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Evaluation of a Circular Business Model for plastic ropes in the maritime industry

Master's thesis in Supply-Chain Management

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Filip Werner

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Abstract

There exist a long list of threats connected to how humankind is disturbing the ecological balance of our planet. Plastics is one large subject of concern, its usage has just in a few years grown to become one of the most used materials and this amount is predicted to continue its growth. The maritime industry does add to the concerns about plastics generating high amounts of waste further giving rise to challenges connected to ocean littering.

ReLine was initiated in 2019 and has since day one had the ambition of challenging the current way of doing business. ReLine does currently consist of three actors; one recycler, one manufacturer, and DFS who together work to find a more holistic solution to the usage of plastic ropes in the maritime industry. The transition to a circular economy is argued by several researchers to be a crucial condition for a sustainable future, adoptions are however generally on a small scale with slow adoptions.

The aim of this master thesis is to identify critical success factors, barriers, and enablers to a circular economy for the usage of plastic ropes in the Scandinavian maritime industry connected to the project of ReLine. The aim was devised from recommendations made by authors who had written articles in the subject of circular economy, while still providing useful information for the company DFS regarding the product ReLine.

The methodology of this thesis began by forming a theoretical framework, which was firstly used to construct questions for the interviews on which the empirical data was based on. The theoretical framework was updated as the empirical data was analysed in order to validate the data. The empirical data consisted mainly of answers from 11 in-depth interviews with actors in the industry, but observations made by the authors of this study was also included to validate the answers.

The study identifies 7 critical success factors, 7 barriers, and 6 enablers which were analysed in three main areas. These areas are Reverse Supply Chain, Supply Chain Collaboration, and Product Requirements. Many of these factors are intertwined and the way forward is difficult to map out in detail given that a lot of uncertainties still exist. The conclusion of this study can help the company DFS map out how to move forward with their CBM, as well as lay the foundation for future research on the topics discussed. DFS is not recommended to alone take ownership of the RSC, DFS should focus on developing strong connections with customers and communicate the benefits of them sending back material to the recycler.

Keywords*: Circular Economy, Circular Business Model, Recycled Plastic Rope, Reverse Supply Chain, Supply Chain Collaboration*.

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1. Introduction

1.1 Background

Plastics have since the 1920s globally spread to become one of humankind's most used materials, production has twentyfold since 1960 and reached 322 million tons in 2015 (European Commission, 2018). The increase of plastic usage is according to Kedzierski et al. (2020) mainly due to three reasons; replacement of normal, traditional materials with plastics, the increased population concentration happening globally (people moving from the countryside to urban cities) and a more global consumer society. Plastic has enabled longer-lasting consumables, efficient packaging, 3D printing, and much more. Plastic can come in many forms depending on the mixture which results in versatile properties and broad application areas. It has however not been a trouble-free success story for plastics, and it has received extensive amounts of publications highlighting its negative impact on the planet. It is common knowledge that plastic waste, especially in the oceans, is devastating to nature and wildlife of our planet. Khan et al. (2019) writes that even though environmentally friendly innovations are rapidly emerging on the market, the planet's plastic waste is an ever-growing problem, mainly due to the convenient usage of plastic. Plastic is also a concern connected to global warming as it extracts carbon emissions when processed. As late as 2017, Geyer et al. explain that 50% of all plastic objects are intended for single use. 4900 million tonnes out of the 8300 million tonnes of plastic produced between 1950-2015 were discarded. Geyer et al. (2017) continues and explains that less than 2% of the plastic produced between these years were recycled and the vast majority is stored in landfills or in the environment. Agamuthu et al. (2019). continues and explains that 5-12 million tonnes of plastics end up in the ocean each year (as of 2019). According to Bucknall et al. (2020) the current life cycle of plastics are linear, by being produced, used once and then discarded. In most recent times however, these single-use plastics are starting to get banned in many countries, including most EU countries as well as China (Bucknall et al., 2020). Bucknall et al. (2020) continue and explains that one way to reduce the harm on the environment from single-use plastics would be to halt their release into the environment. This could be done by implementing a circular flow (instead of the more common linear one) and move towards a circular economy for plastics (Bucknall et al., 2020).

Napper et al. (2022) maritime ropes and netting have historically been mainly produced from hemp, cotton, or flax fibres, however this product, much as many others have in recent years had its production material replaced by plastic fibres. According to Flory et al. (2015) the first material used in synthetic ropes was nylon, however, nowadays there exists an abundance of different compositions of synthetic fibres in ropes, to handle various situations. Napper et al. (2022) explain that a common usage of the

maritime ropes is in the fishing industry. Richardson et al. (2019) estimated in their meta-analysis that approximately 5,7% of all fishing nets, 8,6% of all traps and 29% of all fishing lines are lost in the ocean annually (as of 2017). A fishing industry which uses a large number of plastic ropes is the fish farming (or aquaculture) industry. According to Lindland et al. (2019) Norway is the largest producer of Atlantic salmon in the world. The aquaculture industry in Norway produced approximately 1.31 million tonnes of fish and shellfish in 2017, with a combined worth of 6,7 billion euros according to the same authors. However globally the industry is associated with plastic pollution. According to Tian et al. (2022) approximately 3840 tonnes of plastic waste is expected to be discarded in the next four years, in the Maowei Sea alone.

According to Kirchherr et al. (2017), the circular economy has gained traction among both practitioners and researchers in recent years. The concept, according to Geissdoerfer et al. (2017) revolves around looking at the environment and the natural resources available as limited, and that there is a need to optimize the usage and re-usage of resources. Within a circular economy. Further research suggests that several authors and researchers have imposed various measures on industries and consumers alike. For plastics, the goal is most commonly to recycle more plastic or simply find alternative materials to remove the need for plastic altogether. According to Bucknall (2020), the mismanagement of plastic waste is one of the core origins of an ever-increasing environmental disaster. The evolution of the thought process, regarding the recycling of plastic, has been heading towards the concept of circular economy (CE). Strategies to maintain plastics at a high value for a longer time and prevent the loss of plastic as a resource is an important measures to decrease the overall impact on the environment of plastics (Bucknall, 2020). Not only should recycled plastic be used to create new products, but the recycled plastic should also be sourced from the plastic waste generated by the industry that uses the product in question, hence creating a looped system. Circularity and closed/Open loop supply chain systems are not new concepts, yet their application is very limited in the industry. This is no exception when it comes to plastics with the linear business model still dominating the industry.
The past decades have been influenced by business practices striving for flow efficiency with reduction in waste and buffers i.e., lean and just in time (Elwood, 2020). These practices have been built on the premise of growing globalization leading many companies to outsource activities to developing countries in an attempt to reap advantages in the market (Elwood, 2020). The European strategy for plastics in a circular economy (European Commission, 2018) reveals that improvements rely on many key players together with innovation. For many NGOs (non-governmental organizations) however, there is more to it than innovation. Even when technical breakthroughs are made, there still exist challenges in how to create a holistic business model competing with virgin plastic. Barriers to CE transitioning are not uniform for all companies or activities, van Loon & van Wassenhove (2020) found that transitions to CBM give rise to knowledge gaps within companies as their targeted business model might be far from their current way of business.

1.2 Research gaps

This master thesis takes departure in the research gaps identified from prior studies in the fields of Circular economy, closed & open loop supply chains, reverse logistics, and sustainable/green supply chains. There does not currently exist a clear distinction between these research areas, and many fields are intertwined.

Kumar & Satheesh-Kumar (2013) highlighted a research scope which expressed that there is a need for in-depth studies on individual cases to understand the environmental and economic consequences of closed loop supply chains (CLSC). In 2016, Difrancesco & Huchzermeier expressed that hybrid manufacturing structures are often excluded in research in CLSC but have valuable implications for real-life situations. In 2018, Dentchev et al. followed up on this by explaining that Circular business models (CBM) have been studied extensively on a general level, but it needs to be mapped out for a single industry or company. Van Loon et al. (2021) agrees and argues that there is a need for comprehensive transition case studies in order to better understand and support the industry.

Ludeke-Freund et al. (2019) have contributed to the field of CBMs but still, recommend further studies in the field to strengthen the understanding of how value is captured by different actors. In 2018, Bocken et al. highlights a desire to find the most suited business model (BM) for practitioners in transition to the circular economy, and in 2021 Barakat et al. point out a need to explore ways to reduce operational costs in CBMs. van Loon et al. (2020) explains that there also is a need to understand the actual environmental impact of circular products and CBMs. Bhatia & Srivastava (2019) conducted an empirical investigation clustering critical success factors and expected outcomes with CLSC, Govindan & Hasanagic (2018) presented a literature review of drivers, barriers, and practices for CE. As described by van Loon & van Wassenhove (2020) there exists a gap in how the barriers connect to practice and how single actors can overcome them. A final recommendation speaking for continued research is highlighted by Luoma et al. (2021) as they write that there is a need to understand enablers and barriers for CE in more detail.

1.3 Company Description

The master thesis has been developed in cooperation with AB DFS, a global marine supplier that supplies products of great variety. They have seen the need for sustainable development in the industry of plastic ropes and together with two suppliers, one in Denmark and one in Portugal; have developed ReLine which is manufactured from end-of-life plastic ropes and fishing nets from the marine industry. The project was initiated in 2019 and they have in the initial stage of this master thesis received the first batch. The project separates from AB DFS's usual way of doing business, their ordinary

business model evolves on sourcing and reselling products characterized by low involvement with suppliers. Within their assortment, they are selling plastic ropes following a linear business model. AB DFS strives to enter new customer segments with ReLine where the industry of fish farming represents a significant large proportion of the total demand for plastic ropes globally. They strive to develop a circular business model allowing for the plastic used for ropes to be used in several cycles hence requiring a solution for reverse logistics. AB DFS is the link towards the customers hence also possess information about where consumed plastic ropes and nets can be sourced in a reverse supply chain. Questions remain about the design of the CBM and how the reverse supply chain will be orchestrated. AB DFS, and more specifically ReLine is found applicable to the study as they are currently in a transition towards a circular economy entailing a path that is not straightforward. The authors aspire that e.g., enablers, barriers, trade-offs highlighted can provide practical insights to research.

1.4 Aim

The aim of this master thesis is to identify critical success factors, barriers and enablers to a circular economy for the usage of plastic ropes in the Scandinavian maritime industry connected to the project of ReLine. It strives to ease a transition to circular practices by evaluating how a circular business model can be customized for the actors in the industry.

1.5 Research questions:

The research questions in studied in this master thesis are as follows:

1. *What are the Critical success factors, enablers, and barriers connected to ReLine?*
2. *In what way can ReLine establish a CBM?*

1.6 Limitations

As exemplified by Dentchev et al. 2018, there exists a gap in research for in-depth studies of CBM for single actors and industries. This study will be based on theory on a general level to later limit qualitative data collection to the single industry of circular plastic ropes. The study will not include an in-depth analysis of the plastic material nor create a life cycle analysis for the product; however, data from earlier research in this field was used. The study will be conducted within the field of sustainable supply chains.

2. Methodology

This thesis is built on knowledge from existing theoretical publications and articles while the empirical data was gathered mainly through interviews as well as insights and observations by the authors. Interview targets were representatives at the company, suppliers, potential customers as well as third-party experts on plastic and circular economy. Data gathering was done through an iterative process in order to enable the theoretical framework to develop along the project.

The structure of the methodology chapter starts with an explanation of the research approach, followed by the approach of the methodology in order for the reader to get a grasp of the state of the study at an early stage. Furthermore, the conduction of the interviews will be explained, as well as how these interviews were analysed and who the interviewees were. The final two subsections will help the reader understand how this thesis stayed reliable and relevant to the subject by being objective.

2.1 Research Approach

The research approach of this paper was abductive in nature. The reason for this is because it is a middle ground between inductive and deductive approaches. Strauss & Corbin (1998) describe the inductive approach as a frequently used approach when conducting qualitative research. Furthermore, the inductive approach is described by the same authors as by using observations and research from real life situations which then are analysed and compared to a theoretical framework, in order to find differences and similarities between the real world and the theoretical. Strauss & Corbin (1998) further describe a deductive research approach as the polar opposite of an inductive one. A pure deductive approach would find predefined hypotheses in the theory, and then test their validity towards the real world by using the empirical data for this test of validity.

Since the methodology approach of this paper was qualitative in nature, a pure deductive approach would be inefficient, since this approach would allow no modifications to be made once the theoretical data had been collected. Since a pure inductive approach is the polar opposite of a deductive approach, meaning that the empirical data should be collected and validated towards theory, using this approach would not work since neither of the authors possessed any extensive knowledge of the subject prior to writing the thesis. Thus, it became conducted by the authors of this paper believe that an abductive approach would the best approach for the thesis. Reichertz (2007) explains that the one major advantage of the abductive approach is that it opens up for continuous modification. The theoretical framework can be constantly improved and adapted to fit the problematization of the thesis, and vice

versa. And since the subject of this thesis is prone to change, this approach was deemed the most suitable for this thesis. The reason behind this was because the theoretical framework was decided to be constructed before the empirical data was gathered through interviews in order for the authors to gain knowledge of relevant subjects, to make the most of the interviews. Once the empirical data was gathered, the theoretical framework was supplemented with additional theory to try and validate the empirical information. Thus, making it a mix of what Strauss & Corbin (1998) describe as deductive and inductive. Deductive by having a predefined theoretical framework and inductive by supplementing the predefined theoretical framework with additional theory in order to validate the empirical data.

2.2 Methodology Approach

When choosing an approach, and which methodology to use, one usually chooses from two, namely qualitative or quantitative (Patel & Davidsson, 2011). The authors describe a quantitative method as being based on quantifiable and measurable data. The problematization of a quantitative approach is closed in nature and the results are in most cases used objectively and strict (not much room for adaptation). The problematization in a quantitative approach is also strict in nature and in most cases answers questions in the line of how many or how much (quantifiable results) (Patel & Davisson, 2011).

A qualitative methodology is however freer in its approach. The data collection and presentation are freer in nature, which allows for more adaption as well as room for changes. In a qualitative methodology, the questions asked are less structured and do not need to be quantifiable. The data collection can be conducted by using interviews or observations. The results can also be subjective and contain biases as well as experiences which affect how the results are interpreted (Patel & Davidsson, 2011).

Since this master thesis was explorative in nature, and since the data collection were done through interviews and observations as well as through the theoretical framework, the authors of this thesis deemed a qualitative approach the best way to conduct the thesis.

2.3 Data Collection

The data collection was done in an iterative process, which according to Srivastava & Hopwood (2009) is key to sparking insight and developing meaning for a process. The authors mean that by revisiting data and continuously connecting the data leads to processed understandings and focus on a progressive level. According to Kumar (2014), data can be collected from two sources, namely primary or secondary sources.

Primary sources provide researchers with information first hand and are collected through interviews, observations, or questionnaires usually (Kumar, 2014). Secondary sources are explained by Kumar (2014) as previously collected data. This data can come in the form of published articles, government publications, personal records or mass media, according to Kumar (2014).

In practice, the secondary data collection was done by the authors of this thesis by keeping the aim of the study in an open manner at early stages, and reading articles with subjects of a broad level, and collecting data from them. Further along the process, as the aim got more and more refined, more narratives were added which were on a more detailed level. The following paragraph explains the search words used when finding relevant articles. The databases used were mainly Chalmers Library as well as Google Scholar.

Search words: *Circular economy, Circular business methods, Supply-Chain Management, Open Loop Supply Chain, Closed loop supply chain, waste management, waste hierarchy, sustainability, sustainable supply chains, green engineering, green supply chains, plastics, plastic recycling, industrial ecology, supply chain resilience, business models, arm's length, tetradic relationships*

Other than using the databases to collect secondary data, the authors have used recommended readings from the articles that we found with the search words, as well as relevant citations used in these articles, in order to gain more nuanced insight and establish a broad base of information. An example of this is if Guide et al. writes about a relevant subject, and when explaining, cites van Loon et al. the authors look at the article written by van Loon, and thus gains further insight regarding the relevant subject. The authors have also utilized Google scholar's function to move up and down the "chain" of articles, in order to find other, relevant articles.

The primary data was mainly collected through interviews (which is thoroughly explained in the next subsection), but also through meetings and observations done by the authors.

2.4 Primary data collection

The empirical data of this study consisted mainly of interviews, but also of observations made by the authors of the thesis while they were at the DFS company, as well as on a business trip to the recycler in Denmark. The interviews were done in a semi-structured manner. Semi-structured interviews are described by Gill et al. (2008) as consisting of several key questions which allow for high flexibility and give both the interviewer and the interviewee opportunity to explore subjects at a deeper level where it is deemed necessary. Since this thesis is exploratory in nature, semi-structured interviews suited

it well. The structure of these semi-structured interviews helped the authors analyse the data collected from the interviews, while still not inhibiting the ability for follow-up questions which allowed the answers to be of a higher level of detail.

2.4.1 The respondents

This thesis was based on 12 in depth, semi-structured interviews with a total of 11 respondents. The respondents were either connected to the ReLine project in some way, or experts on relevant topics of the master thesis. In table 1 all the respondent's roles and their respective companies is listed, while a more thorough description of their roles can be found in the empirical data. The reason why these respondents were chosen was because the authors of this thesis wanted to get a nuanced understanding of the ReLine project, as well as insights from experienced Respondents who currently work in the market or in similar markets, in order to be able to gain intel regarding various challenges and enablers of the ReLine project, and of getting a circular economy within the maritime industry to bloom.

The Respondents were chosen by sending out emails to appropriate people working within the fish farming industry, at DFS or in relation to the supply-chain surrounding ReLine, and the respondents in Table 1 below are the people who agreed to participate.

Table 1: List of respondents.

Respondent	**Company**	**Title/Role**
A	Recycler	Manager of Business development and project management
B	Manufacturer	Director of the Scandinavian industry
C	DFS	Project manager
D	DFS	Product development
E	DFS	Board member & Circular economy expert
F	DFS	CEO
G	Fish farm manufacturer	R&D
H	Fish farm 1	Environmental Expert
I	Fish farm 2	Business Area Manager
J	Fish farm 2	Fish Farming Strategist
K	Research company	Plastic expert

All of the respondents were offered anonymity, and all of them accepted this, and thus both their names and companies (except the respondents working at DFS, they allowed the company name to be visible) are anonymous.

The respondents can be divided into 5 different groups depending on their relation to the ReLine project. How they are connected is illustrated in figure 1 below.

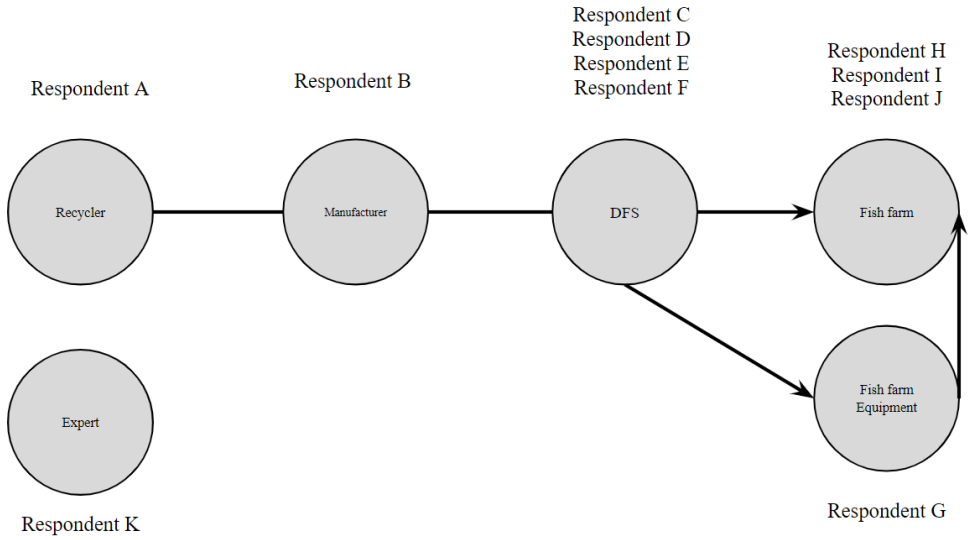

Figure 1: Respondent connection to DFS and subsequently ReLine. (Drawn by: Åsberg, 2022)

2.4.2 Conduction of interviews

As previously mentioned, the interviews were conducted in a semi-structured manner, meaning that there was a predefined questionnaire, but some interviews deviated from the questionnaire due to both follow-up questions from the interviewers regarding relevant topics in order to get a deeper understanding or explanations from the interviewees, which is in line with how Gill et al. (2008) explain the concept of semi-structured interviews. The questionnaire itself consisted of 5 different sections. The first section was a section with questions which was applicable to all different interview subjects. The latter sections were categorized according to which type of interview object was being interviewed (as illustrated in figure 1). For instance, the interview with the recycler focused on challenges, barriers, and enablers regarding the recycling, and how to overcome them, as well as their thoughts and insights on the ReLine project. While interviews with the manufacturer focused on the challenges, enablers and barriers connected to the manufacturing process. And as more knowledge was gained through the interviews, the questions were further modified in order to improve the quality of the answers. The questionnaire is available in appendix A.

Even though the questions were modified to some extent depending on the role of the respondent, all the questions remained open, in order to not influence the answers of the respondents. All of the interviews were recorded, after the approval of the interviewee, in order to allow for a more thorough analysis as well as opening up for a more engaging discussion, since it allowed both authors of this thesis to be fully focused on the interview, which according to Patel & Davidsson (2011) is important for the outcome. Both authors of this thesis were present on all interviews except one, which was handled by one author alone. At the same time, all interviewees were before the recording started offered full anonymity. The reason for this is because some of the questions were answered with sensitive information, and if connected to the company name or name of the interviewee could be harmful, all respondents choose to remain anonymous, while only the respondents at DFS allowed the company name to be visible. The questionnaire used in for the interviews can be found in appendix X

2.5 Observations

During the course of writing this thesis, the authors gained intel by observing the environments which the project took place. During two days in March, the authors together with two representatives at DFS went to visit the recycler in Denmark. The authors got a tour of the facilities and first-hand made observations on how the recycling process worked. The authors also got a presentation by the CEO of the recycling company, who shared the company vision and both near and distant goals, which gave the authors some idea in how their recycling would evolve in the future. The observations made during the course of this thesis was used to validate the information in the interviews as well as to deepen the authors understanding in order to aid in finding relevant subjects for the data collection. The observations themselves have however not been considered primary data, given the unstructured nature as well as not being recorded but have aided the processes of gathering both primary and secondary data. As an example, the interview with the recycler (Respondent A) took place in connection to the trip and influenced some of the questions asked during the interview.

2.6 Conduction of the Analysis

The analysis of interviews was conducted by transcribing as well as coding the interviews. The interviews were transcribed in the language in which they were held (either Swedish or English) and were then translated into English in order to ease the coding process. The coding process was done by categorizing the transcribed answers into suitable categories, these categories later became the basis for the structure of the results, and further used when finding the critical success factors, enablers as well as the barriers for the ReLine project found in this study. To differentiate between what in this study is distinguished as a Critical Success Factor (CSF), enabler and barrier, the

authors of this study based their own definition of a CSF on Freund (1988)s definition of a CSF. Freund (1988) define a critical success factor as:

- Important to achieving the overall goal of the company
- Measurable and controllable in the industry where they are applicable
- Few in number since not everything is critical
- Expressed as things that must be done
- Applicable to all companies in the industry
- Hierarchical in nature

Even though the CSF identified in the study does not apply to all these above-mentioned definitions of Freund (1988), the same essence still applies. The CSFs identified were the most important factors identified by the authors in order to achieve the overall goals of the study, all of them are not measurable however they are believed to be controllable in the industry as well as applicable to all companies in the industry. Barriers are defined as factors that make the process of achieving the goals harder while enablers were the opposite, namely making the achieving of goals easier.

2.7 Reliability and Objectivity

In order for this thesis to be as reliable and objective as possible, the thesis was reviewed both externally and internally. On an internal level, the two authors of this study reviewed each other's contributions, and made sure that both were satisfied with the results. This internal review process took place continuously throughout the writing process and was presented to the other authors during weekly meetings.

On an external level, the validity and objectivity of the thesis came from several sources. One source was the supervisor, Martin Kurdve who had continuous opportunities throughout the writing process to examine the written material and give insights on the contents. Another way the thesis was externally validated was by allowing every interviewee to review the transcribed interview-data and giving their approval of the contents before using it for the empirical part of the thesis. If any respondent wanted to modify its' content, the modifications were in turn reviewed by the authors of this thesis to make sure they were in line with what was said at the interview. Lincoln & Guba (1985) explain that this type of reliability process (external and internal) is one of the most essential techniques to achieve reliability in a study.

In order to avoid bias in the interview-material, the authors always asked non-leading questions when conducting the interviews, in order for the results to be as truthful as possible. Gill et al. (2008) explains that a good way to avoid interview-bias is to record the interviews, so the results can be validated with what was actually said during the interviews. As previously mentioned, all interviews were recorded (with consent of the interviewee).

3. Literature Review

This chapter composes theoretical findings in circular economy, supply chain management and business models acting as a foundation for the following result, analysis, and discussion chapters.

3.1 Circular Economy

The concept of the circular economy does not withhold a uniform definition and many researchers have developed work in progress definitions trying to grasp its outlining. In addition, it can also go under several aliases e.g., circularity, circular supply chains (CSCs), Closed/Open loop supply chains, etc which roughly speaking are extensions to the same concept. It is not known who initially introduced the concept, but early contributors include John Lyle, William McDonough, Michael Braungart, and Walter Stahel. It received accelerated global attention as the Ellen MacArthur Foundation and the European Commission endorsed the concept (Winans et al., 2017). Lüdeke-Freund et.al (2019), explain that CE thinking originates back to visions developed within Industrial ecology. It is further built on several additional concepts e.g., biomimicry and industrial symbiosis as it aims to create energy and material loops (van Loon & van Wassenhove, 2018). Kirchherr et al. (2017) examined 114 definitions of CE. Their definition of circular economy is that CE elicited from a system of business models which instead of adapting an end-of-life concept, uses material recovery as well as reduction or reuse in processes of distribution, production and consumption. On micro, meso and macro levels, this would translate to products, companies, and production (micro), industrial parks (meso) and city or region/nation (macro) respectively. Kirchherr et al. (2017) explains that the aim of circular economy in this case would be to achieve economic stability as well as higher environmental quality.

Resource efficiency is a cornerstone in sustainable development, which according to the Brundtland report from the FN: world conference 1987, should lead to meeting our current needs without compromising future generations' ability to meet their needs. Within this field, many theories have been developed where CE strives for improved resource efficiency by extending the lifespan of products. Developments in sustainability are commonly analysed with the use of triple bottom line (TBL) entailing that social, environmental, and economic perspectives are taken into consideration together with a cradle-to-cradle logic i.e., that the entire life cycle is included instead of isolated activities (Frishammar & Parida, 2018). Companies can, by applying circular economy principles, improve corporate social responsibility (CSR), which according to Bergman & Klefsjö (2012) can generate a strengthened market position. Frishammar & Parida (2018) further emphasize that efforts in circularity can originate

from e.g., volatile prices, threats from competitors, legislation, social pressure, or a combination of factors. Van Loon et al. (2021) highlights that efforts in circularity are often of low scale and that the slow adoption argue that practitioners face difficulties to reap the fruit many researchers argue Circular economy to be.

There exist many theories providing valuable additions to a circular economy, to provide a solid theoretical foundation of the circular economy; Reverse supply chains (RSC), waste management, closed-loop supply chains (CLSC), open-loop supply chains (OLSC) and business models for circular transitions will be further elaborated in the following chapters.

3.1.1 Reverse supply chain

A reverse supply chain is described by Guide et al. (2003a) and Atasu et al. (2008) as the flow of materials backward in a supply chain. This is illustrated in figure X1 below where the manufacturer in this scenario has established contact points with the customer, allowing products to re-enter the supply chain. Krug et al. (2021) explain RSCs to include all facilities connected to the backward flow of end-of-life products aiming to create additional value. RSC should deliver five key processes; Product Acquisition, Reverse logistics, Inspection, and Disposition, Remanufacturing, and lastly Marketing (Blackburn et al., 2004). The implementation of RSCs has increased in recent times in order to counteract growing amounts of waste from end-of-life products.

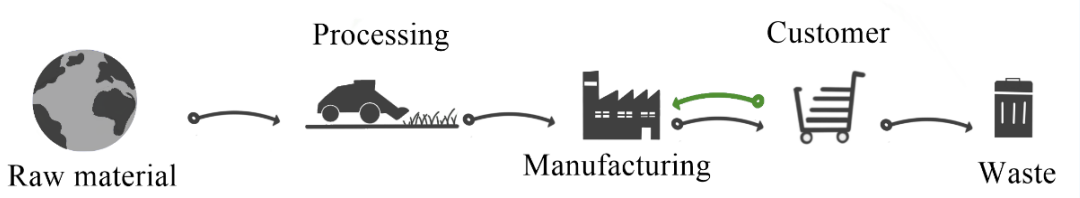

Figure 2: Illustration of a linear supply chain (Drawn by: Åsberg, 2022).

RSCs can give rise to several beneficial outcomes for e.g., job creation, reduction of waste, reduced demand for raw materials and creation of additional revenue streams (Krug et al., 2021). Guide et al. (2003a) write that even if there are common, established activities for reverse supply chains, these activities are of varying importance depending on the scenario. Depending on the market type, which company, or what kind of product is in focus for the RSC, the prioritization of which activities are the most important varies drastically, according to Guide et al. (2003a). Guide et al. (2003b) write that even if activities within a reverse supply chain are of low complexity, it can be difficult to organize all activities given the large variation in products returned.

Adding to RCSs complexity is that products can be returned at different stages of their life cycle i.e., there is no predetermined time when products get returned. Guide et al. (2003a) exemplify this by stating that products can have return policies from 30-90 days after purchase, or can be returned due to: repairs, warranties, or at the end of the life cycle, and each of these different types of return stages require different RSCs in order to optimize the recovery of value.

Blackburn et al. (2004) present guidelines for decision-making when manufacturing companies design their RSC. The arguments presented are highly dependent on the characteristics of the end-of-life (EOL) products and the layout of RSC impacts both time and cost. Gathering information is generally a crucial step when taking strategic corporate decisions, however, as explained by Krug et al. (2021) future supply of EOL products is difficult to forecast and data generally include high uncertainties. One reason for this is that RSCs are in most cases newly implemented lacking experience and historical data (Krug et al., 2021). Blackburn et al. (2004) separate an efficient and a responsive reverse supply chain and use the marginal value of time (MVT) i.e., a variable representing how value in the product is changed by the time when entering the reverse supply chain, and processing cost to motivate the different layouts. Blackburn et al. (2004) concludes that when products have high MVT, it is motivated to have higher process costs and handle the reversed flow responsively with the use of a decentralized structure, see A in figure 3. The reason for this lies in restoring as much value as possible in the product, examples of industries brought up by the authors are electronic appliances. For products with low MVT i.e., less steep value decline, Blackburn et al. (2004), argues that the RCS should be designed to enhance efficiency by reducing processing costs as products are handled in larger batch sizes in centralized processes, see B in figure 3.

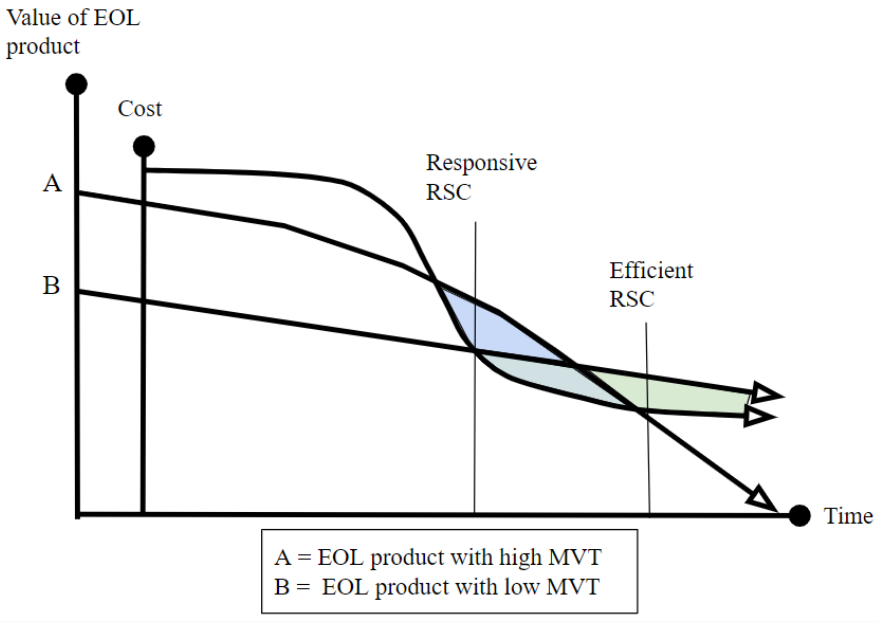

Figure 3: How MVT impacts the performance of RSC (Drawn by: Åsberg, 2022).

In clarification, note that the graph displayed in figure 3 is amended from arguments presented by Blackburn et al. (2004). It is not based on numbers, henceforth the graph can give rise to misleading assumptions if being understood as accurate data.

Going one step further and looking at future challenges with reverse supply chains, Guide et al. (2003a) emphasize that extended environmental restrictions or legislation, more flexible return policies, and increased competition on a global scale can lead to increased product returns. The increased global competition together with an increased amount of returns can lead to a slimmer profit margin for companies (Guide et al., 2003a). The growing pressure for companies to explore new ways to handle product returns can according to Dekker et al. (2003) lead to companies moving further away from selling the ownership of products, and instead moving towards providing more service-based solutions.

When looking at a reverse supply chain, it is important to acknowledge waste management and the impact waste has on the supply chain. Waste management is one of the processes in a reverse supply chain (Williams et al., 2008). Waste generation is inevitable in modern society, it is caused by human activity and has accelerated as consumption has grown to a global market with high availability for e.g., electronic devices and plastics. Waste does not withhold a single definition and its classification depends on who defines it. According to Hoornweg & Bhada-Tata (2012), global waste generation has risen in recent years. In early 1900, the daily waste generation was less than 0,3 Mt (megatonne), while in 2010 it was 3,5 Mt. Hoornweg & Bhada-Tata (2012) has predicted that this number would triple by 2100. Khan et.al. (2022) explain that waste does not exist according to an industrial ecologist, it is only misplaced. The EU waste framework directive classifies end-of-waste as waste becoming a product or commodity. Reasons for end-of-waste classification lie in existing demand and established market for the given material or if the material is commonly used for specific reasons. The European Commission (waste prevention and management) explained that in Europe, only 39% was recycled in 2014 and that Europe does not afford to withhold low resource efficiency. In an attempt to counteract this, the EU commission promoted a waste hierarchy highlighting different outcomes acting as a guideline showing the most to least favourable options (see figure 4). According to Pires & Martinho (2019), the waste hierarchy follows the principles of circular economy as it prevails when material returns to the market. The least favourable option in the hierarchy is disposal, however, land and sea littering is considered the true least favourable alternative (Pires & Martinho, 2019). Zhang et al. (2022) connect the waste hierarchy to the circular economy by emphasizing that both are built upon common grounds, namely looking at a product or service's full life cycle, including the pre-use phase, use phase, and post-use phase. Neves & Marques (2022) state that CE was initially associated with the 3 Rs which follows the order of the waste hierarchy, by time, understanding of CE has evolved and additional models have been interpreted

including a 6R and 10R model. In comparison to the steps in figure 4, the 10 R model further includes Refuse, rethink, repair, refurbish, remanufacture, and repurpose.

Figure 4: Waste Hierarchy (Drawn by: Åsberg, 2022, Amended from EU commission, Waste Framework Directive).

1. *Avoid & Reduce*

This strategy is given the highest prioritization as it leads to a reduction of demand in primary production. It can be seen from two main pillars where the first is based on changing customer behaviour and the second advances in production as the same customer value is satisfied with less material hence allowing for higher resource efficiency (Allwood, 2014). Khmara & Kroneberg (2018) take departure from the degrowth strategy and argue that it is socially and economically possible to achieve downscaling. It shares several similarities with the circular economy as it strives for improved resource efficiency and reduced environmental impact. In contrast to CE however, degrowth does not focus on technical breakthroughs as it argues that it will not be adequate alone to deal with the ecological crises (Khmara & Kroneberg, 2018). Avoiding and reducing does give rise to social dilemmas and equality discussions in emission rights between developed and developing countries, Allwood (2014) points out that this step could result in the most significant change environmentally if rich countries choose to want less new material.

2. *Preparing for reuse*

This phase entails efficient cleaning, refurbishing, repairing, and checking of parts or whole products, after they have become waste (Waste Framework Directive 2008/98/EC). Furthermore, EU legislations state that it is required that the product has become waste, in other words, that it has entered some sort of collection or waste management system, with the intent of being discarded in some way (Pires et al., 2019)

This process, or phenomenon is often described as remanufacturing by the literature (Ferguson et al., 2010, Kumar & Satheesh-Kumar, 2013, Goltsos et al., 2019). Despite the obvious benefits of remanufacturing, Ferguson et al. (2010) explain that the majority of companies still chose to completely ignore remanufacturing as an option. The main reason for this is based on the profitability of the products. The price of a remanufactured product is not always lower than the price of the original product and for some products, it is not profitable to remanufacture, as the margins already are very small. In order for remanufacturing to be economically motivated on a large scale, the total cost of remanufacturing should be lower than producing new products (van Loon & van Wassenhove, 2018). van Langen et al. (2021) mentions that a retailer or service provider can increase the customers willingness to pay for a remanufactured product if they already have established a positive reputation as this increases the confidence of the customer. According to Pires et al. (2019), different approaches exist to promote the preparing for reuse segment and are often paired with the recycling of materials in the products (such as plastics, paper, or glass). A widely used, market-based strategy is the implementation of deposit-refund stations or systems, which means that a customer gets some sort of refund for depositing their waste material in appropriate stations (Pires et al., 2018). Allwood (2014) writes that there are mainly four types of reuse usually considered, namely the reuse of products, components, or the material itself as well as the scrap materials occurring during the manufacturing process. Lüdeke-Freund & Bocken (2019) describe reuse as redistribution, in other words, the process of using a product again after its lifecycle for the same purpose as the original product, with little to no change or modification. The ownership of the redistributed product is in this process usually changed from the original owner to a second hand one. Lüdeke-Freund & Bocken (2019) emphasize that these operations yield high profitability and are eco-friendly due to the efficient material usage.

3. Recycling

Recycling is considered to be crucial in counteracting increasing production rates and usage of primary materials (Geyer et al., 2016). Hopewell et al., (2009) argues that it is the most important action to reduce the impacts of oil usage, carbon dioxide, and disposal of waste. The author further explains that Recycling is the first step in dealing with products entering the waste stream, actions higher up the waste hierarchy act to prevent this from happening. Recycling could in theory work all the way down to particles or the original material form (Lüdeke-Freund et.al, 2019). There are however many materials that today cannot be recycled. Recycling is generally broken down into a liquid that is later purified, and some materials cannot become liquid, and some liquids cannot be purified (Allwood, 2014). Berlin et al. (2022) explain that recycling plays an important role in the circular economy for all industries, but that it is considered even more vital to the processing industry. This is explained by processing industries being characterized by continuous production with high material volumes, it does also highly influence the quality of material entering the supply chain which

affects how applicable recycling is for the given end product. Advances have been seen for metals on a global level as one-third of steel production is processed from scrap (Geyer et al., 2016).

When recycling is not appropriate, the material can be broken down to lower quality and used for other purposes, this is referred to as downcycling. Doing the opposite is also feasible for some material and is called upcycling as the material is processed to higher quality (Lüdeke-Freund et.al, 2019). Downcycling is considered the least favourable option of the two but is not expressed by the International Standard Organization (ISO) in their Life Cycle Analysis (LCA) standard, this is instead dealt with by distinguishing between Open and Closed loop recycling (Geyer et al., 2016). In this perspective, a closed loop recycling should lead to material being recycled in the same product system hence not including downcycling according to the same authors

As the world still relies on fossil fuels, the energy used for recycling strongly influences whether recycling results in environmental developments, this parameter is according to Lüdeke-Freund et.al (2019) often forgotten. Allwood (2014) points out the importance of seeing recycling as one option which is not always applicable. The author further emphasizes that recycling is to be seen as a less attractive option compared to actions higher up the waste hierarchy, but it is challenging to turn the hierarchy to practice. Geyer et al., (2016) explains that there exists a misconception about recycling directly influencing a reduction in primary production. This is however often not considered by the ISO and LCA reports do often calculate with a one-to-one displacement when comparing recycling to primary production, according to Geyer et al., (2016).

The creation of value in used material can result in new markets for actors contributing to the flow of resources. Gathering material from customers allows for further contact points which can lead to better interaction and increased customer satisfaction (Lüdeke-Freund et.al, 2019). The recycling business model can look very different depending on location and its involved actors, some models include customers carrying out the sorting of other uses deposits e.g., for plastic bottles with the aim of incentivizing customers to give them back (Lüdeke-Freund et al., 2019). In the Business-to-business (B2B) segment, third-party actors collect other companies' used materials and build a business case by selling sorted materials or products (Lüdeke-Freund et al., 2019). Geyer et al. (2016) explains that in order to develop a robust recycling system, there must be a steady supply of input together with equal demand for its output. If the waste hierarchy is to be followed, the recycling system should also promote stages higher up the hierarchy to not cannibalize the flow for alternatives with higher resource efficiency.

The high diversity of plastics together with low costs do work against circular plastic models, the large variation in the composition does make recycling more difficult, and

even if the labelling of it contains are increasing, rates are relatively low Allwood (2014). Geyer et al. (2016) further emphasizes that recycling is not commonplace for most types of plastics. Salmenperä (2021) points out that Sweden's recycling infrastructure is not sufficient, and it gets too expensive to recycle plastics on a governmental level. Geyer et al. (2016) uses a formula to calculate recycling impacts on the environment where it votes in favour of recycling if the environmental impacts in gathering, and processing of the material are lower than impacts avoided from primary production together with landfill. Even if it from an environmental perspective is favourable to recycle a given piece of plastic, it is also important to include that plastics are widely used to create commercial value as it is being used as consumable fuel (Allwood, 2014).

4. Recover

Other types of methods (than recycling) retain the energy used to produce. For instance, it can happen by incineration or gasification in order to recover the energy consumed by producing. According to Pan et al. (2015), a common technology used is waste-to-energy (WtE). WtE is according to the same authors divided into four categories, namely; physical, thermal, chemical, and biological. Energy recovery in most cases refers to combusting waste materials to harness the energy to generate power or electricity (Pan et al., 2015). Sweden's incineration infrastructure is under stimulated, which has led to increased levels of imported waste to be used for incineration in recent years (Salmenperä, 2021). The author further highlighted that the opinion of incineration is divided, one respondent from a municipality stated that it is an enabler for clean cycles, but private company respondents argue it steals material which could have been used in recycling, according to Salmenperä (2021).

5. Disposal

Proper disposal of completely unusable waste (such as radioactive waste) and storing it in areas where the impact is as small as possible. Disposal is the last option considered for waste in the hierarchy, since the material as well as the energy stored within the material will be lost to the environment as well as the economy and will not be able to replace virgin products in any shape or form, as the predecessors in the hierarchy have the ability to (Pan et al., 2015). Landfills are a common way to dispose of waste. According to Teuten et al. (2009), A well-managed landfill site lessens the overall impact on the environment, where the highest impact comes from the collection and transportation of the waste to the site. The biggest disadvantage with landfills is that the material is lost, and not possible to recycle, meaning that the flow is linear and not cyclic (Hopewell et al., 2009).

3.1.2 Closed & Open Loop Supply Chains

Ferguson & Souza (2010) explain that closed-loop supply chains (CLSC) has, in addition to the usual forward flow occurring in all supply chains, also a flow back (of products for example) to the starting point, thus creating a full circle. In other words, it refers to all forward flow in a supply chain, such as distribution or procurement of materials, as well as the reverse flows, such as processing of returns and returned products, as described by Kumar & Satheesh-Kumar (2013). The previous statement is also backed by Guide et al. (2003b) who further emphasize that a CLSC includes the activities from both the traditional forward supply chains as well as the reverse supply chains. Cannella et al. (2016) explain that a CLSC extends the forward supply chain by including channels from the reverse supply chain for product returns, recycling/recovery, remanufacturing, and resale. The ISO 14044 defines a closed loop as when "materials from a product system are recycled in the same product system". The history of today's perception of CSLCs dates back 19 years and has since gained a considerable amount of traction (Kumar & Satheesh-Kumar, 2013). More and more topics within circular supply chains have emerged during these years. A well-written definition of CLSC, which is used by many authors in this field is that a closed-loop supply chain "includes the returns processes and the manufacturer has the intent of capturing additional value and further integrating all supply chain activities" (Blackburn et al. 2004). A schematic illustration of a CLSC is presented below, see X4.

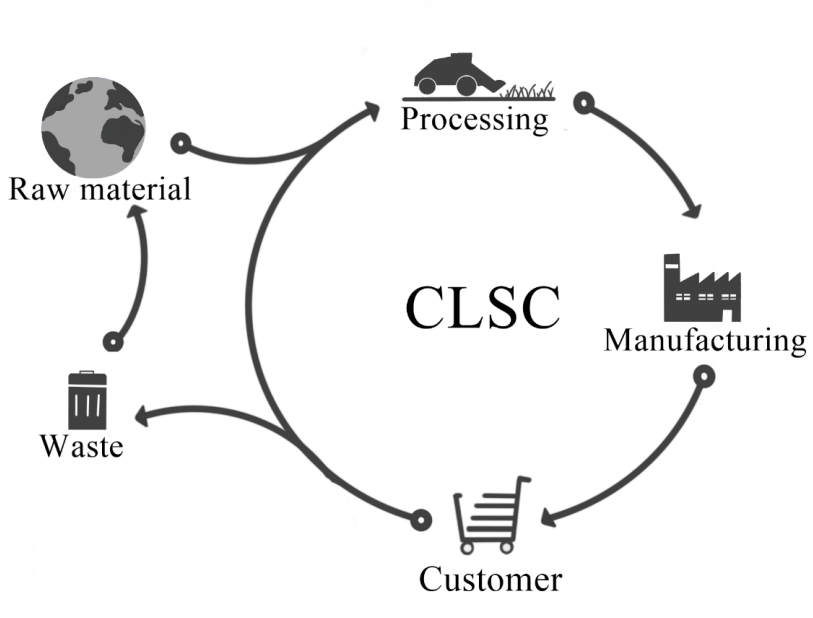

Figure 5: Illustration of a closed-loop supply chain (Drawn by: Åsberg, 2022).

There are plenty of positive aspects to CLSCs however many of these come with their own challenges. Remanufacturing is one benefit. Remanufacturing is when a company takes a product at the end of its life or use cycle and reuses the parts in order to create

new products (Ferguson & Souza, 2010). The benefits a company can gain include (based on the research by Ferguson & Souza, 2010);

- Extension of products life cycle – By reusing the parts of the product, effectively pushes the end-of-life date forward for the product

- Lower production costs – since the company is reusing components, this removes the need to manufacture/buy these components for new products, thus reducing the overall production cost of said product

- The company image can be perceived as greener since the use of remanufacturing will lower its overall impact on the environment

Another benefit of a closed loop supply chain, as compared to an open loop, is that the overall impact on the environment is drastically smaller (Kumar & Satheesh-Kumar, 2013). Kumar & Satheesh-Kumar (2013) further explain that contrary to open-loop supply chains, which has its aim of lowering the overall cost and making the whole chain more effective, a CLSC aims to reduce the overall consumption of resources and energy as well as reduce the pollution of the whole network, while still being as cost-effective as possible. In other words, while there still is a focus on reducing the costs and being more efficient, more environmentally friendly parameters are equally important in a closed-loop supply chain (Kumar & Satheesh-Kumar, 2013). Kumar & Satheesh-Kumar (2013) further emphasize that the environmental performance of the CLSC is included in both the internal and external management of the whole network, as opposed to a more traditional open-loop structure. Closing the loop for companies acting on a global market may involve trade-offs in where the benefits of reusing or recycling take place. If the production takes place in developing markets, they might still have low recycling rates as the material stays in the developed markets (Lüdeke-Freund et.al, 2019).

A reverse supply chain can also be established with either an open- or a closed-loop supply chain (Kabir et al., (2021). Ene & Öztürk (2014) explain that in a CLSC, the material is returned to the original producer, while in an OLSC, the returned material can end up at a new, third-party actor and thus, does not have to end up at the original producer/manufacturer. This is exemplified in figure 6 below with an extension of the CLSC.

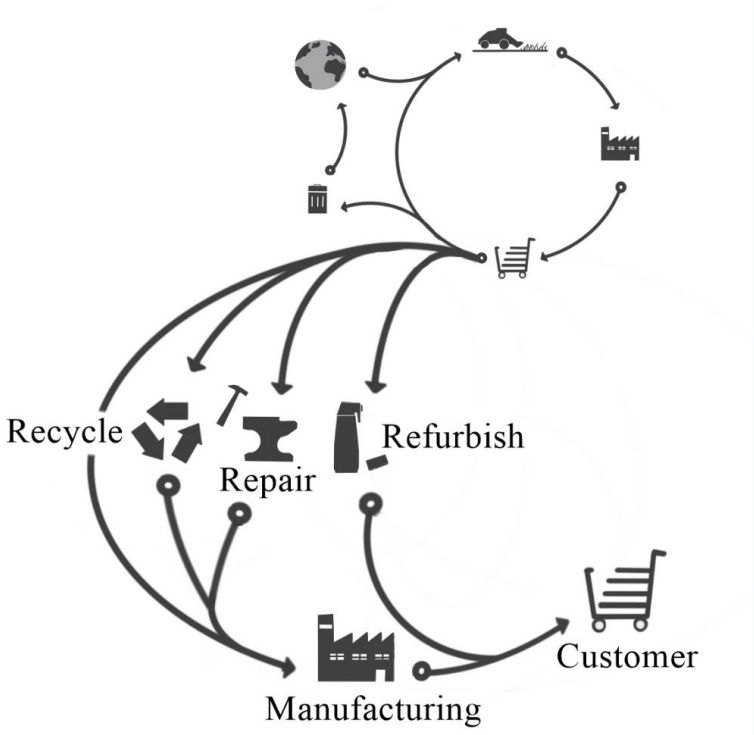

Figure 6: Illustration of an open-loop supply chain (Drawn by: Åsberg, 2022).

In today's society, many companies view the idea of closed/open loop supply chains as a drawback due to cost (Stock et al., 2002). The authors do however counter this by emphasizing that CLSC/OLSC can generate a competitive advantage. Stock et al. (2002) elaborates on this by explaining that factors that were regarded as differentiating prior have become more of a norm or must-have in most markets and adapting a reverse supply chain could be an excellent way for companies to differentiate themselves from competitors. According to Ene & Öztürk (2014), closed/open looped supply chains is a good way for companies in today's society to better their environmental impact as regulations are becoming more frequent, and an open-loop supply chain is one strategy these companies can achieve better results. Open-loop supply chains are, compared to closed-loop supply chains, easier to actualize in real-life situations, as the logistic design of open-loop supply chains is easier to adapt in order to benefit the company, while closed-loop supply chains are less flexible since the material has to go back to the original manufacturer for it to be a closed-loop (Stock et al., 2002). For Open-loop supply chains, the risk is higher that additional material is mixed together which could reduce the quality of the material negatively.

There are different views regarding OLSC, Goltsos et al. (2019) and Difrancesco & Huchzermeier (2016) both view OLSC as a forward supply chain i.e., the most common supply chain, According to these authors, an open-loop supply chain is a by-product of regular forward supply chains, which in simple terms could take the form of a product being sold in a second market. The ISO 14044 standard states that the difference between an open-loop system and a closed one is that in an open-loop system, the

properties of the materials in question can (but do not have to be) changed, whereas in a closed-loop, this is not possible or allowed (Geyer et al., 2016). Not changing the properties can be critical for some application areas hence arguing for a closed loop supply chain. Geyer et al. (2016) mention that it is not certain that less primary material is used in a Closed compared to an Open loop supply chain. It could be argued that the original producers possess the best knowledge of the product hence can optimize value recovery in the product, this argument is however debatable as several significant factors can be neglected (Van loon, 2021). The author mentions further that the number of cycles within closed loops is not a good indication for all products when measuring environmental benefits.

Key points Closed/open loop supply chain:

- There exist different views on whether CLSC is preferable to OLSC from an environmental perspective (Kumar & Satheesh-Kumar, 2013 || Geyer et al., 2016).

- CLSC aims to reduce the overall consumption of resources, and OLSC aims at lowering costs and increasing efficiency (Kumar & Satheesh-Kumar, 2013).

- OLSCs are generally easier to actualize, CLSC are less flexible but does not allow for properties to change in the material (Stock et al., 2002).

- CLSC can increase value recovery as the material is only brought back to the initial manufacturer who possesses knowledge of the material (Geyer et al. ,2016).

3.1.3 Transitioning to circular economy

Turning the traditional linear (take-make-dispose) to a circular economy is argued to be an essential condition for a sustainable future (Neves & Marques, 2022), which is also written by Patwa et al. (2021) who explain that the traditional linear mindset has the assumption that there exists an unlimited number of resources. Yet circular practices are generally limited to small scale initiatives with slow adoptions (Van Loon et.al, 2021). On a high level, barriers and challenges to CE transitions can be categorized as cultural, regulatory, economic, and technical (Baldassarre et.al. 2022). Kevin van Langen et.al (2021) adds to the list of barriers in place for CE transitions and states that without appropriate policies in place, it is not likely to see rapid advances in the field of circular economy. The following chapter summarizes a selection of studies carried

out together with practitioners in order to follow and analyse how a transition to a circular economy can look like in turns of drivers, criteria, and barriers.

Neves and Marques (2022) conducted a study which analyses barriers and drivers to CE in Sweden, Finland, and Austria. They focused on recycling and showed factors based on a triple bottom down perspective influencing the transition to CE. From a social perspective, Neves & Marques (2022) concluded that education is a driver for CE, as higher levels increase willingness to recycle and likelihood to buy products made from recycled material. From an economic perspective, the study showed that higher gross domestic product (GDP) per capita can act as a barrier for CE as higher purchasing power motivates buying new products. This factor is however highlighted by the authors to include uncertainties. In a single case study following leasing of washing machines, it was identified that B2B customers tend to be more functionality oriented which acted as one reason for B2B being better suited than B2C to the given CBM (van Loon et.al, 2021). From an environmental perspective, Neves & Marques (2022) emphasize the importance of removing negative attitudes held towards recycled and reused products and mentions that policymakers should target environmental awareness.
The authors further mentions that CE transitions would benefit from emission regulations together with financial instruments i.e., tax reduction for sustainable choices and increased taxes for products from primary material.

Van Loon and Van Wassenhove (2020) conducted a study following four case companies in their transition to circularity, the authors highlighted four challenges which may be of high significance when weighing whether a transition to circularity can be advantageous. These challenges are:

1. Understand market for recirculated products
2. Cost of operating circular business model compared to cost saving of remanufacturing
3. Access of good quality returns
4. Speed of technological progress

Even though these challenges are weighted to be low for a specific business case, van Loon & Van Wassenhove (2020) state that a transition path could still be hard and risky when acknowledging the details of each particular case.

Table 2: Identified Barriers and drivers for recycled plastics within the automotive industry (Baldassarre et.al. 2022).

	Barrier	Driver
Cultural	Competitive logic in the automotive sector	Increase Customer awareness on plastic waste
Regulatory	Traceability and verification of recycled plastics	Policy targets
Economic	Fluctuations in price for virgin & recycled plastics	High volumes of EOL plastics
Technical	Quality issues due to diversity in post-consumer plastic waste	Advances in chemical recycling

Baldassarre et.al. 2022 conducted a study identifying drivers and barriers for recycled plastics in the automotive industry following the cultural, regulatory, economic, and technical categories. The study presents a schematic illustration of the value chain where the barriers and drivers displayed in Table 2 are pointed out. They argue that the competitive logic in place in the automotive industry hampers the transition to circularity as actors in general do not share information between each other. This challenge is highlighted by Kevin van Langen et.al. (2021) to be particularly difficult for traditional manufacturers and not as applicable to start-ups with CE approaches embedded early on. Berlin et.al. (2022) explored what role supply chain collaboration has in the industry of recycled steel in Sweden. The authors explain that a circular economy transition raises complexity of product design together with issues in assuring quantity and quality. In the studied industry, they could identify dyadic, lateral, and horizontal collaboration. They concluded that lateral collaboration i.e., including both horizontal and vertical collaboration is particularly crucial in solving efficiency and quality issues in the industry.

The price of virgin plastics and recycled plastics does not change on the same parameters, virgin plastics fluctuate in connection to oil and gas prices, even though high volumes of EOL plastics are available, prices for recycled plastics can still vary depending on many factors e.g., sourcing channels, separation methods, testing. which makes it hard to define a business case for recycled plastics (Baldassarre et.al. 2022).

Gusmerotti et.al. (2019) conducted a study which collected data in connection to drivers and approaches to circularity from 821 manufacturing companies in Italy. The authors divided the companies in five levels based on CE adoptions. 65 % of businesses use a linear business approach, of the remaining 35%, only 8% was classified as using CE approaches in a holistic way with principles in all functions of the company. The

extensive study concluded that the economic drivers linked to shareholder expectations are the most effective. They further state that companies only chose environmental practices when also generating economic benefits. Gusmerotti et.al. (2019) points out that likelihood to adopt circular practices increase with dependency of natural resources. Managers of the traditional manufacturing sector do, according to the results of the study, focus on short term economic gains instead of long-term strategies which could reduce risk in e.g., exploiting natural resources.

3.2 Supply chain management

This chapter will cover the current literature on supply chain management on a broad scale and look into the most common actors such as different logistics actors, such as different modes of transportation, and actors within distribution, As well as going into the current literature on business networks.

3.2.1. Business networks

A business network is described by Johanson & Vahlne (2009) as several intertwined relationships consisting of several actors such as suppliers, distributors, competitors, and customers all coexisting in a market. These networks are sometimes referred to as nodes in literature. Håkansson & Ford (2002) explain that these nodes can be connected in different ways e.g., by an exchange in information or physical items, characterized by different compositions or dependencies. These connected nodes are what illustrates a relationship. A network is never completely stable in reality due to conflicts and other differences appearing, which has to be taken into consideration (Håkansson & Ford, 2002). Since the business happening within a given network, it should continuously reflect upon if their role should be an active one in relation to changes happening or the stance should be more reserved, and exploit benefits of being more conservative (in other words, a "wait-and-see" approach) (Håkansson & Ford, 2002). However, this balance between change and stability or being active or conservative is often difficult to base solely on literature, according to Abrahamsen & Håkansson (2012). This is according to the same authors because real-world situations are usually more dynamic in nature, and different real-life situation is usually more complex than the literature and can require their own approaches, depending on the situation at hand. For instance, if one actor in a network decides to change their position, these changes often affect other actors in the network also experience these changes first hand, and also have to adapt (Abrahamsen & Håkansson, 2012). Ford, et al. (2002) further emphasizes this, and these authors mean that developing and exploiting the focal company's own abilities is made possible through adapting, learning as well as losing or gaining access to the different relationships in a network and the changes happening due to this. According to Hoyt & Huq (2000) traditional business relationships are usually considered to be at arm's length where price is the predominant factor. Nowadays however, relationships are more built on trust and information sharing, as stated by

Jamaluddin & Saibani (2021). According to the authors, managing supply chain relationships is always challenging but it is a key factor for a successful process, especially in the B2B (Business-to-Business) paradigm. Jamaluddin & Saibani (2021) found in their study that B2B supply chain relationships can be divided into three approaches. These approaches are trust-based, power-based and coopetition approaches, where the currently most widely used approach is the trust-based one. Coopetition means that the actors are involved in both cooperative and competitive actions simultaneously (Jamaluddin & Saibani, 2021). The authors continue and explain that trust-based relationships can be linked to collaboration, cooperation, and coordination, while power-based relationships consequently are more based on transactional, arms-length, and competitive relationships. Arms-length relationships are further defined by Hoyt & Huq (2000) as relationships where little to no investment is made into the relationship and minimal information is shared between the actors.

Business relationships are complex structures that depend on several aspects. According to Möller & Halinen (1999) these aspects include how different parties act, and developing well-working relationships is a dynamic and time-consuming process, which is prone to constant change which requires continuous effort from all parties. A common perception regarding the management of a relationship is that, according to Möller & Halinen (1999), managing a two-actor relationship, between a supplier and distributor for instance, is challenging from a business network standpoint. This is further enhanced by Abrahamsen & Håkansson (2012), who stresses the importance of the relationships which the networks are built upon. According to Abrahamsen & Håkansson (2012), a good business relationship is the key to a well-functioning network and understanding the issues and challenges of the other part of the relationship is vital.

According to Ford et al. (2002), A good way to describe and analyse networks and relationships between various actors is by the use of a focal company and changes too or in said focal company will impact the entire network of actors and relationships. The stronger the bond or (or link) becomes, the more impactful the relationship is. However, this means that the actors in the relationship have to invest more resources in order to maintain the relationship, according to Håkansson & Ford (2002). Analysing the network from various perspectives and using different data points to gain a broad database is important, in order to minimize risks and identify issues early as well as understanding the consequences of decisions being made at an early stage (Ford et al., 2002).

Within a business network, Wynstra et.al (2014) used triads and tetradic relationship archetypes to describe how actors are influenced, having dependencies together with risk getting bypassed. The traditional triad consists of a supplier, buyer, and customer. In this setting, the buyer can act as a link between the supplier and customers and could therefore be threatened by the supplier establishing contact points directly with the

customer i.e., bypassing the buyer. In figure 7 below, a tetradic relationship archetype is visualized, in comparison to the above example; a manufacturer is included as a fourth actor. According to Wynstra et.al (2014), all actors stand in for threats of being bypassed: the supplier can be switched, or activities completed in-house by the manufacturer, the buyer can switch manufacturer or source directly from the supplier, the retailer can be bypassed by either supplier or manufacturer. In figure 7, the threat of a retailer being bypassed by the manufacturer is highlighted.

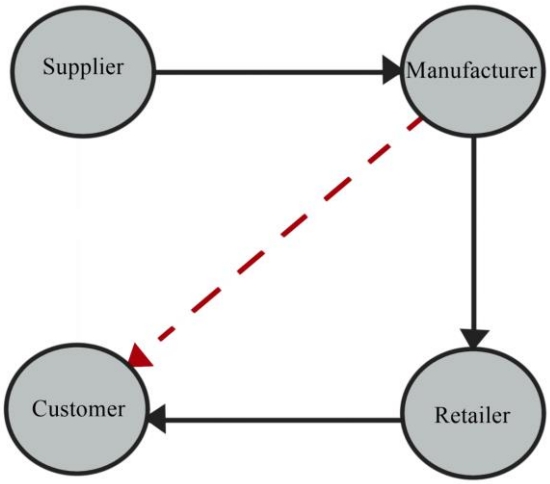

Figure 7: Tetradic relationship model (Drawn by: Åsberg, 2022, Amended from Wynstra et al., 2014).

3.2.2. Sustainable Supply Chains

Sustainable supply chains have, like many other environmentally focused subjects, gained increased popularity in recent years, according to Tsai et al. (2021). The authors explain that the reason for this is because of increased resource scarcity, a severe rise in global population as well an increase in global waste and pollution levels. There are several different descriptions of sustainable supply chains and sustainable supply chain management (SSCM). Carter & Rogers (2009) definition of SSCM is a complete integration of TBL in business processes in order to improve relationships between different actors in the supply chain in the long term. Seuring and Müller (2008) define SSCM similarly as the management of capital, information, and material flow as well as the collaboration for the parties of the supply chain, while simultaneously taking the sustainable development goals in the TBL into consideration and adopting them into the supply chain. Alzoubi et al. (2020) state that Liu et al. (2017) define a sustainable supply chain as having the goal of gaining a competitive advantage while improving the profitability. At the same time, a sustainable supply chain should decrease the

environmental impact of the supply chain, while increasing the positive impact on the people in and outside of the supply chain (Liu et al., 2017). Alzoubi et al. (2019) explain that the triple bottom line (TBL) is a strategic tool used to incorporate sustainability into the supply chain, which can also be understood in the articles from Carter & Rogers (2008) and Seuring & Müller (2008).

Corporations today try to implement their supply chains in sustainable ways, and according to Khan et al. (2019) producing greener products and having a more sustainable way of thinking is trending toward becoming the future business area.

3.2.3. Supply Chain Resilience

Supply chain resilience has its origin in the study of resilience, which in turn has its origin in development theory of social psychology and has relations to social vulnerability, politics as well as risk management (Ponomarov & Holcomb, 2009). The essence of *supply chain* resilience lies in the incorporation of readiness for unpredictable and sudden disruptions/changes in any given stage of the supply chain (Ponomarov & Holcomb, 2009). Ivanov (2018) writes similarly that supply chain resilience refers to the ability to stay robust and adjust in dynamic environments when disruptions occur. This is further elaborated by Scholten & Schilder (2015) who explains that supply chain resilience allows the whole chain to be prepared for unforeseeable events and reduce the impact of disruptions happening as well as strengthen the supply chain in the sense of quick recovery from the disruptions.

Elwood (2020) emphasizes that Agility, Adaptability and Alignment constitute three pillars when building a resilient supply chain. Agility is needed to make quick and appropriate responses, adaptability as supply chains are acting in dynamic markets with high competition, and lastly alignment to establish incentives for increased performance for all key actors involved.

Disruptions in a supply chain can in principle occur unexpectedly anywhere along the supply chain. Since many supply chains in recent years have evolved into global entities with shorter product life cycles and has seen an increase in requirements such as customer requirements, unexpected disruptions can have significant financial as well as operational impact (Ponomarov & Holcomb, 2009). Elwood (2020) writes that supply chains can be broken down to its internal and external entities which are interconnected with the purpose of delivering value to the market. Ponomarov & Holcomb (2009) further explain that disruptions in the supply chains can occur due to many reasons, including internal sources such as failure in integrating all of the functions in the supply chain fully, or external factors, such as natural disasters or events occurring, which is hard to predict and hedge the supply chain against

prematurely. Ivanov (2018) states that when disruptions are not localized, it can lead to a ripple effect and cascade down the supply chain.

The past decades has been influenced by business practices striving for flow efficiency with reduction in waste and buffers i.e., lean, and just in time (Elwood, 2020). These practices have been built on the premise of growing globalization leading many companies to outsource activities to developing countries in an attempt to reap advantages in the market (Elwood, 2020). The author further explains recent events e.g., trade war, Brexit and COVID-19 together with increasing demand for transparency from customers has made companies question whether higher priority should be held on resilience. According to Knemeyer et al. (2003) however, supply chain disruptions can also lead to unexpected opportunities. Examples of this are when UPS employees went on strike 1997, FedEx seized the opportunity to fill the void in shipments during this period, or when Dell took advantage of the West coast port lockout in 2002 and filled the demand of LCD screens by using air freight (Knemeyer et al., 2003).

Companies can take hands-on actions in order to improve resilience. One external action could be to carry out audits of their most important suppliers, which according to Elwood (2020) does not focus on clauses connected to ISO standards, but rather focused around the suppliers capabilities connected to resilience e.g., evaluating the level of engagement in top management, how processes, strategies and decisions are developed at the supplier.

Ivanov (2018) argues that there are interconnections between sustainability and resilience, strategies such as single sourcing, cost efficiency and waste minimization can be environmentally and economically advantageous, but it can also lead to deficiencies in supply chain resilience given shallow buffers and limited availability of supply.

Efforts to enhance visibility in the supply chain often start by mapping out the supply chain (Elwood, 2020). It is important to include lower-level suppliers in order to track the source of material as it could be identified that several suppliers are dependent on a single sub supplier or suppliers that are geographically concentrated which increase the company in question's risk (Elwood, 2020). A second step can be to map out the potential threats focusing on impact on the own company which could be used for decision making to increase the level of resilience (Elwood, 2020).

Elwood (2020) presents numbers entailing that 40 percent of businesses never care to map out their supply chain, entailing that many actors lack understanding of risks, and of those who make efforts in mapping out the supply chain. The author further explains that it is few who reach further up than tier two suppliers and points out a concern for the visibility in small to medium size businesses (SMEs) as it is common that

disruptions within the supply chains are not measured. This can lead SMEs in the dark without understanding of how and what has made the company suffer.

3.3. Business models

Looking at traditional businesses and business models Kurdve (2014) explain that minimizing the unnecessary consumption is something that the customer wants to do, while the supplier at the same time wants to maximize sales in order to achieve high profits. This means according to Kurdve (2014) that the customer takes responsibility to not use the products unnecessarily while the supplier takes responsibility regarding the production and supply of the product(s), in a traditional business setting. Kurdve (2014) further elaborates and explains that the success of this concept does not happen automatically, but revolves around several factors such as supplier selection, allocation of responsibility and the scope of material and connected services need to be considered and connected into the design of the business model. All business enterprises have a business model (BM) that describes how value is both created and presented between a company and its customers and further how revenue streams are designed to generate profit (Bankvall et al., 2014). It gives an accurate view of how management within a company predicts future customer demand together with how they want it and how the organization should be designed to deliver it in that way (Teece, 2010). This can be boiled down to four key questions managers should ask (Frishammar & Parida, 2018):

- What is offered to customers?
- How can the activities and processes be designed to deliver value?
- Are the revenue streams generating profit?
- Who is the target?

Bankvall et.al (2017) divides BMs into two categories, firm-centric and network-embedded. The first is more traditional and focuses on value created by business i.e., revenue streams from customers. The second is a new type of BM which emphasizes the view of networks consisting of multiple actors contributing with dynamic resources and carrying out activities. Teece (2010) argues that a well-established business model does not alone assure sustainable competitive advantage, as the BMs are generally transparent, competitors will by time imitate.

When looking at circular economy, Gusmerotti et al. (2019) explains that there has been a spike in interest for the subject in recent years. There exists a plethora of articles concerning circular economy business models (CEBMs), such as the frameworks by Lacy & Rutqvist (2016). The authors identified five circular business models, which are suitable for the transition from a linear business model to a circular one and for

circular growth. According to Lacy & Rutqvist (2016), the business models are as follows (summarised by the authors of this thesis), and each model operates in different parts of the value chain:

- Circular supplies - Replacing virgin-based resources and instead utilizing renewable energy sources as well as bio-based or recovered material, with the ambition to reduce the extraction of virgin products in the long run.
- Resource recovery - Using waste to generate raw materials. Thereby removing the need for waste disposal at the same time as it reduces the need for extraction of new raw material.
- Product life extension - By extending the life of a product, these types of models gradually slow the rate of the product flow in a system, which in turn leads to less raw material needing to be used.
- Sharing Platforms - By partnering up with other actors, and sharing the same resources, the demand for some resources (such as rare or "slow-running" resources) can be reduced.
- Selling products as services - Instead of selling products (the owner of the product changes), these models promote selling the products as services (owner stays the same), and by doing this, the need for new products can be reduced.

Servitization entails a transformation from a product-oriented offering to a service offering, according to Kindström & Kowalkowski (2009) this transition can also take form as an addition to the product-oriented offering which is common for manufacturing companies as it can enlarge the product portfolio. Frishammar & Parida (2018) argue that incumbent firms are transitioning from a solely manufacturing approach towards a combination in order to reach circularity and sustainable development. Olivia & Kallenberg (2003) argues that services are generally more difficult for competitors to imitate, result in increased customer satisfaction and generate higher margins. Altogether, servitization can increase a company's competitive advantage, explaining why many actors are following this trend (Kindström & Kowalkowski, 2009). Mathieu (2001) separates services supporting a product (SSP) and services supporting the customers (SSC). SSP are usually more traditional and characterized by low customization e.g., aftermarket sales. SSC includes more advanced services with high customization as the supplier supports specific needs and requires more intense relationships with customers. Frishammar & Parida (2018) uses similar logic to separate a use-oriented business model to a result-oriented business model, in this setting, SSP aligns with a use-oriented BM and SSC to a result-oriented BM.

Depending on what type of service is to be provided, it is important that the supplier possesses the capabilities necessary to deliver high qualitative services (Olivia & Kallenberg, 2003). Story et al. (2017) distinguishing different capabilities depending

on the actor in the network, manufacturing companies need to supervise both products and services with customer orientation, intermediaries should manage coordination of third-party products and services and customers need to focus on co-creation of value. The service supplier is according to Grönroos (2015) a value facilitator enabling the customer to create value, this perspective focuses on a joint sphere leading to co-creation of value between the supplier and customer. Frishammar & Parida (2018) explain that product-service systems acts as the foundation for sustainable development and is necessary when targeting increased resource efficiency, this can influence the business model to transform towards pay-per-use.

What to focus on in your business model can shift depending on the state of the market you act in according to Debenedetti et al. (2021). The authors emphasize the importance of achieving and maintaining legitimacy for the product, service, or technology one offers said market. For a new or immature market, it is important to build legitimacy, since legitimacy according to Debenedetti et al. (2021) leads to products being socially acceptable, which in turn makes them more desirable by customers. Debenedetti et al. (2021) also explain that if a market gains illegitimacy, this will have negative effect. Examples of this can be when the use of diesel-powered cars started to receive negative publicity due to the amount of NOx emissions related to diesel (Debenedetti et al., 2021). The authors explain that when you enter a market which is considered new, you should focus on building the legitimacy of the market. If the market is stable, it is important to reinforce the legitimacy of the market. Once the legitimacy of the market is ensured, the threat of competition increases and it is up to all actors to maintain the legitimacy of the market (Debenedetti et al., 2021).

There is a difference in strategy for a company choosing to operate in a B2B or a B2C fashion according to Réklaitis & Pilelienė (2019). A business to consumer market is often limited to a geographical area or amount of people in a city/country whereas a business-to-business market is limited to the number of companies operating in the market (Réklaitis & Pilelienė, 2019). B2B approaches are typically associated with larger orders, longer cycles and are often more complex than B2C business models according to the authors.

4. Results

This chapter will present empirical findings from 11 respondents with varying competencies. This aims to act as the foundation for the next coming chapter where the results will be further analysed

4.1 Background of Respondents

This subsection provides the reader with a small background of the respondents which the interviews for the empirical data was conducted with.

Respondent A - works at a plastic recycler and holds the position of manager for business development and project management. The role consists of both managing single projects together with having an overview of a wide range of projects the company is doing internally and externally. Respondent A emphasizes the importance of alignment in projects and funding to the company's strategy. The respondent argues that the position is not typical if compared to a conservative business setting and that it includes developing different areas of the company including sourcing input material, marketing and communication, and IT.

Respondent B -works at a large, international net and rope manufacturing company. The respondent is the director for the Scandinavian market and has worked within the industry since 1995. The main business area that respondent B covers are trawl fishing and aquaculture in Scandinavia.

Respondent C - has worked at DFS AB for about 10 years and has since 2017 had the role of project manager. The position is explained to include a versatile mix of projects. Respondent C joined the ReLine project about one year after respondent D initiated it. Respondent C joined the team as it was too big of a workload for one person together with them being able to complement their competencies. Respondent C´s role was connected to developing a business case.

Respondent D - is the part-owner at DFS and works close to the fishing and marine industry and has participated in many projects connected to ropes. This includes designing custom-based solutions for customers within the marine industry. Respondent D started the ReLine project and expressed that recycling has been a hobby which is part of why the project started.

Respondent E - has several years of experience in logistics, sustainable development, and circular economy. The respondent works as a circular lead at a large TPL provider and is since a year ago, a board member at DFS. The respondent has worked with funding projects connected to circular economy and logistics at a university.

Respondent F - is the CEO of DFS. The respondent has worked at the company for 10 years. The respondent had the overall responsibility for all the employees earlier but has since delegated the responsibility to several department heads. The primary focus of the respondent is currently to manage the management team and work with the strategic questions the company works with.

Respondent G - works at a netting company owned by a very large corporation. The company that the respondent works at main focus is to provide equipment for the aquaculture industry (fish farming industry). The respondent is part of the R&D department.

Respondent H - is a representative of a fish farming company. The company is part of a company group together with another fish farming company, and the respondent works with environmental questions for both companies. The respondent works a lot with archiving and journaling, as well as legislation.

Respondent I - work at a fish farming company. The respondent's role at the company is that of a business area manager for two different fish farms, which handle different types of fish.

Respondent J - works at the same company as respondent I. Respondent J is a fishing consultant and fish farming strategist. this respondent works on a more macro level with questions regarding fish farming.

Respondent K - works at a company that specializes in plastics. The respondent works in the department for polymer materials and composites at the company, the areas in which the respondent also specializes.

4.2. ReLine

Respondent C explains that ReLine has since early on been developed with the concept of circular economy in mind. According to Respondent D, the business idea was brought to light in a conversation with a customer to DFS. The customer questioned if there were any recycled options in which the customer could substitute from the virgin plastic ropes, Respondent D had earlier experience developing prototypes made of recycled plastics which made the respondent intrigued to investigate the possibilities. Respondent D explains that the action plan included contacting the recycler where respondent A works, located in Denmark, as the recycler processed discarded maritime plastics. The concept of circular economy and ideas of how to close material loops was initiated already at this stage as the intended customer base acted in the same industry as the recyclers input material came from.

The recycler was according to Respondent A initiated by a feasibility study in 2012 where the waste stream of maritime gear, especially nets, was considered a valuable resource that had the potential of being brought back to life in a circular economy. Respondent A explains that during the first five years, the focus was mainly held on technology and innovating machinery necessary to recycle fishing nets and ropes. Respondent A mention that production started in 2017 and from that point, the company has gone through what could be described as a commercialization phase where they strived to create a demand for recycled plastic.

Respondent D believes that there exists a strong desire to choose sustainable materials for companies in the maritime industry. Respondent H works at a fish farm in Sweden and explains that the company is frequently disgusting circular economy and further states that the company would be interested in creating a circular solution for their plastic ropes. The interest arises according to Respondent H because there is a constant inner drive at the company to always improve its environmental footprint. Respondent I, who represents another fish farm, explain that they are also open to being part of a circular economy when it comes to plastic ropes, as long as there are clear routines in place and that everything works as intended. Respondent D further explains that many companies work with EU´s sustainable development goals and that there is a specific goal for ocean plastics.

4.2.1 Receiving top management support

Respondent C explains that efforts connected to a circular economy have previously never been conducted by DFS, the company does however work towards sustainability

goals, including a goal to reduce carbon emissions. Respondent C mentions that it is difficult to point to one reason for DFS's interest in initiating this project, the company has its background in fishing, so ropes and nets have been a large part of the company's history. Respondent C state that this has however changed during the years, but the roots are still noticeable.

Respondent C mentions that they had an advantageous situation in turn of getting support from top management given that Respondent D is part owner in DFS, and Respondent C is part of the management team.

Respondent D explains that they had a lot of freedom and could develop the project without requirements and a sense of being monitored during the first phase of the project. Respondent D mentions that when ReLine received the first price in a environmental competition in Amsterdam, DFS saw that there was potential in the project. Respondent E mentioned that ReLine was not discussed in board meetings for the first two years of the project. Respondent F expressed that the reason for this lies in ReLine not having a physical product in place to sell resulting in not having strategic sales decisions to discuss on the board level. Respondent F explains that DFS has always been selective with the strategic projects and directions they should work with as everything needs to have a natural place in the company.

Respondent C explains that before ReLine was a subject at the board level, Respondent C and Respondent D worked to gather material in order to present a business case for the board members of DFS. The realization of the large plastic rope volumes in the Norwegian fish farm industry accelerated their focus on the project as the respondents believed that it could lead to a profitable business case. Respondent C explains that long-term planning includes other industries as well but if ReLine got a foothold in the fish farm industry, this industry alone has the potential of reaching economies of scale according to their research and it is henceforth given the top priority. When Respondent C and Respondent D presented the business case, they did not hide that the project would most likely not lead to a fast-paced return on investments. Respondent C explain that ReLine was, however, not in need of large initial investments which made it easier to convince the board to keep on developing the project.

4.3 Establishing supply network collaboration

Respondent D believes that it is important to rethink relationship models when transitioning from linear models, the argument is based on that circular business models increase the need for collaboration. Respondent D further explains that actors within the network should not see each other in a traditional setting and develop a level of partnership beyond transactions. Collaboration is according to respondent C, one of the pillars of DFS. The respondent further expresses that this becomes transparent when

looking closer at the ReLine project as the project in itself builds on the premise of collaboration between actors who are dependent on each other.

Respondent D explains that the collaboration with the recycler has from the start been rooted in the alignment of working with recycling. Respondent D expresses that the support has been extraordinary, and the recycler shows that they want to assist in any way possible to reduce the volumes of plastics ending up in the ocean. Respondent D expresses that they share many views on things which makes the collaboration easy going. Respondent C explains that DFS and the recycler of course have individual business interests as the recycler wants to sell pellets and DFS wants to sell ropes. Respondent C continues by explaining that this is however not the full picture, ReLine is not a cash-grab as it aims to transform the industry. Both companies share this goal, according to respondent C, which strengthens the collaboration. Respondent D explains that DFS and the recycler stand on equal ground, and both are dependent on each other. Respondent D expressed that DFS aims to control the backward flow of material for ReLine to increase the recycler's availability of input material.

Respondent C express that even if the pellets from the marine industry can give rise to difficulties in extrusion (making the pellets into threads), they are not willing to change to another recycler at this stage. Respondent C continues by explaining that because they aim at creating a circular economy, they need to have high transparency to be able to assure customers where the input material is coming from. Respondent C explains that the information flow needs to be circular as well. Respondent D mentions that there are actors who recycle plastics in Norway, but it currently does not exist any circular loops as the material goes from e.g., being a rope to a chair and then the cycle ends and the value in the material is lost. Respondent D does however raise a concern that there is an increasing amount of recycling facilities opening which is good from one perspective but could potentially bring difficulties to get the material back to the recycler DFS is in collaboration with. Respondent C mention that if there would open new recyclers in Norway with similar ambitions and quality as the one in Denmark, it could be the case that ReLine uses several recyclers in the reverse supply chain. Respondent C mentioned that this is however not something that has been evaluated in detail at this stage as there is no other actor who has the same quality as the recycler in Denmark. Respondent C explains that the plan is for long-term collaboration with the recycler in Denmark, but if the game plan changes, DFS's responsibility is to assure that decisions align with what is best for ReLine as a product.

Respondent C mentions that one early barrier for the project of ReLine was the difficulty in finding actors to collaborate with. Respondent C continues and explains that this barrier potentially occurred due to producers being sceptical to start with recycled plastics as it could be difficult to go back to virgin plastics. Respondent C elaborates by explaining that if they start delivering recycled plastics, all customers may demand it and it could be a riskier business model. Respondent C states that cannot

verify this, but it did however take the project one year to find the first actor interested in producing the rope.

Respondent D explains that scepticism exists among the suppliers towards recycled material, since they have a steady stream of supply with virgin material in place and looking at the situation from a business point of view, it is rather evident. Respondent D explains that suppliers are hesitant towards recycled material, as this could disrupt this steady stream, and uncertainties still exist regarding how effective recycled material will be as a replacement for virgin material. When delivering a new product to the market, Respondent C explains that it was difficult to find actors which were willing to try something for the first time, especially in the market of ropes, since many actors have been using the same types of products for a very long time. Respondent A explains that their recycled products are at this stage not solely to be seen as replacements for virgin materials, but as complements to the virgin industry depending on the area of application.

Respondent A highlighted that a barrier was initially that they needed to get producers to try their material, Respondent A mentioned that this barrier has been bridged and they have today established a customer base that demands the product. Another barrier mentioned by Respondent A is that the transportation costs are high since the recycler source their input material from various suppliers at various global locations.

Respondent D was the one who initiated the search for actors who could extrude the plastic pellets from the recycler, Respondent D had been in contact with companies in Denmark, Turkey, Germany, and Korea but without success. Eventually, Respondent D found an actor who earlier had succeeded in extruding the recycled pellets. Respondent D mention that after receiving the first sample, interest from rope manufacturers grew substantially. Respondent B who works at the manufacturer has known Respondent D for several years, Respondent B has also worked together with the same recycler and has extensive experience from several projects connected to recycling and plastic extrusion. According to Respondent B, the collaboration with Respondent D was a perfect match as they were heading in the same direction and the company had the competence to carry out both the extrusion and the twisting. Respondent B mentions that many other rope manufacturers outsource the extrusion and only do the twisting.

Respondent D explains that DFS collaborates with the manufacturer besides ReLine as DFS has been sourcing virgin products connected to the marine industry for several years. Respondent D mentioned that ReLine however is the first case where the companies have engaged in a closer collaboration where DFS is included in research and development (R&D). Quality and service are explained by Respondent D to always have been high for the virgin products. Respondent D explains that it has been several changes connected to the product and delivery estimates which are pushed. Respondent D explains that DFS does not know for certain why some of these changes occur.

Respondent C explain that there is no doubt that the manufacturing company is very skilled and has great quality in all their products, they were the ones who in the early days supplied us with the prototype of 100% recycled plastics which was of great quality. Respondent D explains that they checked the quality of these prototypes themselves. Respondent C explain that issues with communication have however occurred after this in connection to difficulties with production as respondent C's opinion is that they have not thoroughly been briefed on the reasons for the delays and difficulties. Respondent C explains that this raises concerns about DFS not being included in what is going on. Respondent C believes that Respondent B believes in the project and has enough influencing power within the company to solve issues connected to the product. Respondent D has been in contact with the manufacturer and emphasized the importance of them having a good dialogue with the recycler, communication has improved after this according to respondent D.

Respondent C explains that a factor that can cause the power balance to shift is the fact that the manufacturer has its own sales channels which could cause interest conflicts in turns of cannibalization or if they were to launch their own recycled rope without DFS. Respondent C explains that similar situations occur in most industries, and it gets important to nurture the relationship to create a situation where all parties benefit.

Respondent D believes that potential customers of ReLine could benefit from collaboration, the respondent mentioned that the customers could possibly get paid for their consumed ropes as they hand them back to the recycler. Respondent E expresses that competitors collaborate in other practices and that it can be advantageous in order to reach mutual sustainable development. Respondent E does however mention that this can be difficult for many actors as they are afraid of competitors getting hold of intellectual property. Respondent D express that it is in the customer's best interest to increase the efficiency of reverse logistics and one way could be to collaborate with each other. Respondent E mentions that one or more actors need to take the first steps toward a more collaborative approach and show other actors that they are open to collaboration to reach sustainable supply chains. This is however according to Respondent E an exception rather than common practice in the industry, thus causing a large barrier to development.

Respondent C mentions that the collaboration with the customer will be important as the collection of old ropes will most likely not be possible to be uniform for all customers as they have different prerequisites in sorting, storing availability, etc. Respondent A mentions that they put a lot of effort into training actors in order to align processes, both in turn of sending plastic to the recycler instead of other outcomes and also for customers who change input material from virgin plastic. Respondent A exemplifies that the first step in their value chain can be described as a circular dialogue that needs to be across industries. This is motivated by Respondent A as the industries get intertwined, on one hand looking at the quality, volume, and availability of the

marine industry and on the other aligning it with demand and dependencies of the plastic industry together with customers. Respondent A mentions that lack of design for recyclability and disassembly are subject to causing barriers in the maritime industry, nets and ropes are not necessarily manufactured today with this in mind which causes difficulties as a large proportion of the material is not feasible to recycle. Respondent A emphasizes that they need to provide the industry with information and find an audience that is willing to listen in order for the design to change in favour of recycling. Respondent I mention that their current way of doing business does not include high levels of collaboration with suppliers. This is also mentioned by Respondent H.

Respondent C believes that ReLine could benefit from collaboration with further actors, but it is difficult to map out which actors it would be most beneficial to collaborate with. Respondent C explains that in short term, they are not dependent on further actors to collaborate with, but in order to establish a reverse supply chain, it would be advantageous to find actors to collaborate with. Both Respondent C and Respondent D propose that DFS as a company can take charge of the reverse supply chain. Respondent C explains that they could put containers at their customers with either the DFS or the Reline logotype on the container, making it extremely easy for the customers to know where to sort discarded maritime plastics. Respondent F explains that DFS has developed capabilities beyond being a ship supplier and could today be described as a logistic provider.

Respondent G and Respondent C both propose (with small variations) to have certain checkpoints in strategic locations close to the customers where the companies can sort their waste properly and where the products from there can be transported to the recyclers, removing the barrier of having semi-full trucks. These checkpoints can according to Respondents D either be a collaborative effort by the customers in the proximity of these locations or an independent actor. Respondent A agrees and also suggests that using a pawn system is another good way of making sure that customers are more willing to participate in the reverse supply chain as well as the forward supply chain. This is backed by Respondent B who believes that adding additional prices to the products (the Reline rope) that the customers will get back upon returning the rope, will help the circularity bloom.

Respondent D suggests that it could exist a conflict of interest due to potential customers having existing contracts in place for the waste streams with other logistics providers. Respondent D does not, however, believe that large proportions of this material are being recycled, it most likely ends up being incinerated. Respondent G explains that they have a recycling operation in place for the nylon they use in their nets, but they send their other plastic waste, such as ropes, to incineration. The actor who currently recycles the nylon is explained by Respondent G to be a subsidiary of the company. Respondent J explains that they currently do not have any contracts in place regarding recycling, this is also the case for the company where Respondent H

works. Respondent H explains that they have looked into developing practices connected to their waste streams but do not have any particular solution in place which would obstruct the usage of DFS's potential logistic solution.

Respondent C mentions that it is not yet decided how the reverse supply chain best can be orchestrated. Respondent C expressed that it is difficult to know at this stage as it depends on several parameters which are currently not known. The respondent mentioned that DFS has experimented in Sweden by collecting EOL plastics in big bags from customers, weighing them, and then sending them to the recycler. Respondent C mentions that they still are in the early stages of this project, so no conclusions can be made yet. Respondent C mentions that actors will need to find economy in this process. Respondent D mentions that the reverse supply chain is part of the recycler's responsibility as well as it lies in their best interest to receive the input material. Further examples given by Respondent C would be to collaborate with actors who could increase influencing power for legislation in Norway as this could trigger higher demand for ReLine according to the Respondent.

A barrier the project has encountered is according to Respondent C scepticism with regards to the ability to target fish farms as the company previously has no experience in working with them. Respondent C continues and explains that they had little knowledge of their processes and from whom they sourced ropes today. It was simply a new market for the company, and it became evident that it came with difficulties. Respondent F believes that DFS can provide value by being experts on recycled ropes. Respondent F does however state that it is important for companies to focus on their core competencies and that DFS currently stands at a crucial tipping point in turns of deciding what processes are advantageous to keep in-house and what to outsource. A second question brought up by Respondent F is to find actors who are interested in establishing some level of partnership. Respondent F further states that it currently exists threats of other actors copying the concept of ReLine. The respondent emphasizes that DFS needs to map out the competition as there is no point in partnering with an actor who has the intention of running off alone further down the line.

Respondent C expressed that DFS has talked about collaborating with a large actor who already sells products on the Norwegian fish farm market as this could generate increased volumes. Respondent C express that establishing this type of deal could be beneficial, but it can be difficult to agree on terms given power imbalances between the companies. Respondent G mentioned that subcontractors usually send ropes to the company and then the respondent carries out tests and gives feedback. Respondent K mentions that it is difficult to get to know the exact mixture of input material when testing plastics. Respondent G expressed that they would like to test ReLine to evaluate if they can use it in their products. Respondent G mentioned that the company is currently on the outlook for increasing their developments connected to sustainability,

which includes going into collaboration with new subcontractors. Respondent G further believes that the company can be part of a circular business model.

Respondent D expresses that a manufacturer of fish farm equipment could be of interest for collaboration. Respondent D explains that there could however exist a conflict of interests given that the manufacturer of ReLine supplies many of these actors today. Respondent D expressed that in this situation, DFS would act as middlemen, and it is important to be cautious as DFS might be bypassed. Respondent C believes the best approach for DFS is to first develop recognition at the fish farms and after this approach other actors. Respondent C explains that this could generate customers to start demand ReLine and it will be harder for other actors to copy the concept. Respondent C mention that it will be important to reach win-win agreements with the other potential collaborating actors, this could induce DFS to receive lower margins in order to reach larger volumes.

4.4 Product requirements

There are many aspects that have affected the composition of the ReLine rope, Respondent D explains that at the beginning of the project, the intention was to make the rope out of 100% recycled material. The first prototypes of the rope were successfully extruded from 100% recycled material, however further down the line of the project, Respondent D explains that they got news from the manufacturer that they would not be able to manufacture ropes made of 100% recycled material, they had to add virgin material. Respondent B explains that this is because the extruding machines did not respond well to 100% recycled material. The line was stopped almost every 20 minutes (on average). In order to solve this problem, virgin material had to be added to the mixture. Respondent B stated that the issue with extruding the recycled plastic pellets occur as the pellets are of varying quality and not as "fine" as virgin. Respondent A explained that the quality of the pellets is highly dependent on the quality of the input material, but even if the input material is of high quality, there will be higher deviations compared to virgin plastics due to the heterogeneity and variety of input materials. Respondent A also explain that virgin plastic manufacturers can assure specific values connected to quality and colour, but the recycler, however, must establish quality and colour ranges where the values can fall within, usually together with customers. Respondent B believes that challenges connected to quality and extrusion will however be bridged as the companies are still in a developing phase connected to recycled plastics and that new innovations and processes will ease this phase.

Respondent C states that the first modification to the composition of the ReLine rope would be that it would be made of 70% recycled and 30% virgin plastics. However, Respondent C continues and explains that the current composition would be made from 20% recycled and 80% virgin plastics. Respondent C mentions that the reason for this

lies in requirements at breaking point, and a mixture of 20% recycled plastics would meet the Norwegian standards connected to fish farm equipment. In the maritime rope industry, there exist several product requirements, especially for the bearing ropes for fish farms according to Respondent D. Respondent D explain that it would be economically and environmentally devastating if a net cage were to break as fish could escape and interfere with the ecosystem, which is backed by respondent J. The recycler, manufacturer, and DFS are all aware of the importance of reaching ISO standards as this otherwise would act as a large barrier to the intended customer segment. Respondent D does however mention that requirements have not been perceived as beeing as strict for the Swedish and Finnish fish farms. Respondent D mentions that DFS has plans to develop two types of ropes. One who meet the ISO standards, and one who maximizes the level of recycled plastics, this level is today 40% recycled according to Respondent D. Respondent C and Respondent D believe that the recycling percentage will be able to increase in the future, but it is important to get the product out on the market as it will motivate investments to improve processes at both the recycler and manufacturer. Both Respondent I and Respondent H mention that they do not have any requirements for ISO-certified ropes.

Respondent B mentions that ISO requirements are much higher than it needs to be, especially for ropes not connected to the construction of the net cage. Respondent C explains that DFS has communicated with the ISO department in order to evaluate if the standard could have exceptions connected to recycled plastics as this slows the sustainable development. Respondent D does however explain that updating an ISO standard is time-consuming and changes will not happen in a near future. Respondent C explains that since DFS marketed ReLine as 100% made of recycled plastics, they had to go back to the customers and explain that the final composition would contain virgin material. Respondent C does however mention that the feedback from customers was not as negative as they feared and all customers who had made orders chose to still keep them and still order the rope. Respondent D believes that the reason for this is because there does not exist any other alternative on the market which has higher recycling percentages.

By increasing the diameter of the rope, it would become more durable, however then the ISO standard would be for the new diameter, so this would not solve the problem according to Respondent D. Respondent B also mention that they do not want to increase the diameter of the rope given that it becomes harder to handle, this factor is also brought up by Respondent J to be important for the people working with the ropes. Respondent J further mentions that an important characteristic of the rope is that it responds well to extreme weather conditions. Respondent K mentions that plastics used in a circular business model should benefit of having stable characteristics as this enables it to last for several process steps, otherwise, there is a risk of the plastic breaking down.

Respondent D has conducted tests in cold conditions and believes that this will not be an issue for ReLine. Respondent H emphasizes that the ropes they use need to have high ultraviolet (UV) resistance as they are exposed to sunlight, Respondent A explained that this is something they can control when developing the plastic pellets, and Respondent D explain that the first version of ReLine had high UV resistance compared to most virgin plastic ropes.

4.5 Legislations

Respondent A expressed that in a world where everyone had a green mindset and wanted to do the right thing, there would be no need for legislation connected to the environment. Respondent A continues by explaining that the increasing numbers of legislation arising can be seen as a sign that the industry is not transitioning fast enough on its own. Legislation is mentioned by Respondent C as having the potential of increasing the transitioning pace, the respondent believes that ReLine has the potential of reaching the market without it but it can simplify the decision-making for customers as it can adjust parameters in favour of recycled plastics.

According to Respondent E, legislation can act as an early driver for a circular mindset in the industry as it incentivizes actors in the industry. Respondent E further states that almost every company today is working with climate plans, and several are communicating a roadmap towards a carbon-neutral future. Respondent E mentions that these commitments validate that the companies will have to invest money in order to find more sustainable alternatives. Respondent J, Respondent H, and Respondent G have all expressed that their respective companies work towards a more sustainable future. Respondent E mention that this is no exception when it comes to investments in technology, both do usually give rise to increased costs in the initial phase. Respondent E believes that EU legislation has a great impact on how companies distribute their assets, the respondent believes that plastics have been drawn a high degree of attention which could validate that legislation in the future can be in favour of circular plastic business models.

According to Respondent J, the fish farming company is obligated to hand in an environmental report to the government which should contain details of their impact on the environment and what efforts have been taken, to e.g., reduce C02 emissions. Respondent C has received similar information from potential customers and expressed that these individuals have mentioned that they are interested in substituting their virgin plastic ropes in order to increase their chances of maintaining valuable certificates from governmental institutions.

Respondent A has noticed that interest in recycled plastics from producers has grown and a few have asked for advice when developing new products. Respondent A believes

that legislation will become an important driver for change in this area as producers will need to take extended responsibility. For the recycler, however, legislation is mentioned by respondent A to also generate barriers. Respondent A mentions that product requirements connected to plastic food placing or construction can hamper a circular transition as these requirements are not created with respect to differences with the process of recycled plastics. Respondent A expresses that it is complex to coordinate all existing requirements and standards, in some application areas the standards in place might not make any sense but it takes a long time to change hence causing barriers to a circular transition.

Respondent A mentions that extended producer responsibility does currently not apply to the entire maritime industry, but it does apply to fishing gear. The respondent believes that it gets actors to move and think about how they design their products and confront themselves with the waste streams. With the extended producer responsibility, Respondent A mention that they will be financially responsible to deal with it. Respondent A further states several countries have legislation that dictates that the recycling option needs to be selected, but it is however stated that it needs to be economically feasible which makes it possible for actors to elope. Respondent A mentions that further legislation that can be significant to the industry are increased carbon taxations and requirements for a certain degree of recycled input material.

4.6 Customer drive

Respondent C believes the strongest drivers for ReLine to revolve around a combination of legislation and customer drive for sustainability. Respondent C expresses that exactly which part incentivizes the given customer the most will most likely separate as they might for example be affected by the legislation and exposed to customers differently. Respondent C believes that the fish farms will value a reduction in environmental impact as this can increase market positions. Respondent A shares a strong belief in consumer drive and adds that it has been enhanced in recent times due to social media awareness.

Respondent A argues this applies to environmental drive at large but social media awareness has been especially significant for ocean plastics. The Recycler does not call their product ocean plastics, their function does however relate to ocean plastics as they are aiming to be a preventive action and a circular solution as they create value in what others see as plastic waste. Respondent A explains that studies have
shown that 11% of plastics end up in the ocean stem from the maritime industry and that several environmental campaigns against plastic usage highlight the effects of ocean littering which has made ocean plastics a large selling point for the company.

According to Respondent E, environmental issues are becoming more and more important in today's society. Respondent E gave an example from a company in the

OEM industry, which weighs the quality of their products, price, and the environmental impact of their product as three equal entities. Respondent A further believes that the younger generation will put more pressure on the industry for change. When Respondents H and I received the question of whether pressure from customers for sustainability is noticeable, the answer was no. Respondent H mentions that they still want to reduce their impact on the environment and stay on the frontline of sustainable development. Respondent I motivate developments connected to sustainability by explaining that the drive comes from within the company.

Respondent E believes that some companies are afraid of committing to projects connected to sustainable development given the bad publicity of greenwashing and emphasize the importance of being transparent and verifying how it impacts the environment. Respondent A has encountered a lot of greenwashing in industries at large and believes that traceability will be a big topic in the future. The recycler proactively works together with most of its customers in order to assure that correct information concerning material origin and processing is communicated according to Respondent A. From a marketing perspective, Respondent A mentions that it sounds however more intriguing using the word ocean plastics compared to recycled plastics from the maritime industry.

Respondent A elaborates and explains that traceability is a key factor to make a system circular and that it is an enabler as it can show that old maritime gear becomes new products. Respondent E explains that a product connected to a circular economy has a wide spectrum and includes system thinking which not is necessary for a product that can be described as environmentally friendly compared to other options. Respondent E believes that the key for ReLine will be to assure that material enters the reverse supply chain and creates additional value. Respondent A explains that the customers of a product who can follow the history of the input material will hopefully be keener to assure that the products re-enter the loop after usage. Respondent D believes that ReLines history is of value for customers as they can see the path and all tests that have been carried out. Respondent C explain that the name ReLine has had some publicity but believes that it is first when customers start using the product and the name is well known that they will have an increased power position in the supply chain. Respondent C belies that this is one of the crucial keys for DFS to create a holistic business case out of ReLine.

4.7 Price

Respondent B has experience working in the fish farm industry in Norway and expresses that the market is characterized by fierce competition between manufacturers as the fish farms utilize their strong purchasing power. Respondent B expresses that the fish farms have not cared about how the ropes were made nor conditions for workers for a long time and have held price as the most important factor for virgin products. Respondent B explains that owners of fish farms in Norway have made large profits and are some of the country's most powerful people, Respondent D explains that

European manufacturers have however lost market shares to Asian manufacturers. Both Respondent B and Respondent D believe that if fish farms were obligated to source more sustainable options, it would be more difficult for them to push the suppliers on price as much.

Respondent I expressed that they noticed that the price was higher but mentioned that they were still interested and wanted to try ReLine. Respondent I mention that ropes are a substantial cost for the company, but they want to be part of the transition towards more sustainable solutions and hence accepted to pay more compared to virgin ropes.

Respondent C views the effect of increased price from two perspectives, the first one connects to initially being able to get orders. The respondent mentioned that this will allow ReLine to start the development of reducing the costs which will bring down the price. Respondent C mentioned that the other part is getting the customer to not compare the product as equivalent to virgin plastic ropes. Respondent C mentions that it is important that the customer is aware that they buy something more than a rope when choosing ReLine. Respondent D expresses that when looking back on the year it is evident that it exists a large interest in the product. Respondent E does however emphasize that there is a difference between having actors interested in the project and having frequent customers which allow volumes to grow.

5. Analysis & Discussion

The analysis and discussion will be presented following the order of a model, see figure 8, which the authors of this study have created with the purpose of showing the most important perspectives connected to ReLine. The empirical data together with theoretical insights motivate the selection of headings which later are broken down into additional factors of importance. An obvious difference to the linear business model is to establish a reverse supply chain which according to several respondents gives rise to challenges. The supply chain network consists of several actors who contribute to the final outcome of ReLine which further puts pressure on collaboration. Industry-specific requirements portray further important aspects specific to the single case of ReLine.

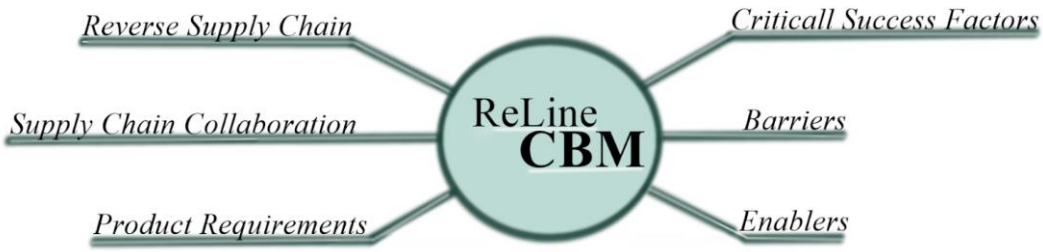

Figure 8: A model to evaluate a CBM (drawn by: Åsberg, 2022).

5.1 Reverse Supply Chain

Making sure that the reverse supply chain is well established and optimized is believed to be a key factor by many respondents in order to get the input material back into the circle. The biggest challenge identified by fish farms was the logistical challenges of the reverse supply chain. CBMs do in general put pressure on logistics, Krug et al. (2021) explained that there is a lack of historical data and experience regarding reverse supply chains which makes it difficult to forecast. The RSC of ReLine does however put further pressure on logistics given that the targeted customer base is situated in remote locations and are in many cases far from each other. Blackburn et al. (2004) explain that reverse logistics, inspection, and disposition are important factors for a reverse supply chain. Due to the logistical challenges associated with the reverse supply chain of ReLine, the logistical infrastructure of the RSC is categorized as a critical success factor as the reverse supply chain will need resources and capabilities to enable a CBM for ReLine, and how this is structured well require considerable time and effort in order to be successful.

Blackburn et al. (2004) separate responsive and efficient RSCs by using the marginal value of time (MVT). Time does not necessarily reduce the value of EOL plastics as the value is dependent on other parameters. Potential factors affecting the value of EOL plastic are believed to be highly connected to quality and the level of sorting that needs to be executed in order to recycle the material. Besides recycling, the value received for selling the EOL plastics for incineration is also considered a factor influencing the value of EOL plastics. In figure 9, EOL plastics' static relation to MVT together with the cost of performing a reverse is illustrated. When applying the logic presented by Blackburn et al. (2004) it is believed that ReLine should preferably operate with an efficient RSC.

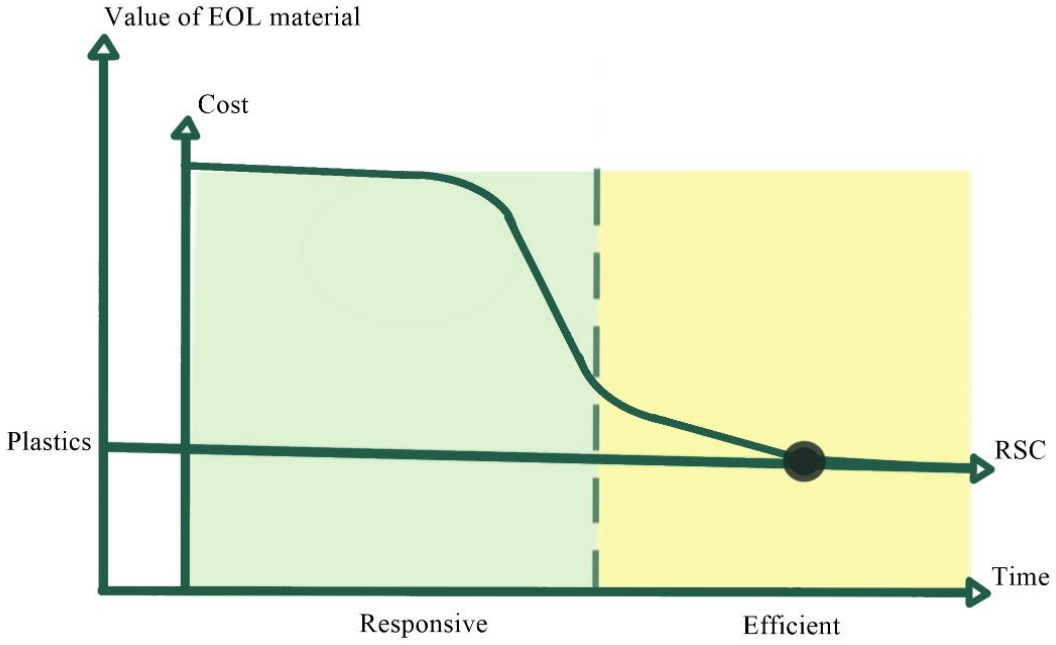

Figure 9: EOL plastics connected MVT (drawn by: Åsberg, 2022. Amended from Blackburn et al., 2004)

The empirical data described a potential solution to the RSC to revolve around centralized checkpoints situated at strategic locations close to the fish farms. This solution would enable EOL plastics to be consolidated from several fish farms hence leaning towards an efficient RSC. Consolidating volumes is important given the barrier of high transportation costs. These checkpoints could help reduce the barrier associated with the cost of transportation mentioned in the empirical data and solve the issues associated with usage of many different transportation modes.

It is not decided who is to run the operations with centralized checkpoints. The empirical findings pointed out that customers benefit from collaborating with each other and together strive towards mutual sustainable development. It could be related to what Jabaluddin & Saibani (2021) explain as coopetition. It was however further stated that this is not the business-as-usual procedure and it can be challenging given that actors are afraid of close contact with competitors, especially since there currently

does not exist much collaboration between the customers according to the empirical data. It could further become challenging that the customer operates this process given that it is not part of their core competence. Logistics is however part of DFS's core competence, although today, most connected to forward flows of material. DFS expressed a belief that they can become a coordinator of EOL plastics between customers to ReLine and the recycler. Respondents at DFS proposed that they could put up containers labelled with the company or product name, ensuring that the discarded material ends up there, but also easing the process for the future customers, as they would know exactly where to throw the ropes and nets after their lifecycle.

As described above, establishing an RCS requires resources and capabilities in turn to having the necessary infrastructure in place. The solution with centralized checkpoints would require initial investments. Further investigation could henceforth come to the conclusion that this solution is not economically viable for DFS to operate. Further examples of setups are that a third party, who already conducts businesses connected to logistics with the fish farms could operate the checkpoints enabling synergies between the flows of material. The empirical findings showed one example which was a manufacturer of fish farm equipment. This actor already operated with the use of service stations along the coastline in Norway.

In order for the reverse supply chain to be relevant, the supply of input material has to be secured and it has been identified that there exists scepticism regarding ensuring that the customers actually send their used ropes and nets to the recycler in order to secure input material for the rope. There is a fear that the customers instead would send it to the highest bidder, which could be an incinerator instead, thus removing the material from the circle. Several respondents believe that including the customers in the processes and making them understand the importance of all steps in the CBM is crucial. Respondent C further emphasized that the flow of information needs to be circular. These factors combined motivate transparency to be seen as a critical success factor for ReLine. Teaching potential customers about the environmental benefits as well as the resource optimization gained by recycling their waste should make new potential actors be willing to participate in the ReLine project. Neves & Marques (2022) concluded that high levels of education will increase the willingness to recycle. Being perceived as an environmentally friendly company is according to Liu et al. (2017) a competitive advantage in itself, as it can allow the companies to differentiate themselves.

Another benefit identified by several respondents is that by participating in a circular supply chain, is that the perception of the company image will be perceived as greener, which is in line with Ferguson et al. (2020) who advocate the same. Drive for sustainability is therefore characterized as an enabler for the RSC as this can lead to customers choosing to send back EOL plastics. Enlightening the customers of the environmental benefits of ReLine compared to incineration is of importance to secure

the flow of input material. Explaining that the waste generation on a global scale has increased more than ten-fold in the last 100 years and is predicted to triple in the next 100 years (Hoornweg & Bhada-tata, 2012) together with ReLine being part of a preventative action toward waste being generated are strong arguments to why companies should aid in the gathering of input material. However, this still may not be a straightforward action, since according to Salmenperä (2021), the incineration infrastructure in Sweden is under stimulated. Incineration in Norway, does currently, according to the empirical data, use the plastic waste from the Norwegian fish farming industry. Disrupting their supply of input material can have consequences which at this stage are hard to predict. Allwood (2014) explains that there are large variations in plastic compositions and only a limited amount can be recycled. This is validated by the recycler which further stresses the importance of educating the customers and making sure that they sort their plastic waste properly, in order for the plastic that actually can be recycled to be sorted properly in order to ease the flow back into the chain. This motivates the quality of EOL plastics to be seen as a possible barrier for the RSC.

According to several respondents, legislative actions are required from companies in the industry. The companies need to show continuous environmental improvements and reductions in emissions. Frishammar & Parida (2018) also explain that sustainable development has origins in legislation. Several respondents emphasize that choosing ReLine over virgin plastic products, allows the customers that use ReLine to show these improvements. In the empirical data it was also emphasized that ReLine is a circular product, and not a green product, since the aim is that the waste material is returned to the manufacturer, creating a full circle. In the context of securing input, legislation, therefore, acts as an enabler, as this can lead to companies choosing to send their waste material to the recycler instead of to incineration since otherwise, they cannot secure enough material to show their environmental improvements.

Connecting ReLine with the waste hierarchy presented by the EU commission, actions are believed to increase in the hierarchy, see figure 10. Material that earlier would have been sent to landfill or incineration has instead been sent to the recycler. From an environmental perspective, it would however be better to reach the highest steps but, Khmara & Kroneberg (2018) state that a circular economy alone is not adequate to deal with an ecological crisis. ReLine does however need to create a holistic business model and as Allwood (2014) points out, it can be difficult to turn the hierarchy to practice. According to Geyer et al. (2016), it is important to not simplify the reality and make one-to-one assumptions, this can be argued to be true for ReLine as well as there are no guarantees that less material is being used for virgin plastic ropes just because some actors chose to buy recycled ones.

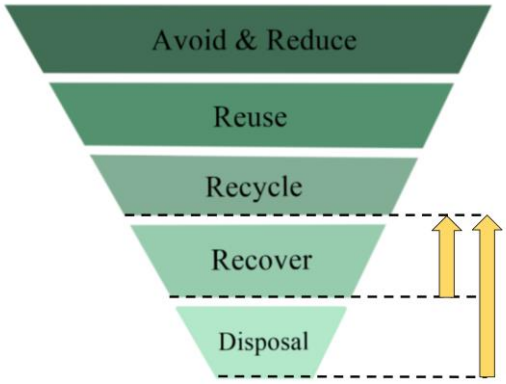

Figure 10: ReLine in the waste hierarchy.

5.2 Supply Chain Collaboration

ReLine has and will continue to challenge its included actors, and one factor which was extensively discussed during the interviews was relationships. Respondent D expressed that it initially was difficult for DFS to find actors to collaborate with, they did, however, manage to establish relationships with both a recycler and a manufacturer which has enabled them to develop a physical product. Given that DFS cannot perform the actions of recycling and manufacturing in-house, relationships are categorized as a critical success factor. Their relationship could be described as trust-based according to Jamaluddin & Saibani (2021). Respondents from each of these three actors have contributed with insights to the collaboration, however, the supply chain of ReLine could be described with a longer list of actors if all actors influencing the outcome were to be identified.

All three actors looked opportunistically at the future of their relationship, although there were some areas indicating that the collaboration has not been trouble-free. Abrahamsen & Håkansson (2012) emphasize the importance of understanding the issues and challenges of the other part of the relationship. van Langen et al. (2020) argue that manufacturers in the automotive industry have a traditional mindset with a competitive logic which hampers a transition to a circular economy. DFS shared a view of wanting to have closer collaboration and work together when challenges arise. The process has been challenging for the manufacturer given that the plastic pellets are of varying quality which is the reason for changes in the manufacturing process. The fact that ReLine is the first plastic rope connected to a circular economy and the argument that circular business models require higher levels of collaboration could together present a potential risk that the actors have not aligned the level of collaboration when going from business as usual with a linear mindset and ReLine. This risk could also be strengthened by the companies DFS conducts business together with besides ReLine, who are connected to virgin products which according to DFS has not required high levels of collaboration. Linear business models are still the main focus of the

companies and neither of the companies is economically dependent on the success of ReLine. The understanding of CE adoption from the study by Gusmerotti et.al. (2019) indicates that both DFS and the manufacturer have a long way to go in order to reach the highest level of CE adoption as this would require CE principles to be holistically implemented in the entire business. Even though the recycler does not only sell recycled pellets to actors creating products allowing the plastics to again be recycled, but their core business is also connected to giving new life to EOL plastics. This could motivate the recycler to be of the highest level of CE adoption of the actors connected to ReLine.

The study by Berlin et al. (2022) concluded that circular transitions benefit from both horizontal and vertical collaboration. Respondents from both DFS and the manufacturer have explained that they have aligned visions of ReLine to the top management indicating a well-functioning vertical collaboration. The recycler mentioned that the company will never be funded out of goodwill and as all companies have commercial business models, they need to create holistic business plans. The study by Gusmerotti et.al. (2019), found that the economic drivers are the most effective for transitions to circular business models, they further mention that managers of traditional manufacturing firms seek short-term gains instead of long-term strategies. The CEO of DFS did share a positive view of the project but did however emphasize that time is important as DFS needs to map out uncertainties and develop a clear and realistic plan in order to decide what steps to take next. This can be motivated as DFS only employs 25 people and the ReLine project does require time from two of DFS's key employees. For the horizontal collaboration, all respondents within the tetradic relationship expressed a vision where the product could scale up in the future. Difficulties connected to the extrusion did put pressure on the collaboration, Respondent M mentioned that DFS expressed a desire for the manufacturer and recycler to work together to solve issues. Ford et.al. (2002) emphasized the importance of analysing relationships at early stages as it minimizes risks, it could be interpreted that this is of increased importance for relationship structures in circular transitions given a higher dependence on collaboration compared to linear business models.

In contradiction to a standard tetradic relationship including a supplier, manufacturer, and retailer, the relationship between DFS and the recycler is close. In a traditional business setting, this would present threats to the manufacturer as it could more easily be bypassed or replaced, see figure 11. The reason for DFS and the recycler being close has a natural explanation as DFS is the product owner of ReLine and the recycler was the first actor which whom DFS interacted in order to develop the product. The respondents of DFS explain that they have had previous experience working with the recycler. However, the situation could perhaps have looked differently if DFS from the beginning found a manufacturer who independently sourced recycled material. According to Wynstra et.al (2014), all actors stand in for threats of being bypassed, DFS and the recycler do however according to respondent D stand on equal grounds and strive towards the same goal with mutual wins. Business relationships are dynamic

and dependent on several factors according to Möller & Halinen (1999). Both companies do have commercial business models and if circumstances change, DFS needs to take decisions in the best interest of ReLine, and the recycler in the same way prioritizes selling pellets. Abrahamsen & Håkansson (2012) explained that the balance between stability or being active to change is dynamic in nature, and the relationships between the Recycler, manufacturer, and DFS can be viewed as highly dependent on each other given that changes from one actor will most likely affect the other. This is exemplified by the manufacturer having difficulties with the extrusion hence causing the product to change recycling percentage. DFS had to adapt to these changes and contact customers, and the recycler is affected as less recycled material will be needed. DFS believes the contact person at the manufacturer shares the vision where all three actors aim for mutual growth, however, as the manufacturer has its own sales channels it could become complicated in the future if these were to be cannibalized. The manufacturer has the competence of extruding the recycled pellets which could additionally become an issue if the manufacturer chose to develop their own recycled rope and bypass DFS, see figure 11. Power balance is henceforth characterized as a possible barrier to ReLine, this is however not something that is believed to be unique for ReLine or circular business models as actors generally are dependent on several other actors, who in turn have their own individual interests. DFS emphasized that it will be important to nurture relationships and assure that all parts reach mutual wins.

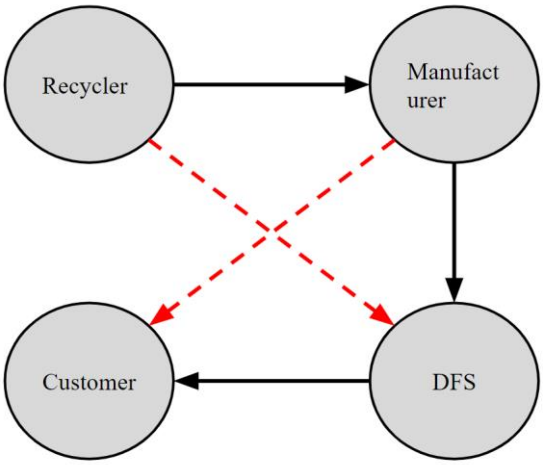

Figure 11: Tetradic relationship archetype: Forward supply chain (amended from Wynstra et.al 2014).

DFS shared that they are evaluating the possibilities of collaborating with further actors as well, this does however further complicate the dynamic power balances in the network. Relationships are time-consuming (Möller & Halinen, 1999), and it could be motivated that DFS is selective when choosing what actors to collaborate with given that they have limited resources and ability to nurture collaboration. The empirical data indicate that DFS desires to initially establish a foothold at the fish farms as this can protect them from getting bypassed. The reason for this is that if a foothold is established and the brand ReLine gets exposure, it could increase the chances of

customers specifically demanding ReLine. Exposure is henceforth categorized as an enabler as it can strengthen ReLine's market position. Exposure will also strengthen the legitimacy of the market according to Denebedetti et al. (2021).

The inclusion of a reverse supply chain, similar to the forward supply chain also gives rise to threats connected to power balances. As illustrated in figure 12 below, DFS believes that they can become a valuable part of this process by ensuring that EOL plastics return to the recycler, it is however uncertain how this solution will be executed, and it is currently not certain that the endeavour is economically feasible. Threats of breaking the loop do additionally arise as customers do not necessarily have to choose this way of handling waste which leads to both DFS, and the recycler risks being bypassed.

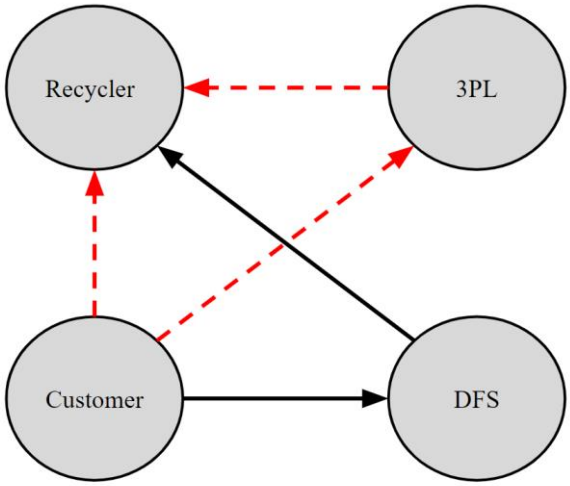

Figure 12: Tetradic relationship archetype: Reverse supply chain (amended from Wynstra et.al 2014).

Resilience is categorized as a critical success factor as it needs to be built in the supply chain of ReLine in order to deal with uncertainties connected to EOL material. In line with Elwood (2020), Agility, Adaptability, and Alignment constitute the resilience of ReLine. The Recycler needs to be able to assure that they can provide input material and cannot be solely dependent on ReLine ropes re-entering the loop afterlife. The reason for this relies upon as previously mentioned uncertainties with forecasting in CBMs, the recycler cannot be certain of how long the customer keeps the product or if the customer will choose to send it back. Results emphasize that DFS needs to align the visions of a circular economy connected to the product even with customers as this can motivate customers to send back material.

5.3 Product requirements

There are requirements related to the product and the industry which has been identified in the empirical data. First and foremost, DFS needs to ensure a certain level of quality

in ReLine and there are several factors that need to be considered. In the results, it became evident that the plastic pellets from the recycler are of varying quality, mainly due to the fact that the input material is of varying quality as well. Which also was identified in the study done by Baldaserre et al. (2022). In order to ensure that the final product is of as good quality as possible, it was suggested by the respondents at DFS that they would do their own check-ups on the rope before it was sent to the customers. This is something they have done with the prototypes which have been produced so far. This enables DFS to be transparent towards their current and future customers since they can verify the quality of the ropes themselves and detect eventual defects. However, in the future once the business grows, it might become very inefficient to the quality verifications themselves. Another reason is that higher quality ropes will lead to higher quality returns (waste material) which in turn implies that the input material is of higher quality. Van Loon & Van Wassenhove (2020) name access to good quality returns one of the main challenges of transitioning to a circular economy. In the earlier stages of the process, when DFS made first contact with potential customers, it was promised that the ReLine rope should be made out of 100% recycled material. However, due to problems occurring at the manufacturer, this later had to be adjusted and the current number is either 20/80 or 40/60 splits in favour of virgin material. This is another example of when DFS had to be transparent with their customers since the company could not deliver the promised quality of the goods. Both quality and transparency have thus been identified as critical success factors for the product requirements. Ensuring that the product is of good quality is extremely important since it can have dire consequences for both the fish farms and the surrounding ecosystems if the net cages (for instance) would break and the fish would escape into the environment. To be able to ensure that the quality of the ropes is sufficient, DFS in turn has to be transparent with the quality of the rope, due to the eventual consequences of a rope failing to perform its task.

A barrier that was identified is the strict industry-specific legislative standards revolving around ropes, especially the ISO standard, but also the national standards in the countries of the customers. It became evident in the empirical data that the ReLine rope made from 100% recycled plastics would fail to meet the ISO standard and was the other reason why the current version of the product has a different material composition. Specifically, the breaking point of the 100% recycled rope was not up to the ISO standard. This standard is required by the fish farms situated in Norway according to the empirical data. According to the respondents at DFS, the company is going to tackle this problem by creating two ropes, one with less recycled plastics which is up to the ISO standard, and one with as much recycled plastic as possible (which is currently 40%) for the other markets who value the percentage of recycled material higher than the ISO standard. The breaking point, therefore, becomes a barrier, since the limit of this point is what is holding the rope back from becoming ISO certified. Which subsequently makes legislation another barrier. To overcome these, the quality of the product has to improve and according to several respondents, one reason can be

due to the technology surrounding recycled materials being further behind the technology surrounding virgin material. The speed of technological progress is another challenge listed by van Loon & van Wassenhove (2020) for transitioning to a circular economy. It can however also somewhat translate to the case of ReLine since it has been mentioned in the empirical data that the barriers regarding quality (and specifically the extrusion) will be bridged since the companies in the market are still in the development stage connected to recycled plastics. Another barrier for the quality of the product is the characteristics of plastic ropes, which according to the empirical data needs to be stable, since if the material is going to last for several cycles, otherwise there is a risk that the material breaks down. It is also worth noting that the legislative standards regarding breaking points are there for a reason, and therefore cannot be seen as only a barrier as it is also a necessity to ensure the correct quality. However, some respondents have advocated for this change in the future and that there should be two different standards for recycled material and virgin material. The recycler for instance mentions that in regard to quality, virgin material can set exact values for the numbers regarding virgin products, such as breaking point, colour schemes, and lift strength, whereas recycled material since it is of varying quality, has to resort to having certain ranges to fall within. Since the process is in its development stage, research and development have been identified as an enabler. Continuous research in new technologies or methods for manufacturing the rope or ensuring higher quality input material will hopefully lead to new advances which could be advantageous for the industry and make these processes more time and cost-efficient.

A barrier that has been identified by many respondents is the price of the recycled rope as it currently is more expensive than its virgin equivalent. A respondent with experience working with fish farms mentioned that price has been the most important parameter in the past entailing the ReLine can have a difficult time reaching the market. Actors representing fish farms did however share that the difference in price did not make them lose interest in the product and several actors have placed orders of small amounts to try the rope. If comparing to remanufacturing, van Loon & Van Wassenhove (2018) mentioned that in order for remanufacturing to be economically feasible on a large scale, the cost of remanufacturing should be lower than the cost of producing a new product. This factor might be true for recycling as well entailing that even though customers are interested and try the product, they might not find it economically feasible on a large scale.

The recycled material is more expensive compared to virgin plastics which is one explanation for higher prices, this difference is however not large in proportion to the price difference of the final product. Prices for virgin and recycler plastics are dynamic but not to the same parameters which entail those future scenarios might entail that virgin pellets are more expensive than recycled and vice versa, this factor will alone however not likely make ReLine as cheap as virgin plastic ropes. (Baldassarre et.al. 2022) expressed that the difficulty of coping with many factors influencing the price of recycled plastics is one reason increasing the complexity of defining a business case.

Economies of scale together with challenges with plastic extrusion of recycled pellets is believed to be the most significant factor leading to higher prices compared to virgin plastic ropes. Technical advanced in these fields e.g., by developing new machines specializing in extruding recycled plastics or increased quality in the plastic pellets, together with reaching economies of scale are henceforth categorized as enablers given that they can generate a price reduction.

5.4 Circular Business models

Questions remain regarding the details of what and how the value is to be offered to customers in the CBM. Dekker et al. (2003) explained that the growing pressure of handling returns can lead to companies choosing service-based solutions. Olivia & Kallenberg (2003) adds that services are generally more difficult for competitors to imitate which henceforth possibly could reduce the risk of getting bypassed. Services are further mentioned by Olivia & Kallenberg (2003) to result in increased customer satisfaction and generate higher margins which both would strengthen the competitive advantage for ReLine. The reverse supply chain needs to respect differences in the customer's ability to send back material and should not be conducted in a uniform way, this type of service tends toward what Kindström & Kowalkowski (2009) refers to as a service supporting the customers (SSC), which Frishammar & Parida (2018) connects to a use-oriented business model. Developing an SSC puts further emphasis on intense relationships with customers.

SSCs puts higher pressure on the service suppliers' capabilities, the reverse supply chain of ReLine does, as previously stated, contain several uncertain parameters which challenge what capabilities will be needed for DFS if they were to offer this service. In figure 13 below, a map of a potential CBM for ReLine is presented. Information and physical flows connect back to DFS who is the service and product provider and according to the service logic presented by Grönroos (2015), also the value facilitator. This would challenge DFS resources, both, managing the relationships and orchestrating a forward and reverse flow of material. It is important to acknowledge that the customer in this constellation is also a business, this is important as characteristics differ in B2B and B2C environments as explained by Réklaitis & Pilelienė (2019). According to Story et al. (2017), it is also important that customers develop capabilities as well, in order to become co-creators of value. This can be translated to ReLine as if the RSC service has a customized solution, it requires both the service provider and the customer to collaborate and find a way that maximizes the value.

The Yellow triangle in figure 13 exemplifies a centralized checkpoint. This solution closes the physical loop which utilizes resource efficiency, it does further build on transparency and close collaboration to reach mutual wins in the supply chain.

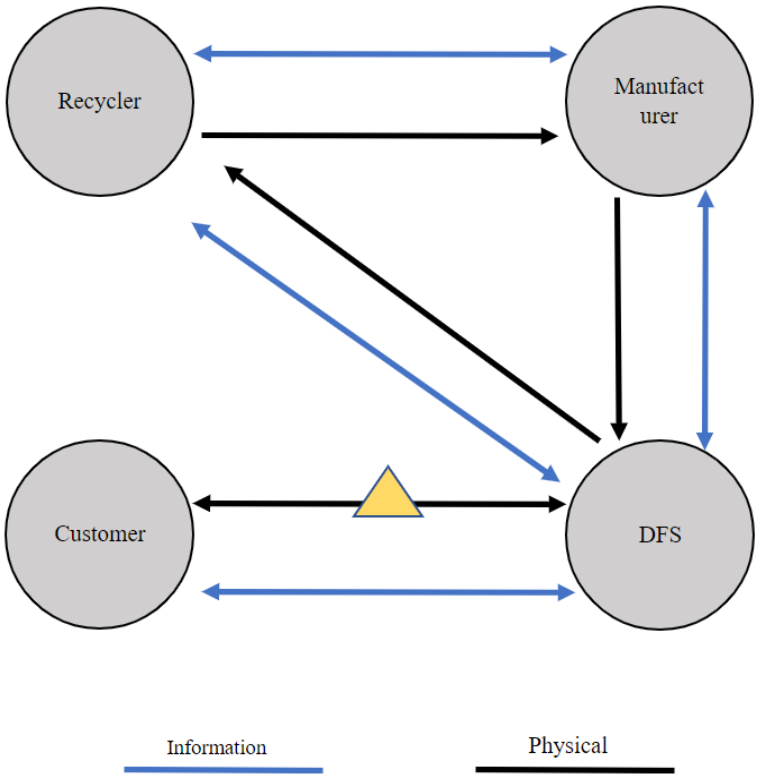

Figure 13: Tetradic relationship archetype - Circular relationships (amended from Wynstra et.al 2014)

In order to reach sustainable development, Frishammar & Parida (2018) explain that product-service systems act as a foundation. Pires et al. (2019), explain that the deposit-refund system is a market-based strategy used within RSC which could be used to incentivize customers' willingness to participate. Frishammar & Parida (2018) mention that pay-per-use can be a viable business model if targeting increased resource efficiency. It is however important to acknowledge that the fish farms today conduct business in a traditional fashion with low levels of involvement, a transition towards a pay-per-use or a deposit-refund model can be too big of a leap. This might however change with time as the market matures and the customers get more used to both the product and the concept of the circular economy.

According to the ISO standard for closed-loop supply chains, the material should be brought back into the same product system and is further mentioned by (Kumar & Satheesh-Kumar, 2013) to be a more sustainable option compared to an OLSC. As described in the chapter in RSC, there do however exist several barriers to this becoming reality. Even if it is concluded that it e.g., is not economically feasible to establish a link between the customers back to the recycler, this does however not mean that ReLine does not have a business case. (Stock et al., 2002) argue that OLSCs are easier to actualize and are more flexible, Difrancesco & Huchzermeier (2016) viewed OLSC as a forward supply chain as it is only a by-product brought back to life in a

second market. As Reline uses recycled plastics from the maritime industry, it is however brought back into the same market. Arguments connected to reducing risks of mixing material and reducing quality speaking for a closed-loop supply chain can be bridged by having a transparent communication with the recycler regarding input material. ReLine has from start been produced from other products speaking for it not necessarily is dependent on the level of control a closed-loop supply chain can reach. From DFS´s perspective, neglecting what will happen to ReLine after the customer takes ownership of it, their processes would, look fairly similar to only being a forward supply chain. There does currently not exist any substitute for virgin plastic ropes, arguing that ReLine would reach higher up in the Waste Hierarchy even if the material is not brought back in further cycles in a CLSC. Figure 14 below illustrates how the plastics in ReLine would flow connected to an OLSC.

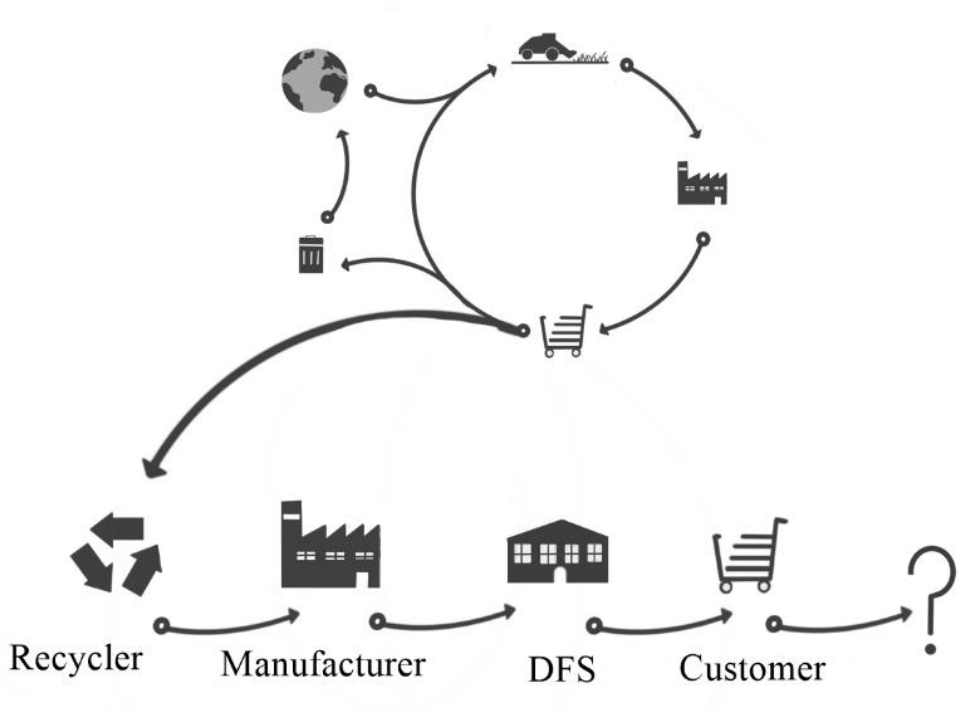

Figure 14: The plastic flow of ReLine in an OLSC climate

As mentioned previously, the choice of lowering the level of ambition to an OLSC could lead to fewer challenges. This connects back to challenges with advanced service offerings as this business model would look more similar to how the fish farms are conducting business today. The vision of ReLine is however to strive toward a circular economy reaching synergies between all actors. Even if this is not reached its full potential during the initial phase, the transition to a circular economy could gradually grow over time. The enablers identified in the analysis are believed to play an important role in dictating what pace the transition will have. The decision to initially have an OLSC could allow for a fast-paced increase in volume which could strengthen the logistical business case for a transition to a CLSC in the future.

6. Conclusion

1. *What are the Critical success factors, enablers, and barriers connected to ReLine?*

The critical success factors, enablers, and barriers connected to reline have been organized into the three main categories of Reverse Supply Chain (RSC), Supply Chain Collaboration (SCC), and Product Requirements (PR). these main categories have subsequently been categorized into their respective critical success factors (CSF), barriers, and enablers. These categories are shown in the table below. Several of the factors below are important for more than one of the main categories identified. The categorization below has been made in regard to the parameters of most significance according to the empirical data.

Table 3: Identified critical success factors, barriers, and enablers connected to ReLine.

	Reverse supply chain	**Supply chain collaboration**	**Product requirements**
Critical success factors	Logistical infrastructure Transparency	Relationship Resilience Communication	Transparency Quality
Barriers	Transportation cost Quality of end-of-life plastics	Power balance Trust	Breaking point Legislations Price
Enablers	Drive for sustainabil Legislation	Exposure Alignment	R&D Economies of scale

2. *In what way can ReLine best establish a CBM?*

The above-listed factors are all considered influential factors for the development of a CBM for ReLine. Given that these factors are not static, it is important to highlight the way forward that should take respect for the industry and further accelerate along with the circular transition. The study concludes that a reverse supply chain of end-of-life plastics should preferably be conducted in an efficient manner due to having low marginal value of time and checkpoints were mentioned as a possible solution to reach this. The thesis does however not have sufficient data to conclude whether this solution is the best way forward. This solution will need to take respect to customer-specific circumstances and should therefore be evaluated when closer contact points with fish farms are established.

Collaboration is concluded to be a key parameter as it could strengthen both resources and capabilities needed for ReLine to be offered in a business model connected to an advanced service offer. If DFS does not engage in collaboration with any actor close to the market that also has core competencies in connection to a reverse supply chain, the authors of this study still recommend DFS to only take ownership of the forward supply chain and with time conduct in-depth analysis together with customers to find synergies and best practice to add further value while establishing a reverse supply chain. This recommendation can further be explained by ReLine potentially not reaching a closed loop supply chain. The maturity of the market is connected to the achievability of many of the critical success factors, for the circular business model to take off properly, the market needs to reach a more mature state, since this would open to parties in the market being more open to both vertical and horizontal collaboration.

Even if DFS does not take ownership of the reverse supply chain, the authors still believe that the company can benefit from not being totally excluded from the reverse supply chain. If a customer wants to send back plastics, DFS who already has a relationship with the customer can help them reaching the recycler. In this way, neither of the parties would be limited to this solution and ropes could still be sent to e.g., incineration if that is what is being concluded as the best option for a given customer. Difficulties such as sorting of material and high transportation cost connected to the reverse supply chain would in this scenario not be DFS's obligation.

The price of ReLine will be an important factor when determining its success on a large scale, customers have showed interests but there have been no large commitments by customers yet. Economies of scale is considered and enabler for ReLine, and it does further also affect the risk of getting bypassed. By initially focusing on the forward supply chain of ReLine, DFS can focus on reaching higher volumes and reduce the price rather than overcoming barriers connected to the RSC. On the other side, a reverse supply chain would increase ReLine's competitive advantage and make it more difficult for other actors to copy the business model. An important remark is that this does not consider that increased volumes without a closed loop supply chain, could lead to challenges in availability at the recycler. The authors of this study recommend that DFS map out the capacity of the recycler and manufacturer both influence ReLine's potential of reaching economies of scale.

7. Recommendations for future studies

To identify what factors are of importance and what ReLine needs to focus on, a broad spectrum was applied, and several parameters were analysed as shown in RQ1. These parameters do by themself present potential areas for further investigation with an in-depth analysis of how they influence the circular business model of ReLine. This thesis also lays the foundation for further research in the circular business model connected to ReLine and the maritime industry, and since the ReLine project is in its infancy, additional research connected to following up on the project is also a recommendation.

In order to bridge the uncertainties currently surrounding the logistical checkpoints, a future study could be conducted revolving around in-depth research about this subject specifically, including cost- and output analyses, in order to get quantifiable data to measure the viability of these checkpoints.

This study had limited insights connected to the characteristics of the plastic which the ReLine rope is composed of. Researching the impact connected to plastics together with quantifiable data connected to ReLine's impact on the environment. Further studies could add further understanding to ReLine if an LCA was conducted together with an analysis of how the composition of different plastic types of influences recyclability and the environment.

Further recommendations are to use a similar point connected to figure 9 presented in the analysis as a departure for an analysis of other business cases. Continuing to explore new markets and industry-specific parameters connected to circular business models is recommended by several authors listed in the background of the thesis, this motivates that further studies are conducted to contribute to the understanding of circular business models and the circular economy at large.

The results of this thesis can be used in comparison with other industries where circular business models and their critical success factors, barriers, and enablers have been identified to further deepen the understanding of similarities and differences between industries.

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Appendix

Appendix A – Interview guide

Questionnaire
Prior to the interviews, a brief explanation of the study by the authors was held to the respondents.

Applicable to all

1. In short, what does X do?
2. Could you please tell us a little bit about your role at company X?
3. How would you describe the supply chain of company X?
4. What does your relationship with customers look like?
5. What does your relationship with suppliers look like?
6. How would you describe the support from top management connected to sustainable efforts?
7. Do you believe that Collaboration is important for the success of ReLine?
8. Have you previous experience working within a business model connected to a circular economy?
9. What do you believe are the main drivers for initiating a CBM?
10. What do you believe are the challenges connected to ReLine?
11. Do you believe that the concpet of a circular economy is realistic?

This was later followed by further questions specifically to respective actor/experience.

Recycler

1. How do you initiate the circular dialogue with new potential customers/suppliers?
2. What needs to be decided before the process begins?
3. How is your reverse supply chain built regarding the return flow of plastics (used for recycling)?
4. How do you warehouse EOL plastics?
5. How does the inspection process work?
6. Which step in your process is the most labor-intensive?
7. What could be done to ease the process of sourcing input plastics?
8. How do you deal with variations in quality and design regarding EOL plastics?
9. Do you have any customers who have a closed-loop supply chain?

Manufacturer

12. Have you encountered cultural barriers internally when transitioning from a linear business model to a circular one?

13. Is your sustainability work important for your customers?

14. Do you have any legal responsibility for what happens to your product after the customer has used them?

15. How can ReLine reach economies of scale?

16. Have you manufactured plastic products made of recycled material prior to ReLine?

17. What separates your process when dealing with recycled plastics compared to virgin plastics?

DFS

12. How was ReLine initiated?

13. What is the USP för ReLine?

14. Have you conducted any theoretical research in connection to ReLine?

15. Have you encountered cultural barriers internally when transitioning from a linear business model to a circular one?

16. How would you describe the relationship between the manufacturer and recycler?
17. How is influencing power devided between actors in ReLine has?

18. Are you serching for further actors to collaborate with?

19. What is the plan to seccure that material is beeing brought back to the recycler?

20. To what degree do you belive that DFS takes part in the RSC?

1. Do you belive that DFS has the resourses and capabilities nessesart to lanch ReLine in the market?

1. How can ReLine reach economies of scale?

Customers

13. Do you believe your company would see value in using ropes as part of a circular economy?

14. Is your sustainability work important for your customers?

15. What are your specific criteria for the plastic ropes you source/manage?

16. Do your plastic ropes need to be ISO-certified?

17. Have you encountered differences in quality and user experience for plastic ropes from different suppliers?

18. Do your products have any form of traceability?

19. Do you know where the waste of the ropes ends up?

20. Could you please describe how you are sorcing plastic ropes today?

Expert

12. What are your biggest barriers to overcome regarding the environment/sustainability?

13. How can ReLine reach economies of scale?

14. What are the main challanges with recycling plastics?

15. What are important to think about when developing a CLSC/OLSC for platics?

16. How do you belive that Legislation can impact ReLine?

17. What do you believe is the difference between selling a green product vs a product connected to a CBM?

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