and education, to industry were identified. Buyers' bargaining power over individual ED is high because they are usually big companies such as insurance companies and corporations and even government. Threat of substitution and rivalry in the industry is high as well. These identified features of the industry make its economic position very insecure. By utilizing Five Forces framework, it was possible to identify these factors and create suggestions to improve market position. (Pines 2006)

Five Forces has been successfully utilized in many industries to create a critical analysis about the shaping factors and situation in the industry. It hasn't been previously used for cleantech product in a maritime industry and therefore it is interesting and reasoned model for this research. The aim of this research is to create an entry strategy and identify product-market fit. With Five Forces it is possible to get knowledge about the industry which is important when identifying product-market fit and creating a strategy.

2.2 Product-market fit

Previously product development has been very product-centric which has caused multiple uncertainties such as resource allocation and financing of the product when the potential market hasn't been evaluated before the development of product. To avoid these issues companies have started to focus more on customers already in development phase which have led to product development process to be more 'building and evaluating' of products. (Blank & Dorf 2012) In customer-centric development companies create a minimum viable product (MVP), which is a test product with minimum number of features needed to test the concept and product. MVP is then tested with potential customers before further development to find the right direction of development and avoid failures. (Eisenmann, Ries and Dillard 2012; Edison 2015) Product-market fit means that the product fulfils target market's needs which is a goal when launching a new product. The better the fit is the more willing the customers are to pay for it. (Fitzpatrick 2010) Even though MVPs are created to find out customers' needs startups often fail to progress their MVP to product-market fit effectively and efficiently (Dennehy, Kasraian, O'Raghallaigh & Conboy 2016). It has been noticed in various studies that with new products the failure often is caused by lack of fit between product features and customer needs (Rothwell, Freeman, Horley, Jervis, Robertson & Townsend 1974). The fit can be improved over the time. One option is to add personalized features for different customers, as not all want the exact same product, and that way improve the fit and increase sales. (Fitzpatrick 2010)

Product-market fit, and MVP are concepts that are often linked with lean startup. In lean startup the key thing is to find out product-market fit through MVP before scaling up the business. That often requires pivoting which means a major change in company's direction. What has been noticed about cleantech industry is that pivoting is notably harder than for example in field of web-based startups. In cleantech industry development of product

requires considerable amount of time and money before getting an MVP and finding out whether it is working or is there product-market fit for it. (Nobel 2011)

According to Feinleib (2012) before the company has found its product-market fit it should completely focus on finding that and put efforts on it. Once the product-market fit has been found the company can start scaling up. The road to product-market fit differs among the companies and some find it right away, like Facebook for example, as for some it takes longer time and resources, or they may never find it. For startups the biggest challenge is to find the fit before running out of resources (Fagerholm, Sanchez Guinea, Mäenpää & Münich 2014). Feinleib (2012) has listed reasons why some startups never find the fit. One reason is that companies focus on building the product and use time and effort to that, but they don't collect customer feedback which leads to unsatisfied customers. In startups entrepreneurs have such a strong confidence about their product that they see collecting customer feedback as waste of time and scarce resources (Hokkanen & Leppänen 2015). Some entrepreneurs refuse to believe the data and adjust their product to fit the market need. For some companies the problem is to reach the customers even though the product is ready and there is need in the market for that product. (Feinleib 2012) Internal issues, such as trying to scale the business before finding the fit is a reason leading some startups to failure (Startup Genome Project 2012). Finding a problem-solution fit is a first step when identifying product-market fit according to Hokkanen and Leppänen (2015) and after finding the fits the venture can be scaled.

2.2.1 Customer acquisition through partnership

When targeting and acquiring customers the company's offering and fit between it and customers should be considered. Finding the "right" customers and being able to keep them effects on company's profitability and business risk. What has been found to be common among companies is that they often communicate marketing programs too broadly to potential customers. They do not properly identify the profitable customers to whom the marketing actions should be targeted. That leads to situation where the new customers are not a good fit with the company and customer acquisition process becomes expensive. (Bolton & Tarasi 2017) It has also been previously noticed that customer acquisition effects on business risk through customer portfolio and its diversity, but it has not been a popular study aspect of CRM (Johnson & Selnes 2005). In B2B environment customer acquisition is more

complex than for B2C companies (Yu & Cai 2007). There are more processes to go through before signing the contract which means that it takes more time (D'Haen & Van den Poel 2013). That is one aspect that highlights the acquisition of right customer from the beginning and that way saving resources.

For startups customer acquisition is important because there are no existing customers (D'Haen & Van den Poel 2013) and resources are limited and therefore should be used wisely. One way to tackle the trouble of finding the right customers is partnership with another company that is already in the desired business. Companies can reduce uncertainty and overcome the limits that scarce internal resources impose by forming alliances between organizations (Casciaro & Piskorski 2005; Pfeffer & Salancik 1978). It has also been noticed that in addition to other benefits such as financial and HR there are network advantages such as reputation, trust and shared goals that company can get from alliances and that are important for development of technology (Musiolik, Markard & Hekkert 2012; Musiolik, Markard, Hekkert & Furrer 2018).

Even though wide network can create strength it should be noted that for startups especially in cleantech industry it may not be possible or even recommendable to collaborate with as many and as diverse partners as possible (Doblinger, Surana & Anadon 2019). Forming an alliance for example with suppliers and customers requires revealing of information on products and technologies and therefore requires broad coordination and commitment from companies (Dyer and Singh, 1998; von Hippel, 1988). Because of these features cleantech startups should carefully consider how many and with whom they are forming alliances. For startups in general forming many alliances to achieve strong diversity in partners is difficult because of limited financial and personnel resources. Therefore, it should be carefully selected that the alliances formed bring the greatest benefits and increase the availability of most critical resources for startup. (Doblinger, Surana & Anadon 2019). These kinds of valuable resources can be for example physical products, technological knowledge and social status (Hillman, Withers & Collins 2009; Lavie and Drori, 2012; Pfeffer and Salancik, 1978). From partnership startup can gain benefits by utilizing partner company's sales channels or winning the partner as a customer. In the development phase of the product partnering with bigger company can reduce the time spent on development and product can be brought to the market for piloting much faster. Also, partner's reputation in foreign market and sales and production structures are things that many startups seek to take advantage of. (Freytag

2019) In the case of mobile BWTS partnership with an existing company could be useful in order to gain more technological knowledge and to utilize their social status for customer acquisition. With the social status and brand reputation of partner company it is possible to increase awareness and interest about the cleantech product among potential customers. According to Blank and Dorf (2012) the selling of MVP should be focused on small customer group called "earlyvangelists". They are a group of early customers who want to be the first ones to solve the problem. If these customers return after sales that can be considered as proof-of-concept. (Ripsas, Schaper & Tröger 2018) Especially in regulation-driven industry such as BWT it is important for the brand to gain awareness and trust from customers in order to succeed. As that industry is still nascent but burdened by regulations it can be easier for customer to rely on bigger and stable companies. For smaller actor with innovative product, it can be easier to break through by utilizing the brand reputation of some bigger player through partnership and that way gain proof-of-concept in the market and attract the right customers.

Downside of startup partnering with existing company is that it may limit startup's future options. If the partner is major player in the industry startup may gain strategic benefits from the partnership such as utilizing existing company's sales channels for the sale of startup's products. Even though it is very valuable benefit for the startup it can limit the selling of startup in the future as revenues are linked with partner and that can cause that direct competitors of the partner company may not be possible buyers. Also, if the partner is major player in the industry, it may affect negatively to the interest of other potential investors. They may have questions about the autonomy of startup and possibilities to maximize the return of investment which can affect their investment decision. Therefore, strategic partnerships should always be carefully considered. Usually, the benefits of partnerships for startups are quite clear but the costs are less obvious and therefore much more challenging to discover. (Freytag 2019)

3 Business model

Business model as a concept has been widely researched after 1990s (DaSilva & Trkman 2014). After the information and communication technologies developed and became more common the use of term business model gained popularity among different groups such as marketing, management, banking and ICT and it was linked with business plan, business strategy, value creation and globalization to name few (Ghaziani & Ventresca 2005). Even though there is large number of research about business model as a concept there has still been uncertainty about its definition and that have led to renowned scholars questioning whether it even adds value to management literature. Nowadays the number of business possibilities is enormous and the ways of making business have evolved. Along with development of business world the term business model has also found its place in academic literature. Resources can be seen as one core of business model which together with transactions create value for customers and company. (DaSilva & Trkman 2014)

Business model can be one way to compete in the market and it can create a competitive advantage (Casadesus-Masanell & Ricart 2010; Markides & Charitou 2004). Business models are important to study because company's possibilities for value creation and value capture are affected by it (Amit & Zott 2001). It has been studied that companies that are financial outperformers put twice the attention to business model innovation compared to underperformers (IBM 2006). With very different business models it is possible that companies offer solution to same customer needs and have alike product-market strategies (Zott & Amit 2008). Business model can be referred to be a *"Hypothesis about what customers want, and how an enterprise can best meet those needs, and get paid for doing so"* (Teece 2007, 1329). Business model is focusing on value creation for customers (Chesbrough & Rosenbloom 2002; Mansfield & Fourie 2004). It is a summary of value proposition's essential details and company's ways of creating value to customers (Seddon, Lewis, Freeman & Shanks 2004).

As mentioned above, in previous research has been identified that business model can create a competitive advantage (Casadesus-Masanell & Ricart 2010; Markides & Charitou 2004) and financial outperformers put more effort on business model innovation compared to underperformers (IBM 2006). In this research the aim is to create an entry strategy for a

cleantech innovation. Deciding the business model is part of entry strategy and to be able to create profitable business the business model and entry strategy should be well planned. With carefully planned business model that matches with the customer needs it is possible to create fruitful customer relationship and gain profits.

3.1 Product-service system

Product-service system (PSS) and its development is strongly linked with sustainability. As the population is increasing and decrease of consumption is complicated the focus has been on 'dematerialising' the economy. The aim has been to create products and services that would lower the environmental impact while still meet the customer needs. Concept of product-services has been suggested to be the solution for dematerialisation when consumers would use more services than products. One way to define PSS is that it is a competitive system that includes products, services, supporting networks and infrastructure while meets the customer needs and reduces the environmental burden compared to traditional business models. (Mont 2002) Goedkoop, van Halen, te Riele & Rommens (1999, 20) have given one of the most famous definition to PSS and defines it as *"a marketable set of products and services capable of jointly fulfilling a user's need"*.

There are multiple trends that have affected and enhanced the development of PSS. A shift from throw-away culture to repairing and change towards 'leasing society' have had a positive impact on development of PSS. Consumers' attitude change from sales to service orientation has positively affected PSS and the idea that services can be the substitutions to the goods. There is increasing popularity that instead of selling the product itself the use of product is sold which has been positively affecting the development of PSS. (Mont 2002) Even though sustainability has been major influencer of PSS it is no longer the main aspect. The focus has shifted now more on strategic value of PSS. (Annarelli, Battistella & Nonino 2016)

One feature of PSS is that higher level of involvement is required from customers and producers. Customers need to be trained and educated for the solution and producers have more responsibility of the full life cycle of the product. The intensity of the relationship between customer and PS provider is increasing when the focus is shifting from product to

process (Mathieu 2001). There are no strict orders about the contents of PSS and it can be any kind of combination of products and services. Customers have important role in PSS and by having close relationships with them companies can get valuable insights about consumers' preferences and buying habits. PSS can decrease environmental impact when intensity of use can be increased with services and total number of products can be lower if products are shared. (Mont 2002)

PSS can be divided into three categories as can be seen in the Figure 4 below. These categories are product-oriented, use-oriented and result-oriented services (Tukker 2004). In product-oriented PSS the focus is on the product and that is the main offering of the company but there are some extra services added (Annarelli et al. 2016). Tukker (2004) divides the offered services to two groups that are product-related services and advice, training and consulting services. Product-related services include services such as maintenance, spare parts supply, refurbishing etc. that supplier offers to customer in order to manage the product. Advice, training and consulting services can help the customer to use the product in the most efficient way. Help desk and training for product use are that kind services. (Gaiardelli, Resta, Martinez, Pinto & Albores 2014) In use-oriented PSS product provider sells the use of the product and ownership of the product doesn't change. Product can be leased, rented, shared or pooled. Contracts can be made for short-term or long-term where long-term contracts usually require closer relationship and short-term contracts are transaction-based. (Gaiardelli et al. 2014) In result-oriented PSS provider and client agree about the result and they may have few predetermined conditions. (Annarelli et al. 2016) Result-oriented services can be divided to pay-per-use, outsourcing and functional-result services (Tukker 2004). In pay-per-use and outsourcing services customer has the right to decide the use of product and has responsibility of activities. In functional-result services supplier has totally free hands in delivering the result. (Gaiardelli et al. 2014) When the company providing PS is offering activities and services that customers used to take care of themselves the PS provider's risk increases (Tukker & Tischner 2005). That risk needs to be included in the price. Adding services to company's offering also affects the pricing that can be based on usage, performance and results rather than traditional "transaction based" pricing. (Sawhney 2006)

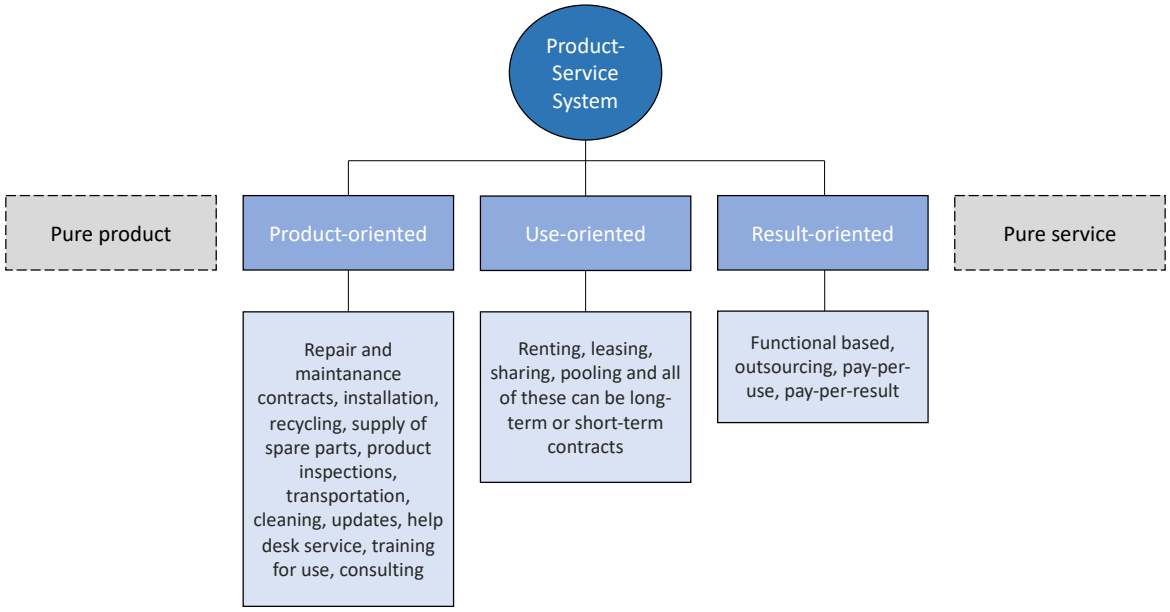

Figure 4 Illustration of PSS and its forms (Tukker and Tischner 2005) and possible offerings (Gaiardelli et al. 2014)

Benefits that manufacturing companies can gain from adding services to their selection are additional value to the product such as refurbishing, improved customer relationships, increased total value for customers and innovation-based growth strategy in mature industry. With PSS customer needs can be better served when the offered services prolong the life of the product, and its functions can be extended. (Mont 2002) From customer's point of view, it improves efficiency in consumption phase (Annarelli et al. 2016). Through recycling and reuse the materials are useful after its life cycle which creates value for customers and manufacturers. (Mont 2002) A concept that is strongly linked with customer engagement is "locking-in customers" (Vandermerwe & Rada 1988). That is a benefit of PSS where the idea is to get the strongest relationships with the customers that are the most profitable instead of large number of customers (Wise & Baumgartner 1999). One important benefit that has been recognized is differentiation (Baines, Lightfoot, Steve, Neely, Greenough, Peppard, Roy, Shehab, Braganza, Tiwari, Alcock, Angus, Bastl, Cousens, Irving, Johnson, Kingston, Lockett, Martinez, Michele, Tranfield, Walton & Wilson 2007).

There are also some barriers that have been recognized for PSS. Cultural shift is the main barrier and that concerns both the producers and customers (Mont 2006). Producers need to be able to change their organizational culture and idea about business value. With customers the challenge is to get them to change their consumption habits especially with use-

oriented and result-oriented PSSs. (Mont 2002; Ceschin and Vezzoli 2010) To be able to create a win-win-win situation for supplier-producer-customer chain it is important that stakeholders accept the PSS. Cooperation and commitment to the model are key things when developing the model and creating an effective strategy. (Annarelli et al. 2016) One barrier to overcome is that personnel need education especially technical and service personnel and retailers. For retailers the education and information systems are extremely important because they need to be able to solve the problems that customers may be facing. (Kuo, Ma, Huang, Allen Hu & Huang 2010) Educating personnel or hiring skilled personnel creates costs and may lengthen the time to get to the market (Ceschin & Vezzoli 2010).

For a company PSS can create competitive advantage and increase its position in the market as the business model is difficult to imitate (Annarelli et al. 2016). The most popular drivers towards PSS are "building relationships with customers" and "cooperating with authorities" (Mont & Lindqvist 2003; Hannon, Foxon & Gale 2015). Other driving factors can be "extending existing offer", "reducing environmental cost" and "best utilisation of assets" to name few (Mont 2004; Centenera & Hasan 2014). In the project that this thesis is focusing it is important to create good relationships with customers and fulfil their needs. Also, the product is new and complex cleantech innovation which may mean that potential customers wish some services in addition to the product. Therefore, PSS presumably suitable option for business model.

3.2 PSS in maritime industry

In maritime industry the business model has been usually very traditional, and focus has been on selling the products or services. According to Rauhala (2021) products are usually fully owned in maritime companies and renting and leasing are not very common. Shipbuilders have been focusing on cost reduction and minimising the selling price for a long time as the way of gaining the competitive advantage. Now competing with low price has become difficult and there has been an idea of changing the focus to life cycle cost optimisation as a source of competitive advantage. It has been considered promising that in the maritime industry there would be "worry free" packages where with a fixed fee it would be possible to get after sales services. That would reduce overall costs when administration costs would be lower, there would be economies of scale effect and customer's risk would be lower. (Norden, Hribernik, Ghrairi, Thoben & Fuggini 2013) In previous literature it has been

noticed that in maritime industry, especially when creating a new digital PSS, cost estimation is one of the main determinants of PSS adoption. With that it is possible for stakeholders to affect internal political environment and get support from management when there is data and insights behind and then finally get towards PSS implementation. (Pagoropoulos, Maier & McAloone 2017) What has been noticed from PSS in maritime industry before is that the operations are global, and vessels can be around the world. That means that it is crucial to be able to service customer's vessels wherever they are or otherwise customers may not be willing to commit. One way to service customers in other countries is to create network and rely on other companies and their infrastructure. (Andersen, McAloone & Garcia i Mateu 2013)

Pagoropoulos, Kjaer & McAloone (2016) have conducted research about unsuccessful service offerings in shipping industry. What they found out to be the most important reasons for failure were lack of synergy between customer and manufacturer focus and capabilities and other reason was inability to deliver on the customer's expectations. Even though the proposed offering had potential for value creation it wasn't adopted by customers because they didn't see it useful, and it would have caused extra costs compared to stand-alone product alternative. In this case that Pagoropoulos et al. (2016) were researching the company failed to lower the risk of customer which has been recognized to be important element with servitized offerings. Customers were disappointed and their expectations were not met as warranty terms were not comprehensive or applicable. Lack of transparency in this case was also one of the main reasons that led to failure. In service business when the costs depend on realized services it is crucial that customers can follow the process. (Pagoropoulos, Kjaer & McAloone 2016)

In previous research was found that port service providers are more interested in services regarding BWTS along the product life cycle compared to shipping companies. Shipping companies were only interested in maintenance in addition to purchase whereas installation and disposal were mentioned to be important to port service providers besides purchase and maintenance. Although it was found out that technical support and spare parts were considered of great worth to both groups through product life cycle. For some companies, dependency on supplier's business was considered challenging and they rather provide some operations in-house. (Rauhala 2021)

3.3 Theory conclusion

At this point the theories of this research has been presented. As mentioned before Porter's Five Forces is a tool to get deep and comprehensive understanding of the existing market environment (Porter 2008). In this research it is used to make market research and to understand the business environment in order to create an effective market entry strategy. With that framework the focus is on external factors that are important to take into account as they are affecting heavily on the implementation of business, but they cannot be affected or changed.

Business model creation is something that the company can design and change by itself. With careful planning it is a way to gain competitive advantage (Casadesus-Masanell & Ricart 2010; Markides & Charitou 2004) and nowadays there are multiple possible combinations of product and services as was mentioned before. In this research business model is representing the internal aspect of market entry strategy planning. By identifying the strengths of the company and the needs of customers business model design can create true value to customers and make operations more efficient to company.

By taking external and internal factors into account it is possible to truly understand the existing business environment and create value to customers. The aim of this research is to identify product-market fit with the aid of these theories focusing on external and internal factors. Only then it is possible to create entry strategy that is successful. This thesis contributes to literature by taking internal and external factors into account in the search of product-market fit. In previous literature there is not at all or very little literature that is focusing on finding product-market fit by using Five Forces and business model theories. This research aims to fill that gap and increase the awareness among entrepreneurs and managers on how to identify the product-market fit and create an entry strategy.

4 Research design

This chapter describes the research design and methodology. In the chapter case selection, data collection, data analysis and reliability and validity of the study will be discussed. A qualitative case study was chosen method for this study and both primary and secondary data were used.

4.1 Methodology

Qualitative research method was chosen because the characteristics of the problem. Qualitative study method is suitable for complex issues where the aim is to understand the phenomena profoundly (Metsämuuronen 2006). In this research the aim is to get in-depth understanding about complex real-world issue and that is why qualitative research method was chosen over quantitative. Maritime industry itself is challenging to understand but with new cleantech product and aim to create solution to environmental issue it becomes even more complicated.

The study was conducted as a case study as the focus is on specific product from particular company that had a demand for market research and entry plan for further product and marketing development. According to Eisenhardt (1989, 534) case study can be defined as *"a research strategy which focuses on understanding the dynamics present within single setting"*. With case study it is possible to achieve deep understanding about the subject (Eisenhardt 1989). Case studies are commonly used in education and especially in business schools. They have been the most aggressive in using learning from cases as a teaching method. (Boisjoly & DeMichiell 1994) According to Yin (1994, 64) case studies are best to use in research projects that are well planned and include the following parts: Overview, Field procedures, Questions, Guide for the report. In case studies the questions are often "how" and "why" questions, and it is researcher's first task to define them. Single case studies are also suitable for cases that are revelatory and where the phenomena have been previously inaccessible. In case studies one of the most important source of information are interviews. (Tellis 1997)

4.2 Case selection

As the goal of this research was gain in-depth understanding of the industry and identify potential customers in order to create entry strategy the interviewees were selected accordingly. Interviewees were representing different organizations so that it was possible to get insights from various perspectives. In a nascent industry that is not yet stable, and changes can be rapid (Shi et al. 2021) it was considered valuable to get as wide perspective as possible. Two interviewees, A and C, were representing two different ports. It was important to get interview from the representatives of ports as they have comprehensive understanding about the companies working in ports as well as contacts to shipping companies. They were also considered as potential customers or partners for mobile BWTS according to previous literature and therefore further research about that possibility was desired. Person B represents port operator and that was also considered as potential customer and therefore interviewed. Port operators are often companies with great resources, and they have knowledge of the industry and atmosphere towards new innovations. Even though BWT is not their core business they have resources to expand if desired. From them it was considered possible to gain valuable insights about the market. Person D represents water distribution and drainage company, and he was interviewed to gain understanding about the potential opportunities outside the BWT industry. With the purification technique used in mobile BWTS there can be opportunities in different industries and the aim with the interview was to get ideas and understanding about those potential business opportunities. Person E that was representing circular economy service company was interviewed because they can be potential customers for BWTS. Even though their all operations are not centralized to ports they have operations and expertise about working there. Their core business focuses on circular economy and therefore they were considered as potential customers or partners.

4.3 Data collection

This research was conducted as qualitative research and the primary data was collected with interviews. With semi-structured interviews it is possible to gather in-depth insights of the subject and it makes the interview situation flexible (Tuomi & Sarajärvi 2003). Interviews were conducted as individual interviews and most of them were made through Teams-calls that were recorded and some were recorded live interviews. Total five interviews were

conducted which was noted to be enough as there weren't emerging any new results. Before the interviews the preliminary structure of the interview was sent to interviewees. It is recommended that interviewees get to know the questions or at least the themes or subject well before the interview in order to get as much information as possible about the subject and interview to succeed (Tuomi & Sarajärvi 2003). In semi-structured interviews there is a theme to follow, and questions can be "what" and "how" questions (Eriksson & Kovalainen 2008). The aim with interviews was to gather valuable information from interviewees as representatives of research group about their opinions considering BWTS. The aim was to also to understand who the potential BWT providers in the ports would be and how the product would fit to the market. Another idea with the interviews was to find out whether there are some other companies in addition to ports and port operators who would be potential customers or business partners. With elite sampling technique chosen interviewees are assumed to have the most valuable information in order to understand the phenomenon (Tuomi & Sarajärvi 2003, 88). To get comprehensive understanding about the industry all interviewees were representing different organizations. As can be seen in Table 1 the interviewees were representing ports, port operator, water distributor and drainage company and circular economy service company. They were all in managing positions in their companies and have deep understanding and experience in their field. Even though companies are operating in different industries, all the companies are significant in their field and business environment. With the broad perspective that was gained from interviewees from different companies it is possible to find the potential customers and understand the industry well enough to create a successful entry strategy.

Table 1 Interviewees

Person	Position	Business area	Interview date	Interview length
A	Head of Sustainable Development	Port	25.4.2022	00:22:02
B	CEO	Port operator	27.4.2022	00:25:21
C	Development Manager	Port	5.5.2022	00:43:59
D	CEO	Water Distribution and Drainage	9.5.2022	00:19:57
E	Development Manager	Circular Economy Service Company	11.5.2022	00:28:29

The interview questions are presented in Appendix 1. These questions were a guideline to follow during the interviews and the order of the questions varied a lot depending on the course of an interview. The main themes were same for all the interviewees, but questions varied a little depending on the company. Main themes can be seen in Figure 5. The aim was not to generalize the information but to gain closer understanding about the subject. Interview lengths presented in the Table 1 above doesn't include the time consumed to introduction of project and interview. Interview lengths varied between 19 and 43 minutes. Interviews were conducted in the turn of April and May in 2022 within three weeks. One of the interviews was live interview whereas others were conducted through Teams-calls because of busy schedules and long distances. All the interviews were conducted in Finnish, recorded, transcribed, and translated into English later.

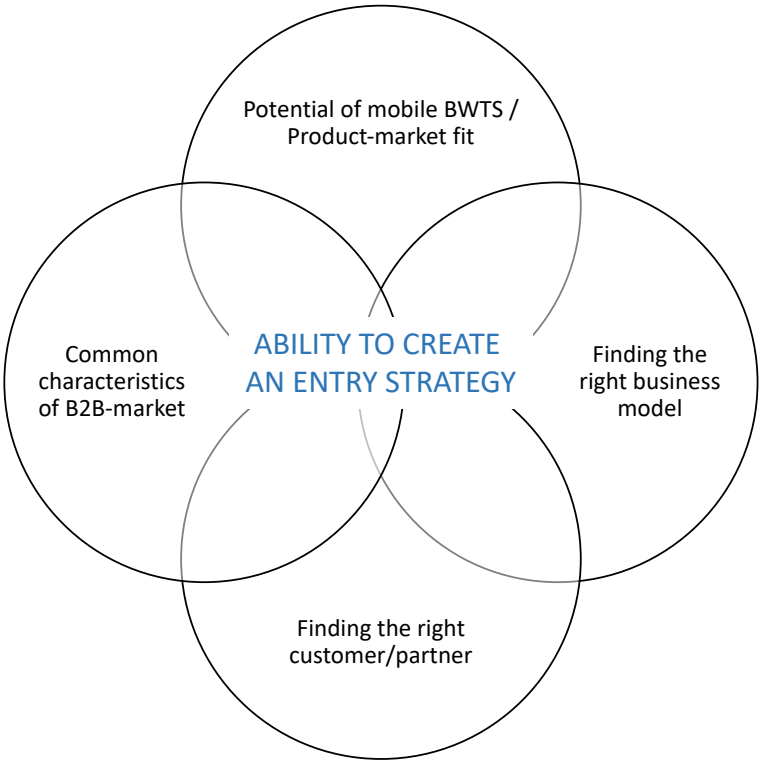

Figure 5 Main themes in the interviews

In addition to data gathered from interviews there is secondary data from variable sources used in the research. For example, data about competitors and potential customers that is collected for the project and also, different statistics from the Internet were useful when analyzing the market. Having multiple different sources of data is useful in case study because with that the reliability and validity of the study can be improved (Yin 2003).

4.4 Data analysis

The chosen analysis method for this study is content analysis. It is considered as flexible analysing method but with content analysis the data is required to be in text form (Cavanagh 1997). There are multiple options for analysis data, and it can be collected from interviews, books, articles, and open-ended questionnaires for example (Klenke, Martin & Wallace 2016). There is no strict definition or procedures in content analysis and even though that makes it flexible method it has probably also limited the use of it (Tesch 1990). With content analysis the aim is *"to provide knowledge and understanding of the phenomenon under study"* (Downe-Wamboldt 1992, 314). The focus is on content of the text and finding contextual meanings of it (Tesch 1990). The language in the text is carefully examined to be able to categorize the text in themes with similar meanings (Weber 1990). Conducting content analysis doesn't require deep theoretical knowledge such as grounded theory -analysis for example (Tuomi & Sarajärvi 2003).

After conducting the interviews, the recordings were transcribed into text by external service as the data must be in text form for content analysis (Cavanagh 1997). Then the text was read through multiple times to get comprehensive understanding and then summarized. Then the selected text was further categorized to themes. With this categorization different themes were better comparable. The aim was to arrange the data to concise and clear form from which reliable conclusions could be made. That is the objective of content analysis. (Tuomi & Sarajärvi 2003)

4.5 Validity and reliability

There has been critics towards qualitative research about not being scientifically punctual enough and having poor reasoning when selecting analysis methods. Also, there has been accusations of not having enough transparency in analytical practices and findings are blamed to be personal opinions of researcher. (Rolfe 2006; Sandelowski 1993) Reliability and validity are commonly used terms in quantitative research but their applicability to qualitative research has been under discussions (Rolfe 2006; Sandelowski 1993; Long, Johnson & Rigour 2000). However, looking from wider perspective these terms can be used to

evaluate qualitative research when validity refers to the cohesion and application of the methods used and the accuracy of the findings reflecting the data and reliability refers to the consistency in used analytical methods (Long et al. 2000). Reliability can also be referred as repeatability of the study and that on the other hand is challenging to achieve with semi-structured interviews (Yin 2009).

According to Yin (2009) validity can be improved by using multiple sources. In this research the primary data was collected through interviews and secondary data was used to support. The interviewees were representing different organizations working in port area and secondary data was collected for market analysis. The aim with this kind of data collecting approach was to secure the comprehensive data coverage and that way improve validity.

To improve the reliability of the research multiple interviews were conducted. All the interviewees were aware of environmental issues in maritime industry and regulations regarding BWTS. Methodology of this research was well planned and therefore possible to conduct again. The database of this study is strong as all the interviews were recorded and transcribed and that supports the repeatability of this research. The study is limited to five interviews and the subject is constantly evolving which means that the opinions of interviewees can change as time passes.

5 Findings and analysis

In this part findings of the empirical research will be discussed and analyzed. This chapter is divided to main themes of this research. At first is a chapter that describes the BWTS industry and findings from secondary data. Then following parts are focusing on findings from the interviews and those are categorized according to interview themes. It begins by describing the common characteristics of B2B-market then the potential of the mobile BWTS in the market is discussed. After that the findings are focusing on what would be the best PSS for the product according to interviews and finally potential market entry strategy is finishing this chapter.

5.1 BWTS industry analysis

This part includes critical market analysis of the BWTS industry by utilizing Porter's Five Forces. The analysis is based on secondary data from the Internet and project sources. This chapter is divided according to Five Forces and it begins with analysis of existing competition.

5.1.1 Competition

Competition in BWTS industry is already high and there are multiple companies globally producing them. In Finland Wärtsilä Corporation is probably the most well-known company that produces BWTSs and it is also globally one of the major players. Some other major players in the industry are Damen Shipyards Group, ALFA LAVAL, atg Evoqua, GenSys GmbH and Evac to name few. It has been estimated that global BWTS market will reach value 9 Bn USD by 2030. Currently the most competition is in North America and Europe but Asia Pacific will potentially become the most profitable market during that time. The market is driven by the demand for ecofriendly treatment systems. (Global Banking & Finance Review 2020) At the moment the main technologies used in ballast water treatment are filtration systems, chemical disinfection, UV treatment, deoxygenation treatment, heat, acoustic, electric pulse systems and magnetic field treatment. It is common to use two or more technologies together. (Raunek 2021) Chemical-free BWTSs are expected to

increase popularity among companies because of their environment-friendly and cost-effective nature and effective way of treating invasive species (Fact.MR 2022). That direction of development benefits our product and will help us compete in the market as we can respond to these needs.

Bawat is a Danish company that utilizes waste heat from ship's engine to purify ballast water and it is low-cost technology. Their system doesn't use filters, chemicals or UV lamps and it can be used in-voyage which means that it takes less time, and it doesn't disrupt cargo handing operations. (Global Banking & Finance Review 2020) Bawat uses different purification technique compared to our product, but it can be seen as one of the main competitors for our product as both are low-cost and ecofriendly. Bawat has also mobile BWTS option that can be used in ports (Bawat 2022) which is answering to same market demand and competing directly with our product. This research is focusing on Finnish market, but the aim is to head towards global market which makes it relevant to be aware of similar products in the market. Competition in BWTS market among Finnish companies is not yet intense. In 2017, according to Lloyd's Register (2017) listing of available ballast water treatment systems, the only Finnish system was Aquarius (UV & EC) from Wärtsilä. What affects the intensity of rivalry is whether the competing companies are about same size (Porter 2008). In Finnish market Wärtsilä is globally major player and large company whereas other companies are smaller challengers. That reduces the competition between the companies as they have different resources, and they target different customers. With mobile BWTS the advantage in the Finnish market is the mobility which makes ports and port operators potential customers. That widens the industry as there are more customer groups to serve and reduces the rivalry among the companies when they are serving different customer groups.

In global market mergers, acquisitions and partnerships are ways of gaining advantages in tough competition. Other strategies to compete in rivalry are technological advancements and expansion strategies which are predicted to remain as key strategies. (Global Banking & Finance Review 2020) For our mobile BWTS acquisition or partnership with a company that is already in the business would be potential entry strategy. A company that operates in the field and has experience could assist on finding the right customers and deciding on how to implement the production. With insider's knowledge it would be possible to gain valuable insights from the industry and decide how to differentiate our product from

competitors and what are the most effective marketing actions to promote the product. They could also have some other ideas how to utilize the water purification technique in other fields.

5.1.2 Bargaining Power of Suppliers

Currently suppliers have high bargaining power because BWTS producers are dependent on their products. If suppliers are not heavily dependent on industry, they can charge maximum profits (Porter 2008). Suppliers have high influence on producers' profits as they can increase prices and during the inflation almost all costs have risen. It has been noticed that between May 2020 and May 2021 measured with Producer Price Index the commodity prices have increased by 19 percent (Helper & Soltas 2021). During Covid-19 problems with supply chains have caused delays and importance of reliable suppliers have become priority. In China there have still been lockdowns which means that operations have been slower because of shortages in labor force and because manufacturing and warehouses have been closed there is a decrease in availability of goods. Also, container shortage has increased the prices tremendously and compared to May 2021 global freight rates have increased 105%. (Freightos 2022) The war in Ukraine has major impact on shipping and freights as well. Shipping routes have been cut off by Russian forces, logistic companies are interrupting their services and prices in air freight are increasing tremendously. Airlines must take longer routes because of avoiding Russian airspace which increases costs and takes more time. Record high oil prices reflects to already high transportation costs. (Tan 2022)

All these recent changes have gotten companies to pay attention to their supply chains and supplier groups. Important aspects when considering suppliers is nowadays geographical location. To have suppliers as close as possible reduces time consumed on transportation and at the same it is less emissions and reduces the burden caused to the environment. Complex supply chains have more challenges and possibilities for mistakes and for that companies have started to pay attention and consider other options. To have fewer suppliers gives the possibility to create closer relationships with them and to monitor the ethicality of production and actions. The aim to find suppliers nearby and centralize production to few reliable suppliers increases the bargaining power of suppliers. Customer companies are willing to pay for ethically produced products that are nearby. Suppliers have power to ask

the price they want and even increase prices. If the production is customized that increases the bargaining power even more when customer faces high switching costs. In Finland and nearby countries there is limited number of suppliers for the parts that are needed to make the mobile BWTS and that increases the power of suppliers. In current world situation when transportation of parts is expensive and takes a lot of time the negotiation power of nearby suppliers' is high. Also, environmental awareness and willingness to improve working conditions of employees and buy ethically produced products favors suppliers in Europe.

5.1.3 Bargaining Power of Buyers

If there are only few buyers, the group of buyers is very concentrated, or the purchases are relatively large percentage of the seller's sales the power of buyer is high (Porter 1998). In this situation as there is limited number of buyers in Finnish market it increases the bargaining power of buyers. The mobile BWTS is a significant purchase for both buyer and seller. That means that even though there wouldn't be large volumes the purchase of the product is so significant that it increases the negotiating power of buyer. If the product is standard and it is easy for customers to find other suppliers with similar product it increases the bargaining power of buyers (Porter 1998). In the case of mobile BWTS in Finnish market the product is not standard and there are no alternative suppliers for it in the market. That is advantage for product supplier when there is less power for buyers. Customers who want port-based solution for BWM have no other possible suppliers and that decreases their bargaining power. In the future as the industry is evolving the situation will change. There are already similar products in the global market and probably in few years they will be available in Finnish market as well. That will increase the bargaining power of buyers and therefore it is important to get to the market now when there is possibility to be the first one.

5.1.4 Threat of Substitutes

Substitutes are difficult to notice and prepare for the threat because they are often something very different than industry's product and therefore easily overlooked. Substitute is something that has different means of fulfilling customers' needs than industry's product, but it serves the same needs. (Porter 2008) When the BWTS market is analyzed globally there are some similar products in the market that can fulfill the same need. As was mentioned earlier Bawat has similar product to this one (Bawat 2022). In Finnish market there

are fewer competitors and at the moment there are no mobile port-based options available. Substitutes can be considered as a lot wider group and some completely different products can be substitutes if they fulfill the same need. Substitute for mobile port-based BWTS in current market can be ship-based BWTS. Those are installed to ships and their advantage is that ships can manage their ballast water by themselves, and it doesn't disturb their operations in ports. They are currently more popular option, but they have their disadvantages. BWTSs that are installed to ships require a lot of space which away from personnel facilities or cargo. They are also expensive and require a lot of capital. These facts support the idea of port-based BWTS. As the industry evolves there will probably become more alternative solutions for BWM. It might not even be any device but new practices. For example, video rental outlets have almost completely disappeared since Netflix and YouTube became popular (Porter 2008). That demonstrates well the change that has happened in practices in a short period after the substitutes came to market. In nascent industries drivers for market are innovative products and services (Zuzul & Tripsas 2020). A nascent feature of BWT industry increases the threat of substitutes as many companies aim to create new innovations to market that can replace the earlier solutions. In this kind of industry there is bigger threat of substitutes as completely new perspectives to the issue can arise which can change the market completely.

5.1.5 Threat of New Entrants

If the entry barriers to the industry are high the threat of new entrants is lower. High entry barriers favor incumbents compared to new entrants. One entry barrier is need for large investments to be able to compete. (Porter 2008) In this industry market entry barriers are high because there needs to be high number of resources invested to create the prototype. In this case when the capital is needed for research and development which is uncoverable expense and therefore hard to finance the barrier is extra high. After that need for high investments decreases but producing the product is still expensive. New entrants are interested in gaining market share (Porter 2008). After investing heavily in the industry new entrants are motivated to get their share of the market. In this research situation the mobile BWTS will be new entrant in the market and incumbents should notice that. In market where entry barriers are high the threat of new entrants is usually low. Looking from incumbents' perspective all new entrants that have overcome the entry barriers should be taken seriously and their actions should be observed in order to stay aware of market situation and competing in it. According to Global Banking & Finance Review (2020) BWTS market is

expected to be worth 9 Bn USD by 2030 which means that there is high threat of new entrants as industry is growing. After market entry the company selling mobile BWTS solution should stay awake about the market situation as new inventions often draw attention and other companies may want to copy the idea.

5.2 Common characteristics of market environment for port-based BWTS

In the beginning of interviews the interviewees were asked to describe their business. The aim with this question was to get the idea how their business operates in practice and to get to know whether the mobile BWTS would be suitable for their selection from interviewer's perspective. The idea was also to understand better complex port environment and business there. What was found out is that most companies are focusing on only few core competencies, and they are determined to keep it that way. Especially in ports companies have a very small part of all port operations, and they are only focusing on that. As person A said, *"The strength of the port is that there are really a lot of companies in the port area that specialize in something and that makes the port working".* Also, person B who represents port operator stressed that they are not interested in expanding their business. They had previously had also some other businesses but now they want to get rid of all the *"extras"* and focus on core business. These comments can also be considered as very representational for nascent industry as BWT is. It is hard to convince companies to take the product into their service selection when their business has been profitable already before and there is no guarantee about the success of the new product. It requires real interest towards environmental issues from the company or the desire to be the first one in the market to offer the solution in order to take new innovation that is working in nascent industry into the service selection. In an industry that is more stable it can be easier to offer new innovation to potential customers when they already have better idea and knowledge about the industry.

Person C described port to be something like industrial park. Port has its own responsibilities and obligations, but they are not *"omnipotent body"*. Companies in ports are all working in their own field but following their common rules. Necessarily there is nothing connecting these companies together besides working in same port. Not having any superior company or parent company makes the industry and its practices complex to understand. The fact

that ports are functional entities when the tasks are taken care by different organizations and there is no supervising or organizing company is what makes it amazing. The role of ports is to offer facilities for other companies to make business. They are taking care of building, maintenance, and ownership of basic port infrastructure according to person A. Person C added that role of ports is *"advisory"*. They are willing to help new companies to create contacts for example and advice on common practices and rules explained person C. When there are new companies in port area port is willing to let everyone know about them in their communication channel, but they are very strict about not marketing anyone too much as actions must be equal to every company.

Interesting information that person A pointed out is that ports don't require as much profit as other companies. *"Port is or at least we are but I think many ports are in same or similar position as we that the owner doesn't have the same high return requirements as what the private sector has in general. So, it means that the margin can be lower, and the business case can be profitable with lower discount rate which of course helps"*. That is a feature that supports the idea of port being BWT service provider.

Something that is very common in this industry is subcontracting. *"Subcontracting is widely used for maintenance and repair, for transportation and stevedoring"*, describes person B from port operator's perspective. Person C also confirms that they are using a lot of subcontracting especially for maintenance and infrastructure. As the workload varies and number of employees is not standard then subcontracting is used to cover the demand says person E. Subcontracting creates possibilities for our product when there are more potential ways to arrange the service such as partnership with some other company.

5.3 Potential of mobile BWTS in the market and product-market fit

The second part of the interviews was focusing on product-market fit and how the interviewees experience the potential of the product. With this part the aim was to gather insights from the companies already working in the industry and ports. They know the daily life in the field and how the operations work. They have the recent knowledge about the regulations and atmosphere towards ballast water treatment. One major goal of this research was to identify product-market fit and that was the aim with this section. In the Table 2 below

gathers the observations about the advantages and challenges of the product that arose from the interviews.

Table 2 Advantages and challenges of mobile BWTS noticed from the interviews

POTENTIAL OF MOBILE BWTS	
Advantages	*Challenges*
• High potential • Growing demand • Potential in Saimaa area • Increasing attention towards environmental issues • Regulations • Improves brand image • Possibilites in other industries	• Challenging customer base • Environmental issues are not core business • Verifiability of BWM • Availability of service in other ports • Needs to be reliable and effortless to use and cannot cause any delays • Demand • Pricing • Capacity of the device

When the interviewees were asked how they experience the potential of mobile BWTS there were some differences in the answers but mainly the atmosphere towards the product was that it has potential. The best potential according to person B for the product would be in Saimaa area: *"There I would have seen possibilities in a way to take this forward because it is not rational that every port would start to invest in it and do it, and there this kind of mobile would have been quite convenient in my opinion".* At the moment though there is not much traffic because of the war between Russia and Ukraine. Person E described the potential of the product as *"growing"*. He said that: *"the general state of mind where we are heading is quite clear that the good state of water systems is wanted to be guaranteed and I would say that the market potential [of the product] is growing"*. According to him alien species are a real threat especially to Baltic Sea which is more closed and sensitive ecosystem. He sees that there will be demand for the product as people are starting to pay more and more attention to these issues.

After analyzing the potential of product, the interviewees were asked to describe issues that may hinder the market potential. Person C representing port was able to give a comprehensive answer and point out aspects that she considered causing uncertainty to the potential of the product. She pointed out that the regulations regarding environment are going to

tighten in following years and forecasting those would be beneficial. In the interviews regulations was mentioned by many to be controlling the need. Person A described the customer base to be *"challenging"* and without any compulsion they tend to go *"from where the fence is the lowest".* Also, person E pointed out the necessity of regulations. He analyzed that if it is still allowed to unload the untreated ballast water to open seas while treating the water increases the costs it will definitely impact on customer volume. According to him sustainability issues are still second after the core business and only few frontrunner companies are ready to increase costs in order to protect the environment. Person C was also considering the verifiability of ballast water management to authorities from ships' perspective. When there is no BWTS on board there needs to be clear contract between the ship and BWT service provider in order to be able to prove to authorities that ballast water is managed. BWTS needs to be approved by authorities such as IMO so that contracts can be made. There was also concern about the availability of the service. It should be guaranteed that the service is available in other ports outside Finland as well, pondered person C.

Another thing that was raising conversation was practical implementation of the service. *"It should be fairly reliable and effortless to use. If you think that ballast water treatment system in ship works almost by itself the system on shore should work about as well"* described person C. According to her the time spent on port is minimized by ships and the most important thing with this kind of service is not to cause any delays. Especially with current fuel prices ships aim to spend as little time as possible in ports so that they could reduce speed on their way to next port and save in fuel consumption. Person E also said that *"if the service delays or complicates the operational action while increasing costs it is a prerequisite and practical challenge that should be solved"*. Persons A and C were considered about the connection between the BWTS and ships. *"Currently when ship empties the ballast water to the sea it has those outlets in the hull of the ship from where those waters get to the sea so how do you connect the device like this to various different ships?"* was something that person C was wondering. Person D on the other hand thought that capacity of container sized device wouldn't be enough to treat such large amount of water.

Person B named demand and pricing as challenges. Person A was also curious about the price and shipping companies' willingness to pay for that service. Person B highlighted that it should be studied that what types of ships visit the ports and what is the need for ballast water treatment in ports. With different ships the needs vary, and in some ports, there visit

more ships with the need for BW treatment. Person C also commented that there are different kinds of ships operating and for some ships the need for BW treatment is bigger. *"It could be a good idea for some existing older small ships that have difficulties installing a BWTS in existing engine rooms or for whom it would be quite an effort"*, she analyzed. For old and small ships installing BWTS to ship would be quite remarkable investment and as the value of the ship is not that high anymore it wouldn't be rational to invest heavily on it anymore. That makes them a potential customer group for ballast water treatment in ports that should be noticed. Pricing was another thing that person B paid attention. Even though there are regulations obligating ships towards ballast water management the pricing should still be competitive. Person B thought that ships won't leave anything to ports where it is very expensive, but they rather carry it to other port where the prices are lower. According to person A most of the transport in their port is coming from ports nearby and they have already conducted a survey with Port of Tallinn about ballast water and according to that ballast water between these ports doesn't need to be treated. This also emphasizes the importance of studying more closely which are the ports where potential BWTS customers visit the most. Another thing that person A was concerned was that ports are geographically such wide areas that it can cause difficulties in operating with BWTS. Although when the mobile BWTS was described more in detail he wasn't that concerned about the mobility anymore. Person A experienced size of container to be convenient: *"Yeah so the size of a container doesn't sound too heavy on the contrary and if it really is inside the container then it would be easy to move"*.

According to person A if all the technical questions that he came up with are solved there are no entry barriers for the product in the market. If the product creates some other value such as environmental protection in this case it is always advantage and fosters the potential purchase at least from port's perspective according to person A. It can be interpreted that environmental protection is also good for company's brand image and fosters the purchase from that perspective.

With person D from water distribution and drainage company the interview was aiming to find out whether there would be some other possibilities for the product besides ballast water treatment. According to person D everything is possible, and they are willing to consider using new water purification techniques if it is *"better suitable, better or more cost-effective"* than previously used techniques. Even though he was suspicious about the

capacity he was interested in the product and was keen on knowing more about the technical implementation. He suggested that it would be useful to further research the possibilities of this purification technique in the treatment of process waters that are used in factories. He pointed out that many factories are located by the sea, and they utilize sea water in their production. That implies that there might be business possibilities for the product in other industries as well that should be researched.

5.4 Selection of PSS

Product-service system was considered as promising business model for mobile BWTS based on previous research (Rauhala 2021). With interviews one goal was to get more insights from industry about possible business models. The interviewees were asked about their business models to understand better what kind of business models are commonly used in the industry. They were also asked about how they see that business model of mobile BWTS should be designed.

Person E saw that there are multiple options for business model. The initial thought for him was to buy the product. For him the decision between different business models depends mainly on the product's need for repair and maintenance. *"If it is very maintenance free then it is easier to purchase own but if it needs a lot of care then it can be easier for us to rent it if we don't have in-house know-how",* he reasoned. Although he was quite sure that in this case, they do have skills for maintenance and repair in-house and therefore, if there is demand for the product in the market, purchasing the product would be more suitable. Another thing that affects the decision between purchasing and renting is the demand for the service. If the demand is seasonal then person E said that they could consider renting but if there is continuous need then it is more likely for them to buy the product. Of course, there are multiple things affecting investing decisions and price is one of them. According to person E if payback time is reasonable then it is wise to invest. Even though person E was initially considering purchasing the product he didn't dismiss the idea of product-oriented PSS. *"Yes, that kind of option is also quite possible. I don't think it is unrealistic at all, but it depends very much on specs and how to use it and need for maintenance as an example of how big the needs for maintenance and this kind of are, but I wouldn't see it as an impossible idea to buy it as a service"*, was his comment about product-oriented PSS. However, in their company's case as they are service company, they most likely have the possibilities to do

maintenance by themselves. Services that they consider valuable are training for the product use and other services that would be necessary before taking the product in to use. *"Good training materials or actual training for the use would definitely be"*, was his answer when he was asked about services that they would request.

Person B was speculating that if the product would be offered to existing service providers, they would most likely be interested in purchasing the product. If the product would be offered to port, they would in his opinion be more open for both purchasing and renting. He found services to be crucial if ports would offer BWT service. Also, for existing service providers he thought after-sales services n to be necessary even if they would purchase the product. Person C's opinion was that there are already existing repair and maintenance companies in ports and therefore it wouldn't be necessary to product vendor to offer after-sales services. According to her clear instructions for use that would be carefully read through together with manufacturer would be enough.

The attitude towards PSS was quite open in the interviews. There are multiple possibilities for the product and the final business model depends a lot on many things such as who would be the service provider for BWT and what is the demand for it. Renting or some other use-oriented PSS was less obvious option and interviewees weren't in fact thought it much. They were open for it but purchasing the product would still be primary option. The need for services varied a lot among interviewees. When selling the product becomes topical the service offering should be customized for the buyer. Companies working in ports especially bigger companies with contacts do not necessarily need any services. For smaller companies it could be easier to commit to the product if there is maintenance contract and they wouldn't need to worry about it.

5.5 Entry plan for case company

The aim of this study is to create entry plan for new kind of mobile BWTS in Finland. The idea was to identify the need, recognize the potential customer or service provider and decide the business model. Also, other business opportunities besides ballast water treatment were surveyed. The interviewees were asked about who the best possible BWT service provider in port in their opinion would be. All the interviewees were positive towards new

service, but it was challenging to find who would be the service provider. According to person B their company is continuously looking for new business opportunities, but they are not the right target group for mobile BWTS. He suggested to approach those companies that already do water emptying from ships and also port would be potential producer according to him. Person A as representative of port was very optimistic towards mobile BWTS. When he was asked if the product would fit their service selection he answered: *"Yes, of course, assuming that technical challenges are solved and there is real demand for it then absolutely. It sounds like the port wouldn't do it itself, but it is suitable for the port area"*. Even though person B suggested port as potential service provider according to person A it is not likely. Person C as another port representative had similar thoughts as person A. When person C was asked whether port could take the mobile BWTS into their service selection the answer was: *"I would say no (...) but I think that as long as there are no laws obligating ports to provide this service to ships and as it is not our core business, I wouldn't see us taking it to our own hands"*. According to person A this kind of service would potentially improve the competitiveness of port and being able to offer additional services *"is not away from anything"*. He suggested that potential service providers could be waste management companies, possibly port operators, container depots or port service companies. Challenge with port operators is that they are only allowed to move in their operating area in the port. Even though person B thought that they are not the right service provider there can be other port operators interested in it. Port service companies have contracts with shipping companies and their job is to do mooring and unmooring of ships for example. According to person A BWT service should be offered to ships inside a service package with other services, such as mooring, that ships require. That would be convenient way for 2ships to buy the service.

Interview with person D differed slightly from other interviews as the person was representing company whose business wasn't related to ships. He has experience from water purification and the idea was to figure out whether the mobile BWTS has potential in other industries for example in industrial process waters purification. According to person D they are open for collaboration, but it depends on many things such as owner of the product and who would be the party or company that they are collaborating with.

Interview with person E was the most successful one from the perspective of identifying the BWT provider. Their circular economy service company was excited about the product and

clearly expressed their interest towards it. *"Well yes I see that it would fit our range very well. That is why we actually got interested in it and we already have operations in ports and process cleaning and also in the field of hazardous waste and then as a strong customer service company this [product] would fit to our business very well"*, was person E's answer to question about the potential service provider.

Person E mentioned that their company would be interested in piloting the product together. He highlighted the importance of being able to further develop the product and do fine adjustments together in collaboration. In the case of new technology such as this he wished to be able to influence to the final form of the product. As was mentioned earlier in the chapter explaining product-market fit it is extremely important for cleantech product to identify the fit before scaling up the business. That is because pivoting is difficult in this kind of industry where considerable number of resources needs to be used to get only the prototype. (Nobel 2011) Based on that it would be truly beneficial for the company to develop and finetune the product in collaboration with future customer or partner. In this kind of nascent and regulation-driven market as BWT the regulations give some directions to develop the product but being a nascent market there is not much experience about the functional practices and there are still many possibilities that haven't been covered. That gives a large scale of potential ways to implement the business and market entry as the ultimate shape of B2B market is uncertain. The company that person E was representing they already have experience about mobile units, working in ports and process cleaning which could be beneficial when piloting the product. According to him they have previously been using this kind of cooperation and person E has found it to be the most efficient way to bring a new product to the market. *"Because many times there are requirements that are site-specific and there are always perspectives and problems that appear on the site and by solving those implementing becomes easier"*, was something that he had learned from previous experiences and should be kept in mind. As the company, that person E is representing, is already interested in mobile BWTS and piloting it in collaboration that is a potential option to consider when planning the market entry to this nascent industry.

As result from these interviews circular economy service company appears to be the most promising service provider for BWT in ports. They themselves expressed the interest towards the product and person A suggested waste management companies as well. Other options that can be considered are finding a port operator that would be interested in

product, finding a company that does other port services for ships and includes BWT to the service offering or utilizing the technique to completely different purpose and industry such as process waters. All these options should be further researched.

6 Discussion and conclusions

This chapter summarizes the findings of this research. It begins with summary of the results from empirical research. In the second part these findings are linked with the findings from previous literature. Then finally managerial implications, limitations and future research opportunities are discussed.

The aim of this research was to create an entry strategy for cleantech innovation in maritime industry. The mobile BWTS has multiple opportunities as the product is new kind in the market and there is no previous experience about producing such a service. That creates opportunities but also prejudices from the potential producers that must be overcome. The maritime industry is complex and before entering the market research must be carefully implemented. Another thing besides new technology that advocates the success of the product is the topicality of environmental issues. At the moment most companies are doing the bare minimum to meet the sustainability requirements, but regulations are tightening, and sustainability will most likely increase attention in maritime industry as it has been doing in other industries.

The first sub-question of this research was:

"What are common characteristics of this nascent and regulation-driven B2B market?"

As it was assumed based on previous literature and readings the empirical research verified that the maritime industry is highly complex. This research was focusing on ports as operating environment and even when excluding shipping companies, the industry remains complicated. The complexity is result of multiple actors operating in the same environment. It was discovered in the interviews that companies operating in ports are focusing only minor part of all operations. They all have their specialty, and most companies are willing to keep it that way and focus only on their core competencies. That is something that makes it more

difficult to sell the mobile BWTS to ports or port operators as it is not their core business, and they should be convinced first to expand their business.

Another thing that is common in this B2B market is that there are common rules in ports for companies operating there but otherwise the companies may not have any connection to each other. The role of port is to provide only the facilities to other companies to be able to do their business. Even though port is no superior to any company it can support companies to operate in port area and for example advice on how to create connections. Port differs from other companies in such way that for them smaller profit is acceptable for business to be cost-effective.

One common thing for this market is subcontracting. It was found out in the interviews that it is extremely common to use subcontracting. Maintenance and repair were popular operations that were subcontracted. Subcontracting was also used to cover the demand when there is not enough capacity in-house.

In the maritime industry the environmental issues are increasing the attention but still most companies are doing only the minimum that is required to protect the environment. In the interviews it became clear that ports are highly positive towards new solutions tackling existing sustainability issues. Having a good reputation as sustainable port would benefit them and improve their brand image. Although they are encouraging towards these innovations, they are not willing to take mobile BWTS to their service selection. It was discovered from the interviews that for many companies in port area the core business and profit come before sustainability, and they are not willing to do anything extra. That makes it highly challenging market to sell the mobile BWTS to and representatives of ports were warning about it.

In a nascent industry the customers have bargaining power as each sale is significant to seller. In Finnish market there are no other similar product which gives power to seller but on the other hand convincing the customers about the product may require more resources than in the case of more common and settled product. With regulation-driven industry the regulations may limit the development of product. However, being a regulation-driven

industry can be seen as a positive matter when regulations give the frames in which the product development must happen and what are the standards that must be met.

The second sub-question was:

"How to identify the best business model?"

To answer that question interviewees were asked about their preferences towards possible business models such as product-oriented PSS and use-oriented PSS. It was discovered that the best business model is highly dependent on the company that the mobile BWTS is offered to. According to previous research product-oriented PSS would be the most potential model for mobile BWTS (Rauhala 2021). This research focused only port-based companies and that provided new insights about potential business models. As it was mentioned earlier subcontracting is extremely common in port environment. There are also multiple companies specialized in various functions. That is why some interviewees thought that there is no need for offering services in addition to the product. There is already know-how in port area and service can be bought from subcontractors. In some companies there is even capabilities to carry out the services in-house.

Something that affects the business model is the product's need for maintenance and repair. If the product would need a lot of maintenance, it would support product-based PSS as companies are more willing to make maintenance contracts. That would also make renting of the product more likely which means that the business model would be use-oriented PSS. Renting of the product was experienced to be a good option in case of highly seasonal use of the product.

The most required services were deployment services. It was found to be crucial to either provide proper training on how to use the product or if there is no interest to offer additional services proper instructional materials would be needed.

There was no superior business model that would have been the most potential for mobile BWTS discovered from the interviews. Findings of this research indicate that business model design depends on the customer, technical features and requirements of the product. Business model should therefore be designed after the customer and technical requirements are clear.

The third sub-question was:

"How to identify product-customer fit and decide on most suitable customer and partner?"

This question was created to be able to identify the potential customers and partners from complex port environment. In this case customer doesn't mean end-customer but service provider. As the business model and implementation is still researched there is possibility for partnership with potential BWT service provider as well. Initially ports or port operators were considered as potential customers for this product. To widen the perspective and to identify other potential customers there were also interviewee from water distribution and drainage company and circular economy service company. All interviewees were asked about who they would see as potential BWT service provider to better understand who the potential customers for this product are.

Even though representative of port operator saw ports as potential service providers both port representatives disagreed and didn't see BWT as their service. They are willing to support and advice a new company to start the business in port but not to take the service to themselves. Both port representatives on the other hand saw port operators as potential customers even though person from port operator company was very confident that it wouldn't suit their service selection. One possible option is to interview other port operator companies and find out if they have interest become BWT service providers.

One potential customer group that came up in the discussions was port service companies that are offering services such as mooring to ships. With them it would be possible to offer

service packages to ships that include BWT in port. That group should be further researched and their interest towards BWTS found out.

There could be possibilities for the purification technique in some completely different industries as well. There is need for water purification in almost all industries and factories are often located by the sea. It was found out in the interview with water distribution and drainage company representative that factories often use sea water as process water, and they could need new more efficient and cost-effective techniques to purify it. This is something to consider and investigate. It is also good to have some possibilities in other industries where to potentially expand the business.

The most promising customer group that was discovered in this research was companies working on circular economy services. The company that was interviewed for this research showed real interest towards the product and was eager to develop the product and business model together. As it was mentioned before pivoting in cleantech industry is notably harder than for example for web-based startups (Nobel 2011). Therefore, it is important to develop the product together to create the best possible solution. The circular economy service company already has experience about working in ports and they are customer service company. Providing BWT would be relatively easy for them to start as they already have trucks that can move the BWTS and they have in-house knowledge for maintenance and repair as well. Waste management companies was also suggested to be potential customers or partners in the interviews with others.

The main research question is:

"How to identify a product-market fit and create entry strategy for a cleantech innovation in a nascent and regulation-driven B2B market?"

With the help of three sub-questions and their answers it is possible to answer the main question. There was found to be product-market fit as potential customer was found and they were willing to purchase the product after piloting it in collaboration. According to

definition of product-market fit if customers are willing to pay for the product and there is demand for it the fit has been achieved (Mailchimp 2022).

Creating entry strategy begins with the market analysis. In this research market analysis was done by utilizing Porter's Five Forces. The market that mobile BWTS is aiming is globally already highly competitive. In Finland the situation is a bit different but there is one major player, Wärtsilä, based in Finland. The advantage in the competition is that there is not yet similar product to mobile BWTS existing in Finland. It is therefore possible to utilize that first in the market position. Compared to Wärtsilä the mobile BWTS is targeting different customers which is a benefit and creates possibilities. With the analysis it was discovered that in global competition mergers, acquisitions and partnerships are common ways to achieve competitive advantage.

At the moment the situation in world is challenging and that affects all business. Recovering from Covid-19, high inflation and war between Russia and Ukraine affects everyone. Increased freight prices and problems with availability have caused increased attention towards suppliers. Suppliers following ethical guidelines in their production and that are geographically located nearby have bargaining power. When discussing about bargaining power of buyers it can be considered high at least in the beginning of the business when every customer has significant importance in terms of business.

Currently ship-based BWTSs can be seen as substitutes but the threat is not too high as they are targeted to different customers. In the future there can be more options and that is very likely as the market is expected to grow and the worth to be 9 Bn USD by 2030 (Global Banking & Finance Review 2020). All the new entrants in the market should be taken seriously as they have overcome high entry barriers.

After analysing the market, the interviews were conducted. As it was described above the industry is complex but with the interviews the comprehensive understanding of it was successfully achieved. The most potential customer that was interested in starting the BWT service was circular economy service company. There are also other options but when there is customer already willing to further develop the product a together and then purchase it that should be considered as highly potential and probable entry strategy. Piloting the

product together would benefit both as the product can then be refined and developed according to customer's wishes. That can prevent dissatisfactions occurring after sales. Other potential customers are port operators, port service companies and then customers from completely different industries such as factories requiring purified process waters. One strategy to enter the market that appeared from the market analysis is acquisition or partnership with existing company. That is strategy worth researching as there is one major player in Finnish market operating in same industry whose interest towards purchasing the product rights for example should be studied. This strategy can also be implemented globally.

When creating an entry strategy, the business model cannot be confirmed before knowing the final technical features and the customer. Business model should be decided after finding the customer and negotiations with them about their preferences. According to this research selling the product without any services seems like potential option as it was found out in the interviews that there is already know-how in the port area to carry out the required services and subcontracting is common there.

6.1 Theoretical contributions

This research contributes to theoretical literature in multiple ways. It combines two commonly used theories, Five Forces and business model development, and utilizes these to research two rarely combined subjects, cleantech innovation and maritime industry.

Five Forces and business model are both popular and studied topics in previous literature. Business model has been widely studied after 1990s (DaSilva & Trkman 2014). There have been discussions about the relevancy of Five Forces in modern world that includes digitalization, globalization and deregulation that the original model doesn't take into account (Flower 2004; Downes 1997). This research shows that the model is still applicable and creates valuable information in order to build market entry strategy. Even though the world has changed from the time that Five Forces was created it is still useful model and helps to understand the market environment more broadly. This research contributes to the literature of Five Forces by adding a new perspective of cleantech product in maritime industry that haven't been analyzed with Five Forces before.

Even though business model is widely researched topic combining maritime industry and PSS is a renewed perspective that has not been popular in previous literature. Adding after sales services to selection in maritime industry has been considered promising (Norden, Hribernik, Ghrairi, Thoben & Fuggini 2013). This research contributes to the theoretical literature about PSS by solving the suitability of services to maritime industry. Figuring out the attitudes towards PSS among companies that operate in the industry is important because it has been previously found that cultural shift has been the main barrier for PSS (Mont 2006). To be able to implement PSS effectively in the maritime industry companies need to change their consumption habits especially in the case of use-oriented and result-oriented PSSs (Mont 2002; Ceschin and Vezzoli 2010). One of the main theoretical contributions of this research is finding out whether the cultural shift and attitudes are the barrier for PSS or is it applicable model in maritime industry and do services add value to customers. This research's findings support the applicability of PSS to maritime industry (Rivas-Hermann, Köhler & Scheepens 2015) but the need for services must be sorted out well before entering the market as not all services are relevant in this industry.

The way that Five Forces and business model are used in empirical part in order to discover a product-market fit hasn't been common before and therefore it gives new perspective and adds value. Combining these three theories that are common in business literature is forming a fresh perspective to analyze the market and create an entry strategy. Cleantech innovations and maritime industry are also topical subjects which increases the importance and topicality of this research. Regulation-driven and nascent industry is quite little studied in previous literature even though these features create possibilities while giving the frames and limits to the development of the industry. This research notices the importance of these features in industry and adds its input to the literature.

6.2 Managerial implications

This research can benefit managers from various industries. The methods and theories used to create strategy for market entry are applicable for multiple market entry situations apart from industry. When managers are creating an entry strategy for a new product this research can give valuable information about ways to research the market and to identify

product-market fit. By following the methods used in this research such as market analysis with Five Forces and interviewing the assumed potential customers the initial ideas about market entry and customers may change and refine. This research can also give new ideas about possible business models besides traditional pure product or pure service.

Particularly useful this research is for companies that are entering maritime industry. In this research the complex industry is analyzed and preferences about business model discovered. Knowing the common characteristics of the industry before entering the market is very useful and can save resources. Especially in an industry as complex as maritime industry and with multiple actors operating there it is crucial to research it carefully before entering. With help of this research the process of entering the market can be less complicated and more efficient.

Whilst this research benefits multiple actors and companies from different industries the most useful it is for port-based BWTS suppliers. Nascent and regulation-driven industry has its own features that are important to understand when planning a market entry. This research focuses on Finnish market, but same practices can be adapted globally. Even though the aim of this study is not to generalize results they can still be considered as guideline for actions. With the market research in this research companies can anticipate other markets and prepare for their market research and market entry.

6.3 Limitations and future research

When the results of this research are interpreted there are some limitations that should be kept in mind. The research is focusing on quite small geographical area as it was conducted in Southern Finland and companies were located there. As this research was focusing on market entry of new cleantech product there might be different attitudes towards innovations in different ports for example. The attitude can be different depending on port size and location which may affect the results. What affects the atmosphere towards port-based BWTSs in ports is what kind of ships there are visiting. That affects the demand for the service and it should be studied further what are the ports that the ships with the need for port-based BWT are visiting the most.

Another thing that affects the results is that the interviewed companies were quite different from each other as the aim was to get as much knowledge about the industry as possible. They had different attitudes towards cleantech and for example company E as circular economy service company was the most positive towards the product whereas company B as port operator was more sceptical. For future research it could be ideal to focus only one specific group of companies such as port operators if that is considered as interesting customer group. Another suggestion is to find such companies from maritime industry that have cleantech in their values and further research and interview them about their interest towards mobile BWTS.

Concerning only market entry of this product there should be more research done about the implementation of market entry before doing it. More practical information is required about the business model and who would be the owner of the product. At the moment the product is university project and there are many aspects that should be considered and cleared before it can become business.

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Appendix 1. Interview questions (translated)

Introduction

- Short introduction of the project
- Acceptance for the recording of the interview

Basic information

- Job title
- Organization
- What is your role in the organization?
- How long have you been working there?

Common characteristics of B2B market

- Could you describe the common practices in port? / Could you describe your business? / Do you operate in port? / What kind of business do you have there?
- Who are your competitors?
- Who are your main customers?
- What is your business model like? How about your income model?
- Do you use subcontracting?
    - When and for what?

Product-market fit

- How do you experience the potential of BWT service in the market?
- What would be the barriers hindering product-market fit?
- How about the opportunities?
- How would you see as potential BWT service provider in port? Why?

Product-customer fit / Product-partner fit

- Are you interested in expanding your business?
- Would BWTS fit your service selection? Why?
- Would offering BWT as a service increase the attractiveness of your port/company?
- How do you see the implementation of BWT service in practice? What would be the biggest challenge for you?
- What are the opportunities for startup to start providing BWT as a service?
- What kind of product-service combination would be most effective to you? Would you be interested in leasing or renting the product or do you consider buying as the best option?
- If you would start providing BWT service what kind of services you would expect from us?