Master's thesis

NTNU
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Faculty of Engineering
Department of Mechanical and Industrial Engineering

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Circular Business Models in the Manufacturing Industry - a Mixed Method Approach

Master's thesis in Mechanical Engineering
Supervisor: Nora Johanne Klungseth
Co-supervisor: Sigurd Sagen Vildåsen
June 2021

NTNU
Kunnskap for en bedre verden

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Preface

The research presented in this master's thesis was carried out at the Norwegian University of Science and Technology's (NTNU) Department of Mechanical and Industrial Engineering, under the supervision of Associate Professor Nora Johanne Klungseth and Research Scientist Sigurd Sagen Vildåsen. The study examines a furniture manufacturer's shift from a linear to a circular value chain and aims to improve the research and knowledge of circular business model innovations in manufacturing companies.

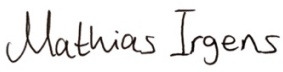
Acknowledgements

Throughout the writing of this thesis, I received a lot of help and support. First of all, I would like to thank my main supervisor Nora Johanne Klungseth, for providing me with frequent guidance and help throughout the research process. Your constructive feedback and continuous availability have been of great help. Moreover, I would like to thank my co-supervisor Sigurd Sagen Vildåsen, who has provided me with important theoretical insight into this research field. Both of you have provided me with informative feedback that has encouraged me to improve my thoughts and raise the quality of my work.

I would also like to express my gratitude to Oda Ellingsen, who assisted me in organizing and planning my work during the start-up phase. At the same time, I would like to thank Lena Skjelbostad, Project Manager in Wonderland, who has been instrumental in ensuring that communication has run well throughout the project period. In this regard, all project participants deserve a heartfelt thank you for their dedication and cooperation.

Finally, I would like to send a big thank you to good close friends and family, who have been essential contributors in a time marked by a global pandemic.

Trondheim, June 2021



Mathias Irgens

Summary

In recent years, the concept of a Circular Economy (CE) has experienced increased attention and interest due to the world's growing sustainability challenges. The concept is widely recognized as a sustainable replacement to the linear economy, which has contributed to unbearable production and consumption patterns for decades. From a business perspective, a growing amount of companies are seeing the potential benefits of the concept and are therefore choosing to innovate towards Circular Business Models (CBM). However, despite the potential advantages, there are several barriers and pitfalls for firms wishing to implement circular solutions to their value chains. This thesis aims to address this uncertain business environment by studying a specific bed manufacturer's transition towards a CBM.

A deductive approach was employed to create a framework of drivers and barriers from the literature, which was subsequently used to evaluate this specific case. First, a quantitative survey was distributed to gain insight into the project participants' views on the various drivers and barriers in their project. Next, nine qualitative interviews were conducted to gain a deeper understanding of the survey responses and to detect the project's enablers and success factors. In addition, structured observations were carried out throughout the project period to acquire a greater understanding and insight into the project. Together, these research methods created the foundation for answering the research question of this thesis:

How can a manufacturer in an established value chain transition its linear business model into a circular business model?

The results show an urgent need for political incentives to support the CE transition as a whole. Moreover, there is a need for additional research that provides both politicians and company managers with the correct knowledge and experience in order to see the potential benefits of the concept. In light of this uncertain CE business environment, this thesis highlights *four key elements* that must be present for a manufacturer in an established value chain to successfully transition towards a CBM. As a result, this thesis contributes to the developing (but underserved) CE research field by providing academics and industrialists with insight into a single manufacturer's move to a circular business model.

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1.0 Introduction

1.1 Background

There is widespread agreement in the literature that the current production-and-consumption model violates sustainable development values, resulting in long-term harm to the environment, social justice, and economic stability (Rees 2010; Vlek & Steg 2007; Anand & Sen 2000; Schaefer & Crane 2005).

In tandem with a global expanded emphasis on sustainability, the idea of a Circular Economy (CE) has received increasing interest from politicians and industrialists around the world. The Chinese Circular Economy Promotion Law of 2009 (PRC, 2008), the EU Circular Economy Strategy of 2015 (EC, 2014), and the European Green Deal of 2019 are all examples of recent governmental and intergovernmental initiatives to support the growth of a CE (EC, 2019). In simple terms, a CE can be regarded as a direct counterpart to the conventional linear economy, representing a shift from the take-make-dispose economy to a regenerative circular economy (Bjørnbet et al., 2021, p. 2). Hence, a CE is generally regarded as a sustainable economic model that intends to provide value to both the society, the economy, and the environment (Lieder and Rashid 2016; EMF 2013; Kristoffersen et al. 2020).

From a strategic point of view, the increased attention for CE stresses the need for new, sustainable business models. In this respect, introducing Circular Business Models (CBMs) represent one potential way for firms to produce a significant improvement in resource efficiency while remaining profitable (Linder & Williander, 2015, p. 182). In short, a circular business model explains how established firms use innovation *to "create, deliver, and capture value through the implementation of CE principles"* (Lahti et al., 2018, p. 3). The Ellen MacArthur Foundation (EMF) points to several firms that have successfully implemented CBMs, and consequently increased their total turnover (EMF, 2013, p. 28). Moreover, their analyzes show that a global transition towards a CE could (by 2030) increase annual net material cost savings by up to USD 630 billion (2013, p. 6), increase GDP by 6.7% (EMF, 2015b, p. 24 & 25), and grow annual resource productivity by up to 3% (EMF, 2015a, p. 12).

1.2 Research Problem

Although research suggests that there exists great potential for value creation in a CE, implementing new business models demands extensive changes in firms. For many businesses, introducing CBMs would affect multiple, if not all, aspects of how firms currently run their businesses (Mentink, 2014, p. 9). Designing a CBM entails more than just coming up with a fresh idea; it also necessitates the integration of various ideas and proposals into a unified whole (2014, p. 9). In order to manage these changes, firms need to take part in processes to innovate their business models in order to experiment, implement, and disseminate these business changes.

Moreover, as the CE is a fairly novel area of research, there is a dispersion of definitions and principles, in addition to a lack of practical implementations around the world. This fact has contributed to several authors pointing to the need for more research in order for the CE to be implemented at a large scale in society (e.g., Ghisellini et al. 2016; Smol et al. 2018; Romero-Hérnandez & Romero 2018; Liu et al. 2018; Saidani 2017). Currently, a great deal of literature on the CE topic relates to various barriers and pitfalls for businesses who wish to transition towards such circular models. This includes, among others, a lack of policy rules and regulations, uncertain economic viability, uncertain market demand, lack of necessary technology, and lack of experience & knowledge.

In other words, firms looking to introduce CBMs may face a high degree of future uncertainty with respect to their businesses' viability (Bocken et al., 2018, p. 80). In order to overcome this uncertainty, firms are dependent on structure and guidance to design an optimal circular and sustainable strategy (Bocken et al. 2019, p. 2; Konietzko et al. 2020, p. 1). In this respect, a deeper understanding of how enterprises, specifically manufacturers, can enable this transition is needed (Antikainen & Valkokari 2016, p. 6; Frishammar & Parida 2018, p.1).

1.3 Aim and Research Question

This thesis aims to assist in filling this lack of research by conducting a case study research of a specific furniture manufacturer in Norway. In order for the results to (potentially) be generalizable, the research question is derived as;

RQ: How can a manufacturer in an established value chain transition its linear business model to a circular business model?

Moreover, two sub-questions have been derived to help address this research question. These questions are in relation to a specific Norwegian bed manufacturer, *Wonderland AS*, which seeks to turn its linear business into a circular business in partnership with five partner companies. This innovation project, named *WondRest*, plans to create a new, circular value chain, that apart from offering a bed with a *50% reduced environmental footprint*, will be commercially and socially viable in the future. The following two sub-question are derived;

SQ1: What are the drivers and barriers in Wonderland's business model transition?
SQ2: What are the success factors and enablers in this transition?

In this thesis, a driver is defined as a *motivational* factor, that is, a factor that motivates enterprises to perform CBMIs. A barrier, on the other hand, is defined as an impediment, or hindrance, that prevents, or may prevent, firms from successfully implementing CBMs. Lastly, an enabler is a facilitator that assists or encourages firms in this transition process.

The answers to the abovementioned sub-questions are obtained through a direct assessment of the WondRest case. Figure 1 illustrates the deductive approach of this thesis, showing how obtained data from existing literature was used as a framework for the analysis and handling of empirical data, as well as how the various data assist in answering the research and sub-questions.

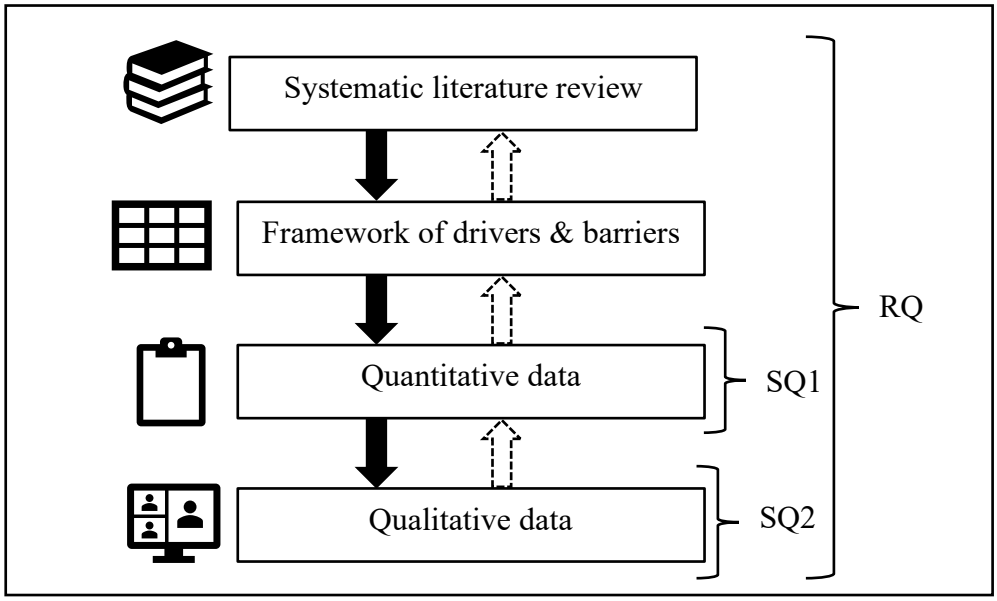

Figure 1: Figure showing how obtained theory shaped a framework that was used for the analysis and handling of empirical data, as well as how the various data is used to answer the research and sub-questions. (Source: Own production).

1.4 Scope of Thesis

As this study is defined as a single case study, the scope of the study is narrowed only to involve the WondRest case. Moreover, when assessing how Wonderland (along with its partner companies) can enable circular business model innovation (CBMI), the perspective is mainly *project*-based. That is, proposals for new technical *product* solutions are not assessed and are deemed to be outside the scope of this thesis. Moreover, this thesis disregards both market and consumer needs for the intended product, as well as any potential collaborating partners who are not included in the current project.

As for limitations, there are three main constraints that should be mentioned: 1) The lack of research on CE related topics, 2) the WondRest project's status quo, and 3) the ongoing Covid-19 pandemic. The former has limited several aspects of this thesis. First and foremost, as CE is a fairly novel area of research, extra attention had to be put on certain, prominent authors when assessing CE theory. Furthermore, the empirical results would undoubtedly be strengthened if there existed more similar case studies for comparison. This is especially true for the completion of the systematic literature collection, where all identified cases should ideally have been single-case bed manufacturers.

The second limitation is concerned with the project's status quo, as the project is still in its early phases. As figure 1 illustrates, current literature is used as a basis for analyzing the

WondRest case. In this regard, the obtained literature consists of drivers and barriers in CBMI-studies, most of whom from finalized projects. In contrast to motivational factors, which are easier to assess regardless of time frame, some barriers arise throughout a project period. Being that the WondRest project is still in its conceptual- and planning phases, some potential barriers are yet to arise.

The third limitation that needs to be pointed out is the ongoing covid-19 pandemic, which has put some clear limitations on this research process. First of all, the pandemic struck just at the outset of the WondRest project, which was, to put it mildly, far from an ideal start. Although the project leaders have handled this issue well, it is apparent that conducting all meetings, seminars, presentations, and other activities using online platforms has been difficult. What's more, the original intention to visit Wonderland's production facilities during this research process had to be canceled as a result of the pandemic.

1.5 Structure of Thesis

The rest of this thesis will be respectively divided into the following seven main chapters: *Conceptual Background, Theoretical Framework, Methodology, Empirical Background, Results & Findings, Discussion & Analysis*, and *Conclusion*. The former presents the necessary background concepts to understand the thesis in its entirety. Here, an assessment of sustainability and its ongoing challenges are be presented, and we will see how these challenges have given rise to the CE concept. Then, chapter 3.0 narrows the focus by first assessing the CE in practice, before breaking down the term *circular business model innovation.* Lastly, the framework that served as a foundation for obtaining and analyzing the empirical data are put forward. Chapter 4.0, *Methodology*, describes the chosen research design and the research strategy, as well as a comprehensive description of the research process. Moreover, how the various data were analyzed are described, and the chapter rounds off by assessing the research quality and credibility of the findings. Thereafter, the *Empirical Background* of the study are put forward, before the *Results & Findings* are presented in chapter 6.0. Here, the answers to the two sub-questions are systematically presented in two separate 'summary of results'-sections. In chapter 7.0, *Discussion*, connections and differences between the theory and results are discussed, and a foundation is created to finally answer this thesis's research question in the *Conclusion*.

2.0 Conceptual Background

This chapter presents the conceptual background for this master's thesis and is divided into two sections: *2.1 Sustainability* and *2.2 Circular Economy*. These sections are meant to provide the fundamental background knowledge that is necessary to get a grip of this thesis in its entirety. Moreover, the chapter provides an essential theoretical link to understand the themes presented in chapter *3.0 Theoretical Framework*.

This chapter starts by presenting a brief overview of the term *sustainability*, its roots, origins, and its importance for stakeholders around the world (section 2.1). Thereafter, we will see how challenges related to sustainability have given rise to the concept of *circular economy* (section 2.2). This section makes it clear how CE definitions are dispersing in the reviewed literature and how this dispersion has contributed to a lack of clarity concerning the concept's principles and aims.

2.1 Sustainability

Scoones describes *sustainability* as *"one of the most widely used buzzwords of the past two decades"* (2010, p. 589). This section will assess this statement, looking to get a grasp of the term's actual meaning (2.1.1), its historical development (2.1.2), as well as the various outcomes and consequences stemming from the prolonged unsustainable human behavior on the earth (2.1.3).

2.1.1 Definition

As for many so-called buzzwords, there may often be a dispersion of clear definitions and meanings. When scrolling through the literature, several definitions of sustainability and sustainable development were found. This is substantiated by Johnston et al., who state that more than 300 definitions of either term exist in the literature (2007, p. 60). Nevertheless, the most commonly accepted definition of sustainable development was presented in 1987 by the Brundtland Commission. As stated by the commission, sustainable development can be defined as "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland 1987, in Geissdoerfer et al. 2017, p. 758).

When the Brundtland Commission put forward their interpretation of the sustainability term, no distinguishment was explicitly made between the sustainable development related to the society, the environment, nor the economy. This was later handled by the business writer, John Elkington, who, through his work from 1994, *The Triple Bottom Line*, presented what is today referred to as *the three pillars* of sustainability; the environment, society, and economy. These three pillars are often illustrated by a Venn diagram, indicating that sustainability as a whole is reached only when evaluating all the three pillars simultaneously (see figure 2). In contrast with previous definitions and meanings of the sustainability term, Elkington saw the need to connect the three pillars in a more integrated way to make sure that "*real environmental progress was made*" (Elkington, 2004, p. 1).

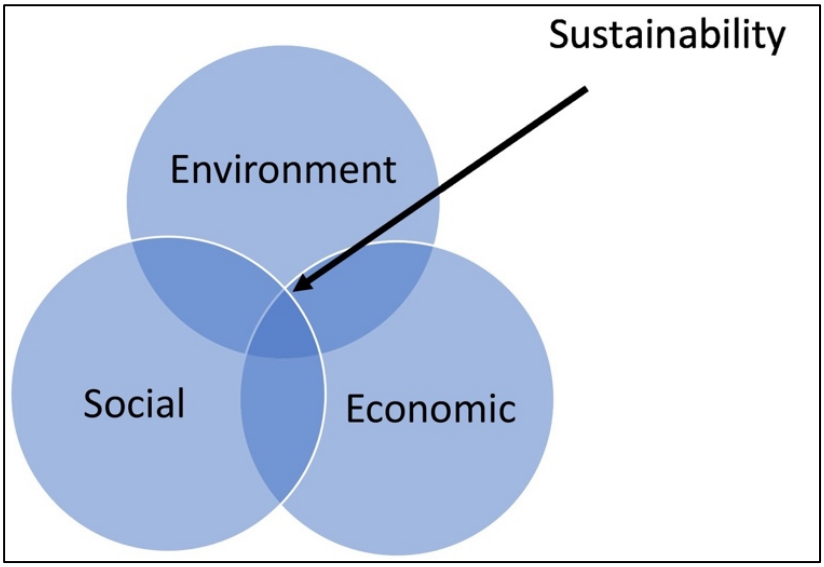

Figure 2: The three pillars of sustainability. (Source: Millar et al., 2019).

With respect to these three pillars, Geissdoerfer et al. simply defines sustainability as "*the balanced and systematic integration of intra and intergenerational economic, social, and environmental performance*" (2017, p. 759). By merging the somewhat general definition of the Brundtland Commission with the more tangible definition of Geissdoerfer et al., this master's thesis defines sustainability as

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs, achieved by a balanced and systematic integration of intra and intergenerational economic, social, and environmental performance.

2.1.2 Brief history

There is a general consensus in the reviewed literature that the first Industrial Revolution (IR) during the 16th and 17th century has contributed as the main accelerating factor for the sustainability issues that the world faces today (e.g., Caradonna 2014, p. 57; Carvalho et al. 2018, p. 672; Foster 1999, p. 20). According to Caradonna, sustainists question whether *"the Industrial Revolution has jeopardized humankind's ability to live happily and sustainably upon the Earth*" (2014, p. 57). However, both Caradonna and Foster (1999) emphasize the necessity of understanding how human behavior prior to the first IR has encouraged the unsustainable behavior we experience today. Foster states that "*Beginning with the development of agriculture 10,000 years ago, all forms of the social organization of production have contributed to the destruction of the environment*" (1999, p. 34). This is supported by Caradonna, who refers to soil erosion, urban air pollution, and deforestation as environmental issues that existed long before the first IR (2014, p. 23).

Pointing the finger at the first IR as the primary source for the world's unsustainable development throughout time is a simplified interpretation. This is why the views of Caradonna and Foster are essential, as they form a linkage between human behavior through history, the first IR, and the unsustainable behavior we see in the world today. Nonetheless, there is no escaping the fact that the first IR hastened a variety of social, environmental, and economic complications: Looking at the gross national income (GWP) of all countries around the world, there has been an exponential increase since the beginning of the first IR (Sachs, 2015, p. 2). Although there are many positive aspects to this incremental growth, it also aggravated social and economic inequality around the world, and led to various damages to the planet earth.

2.1.3 Outcomes and consequences

Mohajan describes the first industrial revolution as "*one of the most distinguished turning points in human history*" (2019, p. 1), where human and animal labor were replaced with various machinery. As he states, the first IR is known for global economic growth, increase in both production and consumption, improved transportation, communication, financial systems, and steep population growth. On the flip side, the first IR has experienced extensive criticism for several reasons, something this subsection will investigate further.

Mohajan emphasizes how the first IR "*created a wide gap between the rich and the poor*" (2019, p. 1) and how factory workers had to work "*sixteen hours a day merely to save the family from starvation*" (2019, p. 1). This is supported by Caradonna, who affirms that "*the industrial revolution actually made most people poorer and more miserable, while making a select few fabulously wealthy*" (2014, p. 59). These statements can be proved by looking at the evolution of per-capita income in developed and underdeveloped countries. In 1750, the per-capita income in both developed and underdeveloped countries was the same; 180$ per capita. In 1930, the per-capita income in underdeveloped countries remained the same, while it grew to 680$ in developed countries (Foster, 1999, p. 20). The World Bank estimates that the number of people that lived in extreme poverty (below 1.90$ per day) in 2020 increased to a total of 729 million people, much due to the Covid-19 pandemic (World Bank, 2020).

Apart from an extensive increase in social and economic inequality, scientists and politicians have become increasingly concerned about a variety of environmental challenges. Global warming, biodiversity loss, and water & air pollution are all examples of environmental concerns that have grown rapidly after the first IR. The former has especially been a largely researched topic, with the United Nation's Intergovernmental Panel of Climate Change (IPCC) having published yearly reports on climate change since 1988 (IPCC, 2021). Their report from 2013 concluded, among other things, that human behavior is the sole cause of global warming (IPCC, 2013). Their various reports from 1990 to the latest of 2019 spotlight ocean acidification, increased sea levels, and more extreme weather as examples of outcomes from increased global warming (IPCC, 2013, 2019).

Apart from the incremental emissions of greenhouse gases, the growing production and consumption model have led to severe damages to other parts of the ecological world. A

measurement used to assess the total environmental damage caused by humans is the *ecological* (or *environmental) footprint*. This footprint measures people's total consumption of natural resources and may provide an honest indication of (for instance) a country's total damage to the environment. The measurement assumes that each person has a specific amount of 'space' in order for nature to "*restore itself"* (FN, 2020). According to the UN's Norwegian corporate website, this number was 1.69 hectares per person in 2014. Qatar is currently the country in the world with the highest ecological footprint of 15.7. Norway, in comparison, has an ecological footprint of 6.0, suggesting that if each person in the world consumed the same way as an average Norwegian, it would require 3.6 globes (FN, 2021). Furthermore, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) discovered that species extinction is occurring tens to hundreds of times quicker now than it has in the previous 10 million years, that 75 percent of the terrestrial surface has "changed remarkably," and that half of the live coral cover on coral reefs has vanished since the 1870s (IPBES, 2019).

2.2 Circular Economy

In light of the sustainability issues presented in section 2.1, the concept of Circular Economy has emerged as a possible solution to the current production and consumption model (Ghisellini et al., 2016, p. 11). The following section will examine this largely fundamental background concept. The concept is described as 'fundamental' as it lays the foundation for understanding the theoretical mindset that pervades this master's thesis. Thus, this section will elaborate on 1) various CE definitions and 2) main principles for the CE.

2.2.1 Definitions

Just as the sustainability definition, the definition of *Circular Economy* varies to a great extent in the literature. This is highlighted by the work of Kirchherr et al. (2017), who analyzed as many as 114 separate CE definitions in their reviewed literature. Their findings indicate that the CE is "*most frequently depicted as a combination of reduce, reuse, and recycle activities*" (2017, p. 221), the so-called 'three Rs' (reduce, reuse, recycle). In this respect, the authors highlight the large number of definitions that seem to associate CE entirely with recycling, specifying that a total of 79% of the explored definitions included 'recycling', followed by 'reuse' (74-75%), and 'reduce' (54%–55%). This is in line with (among others) the definition provided by the Chinese CE promotion Law, which states that

"*CE is a generic term for the reducing, reusing, and recycling activities conducted in the process of production, circulation and consumption*" (CCICED 2008, in Ghisellini et al. 2016).

Although a superiority of CE definitions includes a combination of these 'three Rs', authors refer to other so-called 'R-terms'. Kazerooni Sadi et al. (2012) add on the activity of *recovery*, while Stahel brings attention to *remanufacturing* and *repair*: *"Reuse what you can, recycle what cannot be reused, repair what is broken, remanufacture what cannot be repaired"* (Stahel, 2016, p. 435). Such use of disparate R-terms leads us to another core principle found in various definitions: *The waste hierarchy*. According to Kirchherr et al., the waste hierarchy (or the '9R Framework' as they call it) is found in 30% of their reviewed definitions and is an "*indication of an order or ranking of the various Rs mentioned, e.g. via words such as 'first', 'alternatively' or 'least desirable'*" (2017, p. 223). For instance, Song et al. refer to a waste hierarchy as they state that *"if reuse or repairs are not possible, they can be recycled or recovered from the waste stream and used as inputs, substituting the demand for the extraction of natural resources"* (2015, p. 200). Figure 3 shows a proposed waste hierarchy, ranging from the least desirable option (energy recovery) to the most desirable option (refuse).

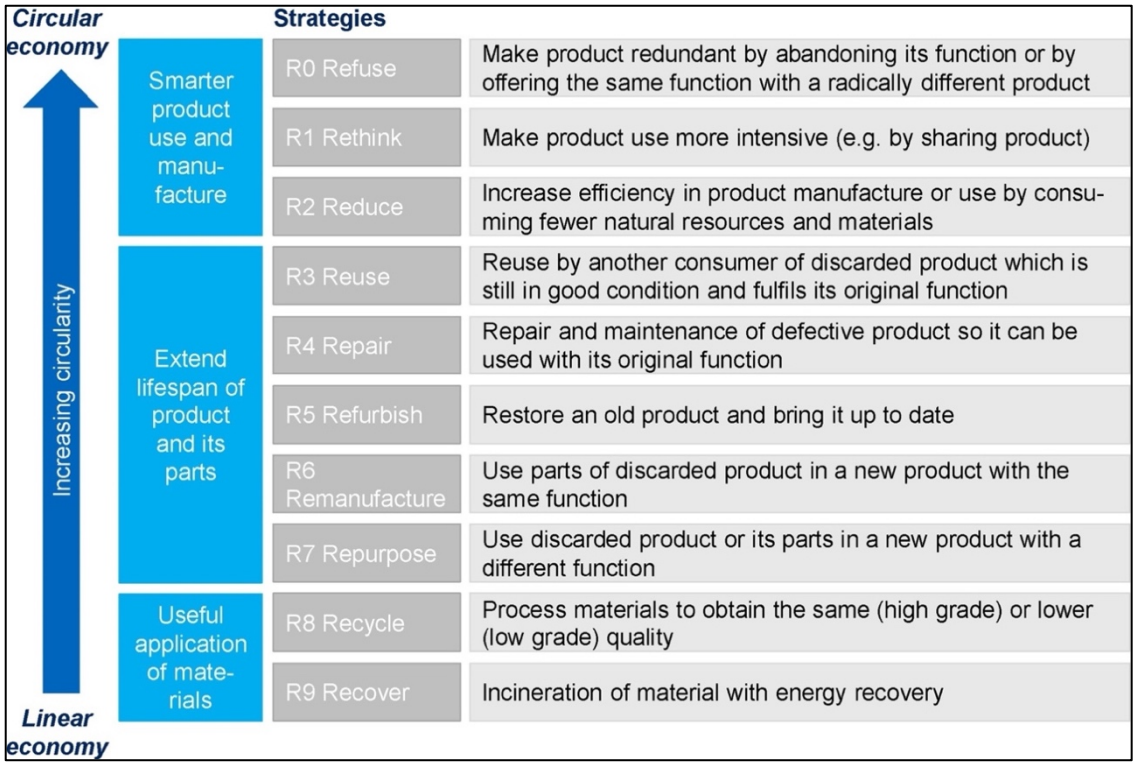

Figure 3: Proposed waste hierarchy. (Source: Kirchherr et al., 2017).

From 2012 and onwards, Kirchherr et al. highlight the growing amount of CE definitions that include a "*system perspective*" (2017, p. 227). For instance, Charonis defines CE as a "*system that is designed to be restorative and regenerative*" (2012, p. 2). Kirchherr et al. presume that the growing amount of CE definitions that include a system perspective is much due to the definition provided by the Ellen MacArthur Foundation (EMF) in 2012. According to both Geissdoerfer et al. (2017, p. 759) and Schut et al. (2015, p. 15), this definition is the most prominent CE definition that has been provided and will hence be the definitions used in this thesis. It states that a CE is

> "*an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models*" (EMF, 2013, p. 7)

2.2.2 Principles

Various authors emphasize the lack of a universal understanding of the exact principles of the CE today (e.g., Prieto-Sandoval et al. 2018; Pesce et al. 2020; Suárez-Eiroa et al. 2019), substantiated by the dispersion of existing CE definitions. As Kirchherr et al. describe it, *"CE means many different things to many different people"* (2017, p. 229). To cope with this somewhat unclear understanding of the CE concept's exact principles, both the *Ellen MacArthur Foundation (2013), Walter Stahel (2016; 2019)*, and the *Circle Economy Organization* (n.d.) have been given extra attention as a result of their prominent work in this field of study.

The 'system perspective' referred to by the EMF in the abovementioned definition is famously illustrated by a so-called "*butterfly diagram*" (EMF 2013, p. 24). The diagram, shown in figure 4, indicates the activities required to close resource loops in industrial systems, distinguished by *technical* and *biological* nutrients.

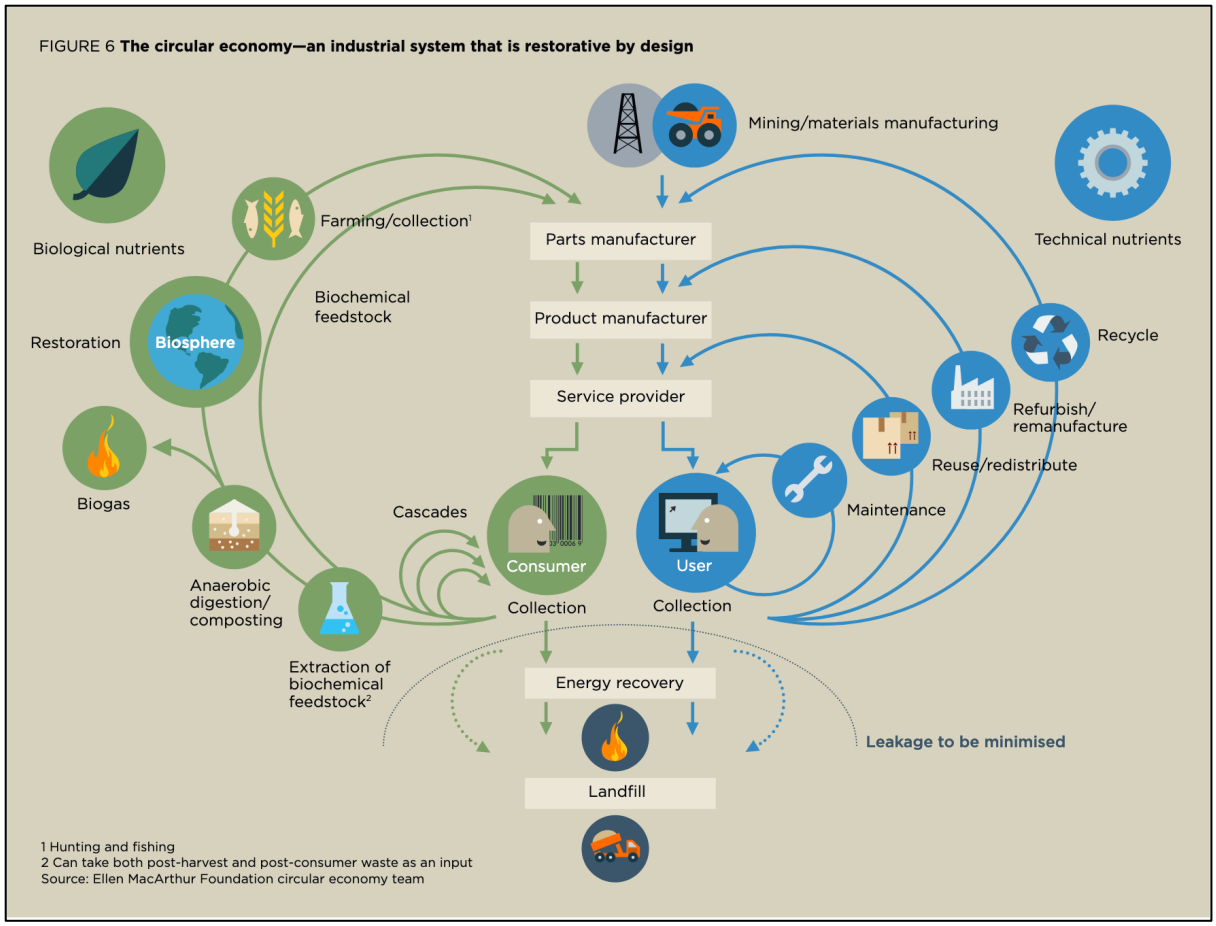

Figure 4: The butterfly diagram. (Source: EMF, 2013).

The middle of the diagram illustrates the (current) linear economic system, where virgin materials are extracted from the earth, handled by various stakeholders, and finally treated as waste. The 'wings' on each side represent the possibilities to close the resource loops in this linear economy and transform the model into a circular economy. The left wing represents the biological nutrients that exist in the *biosphere* (the sum of all ecosystems), while the right wing represents the technical nutrients in the *technosphere* (the environment created by humans). In a circular economy, all *consumables* should consist of biological nutrients that can be returned safely to the biosphere, alternatively in a 'cascade' of successive uses. Likewise, *durables* existing of technical nutrients should return to the technosphere in order to set them apart from disposal, achieved by designing and optimizing the durable products for a cycle of disassembly and reuse (EMF 2013, p. 7).

Stahel emphasizes how a CE encourages the *Performance Economy*, where users are replaced with consumers. As he describes it, *"Ownership gives way to stewardship; consumers become users and creators"* (2016). As such, manufacturers and retailers need to maintain

material ownership, where selling the function of a product replaces selling the ownership of the product. This sustainable economic model will, according to Stahel, boost business model innovation as it "*acts as an initiator for innovative circular industrial economy start-ups*" (2019, p. 66). Furthermore, he emphasizes the environmental benefits of a CE (extensive energy and resource savings), as well as the possibilities of job creation. The latter is substantiated by the findings of NTNU, SINTEF, and the International Labor Organization; through an extensive economic study, they found that a worldwide change towards a CE could increase the total workforce by 2,5% within 2030 (Wiebe, 2020).

Furthermore, the non-profit organization, *Circle Economy,* analyzed more than 20 organizations to uncover the key principles, or core elements, that lie within a CE. Their findings are shown in figure 5, illustrating the seven core elements as proposed by the organization.

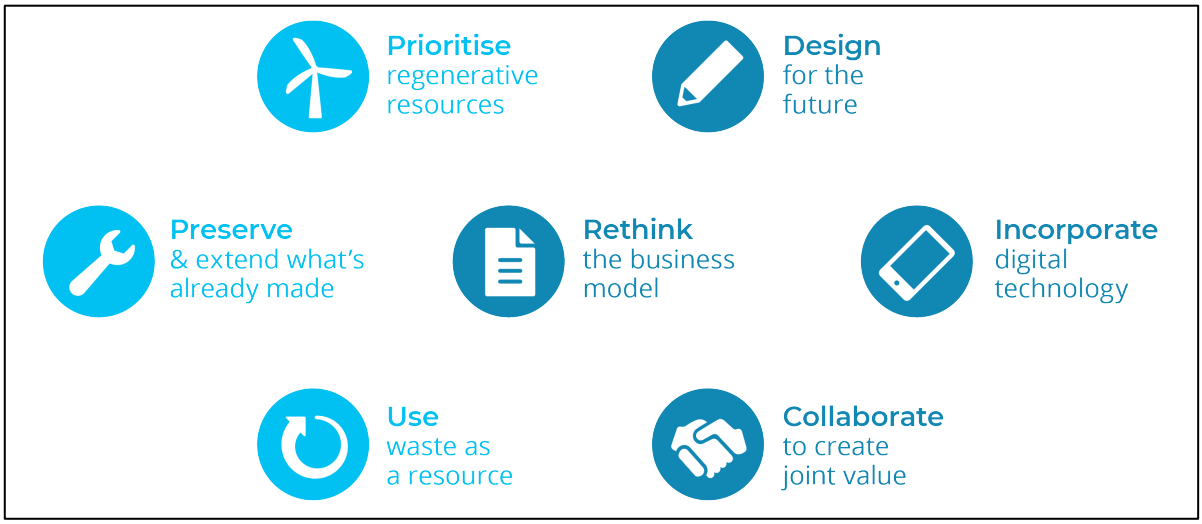

Figure 5: The seven core elements within a CE, as illustrated by Circle Economy (n.d.)

According to their findings, a CE is one that:

1. **Prioritizes regenerative resources.** All resources, both materials, and energy included in circular processes must be renewable and/or regenerative by nature. This includes the use of renewable energy sources, such as solar- and wind power, as well as the use of non-toxic materials only.
2. **Preserves & extends what's already made.** The lifetime of resources and materials should be prolonged through maintenance, repair, and upgrade activities. This requires

the introduction of take-back strategies within firms in order to maximize the lifetime and usage intensity of resources and products.

3. **Uses waste as a resource.** A CE aims to "*design out waste*" (EMF 2013, p. 7). This means that in a CE, waste is regarded as resources, not as unwanted entities. In a CE, waste streams should be utilized as secondary resources and recovered for (e.g.) reuse and/or recycling.
4. **Rethinks the business model.** Adjust business models to account for the entire life cycle of products, from design to end-of-life. Capitalize on collaboration and long-term relationships by changing linear business models to circular business models (see section 3.2).
5. **Collaborates to create joint value.** Structural cooperation among stakeholders has proven to be essential in order to implement CE strategies within firms. This includes working together throughout the value chain, both internally within organizations, as well as externally across the public, private, and social sector.
6. **Designs for the future.** In order to make materials last longer, the design phase of products and systems is crucial. This phase facilitates the future possibilities for (e.g.) regeneration, restoration, repair, reuse, and/or disassembly. Here, 'consumables' should primarily be made of biological nutrients, while 'durables' should be designed in a way that facilities long service life for products and systems (see figure 4).
7. **Incorporates digital technologies.** Digital technologies may serve as crucial enablers when implementing CE strategies. This includes optimizing and measuring resource use, asset tracking, and implementation of online platforms and technologies that help connect actors within supply chains.

3.0 Theoretical Framework

Chapter 2.0 presented two fundamental concepts that, as we will see, link closely to the subjects presented in this chapter. This is illustrated in figure 6, showing how the conceptual background concepts (*Sustainability* & *Circular Economy*) are narrowed down in relation to the themes presented in this chapter. Moreover, the figure shows how section 3.3 are explicitly working to answer this thesis's two sub-questions, while all sections work as a basis for answering the research question.

In chapter 2.0 it was made clear how the sustainability concept and its ongoing issues have contributed to shaping and creating the CE concept. The following chapter builds on this knowledge, with section 3.1 looking to get a grasp of the CE in practice, focusing on Europe and Norway specifically. Having developed an understanding of the CE concept, and an overview of its current practical implementations, it is natural to shed light on how firms and enterprises can incorporate CE principles into their business models. This section, *Circular Business Model Innovation* (CBMI), first addresses the terms *innovation* and *business models*, and we will see how these topics relate to *circular business models* and *circular value chains.* Next, drivers & barriers in CBMIs are elaborated in section 3.3, where a framework of drivers & barriers are derived through a systematic literature review. Lastly, section 3.4 summarizes the findings, and it is elucidated how the current literature has a strong focus on drivers & barriers in CBMIs.

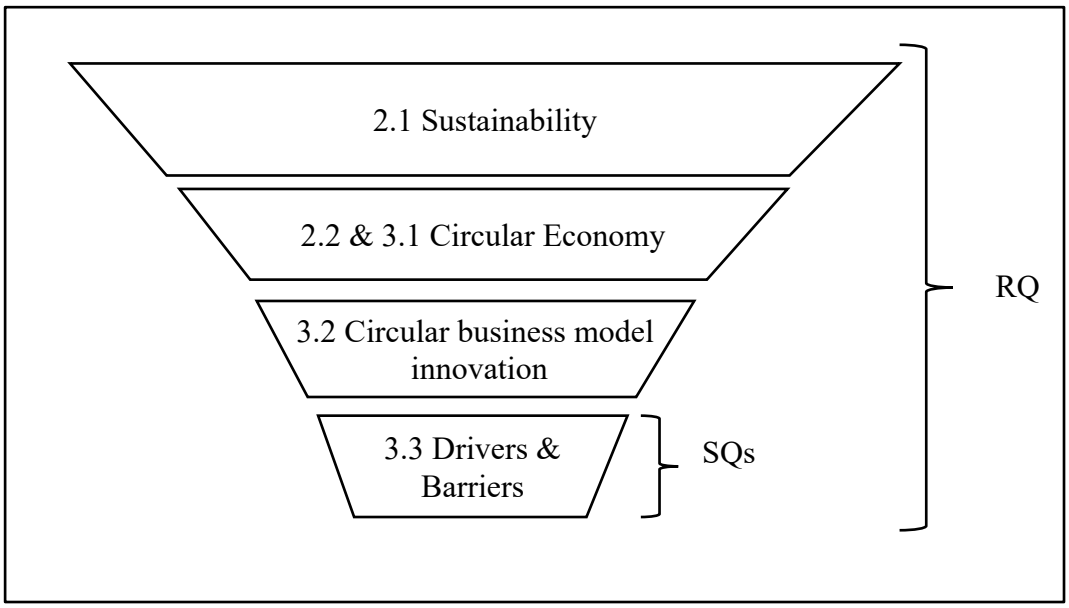

Figure 6: Figure depicting how the many sections build on each other by moving from a wide (Sustainability) to a narrow perspective (drivers, barriers, & enablers). (Source: Own creation).

3.1 Circular Economy in Practice

The linear economic model is still ruling the world economy. This is evidenced by the Circularity Gap Report of 2020, revealing that the world is currently as little as 8.6% circular (Circle Economy, 2020c). This section will take a look at the practical aspects of the CE in Europe and Norway specifically. These areas were natural to assess, as the analyzed case of this thesis is a Norwegian manufacturer and, as we will see, the Norwegian economy is highly influenced by European directives and regulations. This section first introduces two different approaches that enable CE implementation, before the status of CE is assessed in Europe and Norway, respectively.

3.1.1 Top-down vs bottom-up approach

The literature distinguishes among two different approaches regarding CE implementation, namely "top-down*"* and "bottom-up" approaches (e.g., Lieder & Rashid, 2016; Ghisellini et al., 2016; Pomponi & Moncaster, 2017; Winans et al., 2017). As the name suggests, the approaches differ in *where* the CE initiatives come from. In simple terms, a bottom-up approach operates through the industry, whereas a top-down approach operates through public institutions (Lieder & Rashid, 2016, p. 47). Both Winans et al. and Lieder & Rashid emphasize the importance of a concurrent top-down *and* bottom-up approach in order to implement CE at a large scale (Winans et al., 2017, p. 830; Lieder & Rashid, 2016, p. 47)

In a top-down approach, societal factors such as government legislation and customer preferences work as the main drivers for a CE transition. Both governmental bodies, policymakers, and customers/stakeholders have the power to increase the attention to both environmental and societal issues. By contrast, in a bottom-up approach, the incentives towards a CE transition come from the industry through various actions that promote CE implementation. However, as Lieder and Rashid underline, due to competitive pressure, the main focus in firms will most likely be concerned with economic benefits and growth (2016, p. 47). Thus, without clear profit opportunities and economic advantages, CE initiatives will, in most cases, be absent in firms. This is why a simultaneous top-down *and* bottom-up approach is essential, as it contributes to decouple environmental pressure from economic growth (Ghisellini et al., 2016, p. 11). Figure 7 below gives a visual understanding of this concurrent top-down and bottom-up approach.

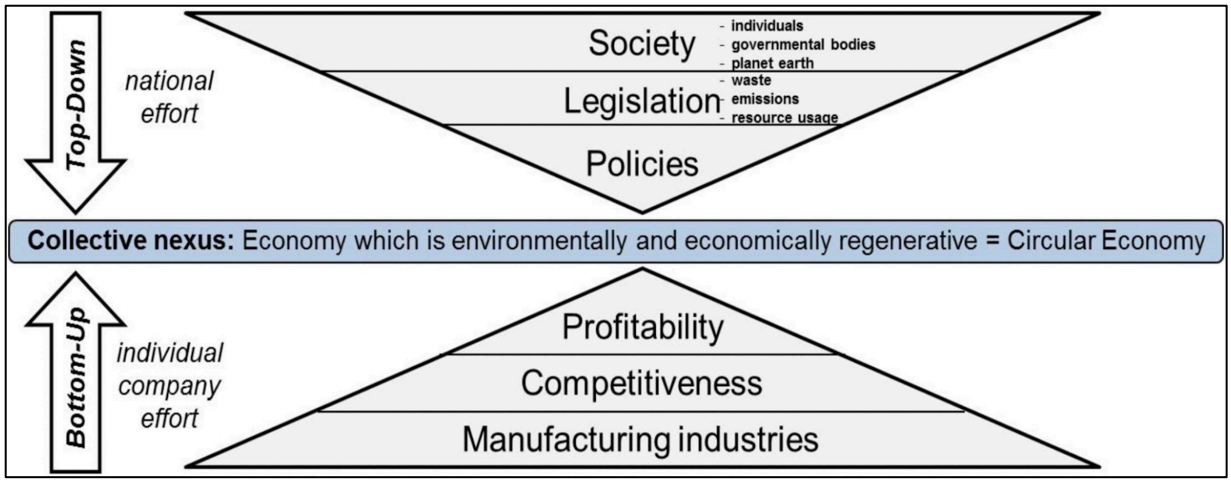

Figure 7: Illustration of a concurrent top-down and bottom-up approach, where the goal is large scale implementation of CE. (Source: Lieder & Rashid, 2016).

3.1.2 Status in Europe

Stahel criticizes Europe for its late actions to promote the CE, pointing to countries like China, South Korea, and the United States, which all have initiated several CE initiatives during the last decades (2016, p. 436). On the other hand, several actions have been taken in the European Union in the last 5-10 years. The *Roadmap to a Resource Efficient Europe* was established by the European Commission in 2011 as a result of high commodity prices (McDowall et al., 2017, p. 652) and outlines how to transition the economy in Europe from a linear to a circular one within 2050 (EC, 2011). In 2015, the same commission initiated the action plan *Closing the Loop - An Action Plan for the Circular Economy*, to *"transform our economy and generate new and sustainable competitive advantages for Europe.*" (EC, 2015). *The European Green Deal* of 2019 is the European Commission's latest action plan to support CE, intending to encourage CE activities, promote sustainable consumption, and focus on keeping resources within the European economy for as long as possible (EC, 2019). What's more, the International Organization for Standardization is currently working on a new ISO-standard (ISO TC 323) to develop frameworks and guidance for activities that support the implementation of the CE (ISO, 2018).

As for individual companies' initiatives, the Ellen MacArthur Foundation (EMF) highlights the five manufacturing firms, Michelin, Caterpillar, Renault, Ricoh, and Desso, to have successfully implemented CE practices (EMF, 2013, p. 28). By implementing strategies such as leasing, renting, and remanufacturing to their business models, all five firms have grown remarkably in scale. Both Michelin and Ricoh have included leasing as a vital part of their

business, while both Caterpillar and Renault have shown significant growth with their remanufacturing strategies. According to the EMF, Renault's circular business model has allowed them to grow into a 200 million euro business, whereas Caterpillar has grown at a rate of 8-10% above the world economy over the last decade (EMF, 2013, p. 28).

As for policy initiatives, Winans et al. mention both Italy and the UK as countries where CE initiatives, in terms of *eco-industrial parks*, have been supported by national programs (Winans et al., 2017, p. 826). An eco-industrial park can be defined as a *"business community seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues, including for instance, energy, water, and materials"* (Halonen & Seppänen, 2019). Under an Italian law from 1997 promoting eco-industrial parks, regions were given the responsibility to develop "*industrial zones equipped with infrastructure and systems able to guarantee health, safety and environment protection*" (Winans et al., 2017, p. 826). Following this, numerous Italian regions have implemented definitions, design, implementation, and management criteria for eco-industrial parks (Conticelli & Tondelli, 2013, p. 187). In the UK, the *National Industrial Symbiosis Program* has since its launch in 2005 contributed to several environmental benefits, such preventing the use of million tons of industrial water and raw materials (EC, 2009).

It is, in other words, evident that CE initiatives have been undertaken by various countries and industries all over Europe even before the relatively new EU initiatives took place. However, the reviewed literature clarifies that Europe has a long way to go in its transition towards a CE. In a European context, the Netherlands is regarded as a frontrunner in the circularity race, with an estimated circularity metric of only 24.5% (Circle Economy, 2020b). In comparison, Austria and Norway have estimated circularity rates of respectively 9.7% (Circle Economy, 2019) and 2.4% (Circle Economy, 2020a). Stahel describes Europe as "*taking baby steps*" in the race towards a CE (2016, p. 436), while Kovacic et al. describe Europe's circular economy in 2019 to be "*quite similar to Europe of 2010 or 2000, namely a modern society characterized by very high and clearly unsustainable levels of consumption of natural resources*" (2019, p. 4).

3.1.3 Status in Norway

The Norwegian economy is characterized by a *mixed economy,* that is, a capitalist market economy with elements of a strong and governing state (Thuesen et al., 2021). This combination of state and private ownership provides a strong foundation for CE growth (Karstensen et al. 2020, p. 300). Moreover, Norway's tripartite model between employers, government, and unions ensures close cooperation and labor force participation, which is crucial in facilitating a circular transition (CGR, 2020).

Based on the circumstances, one could assume that Norway stood out as a frontrunner for circular societal growth. However, Norway has proven to be quite the opposite. At 44.3 tons per person, Norway has one of the highest consumption rates in the world, as stated by the *Circularity Gap Report* of 2020. Moreover, the report reveals that Norway is currently as little as 2.4% circular (CGR, 2020). This means that out of the 235 million tons of materials (metals, fossil fuels, biomass, etc.) consumed in Norway each year, 97.6% of these materials are never returned back into the economy. However, the report highlights some positives, stating that *"with the right intentions, Norway has the potential to increase its circularity up twenty times and become a pioneer in the circular economy"* (CGR, 2020). The report points to various transitions that need to occur in the Norwegian business and industry for this to occur, such as introducing green transport systems, circular forestry, transition to clean energy, circular food systems, and more.

As for governmental rules and regulations to support a sustainable economy, the Norwegian government appointed an Expert Committee in 2015 to *"reduce greenhouse gas emissions by 40% within 2030, and become a low-emission-society within 2050*" (Regjeringen, 2016). Moreover, as a part of the European Economic Area, Norway is obliged to follow various EU rules and regulations (Karstensen et al. 2020, p. 299). This includes, as examples, *The European Green Deal* (EC, 2019) and *The European Waste Framework Directive* (EP, 2008). While the former was presented in the previous subsection (3.1.2), the latter was issued by the European Commission in 2008 and introduced various waste management strategies and targets, intending to "*protect the environment and human health*" (EP, 2008). The directive uses the *Waste Hierarchy Framework* (see figure 3) as a basis for all waste management activities and has since worked as the fundamental framework for the regulatory development in the EU and Norway (Karstensen et al. 2020, p. 299).

Karstensen et al. state that Norway's total material recycling level was approximately 45% in 2017, evidencing a significant potential for circular activities (2020, p. 300). What's more, the authors quantify that the total generation of waste in Norway (both hazardous and non-hazardous) was as much as 11.7 million tons in 2017. Out of this, 21% were placed directly on landfills, which equals a total amount of nearly 3 tons (2020, p. 300). A new study from SINTEF shows that by introducing circular activities such as repair and reuse, the net job growth in Norway can increase by 18.000 man-years and increase the total value creation by NOK 16 billion. Moreover, the study shows that increasing the service life of products will provide a net job growth of 1000 man-years and increase value creation by NOK 1.7 billion (Jahren & Wiebe, 2021).

Although Norway is just in the starting phase of a (hopefully) circular transition, various projects (both national and international) focusing on the CE have been initiated in recent years. Research institutions such as SINTEF, NTNU, and NORSUS often stand in the frontline for these projects by contributing with the necessary research and knowledge. Moreover, funding institutions such as The Research Council of Norway (Norges Forskningsråd) plays a crucial role in enabling the initiation and completion of various projects. Finally, governmental participation is (and will to a greater degree, become more) crucial in order for the Norwegian economy to transition into a circular economy (Karstensen et al., 2020, p. 315).

3.2 Circular Business Model Innovation

This section builds on the theory from the three previous sections (2.1, 2.2, 3.1) and introduces the reader to several core principles and definitions essential for a holistic understanding of this thesis. First, as WondRest is defined as an innovation project, the term *innovation* are assessed in 3.2.1. Following that, basic theory of *business models & value chains* are presented, before introducing the concept of *circular business models & circular value chains.*

3.2.1 Innovation

O'Sullivan and Dooley describe innovation as "*the process of making changes to something established by introducing something new*", changes that can be either radical or incremental

2009, p. xxi). Furthermore, both O'Sullivan and Dooley & Tidd and Bessant (2020) emphasize the importance of innovation in organizations in order to stay competitive. As stated by the latter; *"The logic is simple – if we don't change what we offer the world (products and services), and how we create and deliver them, we risk being overtaken by others who do"* (Tidd & Bessant, 2020, p. 2). From management boards and individual departments to project teams and individuals, innovation occurs at all levels of an enterprise (O'Sullivan & Dooley, 2009, p. xxi).

Kahn highlights the importance of seeing innovation as both an *outcome,* a *process,* and a *mindset* (2018, p. 453). Innovation as an outcome refers to the desired outcome of a particular innovation. This includes product innovation, process innovation, marketing innovation, business model innovation, supply chain innovation, and organizational innovation (2018, p. 453). Research as a process concerns how innovation should be structured so that results can be realized and involves both an overall innovation process and a new product creation process (2018, p. 453). Lastly, innovation as a mindset refers to the integration and creation of innovation by individual representatives of the organization, supported by an organizational culture that allows innovation to flourish (2018, p. 453).

In order to succeed with innovation, *innovation management* is key (O'Sullivan & Dooley, 2009, p. xxii). In this respect, O'Sullivan and Dooley present the 'innovation funnel' to understand how to apply innovation in organizations.

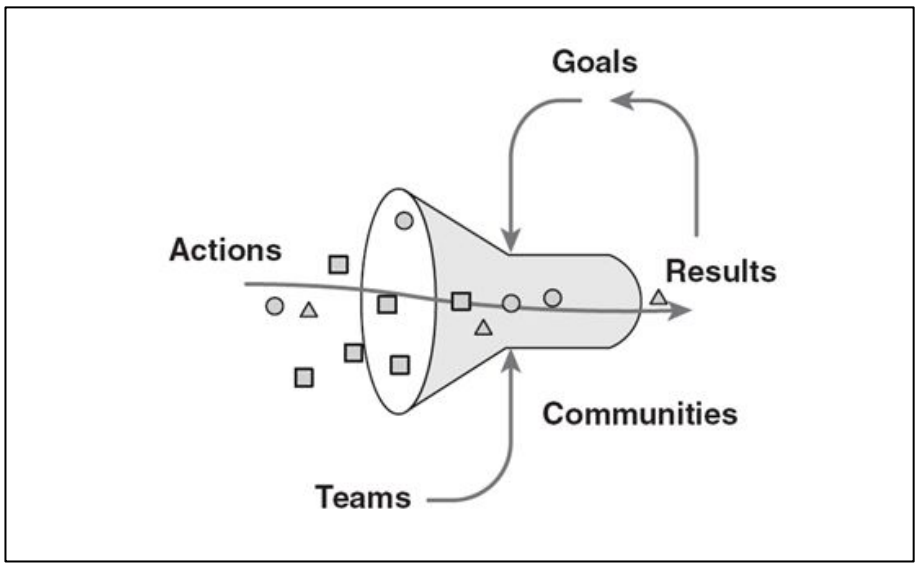

Figure 8: The innovation funnel. (Source: O'Sullivan & Dooley, 2009).

In the funnel, seen in figure 8, innovative thoughts and ideas enter the opening on the left side (represented as *actions*). These ideas can stem from various sources, such as customers, employees, or management. These ideas flow through the middle of the funnel, where they are assessed and 'filtered'. The assessments are mainly done by innovation teams in the corporation, with some ideas being discarded, merged, or postponed, while others move on to actual projects and initiatives. (2009, p. xxiv). Moreover, the middle of the funnel can be loosened or tightened; a tight funnel represents fixed and tightly defined goals, while a loose funnel represents an allowance for more ideas to be evaluated. Finally, the results represent information about the progress. These results are frequently assessed in an iterative approach to guide the innovation process (2009, p. xxv)

3.2.2 Business models & value chains

A business model can be defined as *"a simplified and aggregated representation of the relevant activities of a company"* (Wirtz 2000, in Wirtz 2011, p. 57). Wirtz highlights the multitude of definitions and understandings of the business model term but emphasizes that the basis of a business model is to describe a company's value creation and value proposition (2011, p. 57). This is substantiated by Teece, who states that a business model reflects "*management's hypothesis about what customers want, how they want it, and how the enterprise can organize to best meet those needs, get paid for doing so, and make profit*" (2010, p. 172).

Furthermore, both Teece (2010) & DaSilva and Trkman (2014) underline the importance of distinguishing a business model from a *business strategy*. In this regard, DaSilva and Trkman argue that while a business strategy embodies a long-term perspective, a business model operates in a short-term perspective to face either upcoming or existing contingencies (2014, p. 383). As described by Casadesus-Masanell and Ricart, "*business models are reflections of the realized strategy*" (2010). Thus, a business strategy describes how all the elements of a company fit together (DaSilva & Trkman, 2014, p. 383). To fit all these elements together, dynamic capabilities within firms are essential. A business strategy should enable the evolvement of dynamic capabilities that make a firm able to respond to contingencies and succeed with the chosen business model (DaSilva & Trkman, 2014, p. 383). Figure 9 illustrates these relations.

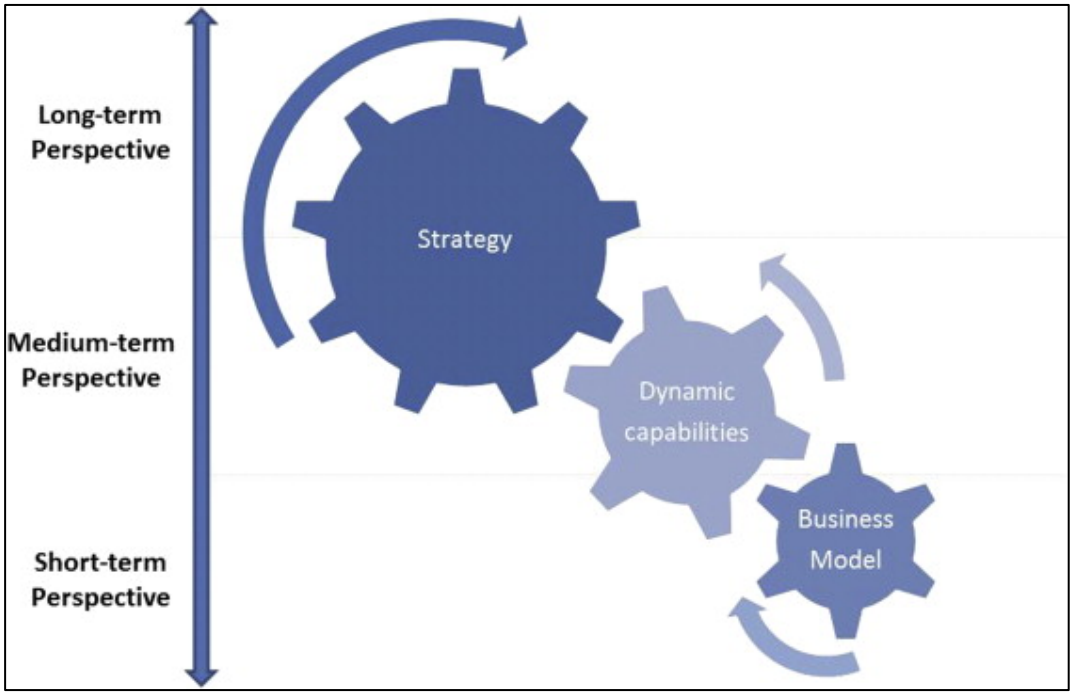

Figure 9: Relationship between a firm's strategy, dynamic capabilities, and business model. (Source: DaSivla & Trkman, 2014).

In order for firms to stay competitive, business model innovation is as important as product innovation (Teece, 2010, p. 173). Managers need to stay up-to-date within business design options, as well as customer needs and new technologies (2010, p. 173). As Teece states, "*business model innovation can itself be a pathway to competitive advantage*" (2010, p. 173). In this respect, gaining a competitive advantage is more likely for firms who differentiate their business models, designing alternative mechanisms to capture value (2010, p. 173) (business model differentiation is further assessed in subsection 3.2.3).

Strongly linked to a firm's business model is a firm's *value chain*, that is, the set of activities a firm carries out to create value for its customers. These activities include, among others, design, production, marketing, delivery, and support (Koc & Bozdag, 2017, p. 561). The concept is based on the process of organization, which entails seeing a manufacturing enterprise as a system comprised of subsystems, each with its own set of inputs, transformation processes, and outputs (Porter, 1985). The value chain concept was first described and popularized by Michael Porter in 1985 when he introduced nine generic categories of activities that make up a firm's value chain (Porter, 1985). These categories are usually illustrated as in figure 10, divided into *primary*- and *support*- activities.

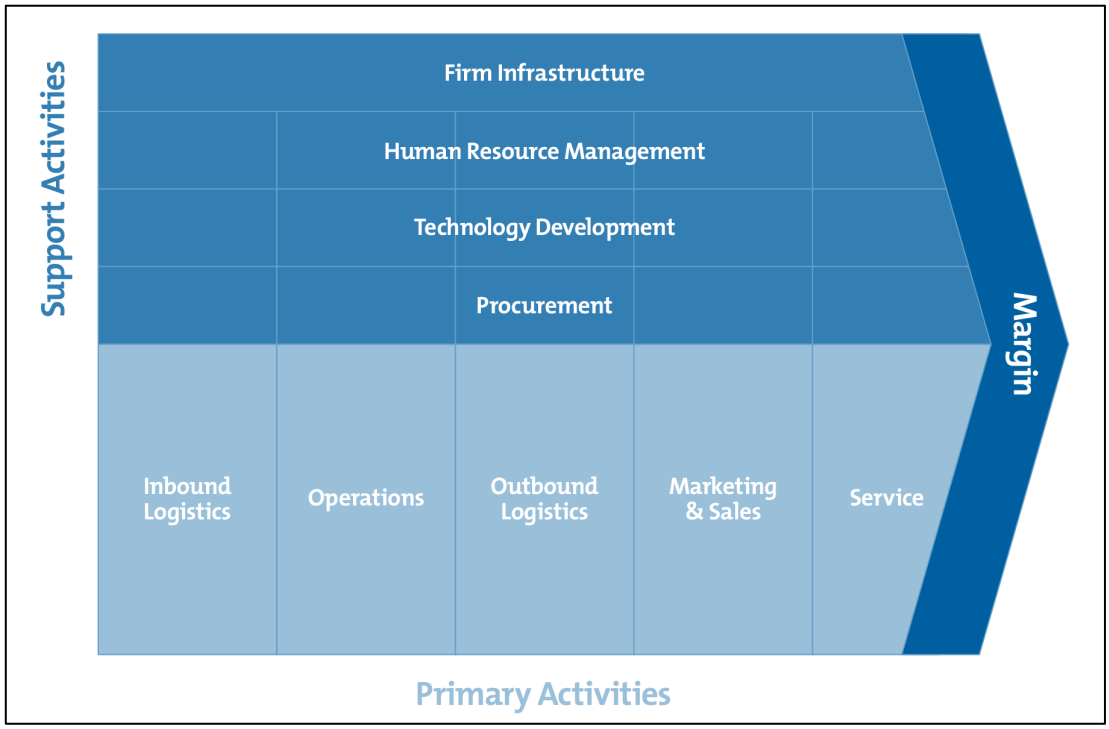

Figure 10: Porter's value chain. (Source: Mindtools, n.d.)

The *primary activities* include all the activities from the physical creation of a product to the sale and aftersale assistance (Koc & Bozdag, 2017, p. 561). These activities include:

1. *Inbound logistics.* Include the activities needed to receive, store, and distribute inputs to the product. This includes the handling of materials, warehousing, quality management, vehicle scheduling, and supplier returns (Porter 1985; Koc & Bozdag 2017)
2. *Operations.* All the activities needed to transform inputs into outputs (Porter, 1985), such as machining, packing, fabrication, repair of equipment, inspection, printing, and facility operations (Koc & Bozdag, 2017).
3. *Outbound logistics.* Include all the activities required to collect, store, and distribute outputs (Porter, 1985), such as finished goods storage, inventory handling, delivery vehicle operation, order processing, and scheduling (Koc & Bozdag, 2017).
4. *Marketing and sales.* Activities associated with informing buyers about products & services, and convincing buyers to purchase them and facilitate their purchase (Porter, 1985). This includes advertising, marketing, salesforce, channel relations, and pricing (Koc & Bozdag, 2017).
5. *Service.* Requires the activities necessary to properly maintain the goods or service functioning for the customer since it has been marketed and shipped (Porter, 1985). Such activities include, among others, installation, maintenance, training, parts supply, and product adjustments (Koc & Bozdag, 2017).

As for the *support activities* in Porter's value chain, these activities are meant to do just what the name implies; to support the primary activities. They do so by providing purchased inputs, various technology, human resources, and a variety of other firm-wide services (Koc & Bozdag, 2017). The activities include:

1. *Procurement (purchasing).* The process of acquiring inputs or services for a business (Porter, 1985), such as raw materials, supplies, machinery & tools, and various office equipment used in companies' supply chains (Koc & Bozdag, 2017).
2. *Technology development.* Refers to the devices, hardware, software, processes, and technological expertise used by the company to turn inputs into output (Porter, 1985).
3. *Human resource management.* Consists of the activities involved in the recruiting, employment, training, development, and compensation of all types of personnel (Porter 1985; Koc & Bozdag 2017).
4. *Firm infrastructure.* Serves the company's needs and connects the different parts (Porter, 1985). This includes general management, planning, finance, accounting, political relations, and quality management (Koc & Bozdag, 2017).

3.2.3 Circular business models & circular value chains

In subsection 3.2.2, it was stated that competitive advantage is more likely for firms that differentiate their business models. Implementing *Circular Business Model*s (CBMs) in firms is one way to differentiate, and may provide firms with such competitive advantages (Bocken et al., 2018, p. 81). In short, a CBM explains "*how an established firm uses innovation to create, deliver, and capture value through the implementation of CE principles whereby the business rational are realigned between the network of actors/stakeholders to meet environmental, social, and economic benefits"* (Lahti et al., 2018, p. 3). Thus, the idea of CBMs is shaped by combining the complexities of implementing the CE with the practice-oriented approach of innovating business models (Geissdoerfer et al., 2018, p. 713).

The *Circular Value Chain* is a closely linked terminology to the CBM terminology. It is built on the principle of *"ensuring that all intermediary outputs (physical, energy, informational, relational, etc.) that have no further use in the value creating activities of the firm are provided as input to other value chains external to the firm"* (Roos, 2014, p. 254). This idea of a shared, collaborative value chain may seem confusing compared to Porter's single-

company value chain (see figure 10). At the time when Porter's value chain was brought to life, scholars and academics focused on how internal processes within companies could create competitive advantages (Jordens, 2015, p. 5). Individual companies later realized that they were no longer competing as purely independent corporations but rather as cooperative supply chains. Thus, managers looked for ways to create collaborative advantages and joint value creation rather than individual strategic advantages (Jordens, 2015, p. 5).

With respect to the principles of CE (see subsection 2.2.2), The Ellen MacArthur Foundation has identified four potential sources of *economic value creation* for firms that implement circular business models and circular value chains. As the butterfly diagram presented in 2.2.2 is closely related to these sources, this diagram is also presented in this subsection.

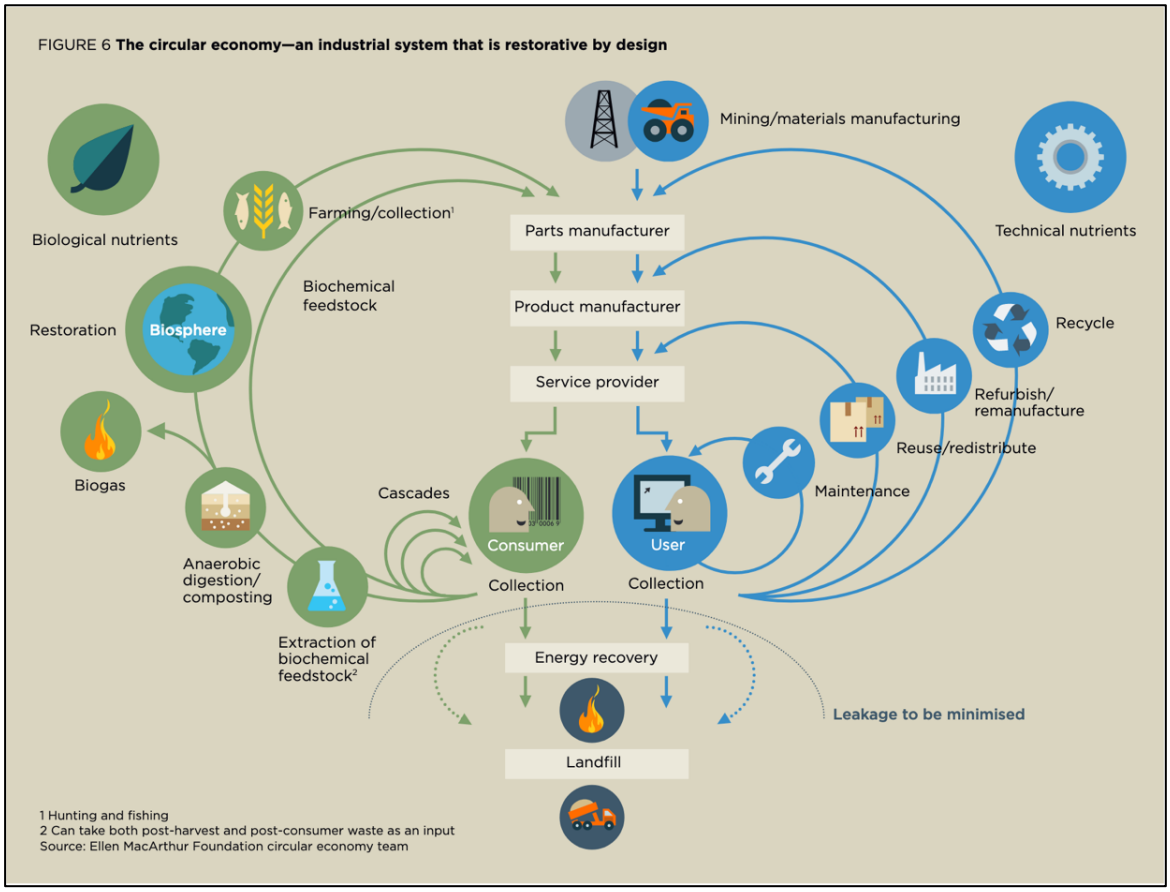

Figure 11: The Butterfly Diagram. (Source: EMF, 2013).

1) **Power of the inner circle:** Generally, the tighter the circles, the larger the savings in terms of materials, labor, energy, capital, and environmental externalities (GHG emissions, water pollution, etc.). As both resource prices and end-of-life treatment costs increase, the costs of collecting, reprocessing, and returning the product into the economy may be lower than the linear alternative. This is especially true for tight circles, where less virgin materials are needed to keep the products within the economy (EMF, 2013, p. 30)

Figure 12: The power of the inner circle. (Source: EMF, 2013).

2) **Power of circling longer:** The second value creation potential comes from keeping materials, products, and components within the circular economy for as long as possible. This can be done in two ways: Either increase the number of consecutive cycles (e.g,. increasing the amount of maintenance operations) or by spending more time within one circle (increasing the service lifetime of products). Increased resource prices, as well as low operating and maintenance costs, help to improve this economic potential.

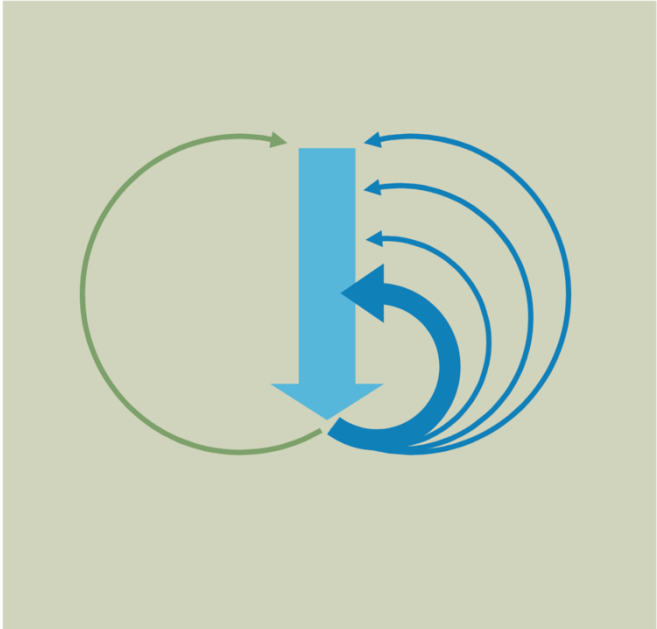

Figure 13: The power of circling longer. (Source: EMF, 2013).

3) **Power of cascaded use:** While there are possibilities for value creation in the reuse of similar products, as indicated in 1) and 2), the EMF identifies value creation opportunities in the cascading of products. These opportunities arise from the "waste is food"- logic, where what may be regarded as 'waste' in one firm may create value in another. As reused materials (in theory) have lower costs than virgin materials, the marginal cost (the cost of producing one more unit) gets lower for reused cascaded materials than for virgin materials.

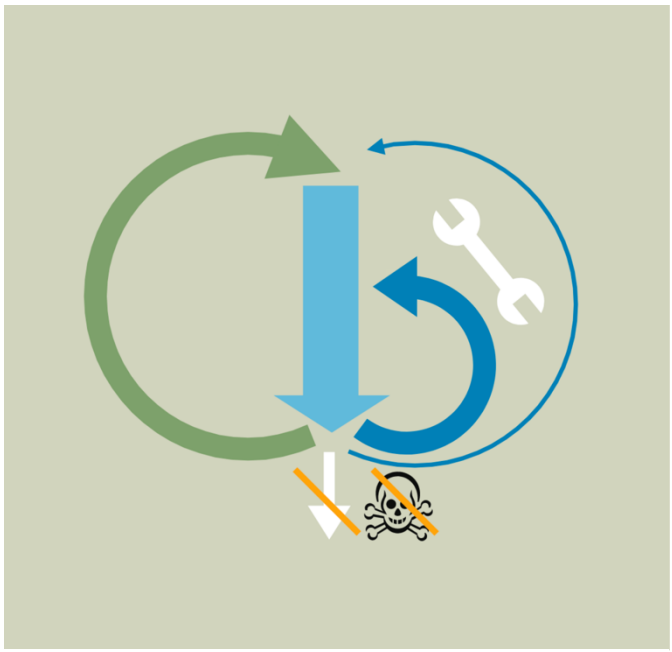

Figure 14: The power of cascaded use. (Source: EMF, 2013).

4) **Power of pure, non-toxic, or at least easier-to-separate inputs and designs:** This fourth lever concerns the importance of purity and quality of materials and components in a circular economy. Pure cycles will ease the separation process at the end of each lifecycle, which enhances reuse, remanufacturing, and recycling. In this respect, the design phase is vital, as this phase builds the foundation for separation, identification, and substitution at later stages of products' lives.

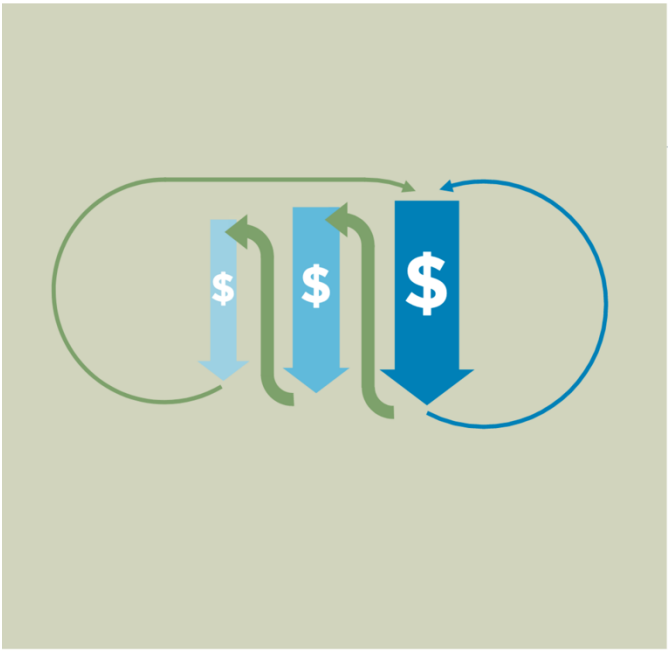

Figure 15: The power of pure, non-toxic, or at least easier-to-separate inputs and designs. (Source: EMF, 2013).

From these four sources of value creation, it is clear that firms may advantage economically through various CBM strategies. This is highlighted by Lacy et al. (2014), who, through their analysis of 120 case studies, identified five underlying circular business models in companies. These business models are:

1) **Circular Supplies.** This business model focuses on providing resource inputs that are completely sustainable, recyclable, or biodegradable and support circular production and usage processes. Companies will use it to replace linear resource methods, phase out the use of finite resources, and cut waste and eliminate inefficiencies. This model is most effective for businesses that compete with scarce resources or have a significant environmental footprint. (Lacy et al., 2014, p. 13).

2) **Resource Recovery.** This business model is concerned with the recovery of resources & energy from disposed products or by-products. The business model makes use of emerging technology and capabilities to recover nearly every kind of resource production at a value that is equal to, if not greater than, the initial investment. Industrial symbiosis, optimized closed-loop recycling, and Cradle-to-Cradle designs, where used materials can be reprocessed into new, are only a few of the solutions available (Lacy et al., 2014, p. 13).

3) **Product Life Extension.** The third circular business model is concerned with extending lifecycles of products and components through activities such as repair, upgrade, and resell. Repairing, replacing, remanufacturing, or remarketing goods preserves or even improves the value of products that may otherwise be destroyed due to waste. Moreover, as the customer usage phase is extended, additional revenue is generated. An organization can use this model to ensure that goods are kept commercially useful for as long as possible and that product upgrades are done in a more tailored manner (Lacy et al., 2014, p. 14).

4) **Sharing Platforms.** This business model encourages product owners, whether individuals or organizations, towards collaboration and sharing. The model helps maximize the utilization of products and can benefit companies whose goods and assets have a low utilization or ownership rate. This business model is most widely seen today

in businesses that specialize in increasing commodity usage without doing any manufacturing themselves (Lacy et al., 2014, p. 14)

5) **Product as a Service.** The fifth business model is a viable solution to the conventional "buy and own" business model. It focuses on the performance of products, where selling the function of products replaces the ownership of products. As Stahel describes it, "*Ownership gives way to stewardship; consumers become users and creators*" (2016, p. 435). This business model might be appealing to businesses whose products have high operational costs and have an expertise advantage over their customers in managing the maintenance of products (Lacy et al., 2014, p. 14).

3.3 Drivers & Barriers

This section introduces the reader to the framework of drivers & barriers used as a basis when collecting the empirical data. When skimming the literature, it was found that several studies focus on the barriers (challenges), drivers (motivational factors), and enablers (facilitators) for implementing circular strategies in business models. As for the latter, the majority of enablers are the polar opposites of the barriers. Thus, to avoid being repetitive, these are not included in their own framework. Supplemental enablers/success factors are observed through the direct assessment of the WondRest case, but these are presented in chapter *6.0 Results & Findings.* The following section first presents the selected literature that was obtained through a systematic literature review on drivers & barriers in CBMI projects. After that, we will see how this collection of literature formed the framework of drivers & barriers, presented in subsection 3.3.2.

3.3.1 Selected literature

Articles explicitly mentioning drivers and/or barriers (or synonyms) related to circular adoptions are presented in table 1. The table shows that a diversity of industries, case categories, and publication countries are represented. Note that some industry categories have been merged to avoid a large dispersion of industries and sub-industries (E.g., mobile- and battery industries are represented as 'electronics'). Moreover, articles that incorporate several industries are categorized as 'multiple' in the industry categorization. Articles with no specifically mentioned industry (in most cases literature reviews) are noted as 'non-specific'. The 'single cases' represent articles in which one single case is analyzed, while the 'multiple cases' represent articles in which two or more cases are analyzed. Lastly, the multiple case

studies differ from the ‘comparative cases’ by the fact that the latter, besides sampling the cases, also compare them.

No.	Author	Industry	Category	Country published
1	Van Keulen & Kirchherr, 2021	Coffee	Single case	Netherlands
2	Upadhyay et al., 2021	Retail	Multiple cases	UK
3	Marke et al., 2020	Electronics	Multiple cases	UK
4	Clube & Tennant, 2020	Sharing (clothing)	Multiple cases	UK
5	Dijkstra et al., 2020	Plastics	Literature review	Netherlands
6	Öhren et al., 2019	Furniture	Multiple cases	Sweden
7	Edbring et al., 2016	Furniture	Single case	Sweden
8	Jabbour et al., 2020	Metal	Multiple cases	Brazil
9	Tura et al., 2019	Non specific	Literature review	Finland
10	Guldmann & Huulgaard, 2020	Multiple	Multiple cases	Denmark
11	Werning & Spinler, 2020	Electronics	Single case	Germany
12	Chen, 2020	Non specific	Literature review	Taiwan
13	Bianchini et al., 2019	Non specific	Literature review	Italy
14	Holtström et al., 2019	Clothing	Single case	Sweden
15	Šebo et al., 2019	Manufacturing	Multiple cases	Slovakia
16	Shao et al., 2019	Automotive	Multiple cases	China
17	Gusmerotti et al., 2019	Manufacturing	Quantitative survey	Italy
18	Singh et al., 2019	Multiple	Multiple cases	Sweden
19	Vermunt et al., 2019	Non specific	Literature review	Netherlands
20	Hopkinson et al., 2018	Electronics	Single case	Germany
21	Donner & de Vries, 2021	Agriculture	Multiple cases	France
22	De Jesus & Mendonça, 2018	Non specific	Literature review	Portugal
23	Su et al., 2013	Non specific	Multiple cities	China
24	Aid et al., 2017	Waste management	Multiple cases	Sweden

25	D'Amato et al., 2020	Bio	Multiple cases	Finland
26	Heyes et al., 2018	ICT	Single case	UK
27	Rizos et al., 2015	Multiple	Comparative case	N/A
28	Linder & Williander, 2015	Sharing (bike)	Single case	Sweden
29	Mendoza et al., 2019	Education	Single case	UK
30	Paletta et al., 2019	Plastics	Multiple cases	Italy
31	Pieroni et al., 2019	Furniture	Comparative case	Denmark
32	Sousa-Zomer et al., 2018	Manufacturing	Single case	Brazil
33	Veleva & Bodkin, 2018	Multiple	Multiple cases	US
34	Whalen et al., 2018	ICT	Comparative case	Sweden
35	Jabbour, 2020	Multiple	Multiple cases	Brazil
36	Fonseca et al., 2018	Multiple	Multiple cases	Portugal
37	Eguren et al., 2018	Multiple	Multiple cases	Spain
38	Gue et al., 2019	Multiple	Multiple cases	Philippines
39	Olsson et al., 2018	Electronics	Multiple cases	Sweden
40	Veleva & Bodkin, 2017	Bio	Comparative case	US
41	Oghazi & Mostaghel, 2018	Multiple	Multiple cases	Sweden
42	Mativenga et al., 2017	Multiple	Multiple cases	South Africa
43	Colucci & Vecchi, 2020	Clothing	Multiple cases	Italy
44	Hossain et al., 2020	Construction	Literature review	Hong Kong
45	Van Loon & Wassenhove, 2020	Multiple	Multiple cases	France
46	Pohlmann et al., 2020	Agriculture	Single case	Brazil
47	Urbinati et al., 2017	Non specific	Literature review	Italy
48	Lewandowski, 2016	Non specific	Literature review	Poland
49	Antikainen & Valkokari, 2016	Nonprofit	Single case	Finland

Table 1: Overview of selected articles containing drivers and barriers for circular adoption. (Source: Own creation).

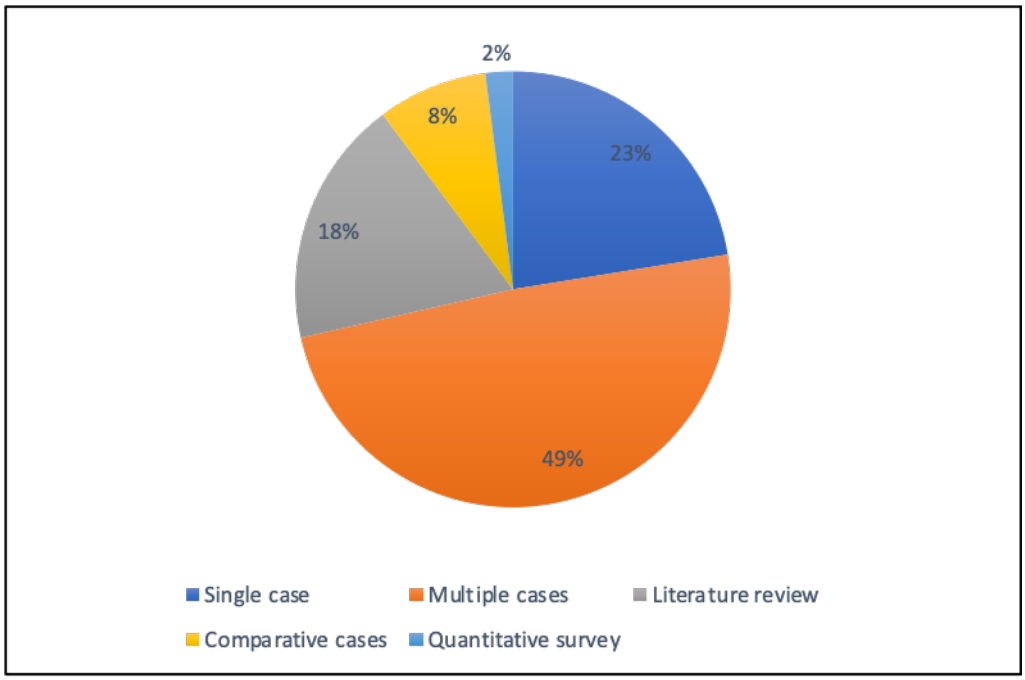

Figure 16: Diagram showing the distribution of case types within the selected articles. (Source: Own creation)

Figure 16 shows the distribution of case types within the selected literature. Out of the 49 selected articles, the figure shows that the 'multiple case' studies make up the majority of 49%. Afterward come the single cases that make up 23% of the selected articles, followed by the literature reviews (18%), the comparative case studies (8%), and the quantitative survey study (2%). The latter only represents one article, which analyzed 821 Italian manufacturing firms in a quantitative survey analysis.

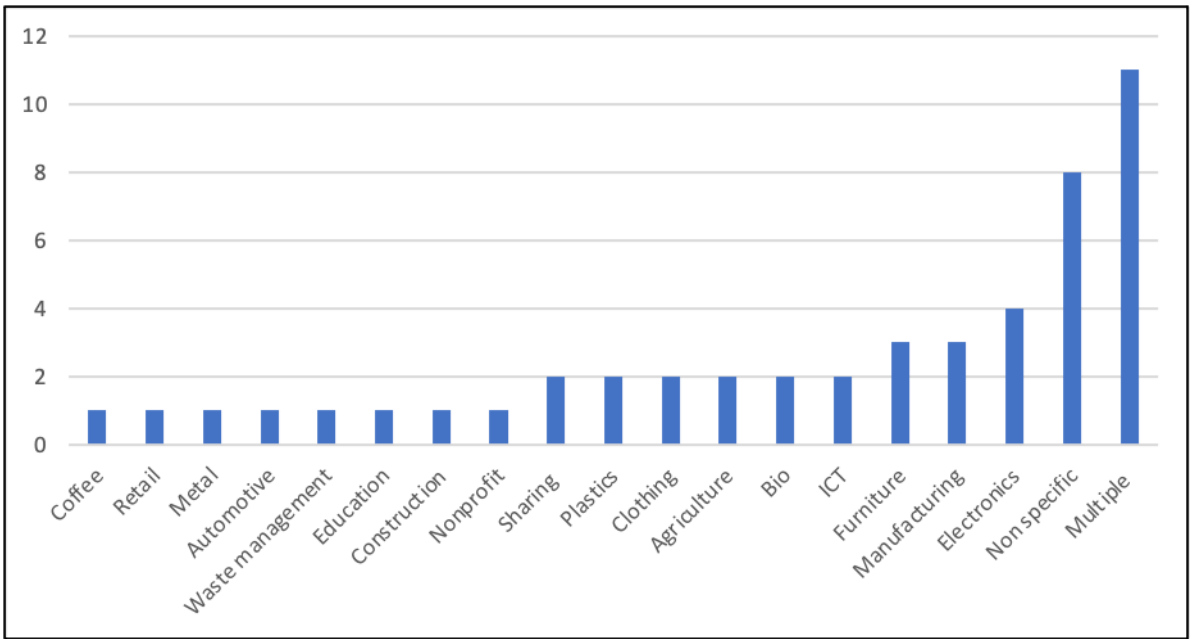

Figure 17: Diagram showing the various industries within the selected articles. (Source: Own creation).

As for the industries represented in the articles, the results show a vast diversity (see figure 17). Articles referring to one or more industries are undeniably in excess, followed by articles with no specifically mentioned industry. For instance, Guldmann & Huulgaard (2020) refer to both the apparel-, textiles-, machinery-, and mechatronics industries, while Su et al. (2013) studied pilot projects in four different Chinese cities with no focus on a specific industry. Furthermore, the results show that the electronics industry is represented in a total of four articles, while both the manufacturing-, and furniture industries are represented in three.

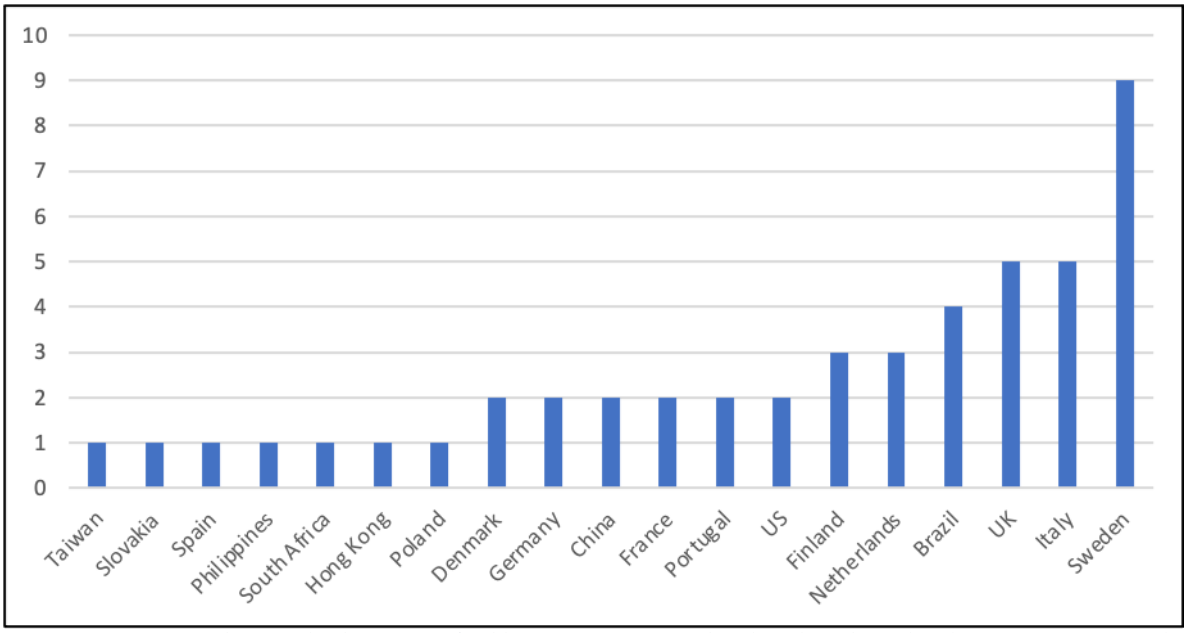

Figure 18: Diagram showing the dispersion of publication countries within the selected articles. (Source: Own creation).

Figure 18 illustrates the selected articles' various geographical origins. The results are gathered from Elsevier Scopus, where the constraint 'country/territory' provides the opportunity to perceive each article's geographical origin. The findings show that articles stemming from Sweden are in excess, followed by Italy, the United Kingdom, Brazil, the Netherlands, and Finland, respectively. Thereafter, a series of countries with fewer published articles follow, such as Portugal, France, and China.

3.3.2 Framework of drivers & barriers

In order to categorize the various drivers and barriers, inspiration was taken from both Aid et al. (2017), Tura et al. (2019), and Bianchini et al. (2019). These authors propose different frameworks for drivers and barriers, including various categorizations. Figure 19 illustrates

how the categorization of these three authors were used to form the categorization used in the framework of this thesis. Tables 2 and 3 represent the frameworks for barriers and drivers, respectively.

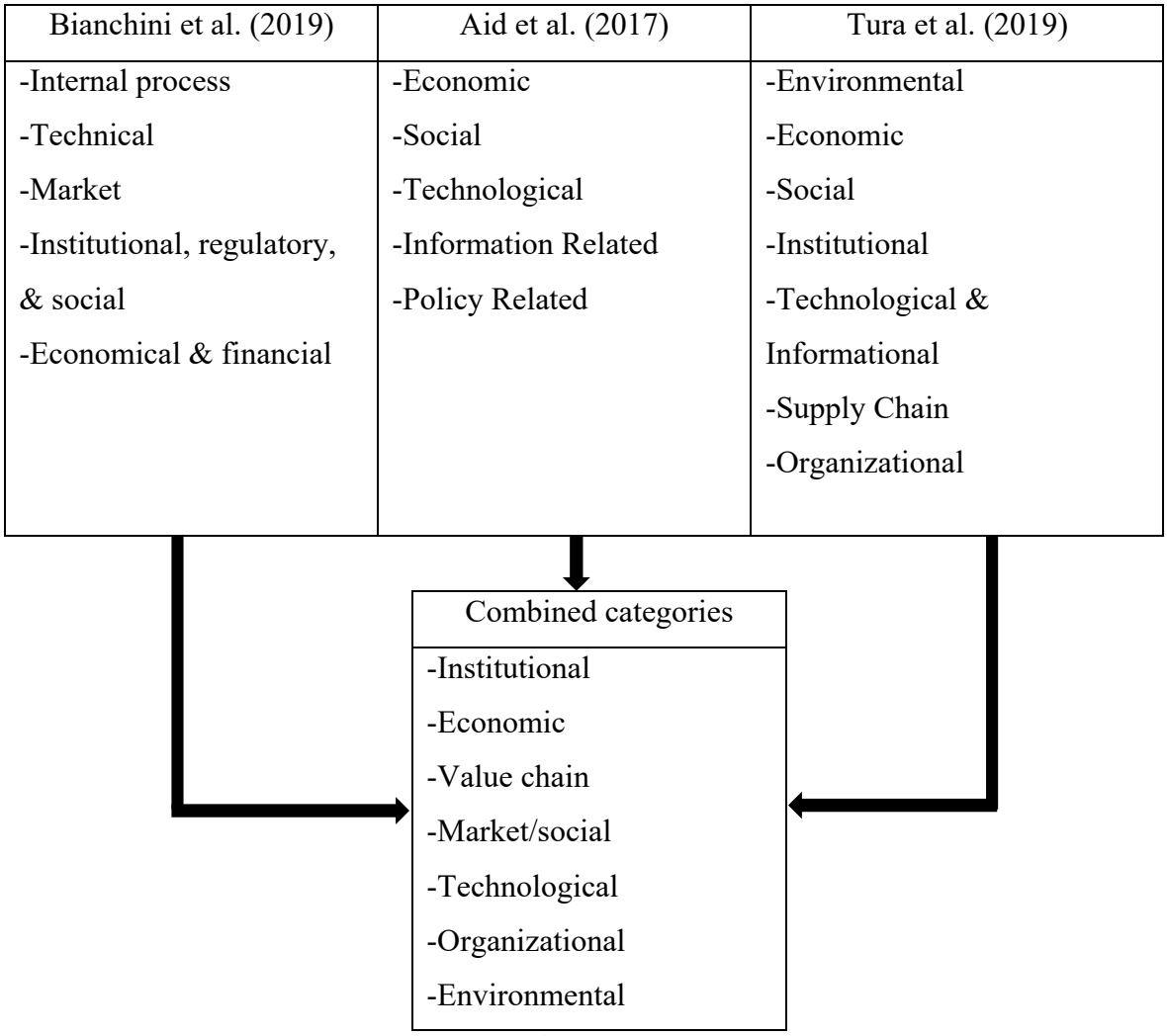

Figure 19: Figure showing how the categorization of three frameworks were combined into the categories used in this thesis's framework. (Source: Own production).

Categories	Barriers	Author contributions (no.)	Tot. Author Contributions
Institutional	Inadequate rules and policies to support CE strategies	1, 2, 5, 6, 9, 10, 12, 13, 15, 16, 18, 19, 22, 23, 24, 25, 27, 30, 33, 34, 39, 46	22
	Lack of a global framework for implementation	46, 47, 48, 49	4
Economic	Uncertain economic viability	3, 9, 10, 14, 15, 22, 24, 25, 26, 28, 30, 31, 32, 41, 44, 45	16
	Potential costs of circular activities (repair, remanufacturing, etc.)	18, 19, 30, 34, 45	5
	High investment costs / costs of project	5, 9, 12, 13, 15, 22, 24, 26, 29, 31	10
	Lack of financial resources / difficulty securing funding	2, 10, 15, 19, 25, 27, 29, 33	8
Value chain	Value chain adaptation	8, 10, 13, 25, 26, 34, 43, 46	8
	Value chain collaboration / lack of partners	9, 10, 13, 19, 24, 25, 27, 28, 29, 32, 33, 34, 41	13
	Supply chain dependencies	5, 10, 19, 24	4
Market/social	Consumer behavior/perception	4, 5, 7, 8, 9, 12, 13, 14, 15, 17, 18, 19, 22, 23, 29, 31, 33, 34, 41, 43, 44, 45	22
	Silo-thinking of industries	1, 12, 19	3
	Uncertain market demand	1, 8, 9, 10, 15, 21, 24, 26, 28, 31, 32, 33, 37, 39	14
	Tough market competition: Linear vs circular	2, 5, 8, 9, 10, 15, 16, 19, 25, 33, 34, 43	12
Technological	New technical capabilities/lack of knowledge and skills of employees	8, 9, 10, 13, 19, 22, 24, 30, 32, 33, 43, 44	12
	Lack of/introduction of new technology	2, 5, 8, 9, 13, 14, 15, 19, 22, 23, 24, 25, 32, 33, 39, 43, 45	17
	Product design- and quality requirements	9, 10, 12, 31, 32, 33, 34, 37, 43, 44	10
Organizational	Conservative company culture and/or general reluctance to change	1, 5, 8, 10, 15, 24, 29, 32	8
	Lack of engagement, priorities, and/or time	24, 26, 29, 33, 34, 45	6
	Lack of knowledge and experience related to CBMs	10, 13, 19, 22, 24, 32	6
Environmental	Uncertain environmental benefits	10, 15	2
	Sustainability trade-offs and/or problem shifting	5	1
	Lack of Key Performance Indicators (KPIs)	9, 23, 33, 44, 46	5

Table 2: Framework of barriers. (Source: Own production).

Categories	Drivers	Author contributions	Total Contributions
Institutional	Following the increasing amount of European and national standards	2, 3, 8, 9, 15, 21, 33, 35, 36, 38, 42	11
Economic	Possible economic advantages (cost efficiency, new revenue streams, gaining profit)	3, 5, 9, 15, 17, 20, 21, 33, 36, 38, 40, 42	12
	Increased price volatility on virgin materials	36, 42	2
Market/social	Socially increased environmental awareness	2, 5, 9, 33, 35, 36, 38, 42	8
	Social recognition	38, 40, 42	3
Technological	Emerging technologies that support CE business (e.g. industry 4.0)	6, 9, 22, 23, 24, 35	6
Organizational	Competitiveness / differentiation	5, 8, 15, 33, 36, 37	6
	Company value growth	15	1
Environmental	The global trend to minimize the environmental footprint (willingness to contribute)	9, 21, 33, 36, 42	5

Table 3: Framework of drivers. (Source: Own production).

Looking at Tables 2 and 3, it is clear that the table containing the various barriers is the most comprehensive, both in terms of the number of barriers and the total author contributions. This underlines an important empirical finding from the analysis; the proportion of articles referring to barriers of circular business model transitions seems to be larger than the proportion of articles related to drivers. This finding substantiates the statement in section 1.4: A great deal of literature on the CE topic relates to various barriers and pitfalls for businesses who wish to transition towards CBMs.

It should be mentioned that several authors refer indirectly, or implicitly to the various drivers and barriers. For instance, Marke et al. state that there are no "*Clear economic benefits*" for product-service systems in China's mobile electronics industry (2020, p. 606), indicating *uncertain economic viability* (See table 2: Categories: Economic) of these product-service systems. The rest of this subsection will look at the various drivers & barriers found in table 2 and 3.

A: Institutional

The institutional drivers & barriers are related to regulatory and policy aspects. The results show that nearly half of the selected articles found *inadequate rules and policies* as a barrier to integrating CE strategies. Van Keulen and Kirchherr criticize the government's lack of "*clear CE policies*" (2021, p. 3), while Tura et al. emphasize the fluctuations of taxes and government subsidies, which provides high future uncertainty for CE solutions (2019, p. 92). This is closely related to the second institutional barrier, namely the *lack of a global framework for implementing CE strategies*. As Pohlmann et al. state, linear supply chains need guidelines that illustrate how to proceed systematically, which needs to be supported by authorities and governments (2020, p. 1). As for institutional drivers, a total of 11 authors point at the necessity of following the increasing amount of sustainability rules and standards in order to stay competitive and up-to-date.

B: Economic

The economic drivers & barriers are related to the investment costs and profitability of transitioning linear business models toward circular ones. As seen from table 2, *uncertain economic viability* is the dominating barrier in terms of author contributions (contr.), with a total of 16 articles referring to this specific barrier. This is followed by *high investment costs* (10 contr.), *lack of financial resources* (8 contr.), and *potential costs of circular activities* (5 contr.). Tura et al. point at various economic factors as the main barriers in CE decision-making in firms (2019, p. 94), while Upadhyay et al. describe the lack of financial support as a "*significant barrier*" to achieve CE targets (2021, p. 8).

Concerning economic drivers, the possibilities of gaining long-term economic advantages stand out as the most mentioned driver among the selected articles. This is in line with the findings of Gusmerotti et al., who state that "*Economic drivers are the most important drivers of circular actions*" (2019). Moreover, firms are increasingly experiencing rapid and unforeseen price changes of materials due to an unsustainable extraction on the earth. This is pointed out by both Fonseca et al. (2018) and Mativenga et al. (2017), who regard a circular transition as a possible solution to avoid such price uncertainties.

C: Value Chain

The barriers related to firms' value chains concern the interrelations between internal and external stakeholders, value chain adaptation, and supply chain dependencies. As for value chain drivers, no explicitly mentioned drivers were found to relate to this category and are therefore excluded from the framework of drivers. The findings reveal that *value chain collaboration/ lack of partners* in the supply chain is the main barrier in this category. The reviewed literature indicates that including existing partners and/or finding new collaborating partners to cooperate with is one of the main barriers for firms who wish to innovate towards CBMs. This is evidenced by Guldmann and Huulgaard, who state that "*The case companies were reluctant to involve value chain partners, including customers, in the development of CBMs*" (2020, p. 6). Adapting to new and oftentimes complex business models is another mentioned barrier (8 contr.). Guldmann and Huulgaard refer to the case companies in their study, stating that it is a "*complicated task to establish new circular systems for many of the case companies*" (2020, p. 6). Lastly, four articles point to firms' aversion to creating dependencies with other actors through collaborations.

D: Market/social

Customer demand, market competitiveness, and social acceptance are examples of market- and social-factor-related drivers and barriers. The results show that *consumers' behavior/perception* for renting and buying used items is one the most mentioned barriers. This is substantiated by Edbring et al., who studied alternative consumption models and found that customers' "*attitudes to long-term renting are negative*" (2016, p. 5). As for this, several authors point to both *uncertain market demand* (14 contr.), and *tough market competition* (12 contr.) as critical barriers. The former is concerned with the underlying ambiguity of whether or not a 'circular' product will be a sought-after item on the market. In contrast, the latter is concerned with the fierce market competition that arises as a result of customers' desires for 'linear' products. Lastly, *silo-thinking of industries* denotes the lack of information sharing in industries, and is highlighted as a barrier in a total of three articles.

Regarding drivers, eight articles identify *socially increased environmental awareness* as a key driver for firms to embrace circular strategies in their business models. As Jabbour et al. state, *"new consumer preferences and more sensitive markets for sustainable products are important motivators of the adoption of CE"* (2020, p. 3). When people become more aware

of the environmental damage that humans are causing the world, their ability to make a meaningful impact grows. This allows circular products and services such as leasing, renting, and secondhand sales to flourish. Furthermore, it increases businesses' desires to appear sustainable, as the social respect that comes with it can help them compete more effectively.

E: Technological

Since technology evolves at a rapid pace, investing in new systems carries the risk of being obsolete in a matter of years. This is highlighted in the reviewed literature, where a total of 17 articles point to the *lack of/introduction of new technology* as a critical barrier in the transition towards CBMs. As Tura et al. state, "*One challenge is the rapid development speed of technologies. For example the best solar panel in the market two years ago can now be out of date" (2019, p. 95).* Furthermore, as technology advances, the need for new technological skills among employees is increasing. As highlighted by several authors (12 contr.), the lack of technological know-how and expertise is a crucial barrier for firms. Lastly, the ability to design and deliver high-quality products using non-virgin materials has proven to be a problematic technological task to solve for multiple firms (10 contr.).

As for technological drivers, six reviewed articles highlight *emerging technologies that support CE business* as a key driver in CBM transitions. This may include, for instance, technologies that support a cleaner production or information sharing platforms that support multi-stakeholder collaboration and knowledge disclosure, assisting in the adoption of CE business models (Tura et al., 2019, p. 95).

F: Organizational

The social processes within companies are shaped by (among other things) goals, routines, and organizational frameworks, which are referred to as organizational factors. Among these, deep-seated, conservative company cultures may work as barriers for firms in their transition towards CBMs, highlighted by a total of seven articles. Jabbour et al. studied the barriers related to a CBM transition for a world-leading producer of LED lighting systems and found "*employee engagement and awareness of the new type of business*" (2020, p. 7) as a key barrier. In close connection is the *lack of knowledge and experience related to CBMs (*6 contr.), which may contribute to uncertainty and reluctance to change. Moreover, the work and effort needed to succeed with the CBMIs are for many regarded as a crucial barrier, as there is a *lack of engagement, priorities, and/or time (*6 contr.) for changes.

Concerning organizational drivers, improved *competitiveness and/or differentiation* (6 contr.) stand out as important factors on why businesses want to innovate in a circular and sustainable direction. As customers demand more sustainable goods, large businesses are differentiating, and new startups are emerging to meet these demands (Djikstra et al., 2020, p. 6). Lastly, Šebo et al. point out *company value growth* as a motivational factor in their review of 116 Slovakian Manufacturing firms.

G: Environmental

The last category represents the environmental drivers & barriers. Regarding barriers, these include *lack of KPIs* (5 contr.), *uncertain environmental benefits*, and *sustainability trade-offs and/or problem shifting*. The former refers to the lack of measurements to quantify the total impacts that a CBM transition may bring with it. Veleva and Bodkin emphasize the lack of "*social impact metrics*" (2018, p. 32), while Hossain et al. point out the lack of KPIs for environmental performance (2020, p. 9). This is highly related to the next barrier, *uncertain environmental benefits*, as well-established KPIs may create a greater understanding of the actual environmental benefits that circular strategies can bring along. Lastly, *sustainability trade-offs and/or problem shifting* refer to the financial, social, and environmental tensions that exist, as intentions to improve one of the sustainability pillars may lead to negative effects on the others (Djikstra et al., 2020, p. 7). Djikstra et al. exemplify this by stating that "*Trade-offs include sacrificing food preservation for less packaging, reduced profits due to higher costs for environmental goods and tensions between providing social or environmental benefits*" (2020, p. 7).

Concerning environmental drivers, five articles emphasize that the global trend to contribute positively to the environment is a great driver for firms to implement circular strategies. We must all share responsibility for the global environmental harm we inflict, a responsibility that may encourage businesses to invest sustainably.

3.4 Summary and Implications of Theoretical Findings

Chapters 2.0 & 3.0 have put forward a vast majority of concepts, definitions, and principles to provide a broader understanding of the underlying theory within this thesis. First, the ongoing sustainability issues were presented grasp why the CE has been gaining increased

attention worldwide. Next, the CE concept was presented, highlighting various definitions and principles from prominent authors. After that, the thesis moved from theory to practice by introducing two different implementation approaches (top-down & bottom-up), before looking at the status of implementation in Europe and Norway specifically. Having developed this overview, the chapter narrowed its focus by looking specifically at how businesses can utilize CE as a competitive advantage. The terms *innovation, business models*, and *value chains* were roughly explained to understand the (later developed) concepts of *circular business models* and *circular value chains*.

All things considered, the reviewed literature has provided one fundamental finding: There is no unanimous definition of the CE concept, its principles, objectives, or outcomes. This finding is described as fundamental, as it lays a foundation for understanding the uncertain business environment for firms who wish to implement circular solutions, thus answering the research question of this thesis. After reviewing the literature, there seems to be no doubt that the CE concept is an emerging field of science, as well as an emerging field of interest among policymakers and industrialists. However, the dispersing definitions of CE seem to have influenced the concept's lack of implementations in practice, as there lacks clarity on the concept's actual meaning and intentions. This is highlighted by a large amount of existing, differing definitions, as well as the general disagreement concerning the meaning and amount of R-terms.

Moreover, the Circular Gap Report of 2020 quantified the world economy to be as little as 8.6% circular. In other words, the (in theory) optimal CE, where resources and materials continue in an infinite closed-loop, preventing the uptake of new materials from the earth, is a long way from being the reality. On the bright side, the literature review suggests that the CE is a growing field of research, as well as a growing interest for policymakers around the world. This is exemplified by the number of CE initiatives in the European Union within the last ten years, suggesting that the existing gap between theory and practice will gradually decrease in the years to come.

Because of this ambiguity and uncertainty related to the CE concept, it seems that a great deal of the current literature chooses to focus on the existing barriers and pitfalls for firms who wish to implement circular solutions to their value chains. This was especially evident when studying section 3.2, *Circular Business Model Innovation*. A quick search on "*Circular*

Business Model" in Google Scholar provides numerous, highly cited, and peer-reviewed articles that either focus on uncertainties, challenges, and/or barriers that researchers and industrialists have experienced when experimenting with CBMs. Moreover, as for the possible advantages that exist within CBMs, various articles focus on the drivers and enablers in this transition process.

Consequently, this master's thesis wanted to dig into a specific manufacturer's motivational factors to move towards such a risky business environment. Furthermore, the barriers and enablers they encounter, or assume to encounter, are of great interest in light of this uncertain business environment. Table 4 combines the two frameworks from subsection 3.3.2 (table 2 & 3) into an integrated framework that makes up this thesis's framework of drivers & barriers.

FRAMEWORK OF DRIVERS & BARRIERS		
Categories	**Barriers**	**Drivers**
Institutional	Inadequate rules and policies to support CE strategies	Following the increasing amount of European and national standards
	Lack of a global framework for implementation	
Economic	Uncertain economic viability	Possible economic advantages (cost efficiency, new revenue streams, gaining profit)
	Potential costs of circular activities (repair, remanufacturing, etc.)	Increased price volatility on virgin materials
	High investment costs / costs of project	
	Lack of financial resources / difficulty securing funding	
Value chain	Value chain adaptation	
	Value chain collaboration / lack of partners	
	Supply chain dependencies	
Market/social	Consumer behavior/perception	Socially increased environmental awareness
	Silo-thinking of industries	
	Uncertain market demand	Social recognition
	Tough market competition: Linear vs circular	
Technological	New technical capabilities/lack of knowledge and skills of employees	Emerging technologies that support CE business (e.g. industry 4.0)
	Lack of/introduction of new technology	
	Product design- and quality requirements	
Organizational	Conservative company culture and/or general reluctance to change	Competitiveness / differentiation
	Lack of engagement, priorities, and/or time	Company value growth
	Lack of knowledge and experience related to CBMs	
Environmental	Uncertain environmental benefits	The global trend to minimize the environmental footprint (willingness to contribute)
	Sustainability trade-offs and/or problem shifting	
	Lack of Key Performance Indicators (KPIs)	

Table 4: Combined framework of drivers & barriers. (Source: Own production)

4.0 Methodology

This chapter intends to provide an overview of the methodological approach that was planned and executed in order to answer the research question of this thesis. The chapter will be organized by respectively addressing the chosen *research design,* the *research strategy,* the *research process*, the *data analysis* process, and finally, the *research quality and credibility*. Table 5 below provides an overview of the total amount of research methods carried out during the process.

What	**Amount**	**Additional information**
Semi-structured interviews	9 interviews	A total of 10 possible interviewees were asked to participate
Questionnaire - WondRest	13 responses	The survey was sent to 20 recipients in the WondRest project. Response rate: 65% (13/20)
Questionnaire – snowballing	5 responses	Eight external companies were contacted directly by phone.
Structured observation	5 engagements	One meeting, two workshops, and two presentations
Systematic literature selection	49 articles	A total of 266 articles were analyzed

Table 5: Overview of the total amount of research methods completed.

4.1 Research Design

A research design can be defined as *"the general plan for how you go about answering your research question(s)"* (Saunders et al., 2007, p. 131). Saunders et al. underline the importance of distinguishing the research design from the research *tactics.* While the former concerns the overall plan of the study, the latter concerns the finer details of the research process (2007, p. 131).

The research design of this study is defined as a *Case Study Design*. According to Gerring, a case study is "*the intensive study of a single case where the purpose of that study is – at least*

in part – to shed light on a larger class of cases (a population)" (2007, p. 20). Furthermore, a distinguishment is made between *single*- and *multiple*-case studies. Multiple-case studies do, as the name implies, incorporate multiple cases. In some studies, as for this master's thesis, multiple cases are analyzed to substantiate the findings of a single case. In such situations, Gerring refers to *cross-case studies*. However, he emphasizes that the distinction between a case-study and a cross-case study is a "*matter of degree*" (2007, p. 20), and states that "*The fewer cases there are, and the more intensively they are being studied, the more work merits the appellation case study"* (2007, p. 20). Hence, as this thesis's main focus is put on one single case study, with supporting contribution from external cases, the term *case study* is seen as most suitable for the work of this thesis.

Saunders et al. state that *"The case study strategy will be of particular interest to you if you wish to gain a rich understanding of the context of the research and the processes being enacted"* (2007, p. 139). Moreover, Yin states that a case study approach is a good research methodology to apply when the research goal is to find out *"how"* and *"why"* (2003). The former is in line with the research objective of this thesis, and the latter fits well with the 'how'-formulated research question of this thesis. Furthermore, 'how' and 'why' questions often relate to the study of phenomena that are "*messy, emergent, non-sequential and politically sensitive, which are best considered within their natural setting*" (Yin, 2003). The latter is also the case in terms of this thesis, as the study of phenomena relates to an emerging, and somewhat messy field of research (i.e. The transition towards a CBM in a specific case).

4.2 Research Strategy

In close relation to the research design is the *research strategy,* that is, the "*plan of action designed to achieve a specific goal"* (Denscombe, 2014, p. 3). Saunders et al. (2012) distinguish between *quantitative*- and *qualitative* collection when referring to data collection methods. Bryman separates the two by stating that quantitative research is "*a research strategy that emphasizes quantification in the collection and analysis of data*" (2012, p. 35), while qualitative research is a "*research strategy that usually emphasizes words rather than quantification in the collection and analysis of data*" (2012, p. 36).

The research strategy chosen for this thesis is a *mixed-method strategy.* Simply put, a mixed-method strategy combines both qualitative and quantitative methods in a research project. Gerring (2007, p. 10) states that case studies traditionally are associated with qualitative studies but underlines the importance of avoiding this limited view. As he says, *"a case study research may be either qual or quant, or some combination of both"* (2007, p. 10). Figure 20 illustrates the chosen research strategy for this master's thesis and how the various data help to answer the research and sub-questions.

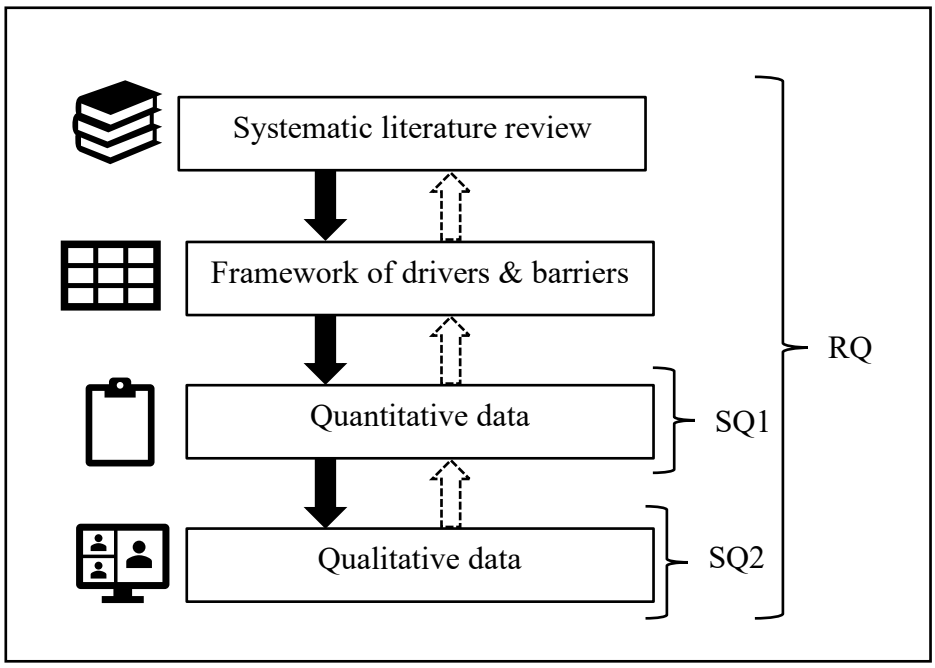

Figure 20:Chosen research strategy for this master's thesis. (Source: Own production.)

The possibility of achieving deeper insight within the research environment of this thesis is the main reason why a mixed-method methodology was chosen. Moreover, several methodological approaches were presumed to add a stronger foundation for answering the research question. Hurmerinta-Peltomaki and Nummela studied the value of mixed methods by a literature review and found that the cases that implemented both quantitative and qualitative methods often gained a "*deeper, broader and more illustrative description of the phenomenon*" (2006, p. 452). Although there exist arguments against the use of mixed methods, such as the idea that quantitative and qualitative data are "*incompatible and*

separate paradigms" (Bryman, 2012, p. 629), the overall benefits have been considered to outweigh the (potential) disadvantages.

The opportunity for *triangulation* within this case study is another important argument for using a mixed-methods approach (described in more detail in 4.5.3). Saunders et al. state that *"if you are using a case study strategy you are likely to need to use and triangulate multiple sources of data"* (2007, p. 139). Triangulation refers to a technique to analyze the results of the same study using different data collection methods (Nightingale, 2020, p. 1). Triangulation supports the research findings by examining whether different methods of the same phenomenon generate the same results (Nightingale, 2020, p. 1). This thesis aims to use the triangulation technique through the following data capturing methods:

1. Systematic literature review
2. Quantitative survey to participants in CBMI projects (WondRest + external projects)
3. Qualitative observations at workshops, meetings, etc. during the project period
4. Qualitative semi-structured interviews (with WondRest participants)

The process of completing these data capturing methods will be explained in detail in the following section (4.*3 Research Process*).

4.3 Research Process

The research process, often known as the *research method*, describes the tools and procedures used to acquire data. Denscombe describes the choice of methods as the "*types of equipment that allow relevant data to be collected"* (2014, p. 3). This section will look at the research process in detail, that is, the methodological process that eventually led to the results and findings presented in chapter 6.0. Figure 21 gives a visual understanding of the overall research process (inspiration was taken from Larsson and Malmgren (2020) in creating the figure). The figure shows how existing literature was used as a basis for creating the framework of drivers & barriers, which in turn formed the creation of the survey, and later the interview guide. In other words, in order to gather the empirical data, existing literature (theory) had to be gathered in the first place.

This way of conducting research is called a *deductive research approach* and is concerned with *"developing propositions from current theory and make them testable in the real world"* (Dubois & Gadde, 2002, p. 559). In contrast, an inductive approach collects data and

systematically generates the theory (2002, p. 559). In this thesis, the collected theory represents drivers & barriers detected through a systematic literature review of articles focusing on CBMIs. This theory (the various drivers & barriers) is tested in the real world, specifically in the WondRest project.

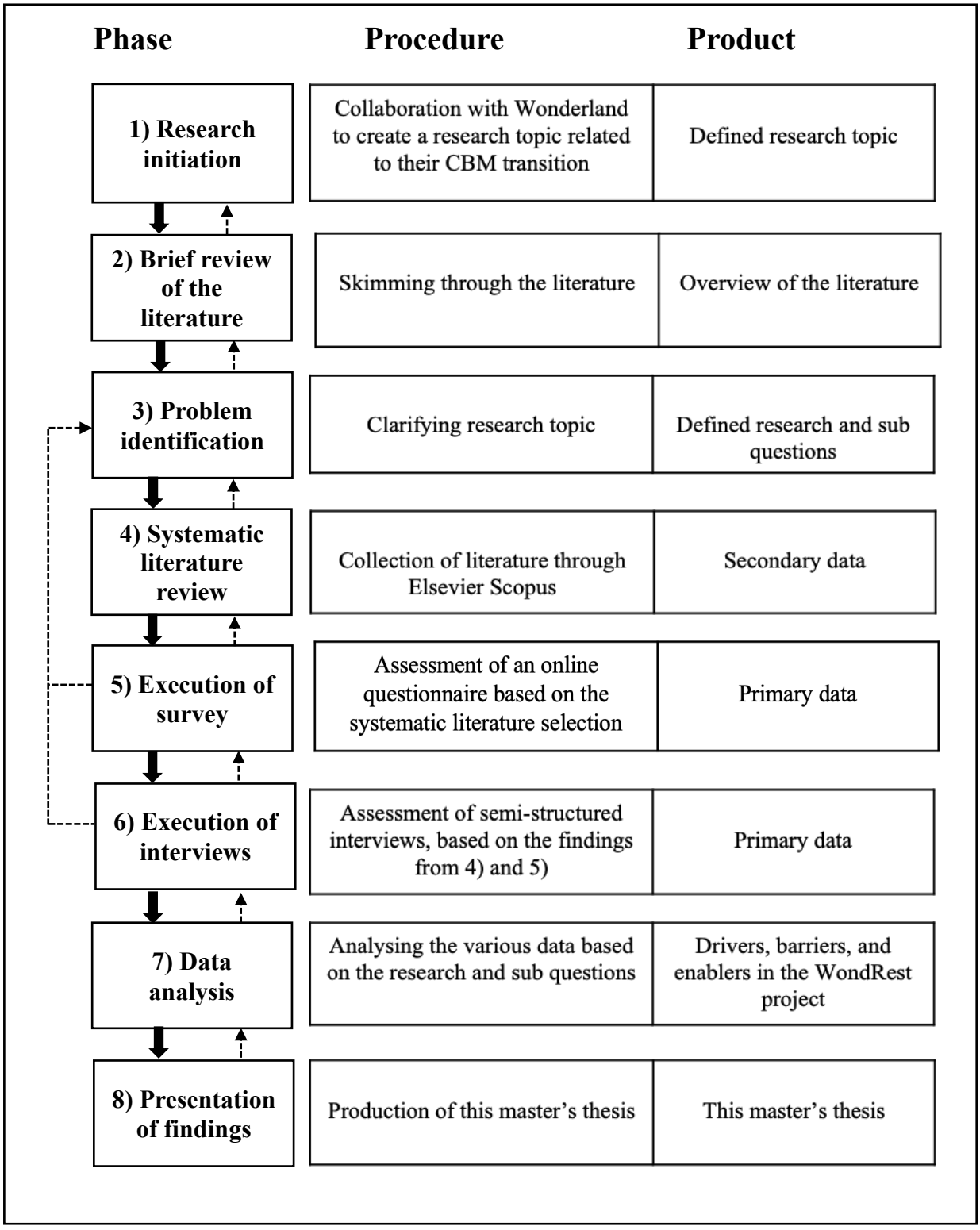

Figure 21: Illustration of the research process of this master's thesis. (Source: Own production).

4.3.1 Systematic literature collection

As a first step in the process, a systematic literature review was conducted to uncover the most frequently mentioned drivers and barriers in CBM projects from the literature. This was regarded as an important step for two main reasons:

1. It built a foundation for further proceeding with the quantitative survey
2. It provided an essential overview of the research field

The former was vital because, as we will get back to in subsection 4.3.2, the survey was directly based on the findings from the literature review. As for the latter, an overview of the research field (in terms of both magnitude and geographical origins) contributed to a stronger theoretical foundation.

In order to proceed with the systematic literature review, inspiration was taken from both Wohlin (2014), Geissdoerfer et al. (2017), Kristoffersen et al. (2020), and Galvão et al. (2020). While Wohlin (2014) provides a step-by-step methodology for how to systematically proceed, the latter three contributed with additional inspiration in terms of graphs, figures, and other illustrations. Furthermore, Xiao and Watson (2017), Jesson et al. (2011), and Nightingale (2009) were used to provide additional knowledge about systematic literature reviews.

According to Jesson et al., a systematic literature review is a "*review with a clear stated purpose, a question, a defined search approach, stating inclusion and exclusion criteria, producing a qualitative appraisal of articles*" (2011, p. 12). According to these authors, a systematic literature review is convenient for those who want to promote research knowledge and put it into action (2011, p. 15). The systematic approach helps to minimize the effect of selection, publication, and data extraction bias (Nightingale, 2009, p. 381) and may serve as a background for empirical studies (Xiao & Watson, 2017, p. 94). As the literature selection in this thesis is meant to provide a foundation for further empirical studies, the systematic literature review was regarded as favorable. Figure 22 shows the step-by-step procedure that eventually led to 49 relevant articles.

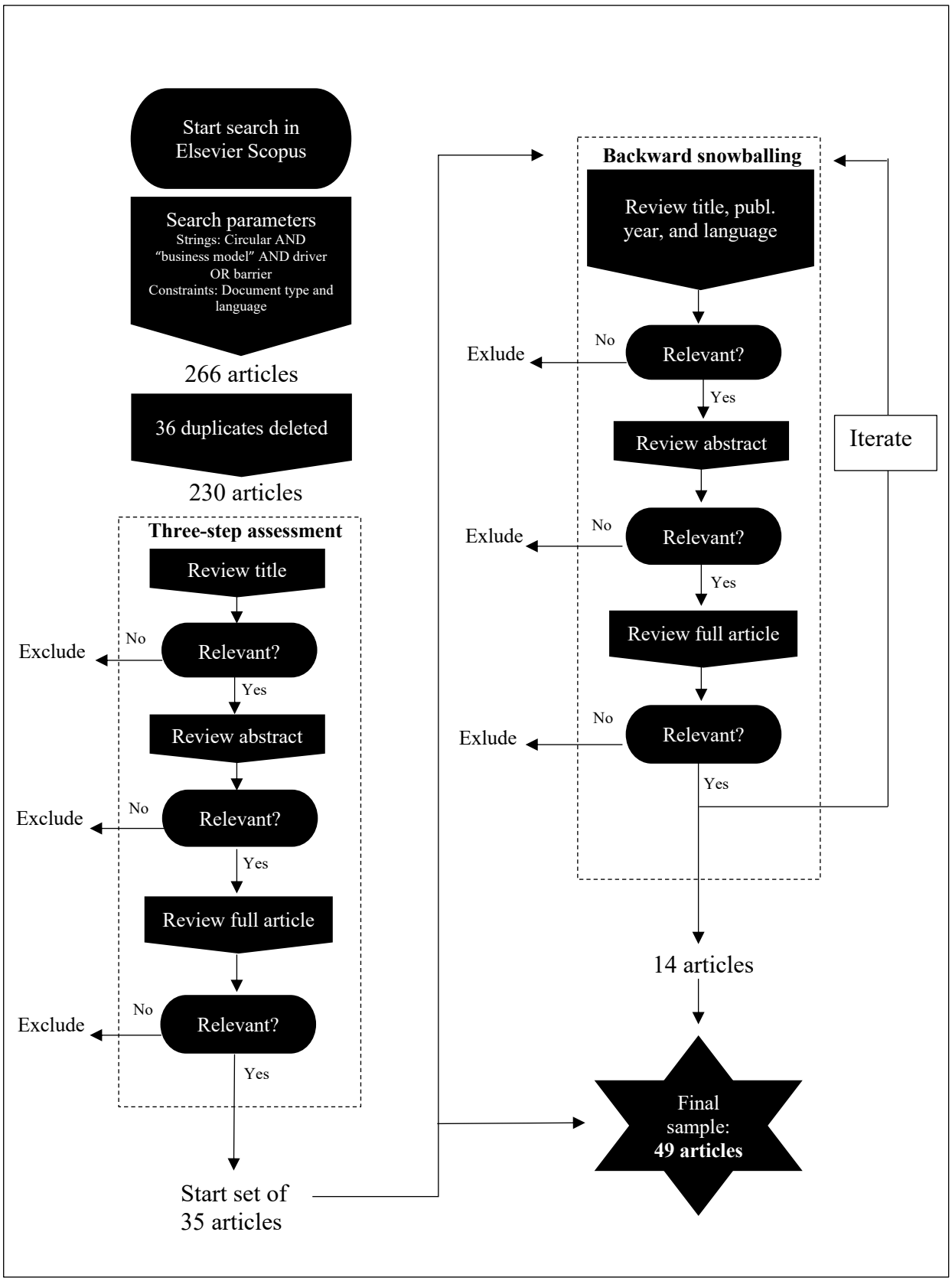

Figure 22: Illustration of the step-by-step approach for the systematic literature collection. (Source: Own production).

In this context, the purpose of the systematic review is to assist in answering the two sub-questions of this thesis, which in order assists in answering the research question. Hence, the systematic review sought to address the question; *what are the main drivers and barriers in CBMI projects found in the reviewed literature?* The first stage in answering this question was to gather a 'start set' of relevant academic literature (Wohlin, 2014). The scientific database *Elsevier Scopus* was used in the search for relevant literature. This database was chosen due to its substantial opportunities in terms of search options and because it is the most extensive database for peer-reviewed literature (Galvão et al., 2020, p. 3). The search string [*circular AND "business model" AND driver OR barrier*] was applied, which initially resulted in 136 publications. By constraining the search to only cover English publications, and only *articles* or *reviews*, the results were limited to 103 articles. Moreover, relevant synonyms were used to cover a broader scope of the literature field. For instance, '*motivator', 'motivation', 'motive'*, and '*incentive'* were used as synonyms for '*driver'*, whereas '*challenge', 'limitation'*, and '*hinder'* were substituted for '*barrier'*. Consequently, an additional 163 articles resulted, with 36 duplications removed.

Next, these articles were analyzed in three different steps; 1) the titles were reviewed, 2) the abstracts were reviewed, and 3) the full texts were reviewed. In each step, articles that were not regarded as relevant to the research objective were excluded. Consequently, 35 articles were selected to represent the start set of relevant literature. Once this start set was established, additional literature were added through a process known as *backward snowballing*, which is an iterative process in which the reference lists of the included articles are utilized to identify new publications (Wohlin, 2014). For each article in the start set, the reference list were analyzed for inclusion/exclusion of new articles. First, the titles of the various articles were reviewed. Moreover, by limiting the language (English only), publication year (no later than 2010), and only requiring peer-reviewed articles, a significant number of papers were removed. Through this snowballing approach, an extra 14 articles were added to the reference list after analyzing the abstracts and full texts of the included publications.

4.3.2 Questionnaire

As a second part of the research process, a questionnaire was created to gather quantitative data to support the research question. The questionnaire was created in *Nettskjema,* a tool for creating and conducting online surveys (UiO, 2018). The recipients of the survey can roughly be divided into three groups:

1) Participants from Wonderland
2) Participants from the partner companies (Recticel, Plasto, Måndalen, Møbelringen, and J.O. Moen)
3) Participants and/or members of other CBM projects in the industry.

In order to reach out to the latter, a *snowball sampling approach* was used. According to Parker et al., a snowball sampling approach is "*one of the most popular methods in qualitative research*" (2019). In this approach, the researcher usually starts with a small number of initial participants, who are then asked to recommend other relevant contacts who might be willing to participate. These participants, in turn, recommend new potential participants, and so on (Parker et al., 2019). Hence, the goal is to capture an increasing chain of participants for the survey, potentially gaining vast amounts of responses.

The initial participants in this snowballing approach were contacted through the network of my co-supervisor, Sigurd Sagen Vildåsen. A total of eight initial companies were contacted directly by phone, where they were given all the relevant information regarding the thesis, the survey, and why they were regarded as favorable respondents. All respondents then received a tailor-made email where the participants were encouraged to engage other relevant participants from their social networks. Moreover, two additional questions were included to acquire some extra insight into the external projects: 1) What industry they represent, and 2) how far they have come in their respective projects.

The questionnaire consisted of 31 questions concerning observed drivers (motivational factors) and barriers (hinders/challenges) in the participants' respective projects, and the questions were the same for all participants. As previously mentioned, the survey was designed with respect to the insights obtained through the systematic literature collection. Moreover, the survey was categorized into seven different categories with respect to drivers and barriers: 1) Institutional 2) Economic, 3) Value chain, 4) Market/social, 5) Technological,

6) Organizational, and 7) Environmental. Each category was further subdivided into barriers and drivers, respectively. A numerical rating scale was used to determine the degree of drivers and barriers within each category. The rating scale ranged from zero (0) to ten (10), with zero denoting 'to no degree' and ten denoting 'to a very high degree'. The participants were asked to rate the degree to which they saw specific statements as barriers/drivers to the project. As an example, table 6 shows how the participants were asked to rank various barriers and drivers related to *economic factors:*

If 0 denotes *to no degree*, and 10 denotes *to very high degree,* to what degree do you regard the following as a **barrier** in relation to the project?											
Uncertain economic viability	0	1	2	3	4	5	6	7	8	9	10
Potential costs for circular activities	0	1	2	3	4	5	6	7	8	9	10
High investment costs	0	1	2	3	4	5	6	7	8	9	10
Lack of financial resources	0	1	2	3	4	5	6	7	8	9	10
If 0 denotes *to no degree*, and 10 denotes *to very high degree,* to what degree do you regard the following as a **driver** in relation to the project?											
Possible economic advantages	0	1	2	3	4	5	6	7	8	9	10
Increased price volatility on virgin materials	0	1	2	3	4	5	6	7	8	9	10

Table 6: Illustration showing the structure of the questionnaire. (Source: Own production).

Moreover, after each category of questions, all respondents were asked to elaborate on their answers in order to gain a more in-depth understanding of their responses. What's more, on the final page of the questionnaire, all respondents were asked to identify the three most important drivers and barriers in their project. Unlike the mandatory rating-scale questions, the respondents had the option of answering these questions.

4.3.3 Semi-structured interviews

An interview is regarded as an important technique for gathering data from verbal communication (Mathers et al., 1998, p. 1). As there exist various approaches for interviewing, from strictly structured interviews to fully unstructured ones, it is vital to choose the method that best fits the research objectives. Moreover, the quality of the gathered data from interviews is highly dependent on both the interview design and the competency of the interviewer, which makes preparation a pivotal factor for success (Mathers et al., 1998, p. 1).

The chosen interview approach for this research project is a *semi-structured interview*. This approach falls between the strictly structured closed-ended survey interviews and the open-ended, unstructured discussion interviews (Adams, 2015, p. 492). Mathers et al. describe such interviews to involve a "*series of open-ended questions based on the topic areas the researcher wants to cover"* (1998, p. 2). Moreover, DeJonckheere and Vaughn state that semi-structured interviews include a "*dialogue between researcher and participant, guided by a flexible interview protocol and supplemented by follow-up questions, probes and comments*" (2019, p. 1). The semi-structured interview allows researchers to explore participants' thoughts, feelings, and beliefs about a particular topic (DeJonckheere & Vaughn, 2019, p. 1) and provides both interviewer and interviewee the chance to discuss certain topics in more detail. Semi-structured interviews are thus useful when acquiring additional knowledge in areas where little is known about the subject (Mathers et al., 1998, p. 2).

As the interviews were intended to provide additional knowledge to the survey results, and because of the novel CE research field, the semi-structured interview approach was regarded as favorable. This facilitated the opportunity to gain supplemental ideas, views, and thoughts to the obtained results from both the literature review and the survey. In this respect, all interviewees were representatives from the WondRest project and can roughly be divided into two groups; 1) interviewees from Wonderland and 2) interviewees from partner companies. Furthermore, in order to obtain ideas and thoughts from a variety of perspectives, the participants represented a diversity of roles in their respective firms. In the week of April 13th to April 16th, nine interviews were conducted using Microsoft Teams. Each interview lasted between 30 and 50 minutes and was recorded with the consent of each participant.

With inspiration from Adams (2015), an *interview guide* was developed. Adams describes the interview guide as the *"outline of planned topics, and questions to be addressed, arrayed in their tentative order"* (2015, p. 496). Hence, the interview guide could help create the interviews' agenda without getting locked to one particular way for completion. The interview guide was established based on the obtained results from both the literature review and the survey. More precisely, each interviewee was presented with graphs displaying the average results from the survey where the aim was to 1) gain deeper insight into each barrier and 2) gain insight into the project's enablers that assist in overcoming these barriers. Thus, each interview aimed to make each interviewee elaborate on the various barriers, the project's driving forces, and important factors for the project to succeed.

4.3.4 Structured observations

Structured observations were used as part of the research process to gain a better knowledge of the project. This involved observation and/or participation at workshops, meetings, as well as various presentations. Initially, an observational fieldwork at Wonderland's own production facilities was planned out. However, due to the Covid-19 pandemic this was not possible.

Czarniawska quote Mintzberg, who refers to structured observation as a "*methodology which couples the flexibility of open-ended observation with the discipline of seeking certain types of structured data."* (Czarniawska 2007, p. 25 in Mintzberg 1970, p. 90). Moreover, Anguera et al. describe systematic observation as a useful method that "*enables a largely unbiased analysis of everyday behaviors and interactions that occur naturally*" (2018, p. 2). Furthermore, both Czarniawska and Anguera et al. distinguish between *direct* and *indirect* observation. While Czarniawska does not provide a tangible explanation of the latter, Anguera et al. describe indirect observation as an observation that "*involves analyzing textual material generated either indirectly from transcriptions of audio recordings of verbal behavior in natural settings or directly from narratives*." (2018, p. 1). By 'natural settings', the authors refer to conversations and/or group discussions, whereas 'narratives' are exemplified as letters of complaint, tweets, and/or forum posts.

As for direct observation, this type of systematic observation includes, as the name suggests, a more head-on form for examination (e.g., observing live activities and behavior).

Czarniawska differentiates between participant and non-participant direct observation. Participant observation, she states, is a type of systematic observation where the observer is "*doing the same as the people (or some of the people), he or she observes*" (2007, p. 55). On the other hand, non-participant observation refers to a less active form of observation, where participants are being observed without actively participating. Czarniawska further divides non-participant observation into *shadowing* and *stationary* observation, of which she describes shadowing as the more mobile observational form among the two. Shadowing is the activity of "*following selected people in their everyday occupations for a time*" (2007, p. 17). Stationary observation, on the other hand, is described as a more static form of a non-participating observational method, and Czarniawska refers to video recording as a frequently used technique in stationary observation (2007, p. 55). Table 7 shows an overview of the various engagements during the completion of this thesis, including a brief description of the main topics that were discussed, presented, and/or observed.

Date	**What**	**Type of direct observation**	**Topics discussed/presented/observed**
12.01.2021	Meeting with Wonderland	Participant	- State-of-the-art introduction of Wonderland and WondRest. - Alternative research questions were discussed.
19.02.2021	Workshop with representatives from WondRest, SINTEF, and NTNU	Participant: Workshop Non-participant, stationary: Presentations	- Presentations and discussion of the status quo regarding 1) the most important components in today's bed in terms of quality sleeping, 2) the most environmentally harmful materials in today's bed, and 3) everyone's "dream bed". - Workshop in *Metro Retro*. Two main aspects were discussed: 1) The dream bed from a material's perspective, 2) The dream bed from a user's perspective.

01.03.2021	Presentation of my master's thesis for bachelor students	Participant	- Presented my findings for a group of bachelor students at the Østfold University College, who wanted inspiration for their bachelor thesis.
10.03.2021	Workshop with representatives from WondRest SINTEF, and NTNU	Participant: Workshop Non-participant, stationary: Presentations	- Presentation of the results from the environmental analyzes - Presentation of the work so far, and the way forward - Inspirational presentation - Workshop in *Metro Retro*. Two main aspects were discussed: 1) The dream bed from a material's perspective, and 2) measures to be taken now, soon, and in the future.
08.04.2021	Presentation of my thesis, including findings so far, for all the participants in WondRest	Participant	- Presented my master's thesis for the five collaborating companies in the WondRest project. I also presented my findings from the literature review and from the questionnaire.

Table 7: Overview of the various forms of structured observations that were conducted during the research period. (Source: Own production).

4.4 Data Analysis

This section provides an overview of the methods that were used to analyze the collected data. The section is divided into two subsections: First, subsection 4.4.1 describes the methods used to analyze the qualitative data, that is, the semi-structured interviews and the structured observations. Second, subsection 4.4.2 presents the methods used to analyze the quantitative data, i.e., the results from the survey. As for the prominent work of Saunders, Lewis, and Thornhill in this area of research, these authors have been given extra attention in the following two subsections.

4.4.1 Analyzing the qualitative data

As stated in section 4.2, qualitative research is a "*research strategy that usually emphasizes words rather than quantification in the collection and analysis of data*" (Bryman, 2012, p. 36). Hence, qualitative data is the data collected from such a strategy and can be defined as *"data that is based on meanings expressed through words"* (Saunders et al., 2007, p. 472). In analyzing qualitative data, Saunders et al. emphasizes that there is no standardized approach but highlight four main categories of strategies:

1) Understanding the characteristics of language
2) Discovering regularities
3) Comprehending the meaning of text and action
4) Reflection.

As the authors point out, the first two categories require a greater degree of structure and procedures to execute, in contrast to the second two. In respect of this research project, the various structured observations can be linked to the second two categories. Here, the focus was to understand the meaning of the participants' behavior to, for instance, spot the degree of enthusiasm and engagement among the members during the workshops. Thus, the analysis of these observations relied more on my interpretation of the situations and did not demand a great amount of time to analyze because much of the reflection and interpretation took place during the observations.

The former two categories can be linked to the semi-structured interviews, as the analyzes of the interviews were more structured and proceduralised and demanded significantly more time to analyze. The semi-structured interviews were analyzed with respect to the three analyzes procedures presented by Saunders et al. (2007, p. 479):

- Categorization
- 'Unitizing' data
- Recognizing relationships and developing the categories you are using to facilitate this

The first procedure involves classifying the data into meaningful *categories* (2007, p. 479). After the recorded interviews had been transcribed (that is, reproducing the interviews into written material), the work of identifying recurring themes and categories began. The purpose of the research should guide these categories, that is, they should be expressed through

research question(s) and objectives (2007, p. 480). As the sub-questions in this research project are concerned with either drivers, barriers, or enablers related to CBMI, the initial set of categories was guided towards these specific themes.

The second procedure concerns attaching units of data (e.g., a number of sentences or a complete paragraph) to the appropriate categories (2007, p. 480). While reading through the transcripts, units of data were labeled with the appropriate category, which was later cut out and sorted into piles of related categorical data. At this stage, the data were divided into eight various categories, of which each category was given a specific number to keep control of the various piles of data.

The last procedure is a continuation of the second, as analyzing the arranged piles of data will continue as one seeks additional key themes and relationships. In this respect, new themes and patterns may occur, and one may decide to integrate, or split, some initial categories (2007, p. 482). The prolonged analysis resulted in both integration and splitting of some categories from the initial set of eight categories. Eventually, the results from the semi-structured interviews were divided into five categories, as presented in subsection 6.2.1.

4.4.2 Analyzing the quantitative data

In section 4.2, quantitative research was defined as "*a research strategy that emphasizes quantification in the collection and analysis of data*" (Bryman, 2012, p. 35). Thus, quantitative data is data based on meaning derived through numbers (Saunders et al., 2007, p. 472). The word 'meaning' is essential in this context, as quantitative data in its raw form brings very limited meaning to most people and thus needs to be processed to emerge as any valuable information (2007, p. 406).

Saunders et al. distinguish among two types of quantitative data; *categorical* and *quantifiable*. The former represents data that can be classified according to the characteristics of the data, while the quantifiable data are *"those whose values are measured numerically as quantities"* (2007, p. 409). As a numerical rating scale (ranging from 0-10) was used for the questionnaire, the latter is the type of data obtained in this research project. Saunders et al. point to quantifiable data to be advantageable, as they are *"more precise"* than categorical data and can be analyzed using a broader range of statistics (2007, p. 409). Furthermore,

Saunders et al. distinguish between *continuous* and *discrete* data; continuous data refer to data that can (theoretically) take any value, while discrete data are measured more precisely. In this respect, the (restricted) numerical rating scale relates to discrete data, which were regarded as favorable as *"the more precise level of measurement, the greater the range of analytical techniques are available to you"* (2007, p. 410).

As previously stated, the survey was created using the survey tool, Nettskjema. This tool allowed all obtained data to be directly converted to an Excel sheet, making it feasible to structure and analyze the various data. Excel comes with a slew of built-in features that makes it easy to calculate (for instance) the mean and standard deviation from a sample of data, as well as converting these analyzed data to well-illustrated graphs. By visualizing the results with graphs, it became easier to spot how the rated drivers and/or barriers varied compared to each other.

4.5 Research Quality and Credibility

Striking for the best possible quality when conducting and documenting research is a major challenge for researchers (Cope, 2014, p. 89). This is because, as Saunders et al. state, high research quality reduces the possibility of getting wrong answers (2007, p. 149). In this respect, research credibility refers to the *"truth of the data […] and the interpretation and representation of them by the researcher"* (Cope 2014, p. 89). A researcher's credibility is strengthened by explaining his or her study experiences and verifying the research results with the study participants (Cope, 2014, p. 89). In order to improve the credibility of research findings, Saunders et al. emphasize two critical aspects of study design: *Reliability* and *validity.* The rest of this section will assess the quality and credibility of the findings concerning three aspects: Reliability, validity, and triangulation.

4.5.1 Reliability

Reliability refers to "*the extent to which your data collection techniques or analysis procedures will yield consistent findings*" (Saunders et al., 2007, p. 149). Saunders et al. cite Easterby-Smith et al. (2002), who reveal three questions that can be asked to assess reliability:

1) Will the measures yield the same results on other occasions?
2) Will similar observations be reached by other observers?

3) Is there transparency in how sense was made from the raw data?

In regard to these questions, Saunders et al. point to the work of Robson (2002), who suggests that there may be four threats to the research reliability; 1) *subject or participant error,* 2) *subject or participant bias,* 3) *observer error* and 4) *observer bias.* The rest of this subsection will discuss these threats with respect to this research project.

Subject or participant error concerns the fact that people have 'highs' and 'lows' during a day in terms of their general mindset (motivation, mood, etc.) (Saunders et al., 2007, p. 149). For example, a person coming straight from an internal meeting that brought stress and negative feelings might express more negative expressions in the interview and/or the survey. Regarding this research project, one factor should be framed: In relation to the abovementioned example, both the survey and the interviews were conducted at times that fit the participants' time schedules. This might have affected the results, both in terms of the respondents' emotional neutrality to the project, but also in terms of their willingness to elaborate on their answers.

Subject or participant bias concerns the fact that external factors may affect how the participants answer the various questions (Saunders et al., 2007, p. 149). Saunders et al. exemplify this with bosses who may instruct interviewees what they should or should not say. To eliminate such bias, all participants were informed that their responses were secret and that all recordings will be destroyed at the conclusion of the study. Furthermore, each participant was given the opportunity to read their interview report and provide input on anything they wanted to leave out. Another source of bias could have been the manner the semi-structured interviews were conducted. As previously mentioned, each interviewee were presented with graphs showing the survey results. Although this method of 'mixing' results provided more insight and knowledge into the outcomes, it may have resulted in a bias in how each participant elaborated on their responses.

Observer error relates to the fact that various observers may have different ways of asking questions when collecting data (Saunders et al., 2007, p. 149). In regards to the questionnaire, respondents may interpret questions completely different if the questions are unclear or unprecise. To deal with this possible error, my supervisor, Nora Johanne Klungseth tested the questionnaire several times before it was dispatched. Furthermore, the use of *italics,* **bold,**

and underline were used to remove this possible threat. Concerning the interviews, Saunders et al. state that introducing a high degree of structure to the interview schedule might reduce this error. As the same person conducted all interviews in this research project, this error was greatly reduced. Moreover, as Adams recommends, each interview should be followed up with questions such as *"what works well, and what needs to be modified?"* (2007, p. 499). This method of refining each interview was used after each one (see figure 23), and it undoubtedly assisted in obtaining better responses and eliminating unnecessary questions.

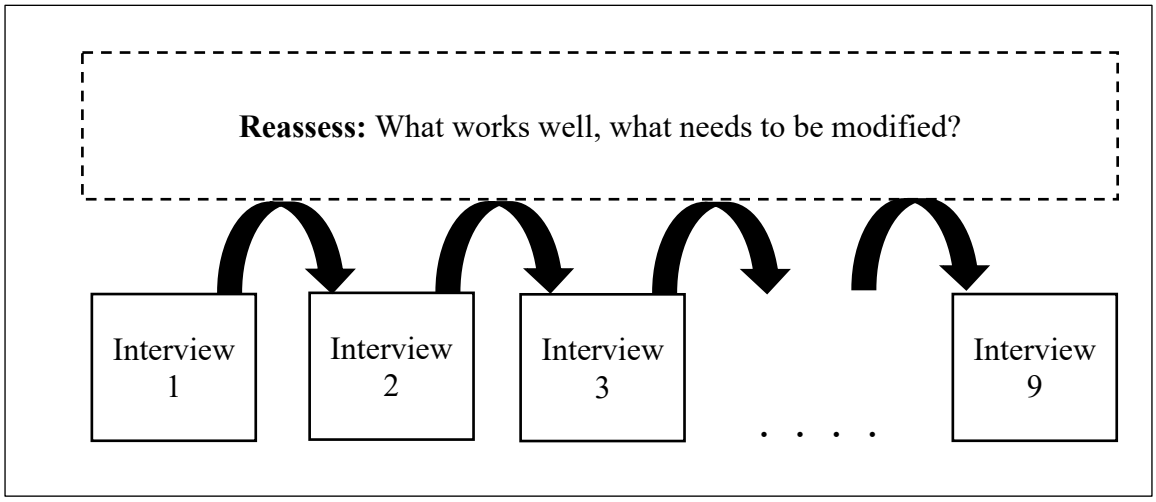

Figure 23: Illustration of how each interview were improved in an iterative manner. (Source: Own production).

The fourth factor relates to *observer bias,* that is, the fact that observers may interpret answers and results in various ways (Saunders et al., 2007, p. 150). Moreover, observer bias may occur with only one observer, as for this research project. Correctly interpreting various statements and explanations can be difficult if one is not observant about this possible threat to reliability. Two important actions were taken to address this potential hazard. Firstly, if there were any uncertainty related to the meaning of the interviewees' statements, they were always asked to either elaborate or state differently. Secondly, as previously mentioned, all respondents were asked to read through their particular interview reports to confirm their statements and interpretations. The risk of observer bias was greatly decreased by obtaining such input from each respondent.

Lastly, the reliability of the systematic literature collection should be assessed, as the obtained literature created the foundation for the survey, and later the interviews. The

obtained literature was, as previously mentioned, gathered from Elsevier Scopus, the "*largest abstract and citation database of peer-reviewed literature*" (Elsevier, 2021). Obtaining peer-reviewed articles of high quality was regarded as the most crucial factor when choosing what database to use. Moreover, as the collection was based on the step-by-step framework of Wohlin (2014), all literature was gathered in a systematic manner. Hence, the lack of experience in conducting systematic literature reviews was eased by this (prominent) step-by-step framework.

4.5.2 Validity

Validity is concerned with "*whether the findings are really about what they appear to be about*" (Saunders et al., 2007, p. 150). Saunders et al. differ between *internal* and *external* validity (2007, p. 137). Internal validity is described to be *"the extent to which the findings can be attributed to the interventions rather than any flaws in your research design"* (2007, p. 137). In other words, internal validity refers to the truthfulness of research findings. On the other hand, external validity refers to whether the research results may be equally applicable to other settings (2007, p. 151). The following subsection will look further into both the internal and external validity related to this research project.

Saunders et al. point to five relevant threats to *internal validity* in research, where the first is related to *history.* That is, historical events that may have "*dramatic, and quite misleading, effect on the findings*" (2007, p. 150). Regarding this research project, one event should be highlighted: At the end of 2020, one of the project's work packages was finalized, along with a milestone report that summarized the findings from this work package (see section 5.2). The respondents' subjective opinions on whether the work package was successful or not may have affected their survey and interview answers.

The second threat to internal validity is related to *testing.* Saunders et al. state that if the participants of a research project think the results may disadvantage them in some way, the results are likely to be affected (2007, p. 150). This threat is highly related to *subject and participant bias.* Hence, the same strategy applies to reducing the threat to validity as reducing the threat to reliability. All respondents were assured about their responses' anonymity and were given a chance to read through the interview reports. Moreover, as each interviewee was presented with the survey results, they were assured that no one was recognized in their answers.

The third threat to internal validity that Saunders et al. point out is concerned with *instrumentation* and is concerned with the fact that circumstances might change between batches of testing (2007, p. 150). For instance, if the project were to receive large financial support from the government between the conduction of the survey and the interviews, this would unquestionably affect the participants' answers to drivers/barriers related to institutional and economic factors. The survey was sent out to the respondents from the WondRest project on February 24th, and the last survey result was obtained on April 12th. The interviews were conducted in the period from April 13th to 16th. In other words, obtaining all survey results took nearly two months, which clearly makes instrumentation a possible threat to validity in this research project (although, as far as I am concerned, no influential circumstances have occurred in this two-month period).

The fourth threat to internal validity is concerned with *mortality,* that is, the fact that participants might drop out of the research project. As for this research project, no participants left the project during the work of this thesis. Concerning the interviews, all but one partner company missed out. Although having all of the partner companies participate would improve the final results, the overall participation in the interviews is considered high. The number of responses to the survey, however, was lower than expected. Although the response rate (the number of responses divided by the number of receivers) in the WondRest project was reasonably high (65%), the snowball sampling approach only resulted in five responses. In retrospect, it is clear that more actions should have been taken to succeed with the snowball approach. First of all, the number of initial participants should have been higher to increase the possibility of the survey getting forwarded. As previously mentioned, all the initial participants were contacted through the network of my co-supervisor. To gain more initial respondents, additional sources could have been sought to get in touch with other relevant companies. Lastly, more stress should have been put on the importance of forwarding the survey to each participant (although this came clear both in the phone calls and in the received emails).

The fifth threat to internal validity pointed out by Saunders et al. is concerned with *maturation,* that is, the fact that participants' may mature during the research process (2007, p. 150). This might affect the way they think and/or act towards, for instance, circular business models, business model changes, and questions related to sustainability in their

business. As this research project extends over a five/six month period, there is a possibility that some participants might change opinions or the way they regard the ongoing changes.

External validity, or generalizability, refers to the extent to which the research results are generalizable, or equally applicable to other settings (2007, p. 151). Saunders et al. state that concerns to generalizability might be a particular worry in single case study research, where it is important to address whether the particular case organization is similar, or different, in some ways than other organizations. As for this research project, the findings are based on the results in one specific case study. As for this, one can argue that the research results do not apply to other cases/organizations, as several factors distinguish this project from other projects. However, as the results are based on a case study of the bed manufacturer, Wonderland AS, together with their partner companies, the findings can be argued to be applicable to other similar bed manufacturers along with their partners. Nonetheless, for the results to be generalizable, they should be exposed to other research settings at a later time to test the results' robustness (2007, p. 151). Hence, the results of this research can be regarded to be *potentially* generalizable.

4.5.3 Triangulation

As mentioned in section 4.2, this thesis uses *triangulation* as a research strategy to ensure high research quality and credibility. Triangulation refers to a technique to analyze results of the same study using different methods of data collection (Nightingale, 2020, p. 1) and is often represented as a triangle, as illustrated in figure 24.

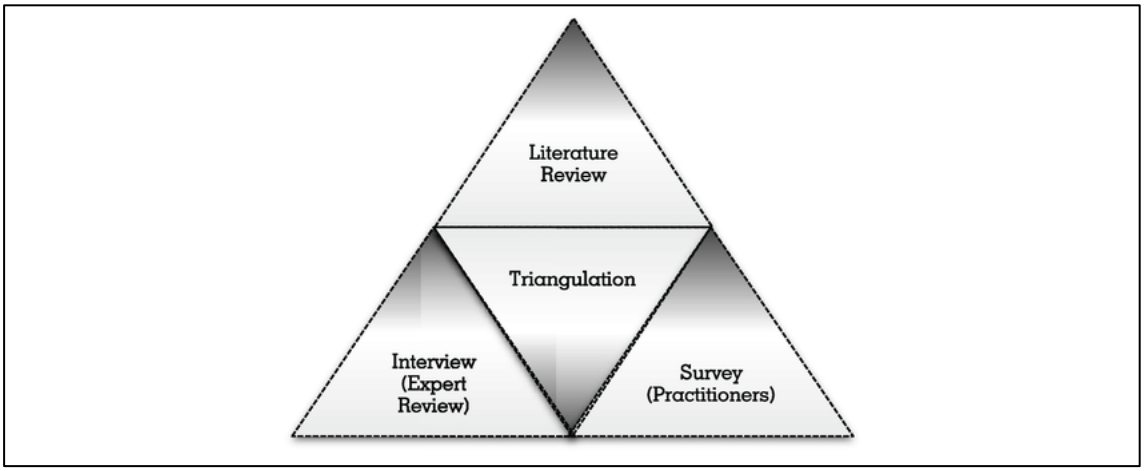

Figure 24: The Triangulation method. (Source: Alassafi et al., 2017).

Nightingale states that triangulation is used for three main purposes: 1) To enhance validity, 2) to create a more in-depth picture of a research problem, and 3) to interrogate different ways of understanding a research problem (2020, p. 1). However, triangulation is most often used to check that various methods, or different observers of the same phenomena, produce the same results (2020, p. 1). As for this research project, triangulation is used in the following way: First, through the systematic literature review, a framework of drivers and barriers was created, based solely on existing literature. This framework was then used as the foundation for creating the quantitative questionnaire, where each question referred to drivers and/or barriers from the framework. Both the results from the framework and the survey were then used as basis for the conduction of the semi-structured interviews. Moreover, structured observations through workshops, presentations, and meetings helped gain additional knowledge, thus enhancing the validity of the research problem. Figure 25 illustrates these methodological connections.

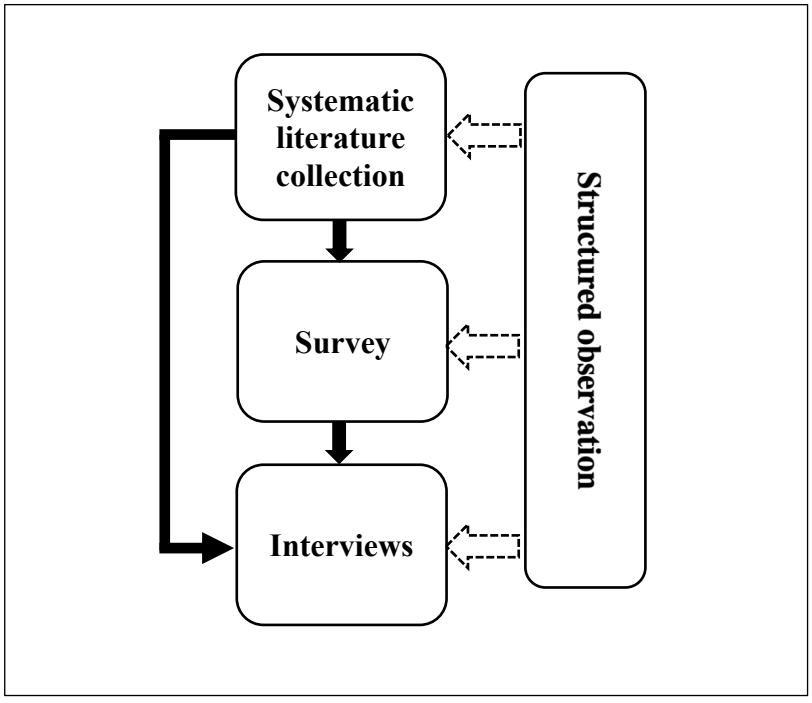

Figure 25: Illustration of the methodological connections of this master's thesis. (Source: Own production).

5.0 Empirical Background

The following chapter presents the empirical background for this thesis. The knowledge provided is based on both external (public websites) and internal data (internal documents, interviews). First, a brief overview of Wonderland's organization is presented, followed by their partners and current value chain. Thereafter, each organization in the value chain is be presented, and the chapter will finish off by looking into the initiated project case, *WondRest*.

5.1 Wonderland AS

Wonderland AS was established in 1969 in Åndalsnes, Norway. Starting off as a foam producer for the furniture industry, the company has grown to become one of Scandinavia's leading producers of high-quality beds (Proff, 2021). From their first simple foam mattress in 1971 to their adjustable multi-mattress beds of today, Wonderland's focus on continuous improvement stands out as one of the main reasons for the company's success.

Wonderland wishes to "*create and deliver personally customized beds with unique characteristics and design*" (SINTEF, 2020). They are proud of their Norwegian roots, their short-haul production, as well as the unique characteristics of each bed. The former is evident from their official website, where quotes such as "*innovative Norwegian design*" and "*beds in Norwegian quality*" are highlighted (Wonderland AS, 2021). Their short-haul production contributes to reducing their total environmental footprint, as well as sustaining their image as a Norwegian enterprise. Moreover, the bed's possibilities to customize the hip-zone, wash the exterior textiles, and turning the mattress to extend its lifetime are all important contributors to the products' unique features. Figure 26 shows the three main bed types that Wonderland produces today.

Figure 26: Wonderland's three types of beds. From left to right: The adjustable bed, the frame bed, and the continental bed. (Source: Wonderland AS, 2021).

Just as their established location in 1969, Wonderland's production facilities are today located in Åndalsnes in Norway. The Scandinavian market makes up 98% of Wonderland's total turnover, out of which the Norwegian market comprises more than 70%. The rest, 2%, is represented in non-Scandinavian countries such as Belgium, Holland, and Germany (SINTEF, 2020). Wonderland reported a total turnover of 300 931 NOK in 2019, a number that has stayed reasonably steady since the first reporting in 2015 (Proff, 2021).

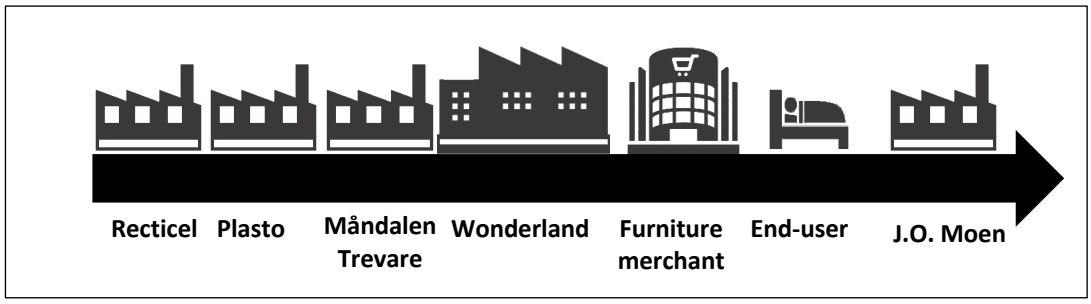

Figure 27: Wonderland's current value chain. (Source: SINTEF, 2020)

Figure 27 shows the current value chain of Wonderland, along with its cooperating stakeholders. Roughly speaking, Recticel AS produces the foam for the beds' mattresses, Plasto AS produces various plastic components (plastic fittings and spacers), while Måndalen Trevare AS produces the beds' wooden frames. From Wonderland's production facilities, the end-products are further distributed to furniture merchants (mainly Møbelringen, Bohus, and Skeidar) who work as retailers toward the end-customers. Finally, J.O. Moen Miljø AS represents the end-of-life management of the beds. The following subsections will take a closer look at Wonderland's various collaborating companies.

5.1.1 Plasto AS

Starting as a production company for ballpoint pens in 1955, Plasto AS has established itself as a high-technological production company for thermo-molded plastic products. Being a third-generation family-owned company located in the very center of Åndalsnes, Plasto has developed a strong connection to the local industry.

Plasto's strong focus on continuous improvement through research and problem solving has been vital for its competitiveness as of today. This is substantiated by its collaboration with leading research institutions, such as SINTEF, NTNU, Norner, and Rise (Plasto AS, 2021).

Furthermore, Plasto takes part in several research- and development projects to stay up-to-date within the newest of technologies, and to maintain their competitiveness. Amongst these are the WondRest project, in which Plasto wishes to "*replace all the plastic in Wonderland's beds with plastic that is produced from recycled materials*" (Wonderland AS, 2021).

5.1.2 J.O. Moen Miljø AS

J.O. Moen Miljø AS is one of three subsidiaries within the J.O. Moen AS company. J.O. Moen Miljø AS is responsible for the handling of all types of waste, and delivers complete waste solutions for companies and individuals (J.O. Moen AS, 2021). Its main office is located in Åndalsnes, where a waste disposal facility handles the waste generation stemming from the county of Rauma.

As for their linkage with Wonderland, J.O. Moen Miljø are responsible for handling the waste generation coming from Wonderland's production. Moreover, they compile waste statistics and offer advice on the various challenges they face (SINTEF, 2020). The waste handling from Wonderland's production mainly includes wood, residual waste, and fabric residues. Apart from cardboard and plastics, which are both recycled, their received waste from Wonderland is treated as residual waste (energy recovery).

5.1.3 Møbelringen

Since its establishment in 1985, Møbelringen has expanded to more than 60 locations well spread around Norway. Møbelringen is a furniture merchant that offers "*quality furniture to the Norwegian people*" (Møbelringen, 2021). It aims to appear as the leading furniture merchant in Norway by providing "*good service, have pleasant shops, and provide professional guidance to our customers*" (Møbelringen, 2021)

Moreover, Møbelringen is one of three main furniture merchants for Wonderland's various beds. Speaking to one of Wonderland's representatives, it was confirmed that Skeidar, Bohus, and Møbelringen make up approximately 30%, 35%, and 35% of Wonderland's total sales, respectively (Anon, 2021).

5.1.4 Recticel AS

Recticel AS, part of the European Recticel Group, is one of the largest distributors of polyurethane foam in the Nordic region (Recticel AS, 2021). Recticel specializes in the production and supply of foam for home furniture, mattresses, office furniture, and the transport sector, to name a few. Additionally, Recticel produces and supplies insulation products on demand from various customers (Recticel AS, 2021).

Recticel thus plays a crucial role for Wonderland's products, as the polyurethane foam and stuffing make up significant amounts of the beds' total volume (see figure 28). As for many of Wonderland's collaborating partners, Recticel's situated location in the center of Åndalsnes contributes to strong local collaborations.

5.1.5 Måndalen Trevare AS

Måndalen Trevare AS, situated a twenty-minute drive west of Åndalsnes, supplies a wide range of self-produced wooden products. It has long traditions as a wood producing company, traditions that go back more than 70 years. Today, they produce and deliver wooden products for both households and hotels, such as sideboards, tables, beds, chairs, and cabinets (Måndalen Trevare AS, 2021)

Måndalen Trevare produces and delivers all the wooden materials for Wonderland's beds. This includes the bed's base and footboard (see figure 28), which mainly consists of pine, birch, and beech.

5.2 Case Description: WondRest

As mentioned in section 5.1, Wonderland's continuous search for improvement has been vital for the market position they hold today. This is substantiated by their latest initiation of the sustainability project, *WondRest.* In collaboration with all the companies in today's value chain, the goal of WondRest is to:

1) Design, produce and deliver a bed with a 50% lower environmental footprint compared to today's beds.
2) Deliver a service that facilitates sustainable behavior, use, and handling at the end-of-life.
3) Create a new circular business model that takes responsibility for the product's entire life cycle.

Representatives from SINTEF and NTNU are part in the process to contribute to the project's research and development. Furthermore, the project is partly financed by the Research Council of Norway (Norges Forskningsråd), and the goal is to complete the project within April of 2023.

5.2.1 Reference bed

To achieve the project's objectives, a reference bed from today's production line was chosen for comparison. The reference bed chosen is the so-called *Exclusive Kontinental 180x200 Navy 61*, which is one of Wonderland's best-selling models (see figure 29). As illustrated in figure 28, this continental bed is made up of five main parts: The mattress topper, two main mattresses, the bed's base, and the footboard. As for the chosen size (180x200) and textiles (Navy 61), both were picked because of their popularity among customers.

The mattress topper mainly consists of foam material, either *Pulse latex* or *Hyperflex polyurethane foam*. The former comprises a mix of natural and synthetic latex and is designed to have a long service life, unique flexibility, ventilation, and moisture regulation (Wonderland AS, 2021). As for the Hyperflex polyurethane foam, Wonderland mentions high elasticity, moisture control, and quality ventilation as major characteristics (Wonderland AS, 2021).

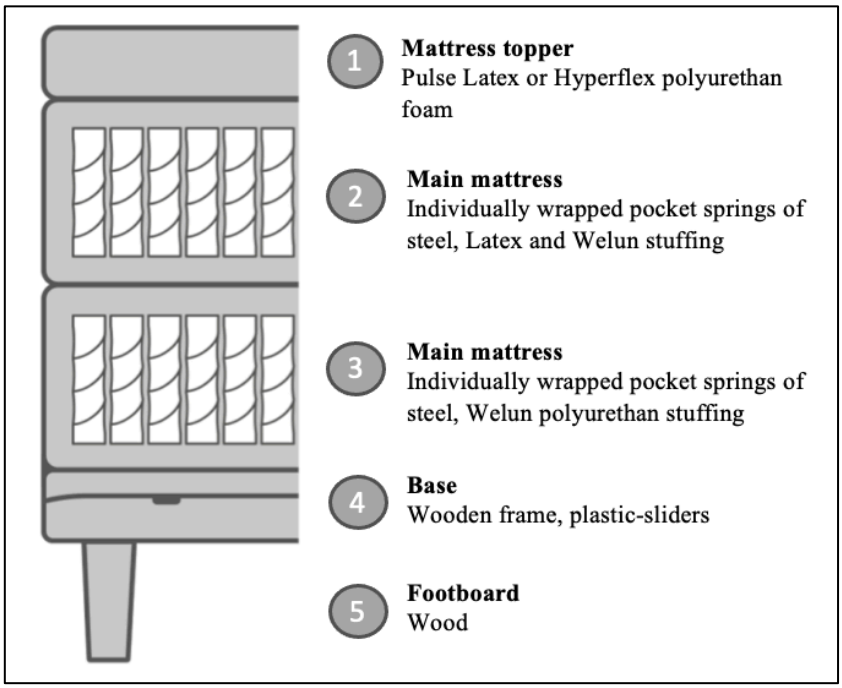

Figure 28: Content of materials in the reference bed. (Source: SINTEF, 2020).

Concerning the main mattresses, the stuffing consists of either *Latex* and/or *Welun*. Out of the two, Wonderland explicitly refers to Latex as an "*exclusive material that will provide a perfect sleeping climate*" (Wonderland, 2021). As for the base and footboard, the content of wood is mainly pine, birch, or beech. In addition to the materials listed, the bed consists of various textiles, threads, zippers, hook-and-loop fasteners, and glue.

Figure 29: The reference bed: Exclusive Kontinental 180x200 Navy 61. (Source: Wonderland AS, 2021).

5.2.2 Criteria for materials and textiles selection

Wonderland aims to be an *"ambassador of sleep"* (Wonderland AS, 2021), and they have a *"genuine desire to make people sleep better"* (SINTEF, 2020). In the light of this, they have some prevailing principles and criteria they follow in order to choose the right materials and textiles. Table 8 provides an overview of some of these principles and standards.

Criteria for materials selection	Criteria for textiles selection
• Provide the best relaxation and quality of sleep • Provide good pressure relief • Provide good ventilation • Provide good moisture transportation • Be robust, have a long material life • Provide a healthy sleeping climate • Function in the current production line • Suitable for module-based production • Environmentally certified • Long-term quality suppliers from both Norway and Europe • Traceable	• Durable, high color- and lightfastness to withstand both sunlight and washing for many years • Washable at 60°C to remove dust mites • Withstand being washed time and time again without losing quality or shape • OEKO-TEX certified* • Mattress topper: Knitted fabric that provides good stretch and sensitivity • Provide good ventilation, moisture transport, or temperature control • Not made from animal fibers • Function well in the current production line (sewing, cutting, etc.)

Table 8: Wonderland's criteria for materials- and textiles selection. (Source: SINTEF, 2020).
**OEKO-TEX certification tests textiles and materials for hazardous substances (Wonderland AS, 2021).*

5.2.3 Work packages

As a way to structure the project's progress, five 'work packages' (H*), with corresponding milestones (M*), were settled in the project's initiation phase. Table 9 presents an overview of the project's planned structure, where each year is divided into four quarters, and the dark blocks indicate the planned duration of each work package. The rest of this subsection will present these work packages, along with the main tasks for each package.

Work package	2020				2021				2022				2023
	1	2	3	4	1	2	3	4	1	2	3	4	1
H1				M1									
H2							M2						
H3										M3			
H4												M4	
H5													M5

Table 9: Work packages and milestones in the WondRest project. (Source: SINTEF, 2020).

H1: Environmental Analysis

The first work package is concerned with the environmental analysis that was planned and executed prior to the first milestone (M1). The goal of H1 is to "*use environmental analyzes to ensure the least possible environmental footprint for the product (50% reduction from today)"* (SINTEF, 2020). Some main tasks within this work package include:

1. Study the opportunities for final handling options.
2. Scenario development for material selection, service life, and options for disposal.
3. Environmental analyzes.
4. Create some 'limit values' within which the new bed should be designed.

H2: Circular Design

The second work package includes the development and design of a circular business model. The goal of this work package is to "*develop a concept for a sustainable bed, along with its services, that takes part of a circular business model*" (SINTEF, 2020). Moreover, H2 aims to "*develop a mindset and tools for circular design of voluminous composite products with a long service life*" (SINTEF, 2020). Main tasks include:

1. Develop a sustainable design strategy from a circular perspective.
2. Design services that facilitate sustainable behavior in use and at the end of the service cycle/service life.
3. Design for the least possible use of energy and resources.
4. Find solutions for reuse - design for End-of-Life.
5. Co-creation opportunities between the actors along the value chain.
6. Concepts for sustainable bed solution.
7. Concepts for services that ensure a circular business model.

H3: Circular Value Chain & Business Model

The third work package is concerned with establishing both a circular value chain and a circular business model (see figure 30). Hence, the goal is to "*establish a circular value chain for a bed, as well as a circular business model to support the implementation*" (SINTEF, 2020). Some main tasks within this work package include:

1. Mapping of the business partners' interests in the context of current value chains.
2. Map new and potential circular chains and associated stakeholders.
3. Case study of the current material flow related to the entire life cycle of the bed.

4. Development of a strategy based on an assessment of stakeholders, activities, and competency requirements.

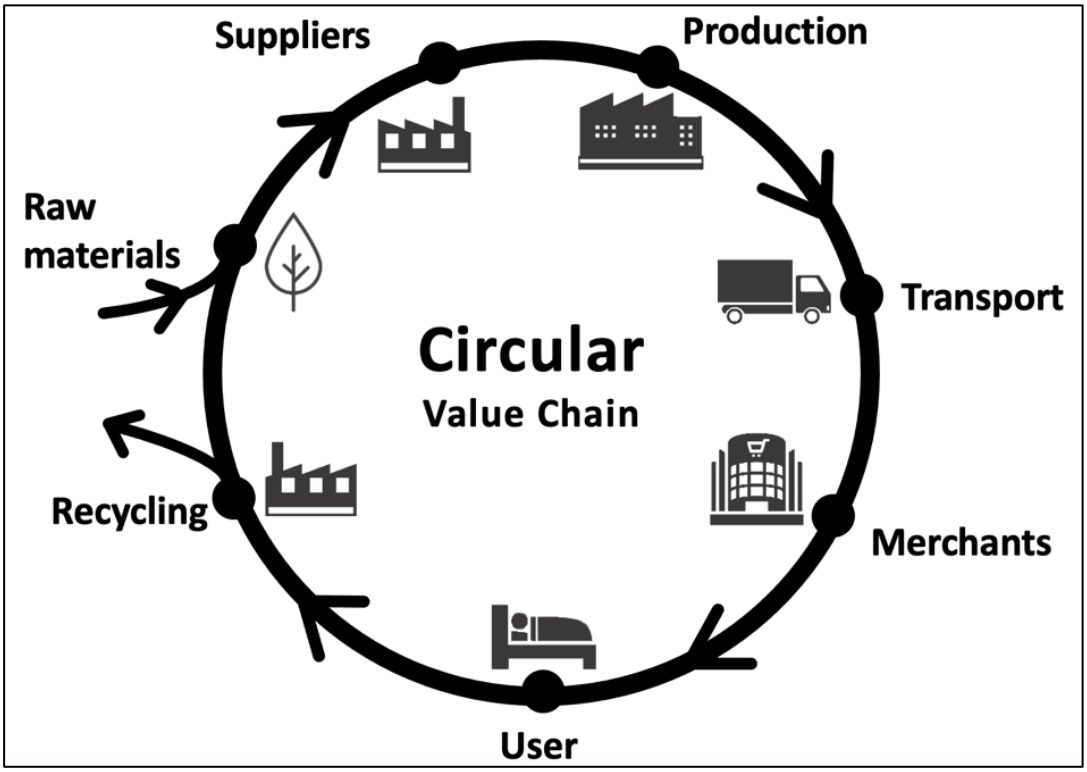

Figure 30: Simple illustration of Wonderland's desired circular value chain. (Source: Wonderland, 2020).

H4: Implementation of a CBM

The fourth work package is concerned with the implementation of the proposed circular business model from H3. This work package aims to "*develop and demonstrate a prototype, including its circular business model*" (SINTEF, 2020). Main tasks associated with the work package include:

1. Evaluate and test materials and production processes in the factory
2. Evaluate and test the product for sleeping comfort.
3. Mapping of consumer behavior and demands for sustainability
4. Construction of a full-scale prototype bed for use in connection with evaluation and testing.
5. Testing of new materials and solutions in production.
6. Production adaptation of solutions.
7. Possible digital communication solutions, information flow in the value chain
8. Mapping and strategy development for sourcing, logistics, and warehousing.

H5: Dissemination

In the last work package, H5, the goal is to disseminate and spread the project's results. Some main tasks involved in this work package include:

1. Scientific publications
2. Teaching and training of retailers. Develop training materials for the stores' staff.
3. Publications in interior and lifestyle magazines.
4. Publications in industry-related journals.
5. Develop marketing communications that support consumers to make more sustainable choices.
6. Develop marketing communications that support retailers to contribute to a more sustainable product range.
7. Display and present the prototype at various furniture fairs

5.2.4 Status quo

As seen in table 9, milestone M1 was finalized by the end of 2020. For the project's participants to gain an overview of the work and findings so far, a milestone report was produced by the beginning of 2021. This subsection is based on the information provided in this milestone report, and is meant to provide an overview of the current state in the WondRest project. Note that, for confidential reasons, some findings and data have been left out.

As mentioned in subsection 5.2.3, the goal of H1 was to "*use environmental analyzes to ensure the least possible environmental footprint for the product (50% reduction from today)"* (SINTEF, 2020). These environmental analyzes were performed by SINTEF in collaboration with Wonderland and provided a rough overview of the total environmental footprint of the reference bed today. The environmental analyzes were performed based on two ISO standards:

1) ISO 14044 - Environmental management, life cycle assessment, requirements, and guidelines

2) *ISO 14040 – Environmental management, life cycle assessment, principles, and frameworks*

These standards provide requirements, guidelines, principles, and a framework for life cycle assessment (LCA) (ISO, 2016). In short, an LCA is a standardized method to both calculate and analyze environmental impacts throughout a product's life cycle, from 'cradle to grave' (SINTEF, 2020). In this respect, it is important to note that an 'environment impact' can be anything from climate change and freshwater ecotoxicity to ionizing radiation. As for confidential reasons, the exact results from the LCA are not presented.

In addition to the environmental analyzes, a competitor analysis was performed to uncover existing bed producers that market themselves as 'green' and 'sustainable'. Also, several meetings have been scheduled and executed during the project period. Together, these results have formed a basis for a multitude of research questions and issues that needs further investigation in the project:

- How should the various environmental categories be weighted to each other? That is, how damaging is (e.g.) marine ecotoxicity to the environment compared to global warming?
- How will the results from the LCA look like if we include recycled/reused materials?
- How would the results from the LCA look like if we had exact data for all materials included in the bed? (There is a lack of data for some materials)
- How environmentally friendly is an organic material compared to a synthetic material?
- There is still a need to dig deeper into the existing value chain to obtain more accurate results. How are the production processes for materials coming from foreign countries?
- How could alternative textiles and materials decrease the bed's total environmental footprint? What are these textiles and materials?
- Would increasing the product's service life with robust and synthetic materials contribute more or less to the environmental footprint compared to a bed consisting of solely organic, degradable materials?
- What does the customer want? What are our future customers, and how does the future market for beds look like?
- What kind of business strategy will be most viable? A 'Green Line Collection'?

6.0 Results & Findings

This chapter presents the results and findings from this study in order to provide additional information for the discussion in chapter 7.0. First, the quantitative results are presented, consisting of the results from the dispatched survey. Next, the qualitative findings are presented, consisting of the outcomes from the semi-structured interviews and the structured observations, respectively. At the end of both sections, the results and findings are summarized in a '*summary of results'*-section, where the sub-questions of this thesis are answered:

SQ1: What are the drivers and barriers in Wonderland's business model transition?
SQ2: What are the success factors and enablers in this transition?

6.1 Quantitative Results

This section presents the survey results in four subsections: 6.1.1, 6.1.2, and 6.1.3 presents (respectively) the obtained results from Wonderland, the project partners (i.e., Plasto, Recticel, etc.), and the external projects, while 6.1.4 summarizes the survey results. As previously stated, the survey was divided between three groups of respondents:

1) Respondents from Wonderland
2) Respondents from the partner companies in WondRest
3) Respondents from external companies with experience in other sustainable/circular projects

While the former two contributed with 16 responses (seven from Wonderland, nine from partner companies), only five responses were collected from external projects. The latter is regarded as insufficient to provide any noteworthy statistics and are hence given less attention than the results from the former two.

Furthermore, because the survey questions were based directly on the collected drivers and barriers from the literature, the frameworks of drivers and barriers will be provided again throughout this section. These frameworks (tables) include the average (avg.), maximum (max), and minimum (min.) values from each question, as well as the standard deviations (st.d.). Based on these tables, graphs will be presented to provide a greater visualization of

the (on average) highest and lowest ranked drivers & barriers, and the standard deviation for each. Moreover, in order to prevent the graphs from becoming overly comprehensive, each category was assigned with a specific letter:

A = Institutional
B = Economic
C = Value Chain
D = Market/Social
E = Technological
F = Organizational
G = Environmental

For instance, all drivers & barriers represented in the *institutional* category will be presented as A1, A2, A3, etc., while all drivers & barriers in the *economic* category will be displayed as B1, B2, B3, etc. The following tables and graphs illustrate this system in an understandable manner.

6.1.1 Wonderland's responses

The following subsection presents the survey results obtained from Wonderland's seven representatives. The subsection is further subdivided into two sections: 6.1.1.1 *Barriers Wonderland* and 6.1.1.2 *Drivers Wonderland*. As the names imply, the two sections present the Wonderland representatives' responses to the barriers and drivers, respectively. Each section starts by presenting a table showing various statistics of the responses (avg., max, min., st.d.) before a bar chart visualizes each driver/barrier's average value and standard deviation.

6.1.1.1 Barriers Wonderland

Category	Barrier	Avg.	Max	Min	St.D.
Institutional	**A1:** Inadequate rules & policies to support CE strategies	6,6	10	3	2,94
	A2: Lack of a global framework for implementation	6,4	10	2	2,70
Economic	**B1:** Uncertain economic viability	6,9	10	4	2,48
	B2: Potential cost of circular activities	7,7	9	5	1,38
	B3: High investment costs / costs of project	7,6	10	4	1,81
	B4: Lack financial resources	6,9	10	5	1,68
Value chain	**C1:** Value chain adaptation	7,7	10	6	1,70
	C2: Value chain collaboration	6,7	10	5	1,80
	C3: Supply chain dependencies	7,3	9	2	2,56
Market/social	**D1:** Consumer behavior/perception	6,4	9	3	1,90
	D2: Silo-thinking of industries	5,6	8	3	1,72
	D3: Uncertain market demand	8	10	5	1,73
	D4: Tough market competition: Linear vs circular	6,9	8	2	2,27
Technological	**E1:** New technical capabilities	4,7	8	2	2,43
	E2: Lack of/introduction of new technology	5,3	8	2	2,63
	E3: Product design- and quality requirements	4,4	7	2	2,64
Organizational	**F1:** Conservative company culture	3,9	7	2	2,12
	F2: Lack of engagement, priorities, and/or time	6	8	4	1,29
	F3: Lack of knowledge and experience related to CBMs	5,7	9	2	2,43
Environmental	**G1:** Uncertain environmental benefits	5,7	8	2	2,29
	G2: Sustainability trade-offs	4,4	8	2	2,51
	G3: Lack of Key Performance Indicators (KPIs)	5	8	2	2,58

Table 10: Table showing statistics of Wonderland's answers to the survey regarding barriers in the WondRest project. (Source: Own production).

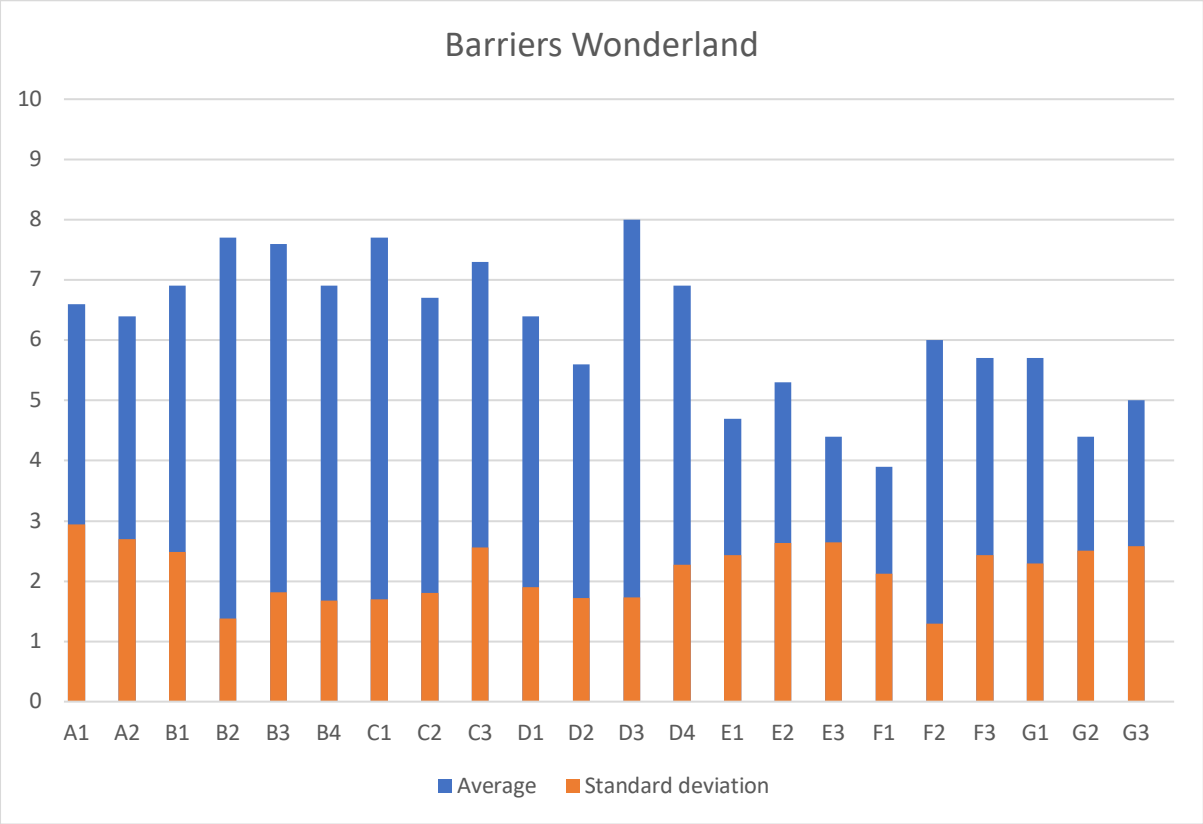

Figure 31: Bar chart showing Wonderland's responses to barriers in the survey, represented by average values and standard deviations. (Source: Own production).

From figure 31, it is clear that D3, *uncertain market demand,* received the (on average) highest score among Wonderland's respondents regarding barriers in the project (8.0). Moreover, this barrier has the fifth smallest standard deviation of all the 22 barriers (1.73), with six out of seven answers scoring 7 or higher. Furthermore, both B2, *potential costs of circular activities,* and C1, *value chain adaptation,* received an average score of 7.7. The former has the second-lowest standard deviation of all the 22 barriers (1.38), as five out of seven answers scored 8 or higher. The latter has the fourth-smallest standard deviation (1.7), with all respondents ranking this barrier as 6 or higher. Further follows B3, *high investment costs,* and C3, *supply chain dependencies,* scoring 7.6 and 7.3 on average, respectively. As for the former, five out of seven respondents ranked this barrier as 8 or higher, while one respondent ranked this barrier as 4. As for C3, *supply chain dependencies,* five respondents ranked this barrier as 8 or higher, while one respondent rated it as low as 2, increasing its standard deviation to 2.56.

Furthermore, figure 31 shows that from A1, *inadequate rules and policies to support CE strategies*, to D4, *tough market competition*, 12 out of 13 barriers rank above 6 on average. This is in contrast to the barriers from E1, *new technical capabilities,* to G3, *lack of KPIs*, out of which all barriers rank below 6. In other words, the survey results from Wonderland's participants show that the barriers related to *institutional* (A), *economic* (B), *value chain* (C), and *market/social* (D) factors are rated as larger barriers than the ones related to *technological* (E), *organizational* (F), and *environmental* (G) factors (by only assessing average values). By taking the standard deviation into consideration, the results show that except from F2, *lack of priorities and/or time* (which has the lowest standard deviation of 1.29), all barriers from E1 to G3 has a standard deviation above 2. These results indicate that whilst the barriers are ranked relatively low on average, there is a somewhat large disagreement among the participants concerning the actual significance of each barrier. This is highlighted by (for instance) F3, *lack of knowledge and experience related to CBMs,* which was ranked in the full span between 2 and 9, and has a standard deviation of 2.43.

It is clear from figure 31 that F1, *conservative company culture,* received the (on average) lowest score for barriers among Wonderland's participants. Although this barrier received a maximum score of 7, four out of seven respondents rated this barrier as 3 or lower. This is followed by E3, *product design and quality requirements*, and G2, *sustainability trade-offs*, which both ended up with an average score of 4.4. Lastly, both E1, *new technical capabilities*, and G3, *lack of KPIs*, received average scores of 5 or lower (E1 averaged 4.7, while G3 averaged 5).

6.1.1.2 Drivers Wonderland

Categories	Drivers	Avg.	Max	Min.	St.D.
Institutional	**A3:** Following the increasing amount of European and national standards	8,3	10	4	2,06
Economic	**B5:** Possible economic advantages	8,0	10	7	1,10
	B6: Increased price volatility on virgin materials	5,4	9	2	2,37
Market/social	**D5:** Socially increased environmental awareness	8,1	10	5	1,57
	D6: Social recognition	8,7	10	7	0,95
Technological	**E4:** Emerging technologies that support CE business (e.g. industry 4.0)	5,7	9	1	3,09
Organizational	**F4:** Competitiveness / differentiation	8,4	10	6	1,40
	F5: Company value growth	8,0	9	6	1,00
Environmental	**G4:** The global trend to minimize the environmental footprint (willingness to contribute)	9,1	10	7	1,07

Table 11: Table showing statistics of Wonderland's answers to the survey regarding drivers in the WondRest project. (Source: Own production).

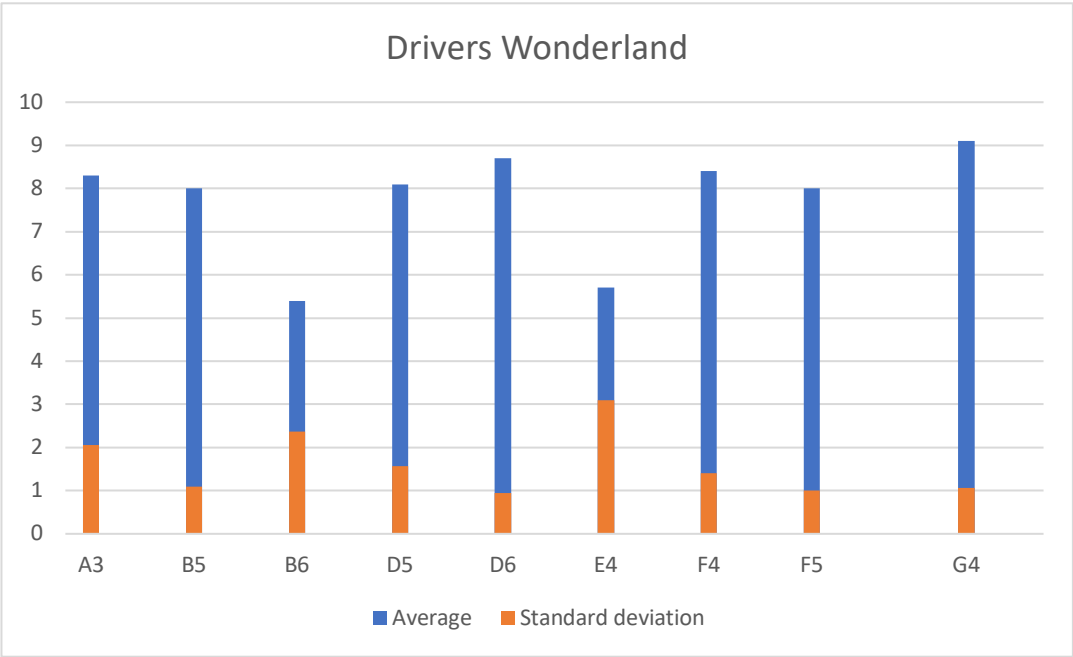

Figure 32: : Bar chart showing Wonderland's responses to drivers in the survey, represented by average values and standard deviations. (Source: Own production).

As for drivers, figure 32 provides one evident finding; the drivers represent the highest average values for all drivers & barriers, with the correspondingly lowest values for standard deviations. This is evidenced by (for instance) G4, *willingness to minimize the environmental footprint,* which received the highest average value of all drivers & barriers (9.1). Moreover, G4 has a standard deviation of only 1.07, as six out of seven respondents rated this driver 9 or higher, while three respondents rated it as 10. D6, *social recognition,* follows as the second-highest rated driver, scoring 8.7 on average. What's more, this driver has the smallest standard deviation of all received answers (0.95), with six out of seven respondents rating this driver 8 or higher. Lastly, we observe that the third-largest rated driver is F4, *competitiveness/differentiation,* received an average of 8.4, with a standard deviation of 1.4.

Furthermore, both A3, *following the increasing amount of national and European standards*, D5, *socially increased environmental awareness,* B5*, possible economic advantages,* and F5, *company value growth*, scored high on average (all above 8). Although there are some variances in their standard deviations, all three are rated 8 or higher by six out of seven respondents. B6, *increased price volatility on virgin materials*, is the driver that received the lowest average rating, followed by E4, *emerging technologies that support CE business*. Although these are the lowest rated drivers, they are all rated well above 5, making them favorable drivers for a CBM transition.

6.1.2 Partners' responses

The following subsection presents the results obtained from the nine survey respondents from the five various partner companies in the WondRest project (Plasto, J.O. Moen, Recticel, Måndalen Trevare, and Møbelringen). The subsection is further subdivided into two sections: 6.1.2.1 *Barriers partners* and 6.1.2.2 *Drivers partners*. As the names imply, the two sections present the representatives' responses to the barriers and drivers, respectively. Each section starts by presenting a table showing various statistics of the responses (avg., max, min., st.d.) before a bar chart visualizes each driver/barrier's average value and standard deviation.

6.1.2.1 Barriers partners

Category	Barrier	Avg.	St.D.	Max	Min
Institutional	**A1:** Inadequate rules and policies to support CE strategies	5	2,55	8	0
	A2: Lack of a global framework for implementation	5	1,94	8	4
Economic	**B1:** Uncertain economic viability	5	2,69	9	1
	B2: Potential costs of circular activities	5,9	2,85	9	1
	B3: High investment costs / costs of project	6,3	2,69	9	1
	B4: Lack financial resources	5,1	2,67	9	1
Value chain	**C1:** Value chain adaptation	5,9	2,57	10	2
	C2: Value chain collaboration / lack of partners	5,6	2,51	9	1
	C3: Supply chain dependencies	5,4	2,51	9	2
Market/social	**D1:** Consumer behavior/perception	5,9	2,42	9	2
	D2: Silo-thinking of industries	5	2,60	9	2
	D3: Uncertain market demand	5,9	2,47	9	2
	D4: Tough market competition: Linear vs circular	5,8	2,39	9	2
Technological	**E1:** New technical capabilities/lack of knowledge and skills of employees	4,8	2,33	8	1
	E2: Lack of/introduction of new technology	4,8	2,33	8	1
	E3: Product design- and quality requirements	5,9	2,85	9	1
Organizational	**F1:** Conservative company culture	4,6	2,74	10	1
	F2: Lack of engagement, priorities, and/or time	5,1	2,03	7	1
	F3: Lack of knowledge and experience related to CBMs	4,3	2,24	9	2
Environmental	**G1:** Uncertain environmental benefits	3,9	2,37	7	0
	G2: Sustainability trade-offs	3,0	1,73	5	0
	G3: Lack of Key Performance Indicators (KPIs)	3,8	2,68	9	0

Table 12: Table showing statistics of the partners' answers to the survey regarding barriers in the WondRest project. (Source: Own production).

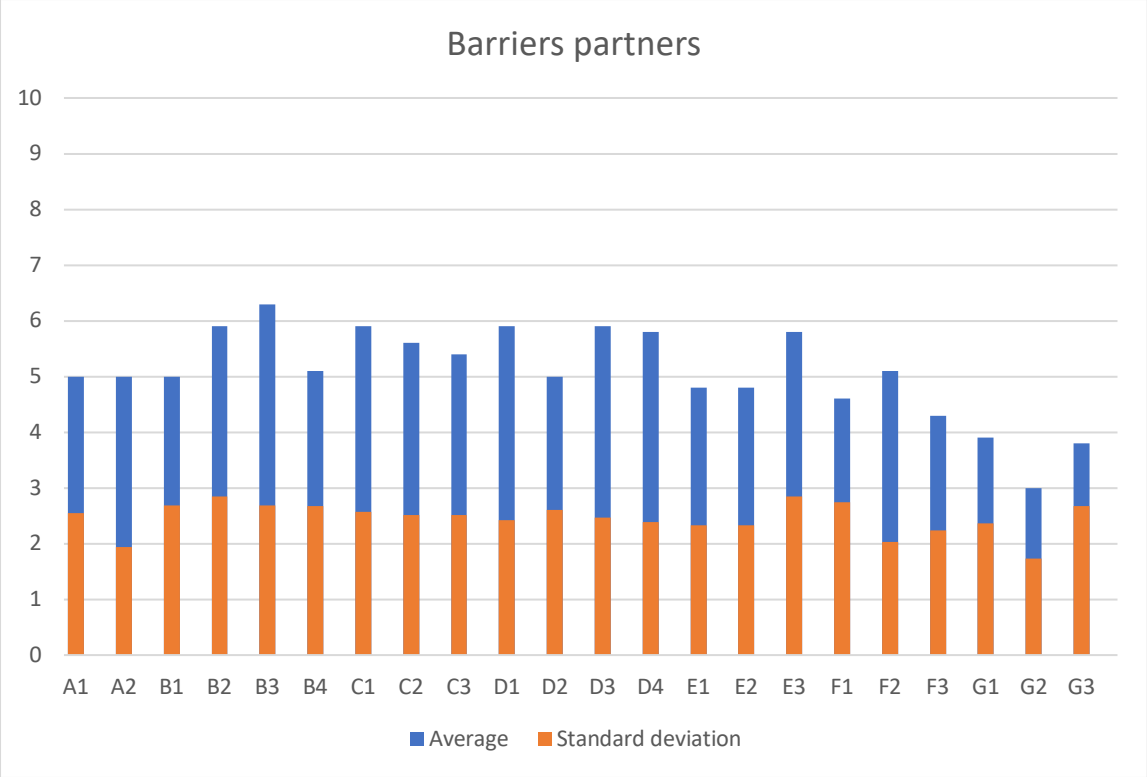

Figure 33: Bar chart showing the partners' responses to barriers in the survey, represented by average values and standard deviations. (Source: Own production).

The partners' responses are first and foremost characterized by the dispersion answers (i.e., high standard deviations). This is clear from figure 33, showing that as many as 20 out of 22 barriers have a standard deviation above 2.00. This is further evidenced from table 12, where there are visible differences between the maximum and minimum answers to several barriers. In this respect, only A2, *lack of a global framework for implementation*, and G2, *sustainability trade-offs*, possess standard deviations below 2.00 (1.94 and 1.73, respectively). On the opposite scale, we find B2, *potential costs of circular activities*, and E3, *product design and quality requirements*, which both possess standard deviations of 2.85. Moreover, both barriers received scores in (almost) both ends of the scale (maximum at 9, minimum at 1), and the obtained results show that the full scale was used by the various respondents (that is, high variance in the answers). This finding applies to several answers from these participants; the representatives from the partner companies were more likely to use the full scale of the rating system.

Furthermore, figure 33 shows that only one barrier received an average score above 6 (B3, *high investment costs,* average score 6.3). This is followed by four barriers which all received an average score of 5.9: B2, *potential costs of circular activities,* C1, *value chain adaptation,*

D1, *consumer behavior/perception,* and D3, *uncertain market demand.* On the opposite scale, we find G2, *sustainability trade-offs* (average 3.0)*,* G3, *lack of KPIs* (average 3.8)*,* and G1, *uncertain environmental benefits* (average 3.9)*.* The former has the overall lowest average score of all drivers & barriers, indicating that the partners do not regard sustainability trade-offs as a threatening challenge to the project. Lastly, we see that both A1, *inadequate rules and policies to support CE strategies*, A2, *lack of a global framework for implementation*, B1, *uncertain economic viability,* and D2, *silo-thinking of industries*, received an average score of precisely 5.0.

Moreover, from A1 to D4, all barriers have an average score of 5 or higher. This is in contrast with the barriers from E1 to G3, out of which seven of a total nine barriers scores below 5 on average. This indicates the same result as the ones from Wonderland's responses: The barriers in the *institutional, economic, value chain*, and *market/social* categories seem to perceive a higher negative impact on the project compared to the ones in the *technological, organizational*, and *environmental* categories.

6.1.2.2 Drivers partners

Categories	Drivers	Avg.	Max	Min.	St.D.
Institutional	**A3:** Following the increasing amount of European and national standards	6,3	9	2	2,0
Economic	**B5:** Possible economic advantages	6,3	8	4	1,66
	B6: Increased price volatility on virgin materials	4,7	8	0	2,87
Market/social	**D5:** Socially increased environmental awareness	6,8	8	5	1,20
	D6: Social recognition	7,2	8	5	1,09
Technological	**E4:** Emerging technologies that support CE business (e.g. industry 4.0)	5,8	8	3	1,56
Organizational	**F4:** Competitiveness / differentiation	7,6	9	5	1,59
	F5: Company value growth	7,8	9	5	1,30
Environmental	**G4:** The global trend to minimize the environmental footprint (willingness to contribute)	7,9	9	5	1,25

Table 13: Table showing statistics of the partners' answers to the survey regarding drivers in the WondRest project.(Source: Own production).

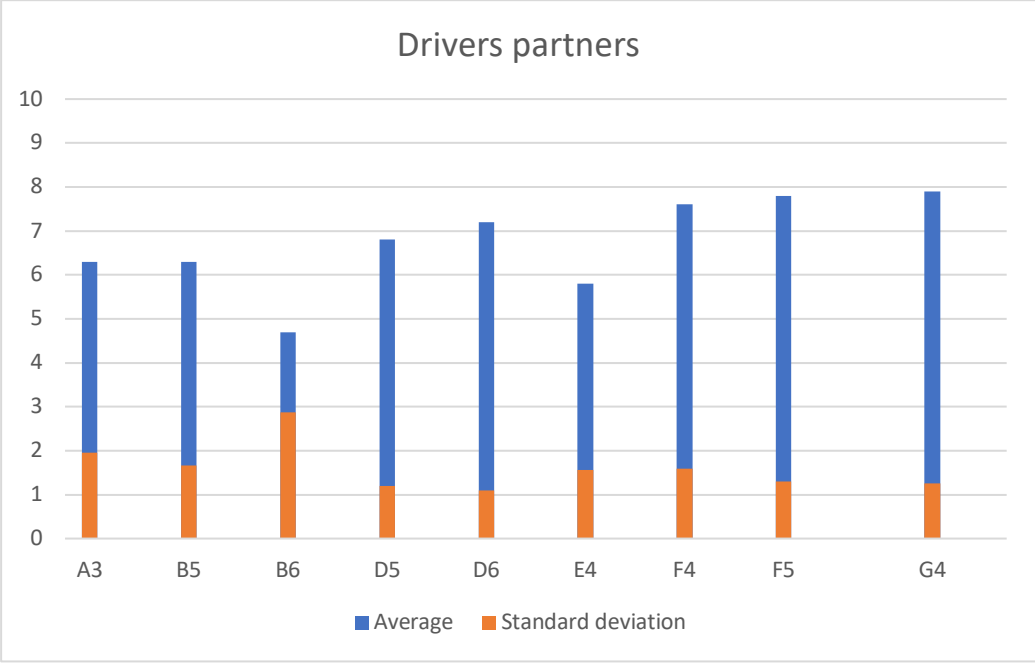

Figure 34: Bar chart showing the partners' responses to drivers in the survey, represented by average values and standard deviations. (Source: Own production).

As for drivers, the results provide especially two interesting findings compared to the barriers: 1) The standard deviations are significantly lower, and 2) the average scores are significantly higher. While a total of 20 out of 22 barriers proved to have a standard deviation above 2.00, eight out of nine drivers have a standard deviation *below* 2.00. This is further evidenced by table 13, which shows less differences between the maximum and minimum rated answers for most of the drivers. This suggests a broader agreement among the participants from the partner companies concerning the importance of the various drivers. As for finding 2), the results showed (as stated) that only one barrier scored above 6.0. Figure 34 illustrates that seven out of nine barriers score above 6.0, indicating that the participants from the partner companies regard the drivers in the project to have a greater impact than the barriers.

Both G4, *willingness to minimize the environmental footprint*, F5, *emerging technologies that support CE business, F4, competitiveness/differentiation,* and D6, *social recognition,* scored 7 or higher on average. Moreover, these drivers have fairly low standard deviations, with only F4 having a standard deviation above 1.3.

6.1.3 Responses from external participants

The following subsection presents the survey results obtained from the five external project participants (obtained through the snowball sampling approach). The subsection is further subdivided into two sections: 6.1.3.1 *Barriers external participants* and 6.1.3.2 *Drivers external participants*. As the names imply, the two sections present the participants' responses to the barriers and drivers, respectively. Each section starts by presenting a table showing various statistics of the responses (avg., max, min., st.d.) before a bar chart visualizes each driver/barrier's average value and standard deviation.

6.1.3.1 Barriers external participants

Category	Barrier	Avg.	St.D.	Max	Min
Institutional	**A1:** Inadequate rules and policies to support CE strategies	7,8	1,3	9	6
	A2: Lack of a global framework for implementation	6	1,87	8	3
Economic	**B1:** Uncertain economic viability	7	1,22	9	6
	B2: Potential costs of circular activities	7,6	1,34	9	6
	B3: High investment costs / costs of project	6,4	3,13	9	1
	B4: Lack financial resources	4,4	2,88	8	1
Value chain	**C1:** Value chain adaptation	4,6	3,05	7	0
	C2: Value chain collaboration / lack of partners	6,2	1,92	9	4
	C3: Supply chain dependencies	6,2	1,64	8	4
Market/social	**D1:** Consumer behavior/perception	4,4	3,21	7	0
	D2: Silo-thinking of industries	6,8	2,05	10	5
	D3: Uncertain market demand	5,2	3,27	8	0
	D4: Tough market competition: Linear vs circular	5,6	3,44	9	0
Technological	**E1:** New technical capabilities/lack of knowledge and skills of employees	7,2	1,92	10	5
	E2: Lack of/introduction of new technology	8,2	1,48	10	6
	E3: Product design- and quality requirements	8,4	1,14	10	7
Organizational	**F1:** Conservative company culture	3,6	2,7	7	1
	F2: Lack of engagement, priorities, and/or time	5,8	2,77	9	2
	F3: Lack of knowledge and experience related to CBMs	4,6	2,7	8	2
Environmental	**G1:** Uncertain environmental benefits	4,2	2,28	7	2
	G2: Sustainability trade-offs	3,2	2,28	7	1
	G3: Lack of Key Performance Indicators (KPIs)	2,6	2,61	7	1

Table 14: Table showing statistics of the external participants' answers to the survey regarding barriers in their respective projects. (Source: Own creation).

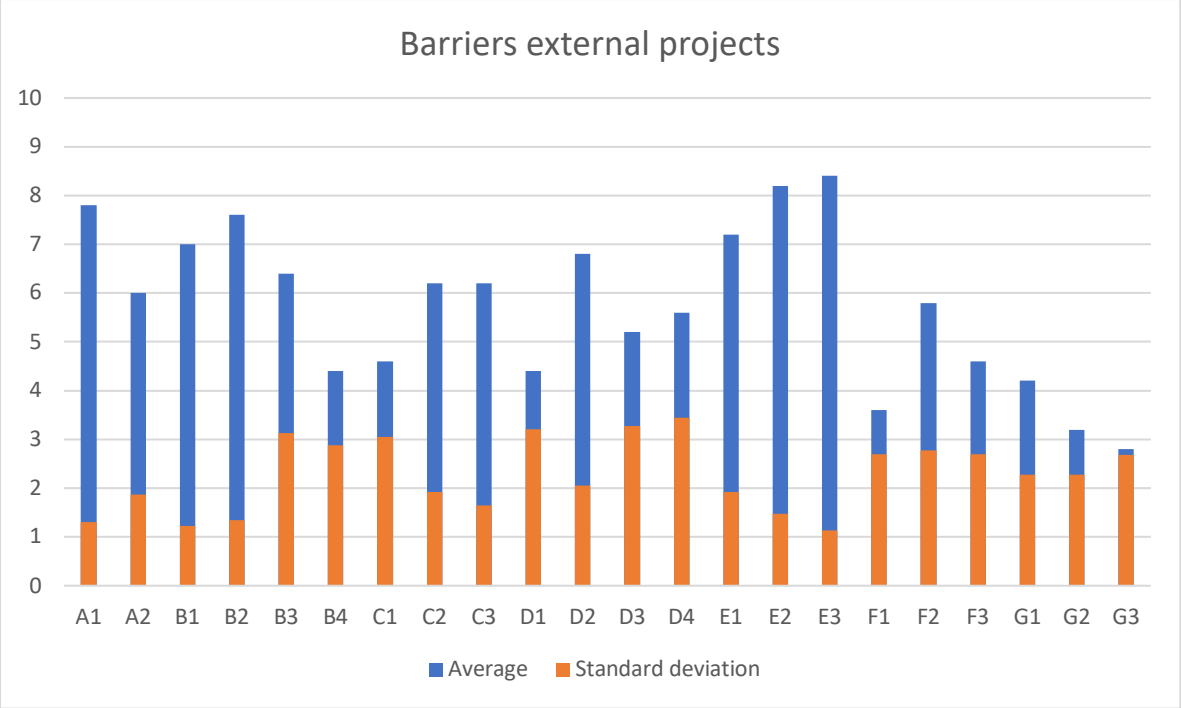

Figure 35: Bar chart showing the external participants' responses to barriers in the survey, represented by average values and standard deviations. (Source: Own production).

The external participants are representatives from additional (external) sustainability projects in Norway. A total of five survey responses were obtained from participants representing three businesses: 1) Production- and manufacturing (three projects), 2) Water supply, sewerage and waste management (one projects), and 3) Building and construction (one project). Moreover, the various projects varied a lot in terms of project length and execution. According to the responses, two projects are in the planning stages, one project is in the execution stage, and the last two projects have progressed even farther (monitoring, controlling, continuously improving).

The most prominent barrier from figure 35 is E3, *product design and quality requirements.* Apart from being the barrier with the highest average rating (8.4), it has the lowest SD of all the represented barriers (1.14). This is substantiated by looking at its maximum and minimum rating, as no responses were below 7. In this respect, both E2, *lack of/introduction of new technology* and A1, *inadequate rules and policies to support CE strategies* are notable barriers. The former has a standard deviation of 1.48 and a maximum score of 8.2, whilst the latter has the fourth-lowest standard deviation of 1.3 and a maximum score of 7.8.

6.1.3.2 Drivers external participants

Categories	Drivers	Avg.	Max	Min.	St.D.
Institutional	**A3:** Following the increasing amount of European and national standards	6,5	9	2	3,11
Economic	**B5:** Possible economic advantages	6,2	7	4	1,3
	B6: Increased price volatility on virgin materials	4,6	8	0	3,21
Market/social	**D5:** Socially increased environmental awareness	8,6	10	6	1,67
	D6: Social recognition	9,4	10	8	0,89
Technological	**E4:** Emerging technologies that support CE business (e.g. industry 4.0)	8	10	6	1,58
Organizational	**F4:** Competitiveness / differentiation	8	10	6	1,58
	F5: Company value growth	7,8	10	6	1,64
Environmental	**G4:** The global trend to minimize the environmental footprint (willingness to contribute)	9,6	10	8	0,89

Table 15: Table showing statistics of the external participants' answers to the survey regarding drivers in their respective projects. (Source: Own creation).

Figure 36: Bar chart showing the external participants' responses to drivers in the survey, represented by average values and standard deviations. (Source: Own production).

Figure 36 shows two drivers that stand out in particular: G4, *willingness to minimize the environmental footprint,* and D6, *social recognition.* Both have standard deviations below 1.0 (0.89), and score well above 9 in terms of average values. G4 reaches an average rating of (as much as) 9.6, as four out of five respondents rated this driver as 10. D6 rates 9.4 on average, having received a total of three 10/10 ratings. Furthermore, both D5, *socially increased environmental awareness,* F4, *competitiveness/differentiation,* and E4, *emerging technologies that support CE business,* are perceived as important drivers in these external projects, having obtained average scores of 8.6, 8.1, and 8.0, respectively.

6.1.4. Summary of results

The obtained results show that the partner companies were more likely to use the full scale of the rating system when they conducted the survey (at least for the barriers). This clearly affected the results, as their average answers generally scored lower than Wonderland's, and the standard deviations are higher, especially related to the barriers. Furthermore, both Wonderland and the partners score higher average values related to the drivers in the project compared to the barriers. There also seems to be a greater consensus about the degree of importance for each driver, as their standard deviations score considerably lower than the barriers. Moreover, the graphs representing barriers indicate that both Wonderland and the partners regard the *institutional, economic, value chain*, and *market/social* categories as more significant barriers to the project compared to the *organizational, technological*, and *environmental* categories (when relying solely on average values).

As for the low number of external participants that conducted the questionnaire, less attention has been given to these results. Nevertheless, the results from these external projects reveal (similar to both Wonderland's and the partners' responses) that the highest averaged ratings stemmed from the drivers, with the correspondingly lowest values for standard deviations. Table 16 and 17 show the highest to lowest ranked drivers & barriers from the representatives of Wonderland and the partner companies, based on their average values. Thus, these tables answer the first sub-question of this thesis:

SQ1: What are the drivers and barriers in Wonderland's business model transition?

Barriers Wonderland	Barriers partners
1) Uncertain market demand **2)** Potential cost of circular activities **3)** Value chain adaptation **4)** High investment costs / costs of project **5)** Supply chain dependencies **6)** Uncertain economic viability **7)** Lack financial resources **8)** Tough market competition: Linear vs circular **9)** Value chain collaboration **10)** Inadequate rules & policies to support CE strategies **11)** Lack of a global framework for implementation **12)** Consumer behavior/perception **13)** Lack of engagement, priorities, and/or time **14)** Lack of knowledge and experience related to CBMs **15)** Uncertain environmental benefits **16)** Silo-thinking of industries **17)** Lack of/introduction of new technology **18)** Lack of Key Performance Indicators (KPIs) **19)** New technical capabilities/ lack of knowledge and skills of employees **20)** Product design and quality requirements **21)** Sustainability trade-offs **22)** Conservative company culture	**1)** High investment costs / costs of project **2)** Potential costs of circular activities **3)** Value chain adaptation **4)** Consumer behavior/perception **5)** Uncertain market demand **6)** Product design- and quality requirements **7)** Tough market competition: Linear vs circular **8)** Value chain collaboration / lack of partners **9)** Supply chain dependencies **10)** Lack financial resources **11)** Lack of engagement, priorities, and/or time **12)** Lack of a global framework for implementation **13)** Inadequate rules and policies to support CE strategies **14)** Uncertain economic viability **15)** Silo-thinking of industries **16)** New technical capabilities/lack of knowledge and skills of employees **17)** Lack of/introduction of new technology **18)** Conservative company culture **19)** Lack of knowledge and experience related to CBMs **20)** Uncertain environmental benefits **21)** Lack of Key Performance Indicators (KPIs) **22)** Sustainability trade-offs

Table 16: Ranked barriers from Wonderland and its partner companies. (Source: Own creation).

Drivers Wonderland	Drivers partners
1) The global trend to minimize the environmental footprint (willingness to contribute) **2)** Social recognition **3)** Competitiveness / differentiation **4)** Following the increasing amount of European and national standards **5)** Socially increased environmental awareness **6)** Possible economic advantages **7)** Company value growth **8)** Emerging technologies that support CE business (e.g. industry 4.0) **9)** Increased price volatility on virgin materials	**1)** The global trend to minimize the environmental footprint (willingness to contribute) **2)** Company value growth **3)** Competitiveness / differentiation **4)** Social recognition **5)** Socially increased environmental awareness **6)** Possible economic advantages **7)** Following the increasing amount of European and national standards **8)** Emerging technologies that support CE business (e.g. industry 4.0) **9)** Increased price volatility on virgin materials

Table 17: Ranked drivers from Wonderland and its partner companies. (Source: Own creation).

6.2 Qualitative Findings

This section presents the qualitative findings that were obtained through both the semi-structured interviews and the structured observations. Both methods were meant to provide more deep-lying knowledge to the already observed results, in addition to obtain new insight to the project's success factors and various enablers. Because the interviews were considerably more time-consuming than the observations and yielded significantly more results, they are covered in greater depth. The section is divided into two additional subsections; subsection 6.2.1 presents the results from the semi-structured interviews, while subsection 6.2.2 presents the results from the structured observations. Finally, a summary of the qualitative results is presented in subsection 6.2.3.

6.2.1 Findings from the semi-structured interviews

The results from the semi-structured interviews conducted between April 13th and April 20th are presented in this subsection. As previously stated, the interviews aimed to provide a better understanding of the findings from the questionnaire, and to gain insight into the project's methods for overcoming the various barriers. Due to the Covid-19 pandemic, all nine interviews were conducted digitally via Microsoft Teams. The interviews lasted between 30 and 45 minutes and were attended by representatives from all but one of the project's companies. The remainder of this subsection will include an overview of the most relevant findings from these interviews, sub-divided into the following sections: *6.2.1.1) The importance of political incentives and financial support, 6.2.1.2) The importance of building knowledge, 6.2.1.3) The importance of long-term perspectives, 6.2.1.4) The importance of high-level commitment & correct mindset,* and *6.2.1.5) The importance of collaboration & knowledge sharing.*

6.2.1.1 The importance of political incentives & financial support

Out of the nine interviews conducted, a total of eight specifically stated that *political incentives* are important to help accelerate the CBM transition. Out of these eight, only one participant uttered satisfaction towards the governments' measures to support CE in the industry, pointing at existing tax deductions that help firms implement sustainable solutions. On the flip side, two interviewees stated that going circular in Norway is fairly tough. One interviewee stated that *"Norway is clearly far behind both Sweden and Denmark in terms of political incentives to support CE"*. The other interviewee pointed at the importance of

incentives that support national waste handling, thus removing our dependencies to other countries such as China to handle our waste creation. In this regard, three interviewees specifically highlighted how the government needs to take action to support recycling and waste handling within the firms' supply chains, as "*setting up large recycling stations would be extremely costly if we are to do this by ourselves*".

Another essential enabler that was mentioned frequently in the interviews is *economic viability*. In order for firms to implement sustainable solutions to their value chains, there needs to be an economic profitability as a grounded foundation, as specifically highlighted by a total of seven interviewees. The interviewees put forward various examples of economic uncertainty. One participant pointed to the unprofitability of shipping used bed components compared to creating new components with virgin materials. Two interviewees emphasized the high uncertainty related to the total costs of 'circular activities' such as repair, maintenance, and remanufacturing. On the other hand, both stated that while the economic uncertainty is clear per date, the uncertainty *"will decrease drastically, as sustainability is the future, and circular economy helps create a viable future*".

In this respect, several participants highlighted how fees, requirements, and economic support could ease economic uncertainty. One interviewee pointed to the need for fees and requirements for recycled materials to become cheaper than virgin materials, which, as stated, "*is clearly not the case today*". Another interviewee indicated the need for more venture capital, or capital to "*support research and development to a greater extent*". Nonetheless, all interviewees emphasized the importance obtaining economic support from the Research Council of Norway (Norges Forskningsråd). As one interviewee expressed, *"The government is undoubtedly generous for our project; we receive millions of NOK to support the project".*

6.2.1.2 The importance of knowledge & experience

As the project is still in an early stage, several questions are yet to be answered. This became clear through the interviews, as the interviewees came up with a diversity of personal opinions, thoughts, and ideas regarding the project's possible directions and solutions. In this respect, gaining *knowledge* and *experience* were reported by the interviewees to be important enablers.

The current knowledge and experience related to sustainability, CE, and CBMs varies greatly among the companies involved in the project. Nonetheless, all interviewees reported that the project has increased, or assumedly will increase, their knowledge on such subjects. As one interviewee stated, *"this project has initiated completely new thought processes for us involved in the project"*. Another said that *"terms such as 'sustainability' and 'circular economy' were totally unknown for us before we entered this project"*. This was substantiated by a third interviewee, who claimed that *"we have moved on from intuition to knowledge by participating in this project. Before the project, we believed that all organic materials have lower carbon footprints than petrochemical materials, which is clearly not the case"*.

Moreover, three participants pointed to how the project has increased the firms' daily focus on sustainable behavior. These three interviewees also highlighted how gaining new knowledge through the project has provided important inputs to other projects: *"The project wants to use less energy and materials, something we have in mind in other, ongoing projects"*. On the flip side, four interviewees specifically stated that they feel a lack of knowledge and/or reliable data so far in the project. This was, however, grounded (by the interviewees) in the fact that the project is still in its early phases, and all participants indicated that they feel optimistic that the project will bring the necessary knowledge and data. As stated by one interviewee, *"We do have lack of information – however, we are curious, and want to discover existing knowledge"*. As for the lack of reliable data, the interviewees expressed the need for *"more key performance indicators"*, *"less industry-based numbers"*, and *"reliable data to show the consequences of doing X or Y"*.

6.2.1.3 The importance of long-term business perspectives

Another characteristic among the interviewees is the ability to both see and create *future business opportunities*; the interviewees seemed to be unanimous that this project could create new business opportunities in the future. Although there is economic uncertainty, the potential advantages are clearly regarded as favorable among most participants. Like one interviewee replied when asked about the project's uncertain economic viability: *"Of course there is uncertainty - however, we see that there exists a great future potential for such a circular product"*. Another replied, *"It is uncertain whether the customers know exactly what they want. That is why we need to develop products and educate the public on why to choose circular and sustainable solutions – we need to create the demand"*.

Having developed such future scenarios seems to be an important enabler in the project. The participants seem to accept the fact that the project has a long-term business perspective and will not create added value tomorrow. As one interviewee stated, *"I believe that people's desire and will to upgrade and maintain their beds will grow in the future, which is why I see great potential in this project".* This was substantiated by another interviewee, who emphasized the great *potential* in a future, circular bed. Moreover, one participant highlighted the belief he/she had in circular business models in the future, stating that *"I am 100% certain that there will be a shift when circular businesses become more profitable than traditional businesses".*

6.2.1.4 The importance of high-level commitment & optimistic mindset

In 6.2.1.3, it was shown how the participants observe future value creation opportunities within this project. As a result, the project's participants seem *highly committed* to the project, with an inherent *positive attitude* toward its implementation and time invested. This is underlined by the numerous of times the interviewees used words such as 'opportunity', 'potential', and 'commitment': The analysis shows that the word 'opportunity' was used a total of 20 times, 'potential' 16 times, and 'commitment' 15 times.

When asked if changing the existing value chain is a barrier in the project, one interviewee stated that *"I don't regard this as a challenge – I regard it as an opportunity. We want to continuously improve by making our business concept more sustainable".* Another participant gave a similar answer, pointing at the firm's culture as an enabling factor; *"I see this as an opportunity. Our people are used to changes, and we are flexible in the way we work. Thus, this is not an issue for us".* This way of switching the focus from potential barriers to potential drivers and/or enablers proved to be a recurrent trend through the interviews. Like one interviewee replied when asked about the uncertainty related to potential costs for circular activities, *"I definitely see a greater potential for value creation than potential costs".*

Furthermore, the participants' high level of commitment to this project came clear through the interviews. This was especially evident when asked about the difficulties of spending time on the project. Although most interviewees revealed that it is difficult to prioritize the project

simultaneously with daily business operations, the same majority indicated a great desire to spend time on the project. One interviewee stated that *"It is difficult to spend time on the project as the running business needs to be the main priority – however, we live to become more sustainable every day. Thus, this project is always in our minds".* This was supported by another, who stated that, *"as each day demands its daily operations, it would be easy to choose to not prioritize it – anyhow, we are all very engaged in this project, which makes it easy to spend time on it".* What's more, positively weighted sentences such as *"we work continuously"*, *"we need to work harder than others",* and *"we have competent people"* were a common trend in the interviews, evidencing the participants' high-level commitment to the project.

6.2.1.5 The importance of collaboration & knowledge sharing

The final recurring theme throughout the interviews is *collaboration* and *sharing of knowledge*. As for the latter, four interviewees stated that there is some lack of knowledge and information sharing among competing firms in the industry. As one interviewee stated, *"yes, there is a lack of information sharing. As for now, there is no dialog with other competing firms".* This was affirmed by another, who stated that *"among competitors, there is clearly some sort of secrecy".*

On the flip side, three interviewees highlighted how their firms' have a 'culture of sharing'. One interviewee expressed that his/her firm *"shares a great amount of knowledge to the industry".* Two additional interviewees gave credit to the knowledge-sharing culture in the county of Rauma, one stating that *"I don't think there is a great lack of knowledge sharing. In Rauma, firms collaborate and share what we have of knowledge".* Nevertheless, most respondents confirmed that increased collaboration and knowledge sharing among competing firms could be beneficial. As one interviewee pointed out, *"It would undoubtedly be helpful to collaborate more with competing firms than we do today. If we collaborated better, we could build our brands even stronger".* Another source corroborated this; *"The day we begin asking our competitors, I am sure they will be open for collaborating – which would doubtlessly be valuable".*

Moreover, collaboration and information sharing is an important success factor within the project itself. This became apparent in the interviews, as *cooperation* and *information sharing*

were highlighted as key success factors by various interviewees. In this respect, the importance of frequent gatherings such as workshops, meetings, and presentations were emphasized. These gatherings allow for ideas and opinions to flourish and bring further motivation and belief to the project. As one interviewee stated, *"We feel both important and trusted in this project, which makes it easier to come up with our own thoughts and ideas – this is a clear motivational factor for us".* This was substantiated by another, who specified that *"people are open-minded, dear to discuss and exchange thoughts and ideas. At the same time, people are very conscientious: We want to create a product that is significantly more environmentally friendly than the product we started out with".*

6.2.2 Findings from the structured observations

This subsection is meant to provide an overview of the findings from the various structured observations (see table 7 in subsection 4.3.4). As presented in subsection 4.3.4, five engagements were carried out in the period between January 12th and April 8th. Out of these five, three engagements were solely participatory, where I either presented my (current) findings or discussed possible directions and research questions for this thesis. Although these participatory engagements increased my own understanding of this thesis, they did not contribute directly to the research or sub-question. Hence, they are excluded from this subsection. The focus is rather put on the two workshops that were attended on February 19th and March 10th.

6.2.2.1 Scenarios, issues, and ideas

While the semi-structured interviews provided discussions related to the *project*, the workshops allowed for discussions related to the *product.* As the project is still in its early phases, the workshops provided opportunities to share thoughts, ideas, and scenarios for how the final value chain and product could look like. From the non-participatory observation on these workshops, three main findings were observed:

1) *The engagement is high*
2) *The motivation is high*
3) *The ambitions are high*

The former two findings are underlined by the high attendance of representatives, as well as the great engagement during the various discussions and exercises. The exercises included brainstorming activities in the online platform, *Metro Retro*, where the participants were asked to share their ideas and thoughts on the bed's future design. Through both workshops, a multitude of ideas were brought to light, and later discussed with great enthusiasm. Moreover, all participants seemed to have incorporated a 'circular mindset', as a majority of the thoughts and ideas were directly related to principles from a CE, such as recycling, reuse, remanufacturing, increased service life, reduced waste, etc. For instance, these were some questions that were discussed:

- Is it possible to use decomposable pocket springs?
- How can the use of plastic in packaging be reduced?
- How can the total number of components in the bed be reduced?
- What materials can make the bed's service life longer?
- What materials can make it easier to decompose and recycle the bed?

The third finding is highlighted by how the participants showed a will to 'think big': All possible ideas for how a future circular bed can be designed were brought to light, with no signs of reluctance. These are some examples of thoughts and ideas that were raised:

- Use components and materials from existing waste.
- A module-based bed of which some parts or components can be changed.
- Design a bed that facilitates alternative use at the end-of-life.
- A bed with easily separated pieces and components to facilitate recycling.
- Offer the customer a swap deal that runs for several years.
- A push notification that tells you when to turn or wash the mattress.
- Create an app to build a closer relationship with the customers.

6.2.3 Summary of findings

This section has provided various findings. First, the semi-structured interviews provided a deeper insight into the obtained results from the survey, as the interviewees were asked to elaborate on the various barriers from the questionnaire. This enabled a deeper understanding of the current difficulties, as well as success factors in the project. Secondly, the structured observations contributed insight to the project's current state and how the participants work and collaborate during workshops. The latter revealed three specific success factors, as it

became clear that both the *engagement*, *motivation*, and *ambitions* are high in this project. Furthermore, the interviews provided similar findings as it was shown how the participants obtain an *optimistic mindset*, a *high level of commitment*, and a *great belief in future business opportunities*.

Moreover, the interviews highlighted four additional enablers/barriers that either assist or hinder the project at present. First of all, a majority of the interviewees emphasized the need for more *political incentives to support CBMI*. The same majority pointed out the *lack of economic viability*, as well as fees, requirements, and economic support that could ease the current economic uncertainty. On the flip side, all participants pointed at the financial support from the Research Council of Norway as an important enabler for the project's execution.

Furthermore, *obtaining knowledge and experience* came forth as a crucial enabler in the project. Although the representatives clearly have obtained knowledge through the project, the need for increased knowledge and experience was specifically mentioned by a total of four interviewees. Lastly, *collaboration and knowledge/information sharing* (both among competing firms and within the project) were two themes that recurred in the interviews. The interviewees seemed unanimous that good collaboration within the project is key for the project to succeed. Furthermore, the importance of having every firm in the value chain represented in the project was repeatedly emphasized. As for collaboration and knowledge sharing with competing firms, a majority of the respondents confirmed that increased collaboration and knowledge sharing among competing firms could be beneficial.

Table 18 summarizes the observed enablers and success factors from the qualitative results, distinguished between *phycological* and *practical* enablers/success factors. Thus, this table answers the second sub-question of this thesis:

SQ2: What are the success factors and enablers in this transition?

Phycological enablers/success factors	Practical enablers/success factors
- High engagement - High motivation - High ambitions - Optimistic mindset - High-level commitment - Belief in future business opportunities	- Political incentives to support CBMI - Economic support - Obtaining knowledge & experience - Collaboration & knowledge/information sharing

Table 18: Phycological & practical enablers/success factors. (Source: Own production).

7.0 Discussion & Analysis

The previous chapters have provided a plethora of topics to be discussed. First, the ongoing sustainability challenges were presented to better understand why the CE has been garnering increased attention worldwide. We learned about several fundamental CE principles and how circular business models and circular value chains attempt to include these principles for value generation. Section 3.4 presented the established framework for drivers & barriers that were used as a basis when gathering the empirical data. In the *Results & Findings* chapter, drivers & barriers were presented from both the WondRest project and five external projects, and SQ1 was answered by providing a table in the summary section. Following that, the outcomes of the interviews and structured observations were presented in turn, and SQ2 was eventually answered in this section's summary. This chapter will wrap up the main findings of this master's thesis in relation to the previous chapters, with the goal of *discussing* the research question in relation to the answers to the two sub-questions.

RQ: How can a manufacturer in an established value chain transition its linear business model to a circular business model?

The chapter is divided into three main parts. The first section, 7.1, intends to provide the reader with a deeper understanding of three cornerstones within this thesis: The framework of drivers & barriers, the quantitative results, and the qualitative results. The section reflects on some essential underlying aspects in order to see the various parallels discussed in section 7.2 in context. As for 7.2, this section first presents the thesis's framework of drivers & barriers. This framework is subsequently used to discuss the obtained results in context with the rest of this thesis and, most importantly, the research question. Lastly, section 7.3 provides a quick review of the lack of research within the CE research field and provides a figure that illustrates a domino effect that seems to have occurred as a result of this novel research field.

7.1 Reflections & Underlying Analysis

The deductive approach of this master's thesis contains some elements that need discussion in order to see the various results in context. First of all, the results from both the survey and the interviews are shaped by the initial results from the systematic literature review. This is an important aspect to be mindful of, as it is unclear how the results would be affected by, for instance, a completely different sample of initial literature. Secondly, in order to compare the

results from the systematic literature selection with the quantitative and qualitative results, one needs to accept that the results stem from different methodological procedures. Hence, the outcomes are based on different units of measure. In this regard, the framework of drivers & barriers highlights the most significant drivers/barriers with the *number of mentioned articles*, while the results from the survey are represented with *average values*.

This section will begin by analyzing the findings from the systematic literature review in a broader context (7.1.1). Next, some vital reflections on both the quantitative (7.1.2) and qualitative (7.1.3) results will be put forward in order to perceive a more profound understanding when comparing the results in section 7.2.

7.1.1 Underlying analysis of the selected literature

To recap, a total of 49 articles were selected to form a framework of drivers & barriers. This sample of articles consisted of various industries, article types (categories), and countries of origin. This great diversity can be argued to underline the statement in section 1.4: *CE is a fairly novel area of research*. This may explain why such a great diversity of both industries and article types had to make up the framework at the expense of similar case types to the one studied in this thesis (single case studies, furniture industries). Searching solely for circular innovation projects in the furniture industry did not produce enough results to develop a useful and comprehensive framework.

Although a variety of industries and study types are represented in the framework, the findings show that several drivers & barriers are common across sectors. This is highlighted by the barrier, *consumer behavior/perception*, which was mentioned by a total of 22 articles across nine different industries. This is further substantiated by the driver, *possible economic advantages*, which was mentioned by a total of 12 articles across six industries. This finding indicates that regardless of represented industry, firms experience many similar challenges and motivational factors in CBMIs. On the other hand, some of the results indicate the exact opposite. Looking at the articles representing ICT, all articles point to *value chain adaptation* as a barrier. This is in contrast with the three articles representing the electronics industry, none of whom highlight this as a barrier. In this regard, it is important to bear in mind that the present evidence relies solely on 49 selected articles. Therefore, additional research is required to link specific drivers & barriers to specific industries.

Moreover, the fact that the various articles stem from a total of 19 different countries requires discussion. The results show that 12 European countries, four Asian countries, one African country, one South-American country, and one North-American country are represented. In other words, the articles stem from countries all over the world. This is an important fact to bear in mind, as culture, government power, and infrastructure all play a part for firms who wish to transition towards CBMs. This may explain why some of the results from the literature review vary as much as they do from the drivers & barriers in the WondRest project. However, this is elaborated further in section 7.2.

Lastly, the framework clearly shows how the number of detected barriers are in excess of detected drivers. This was evidenced when searching for relevant articles in Elsevier Scopus, as the search *Circular AND "Business model" AND barrier* provided almost twice as many hits as *Circular AND "Business model" AND driver*. Although there is no empirical *evidence* explaining this difference, one empirical *finding* is that the words 'drivers' and 'enablers' often are used interchangeably in the reviewed literature. This is substantiated by the numerous articles that defined a driver as an enabler and vice versa. As for this, it can be argued that future research on related topics needs to be more clear in the exact definitions of these two words, as the unclear definitions, per date, contributes to increased misunderstanding in what is already a restricted area of research.

7.1.2 Underlying analysis of the quantitative results

The results from the survey make up the quantitative results of this thesis. As previously described, the survey was dispatched to three various groups of respondents: Participants from Wonderland (7), participants from the partner companies (9), and participants from external projects (5). This subsection will discuss these results from a broader context.

As for the obtained answers from the participants of the WondRest project (i.e., Wonderland and partners), one of the most interesting findings was the degree to which the drivers were ranked higher than the barriers. Furthermore, the WondRest participants appear to be more unified about the influence of the drivers, as their standard deviations were substantially smaller compared to the various barriers. The analysis has identified three possible reasons for this:

1) The project is in its early phases
2) The participants have an *optimistic mindset*

The former refers to the fact that motivating elements are easier to comprehend at the start of a project, as opposed to various barriers that may arise as the project progresses. As the project has completed one out of a total of five work packages, there are several barriers that the participants have no prerequisites to answer. This goes for, among others, *uncertain economic viability, new technical capabilities,* and *sustainability trade-offs.* Consequently, the participants had to assess several *future scenarios* when answering the survey, which clearly affected the standard deviations. On the one hand, one can argue that this is a limitation of the results, as the answers would (likely) be more unified if the project was in its finalizing stages. On the flip side, it provides an indication of the participants' view on several future scenarios, which gives an indication of the uncertainty, the mindset, and the belief in circular innovations. Furthermore, it allows for the comparison of results at a later stage in the project, providing that a similar study is repeated subsequently at a later period.

The second point is concerned with the project participants' mindset. As proven from both the semi-structured interviews and the structured observations, the participants have a generally optimistic mindset and show a great belief in future, circular business opportunities. These findings support the overall results from the survey, as drivers such as *company value growth, economic advantages,* and *competitiveness* all received high scores from the WondRest participants. Although this mindset is not solely why all drivers scored high, it seems to demonstrate a pattern that is further elaborated in section 7.2: The participants perceive (in general) the positive motivational factors as more important to the overall project than the possible pitfalls and barriers.

7.1.3 Reflections of the qualitative results

The most important thing to remember when reviewing and interpreting the qualitative results is that they are affected by the outcomes of two prior results: 1) the results of the literature analysis (framework), and 2) the quantitative results (the survey). This is important to be aware of since there is a good chance that the outcomes of the interviews would have looked different if the research approach had been different.

In this context, one may ask the question: What would the results look like if, for example, open interviews were conducted as a first step in the research process? Today's results point to the importance of, among other things, knowledge sharing, high ambitions, and financial & political support, where the issues discussed are clearly influenced by the framework and the many categories (institutional, economic, value chain, etc.). It is crucial to note that this framework, with its selected categories, is not a final conclusion that addresses all possible drivers and barriers. Furthermore, there are several ways to categorize these drivers and barriers. A different formulation of categories and/or drivers and barriers will most certainly have a varied effect on the interview outcomes.

It was evident from the interviews that the interview participants agreed with several of the survey results. This could be due to two factors: 1) the participants honestly felt that the presented results accurately represented reality, or 2) the participants experienced a type of prejudice when presented with current data. The latter is especially vital to be aware of, as the probability of bias is a clear weakness with the chosen approach of this master's thesis. On the other hand, this theory is undermined by the fact that most participants expressed a great inclination to disagree with the quantitative results (further elaborated in section 7.2). This underlines the need for triangulation in order to add depth to previously existing results rather than relying solely on the outcomes of one set of research results.

7.2 Comparison of Results

By having perceived a deeper understanding of the obtained results and findings in this thesis, this section aims to compare these results based on the framework of drivers & barriers (presented in table 19). Hence, the section is divided into seven subsections, where each subsection represents a category from the framework. As we will see, there are several analogies and correlations that can be found between the various data, providing clarity to the research question of this thesis.

FRAMEWORK OF DRIVERS & BARRIERS		
Categories	**Barriers**	**Drivers**
Institutional	Inadequate rules and policies to support CE strategies	Following the increasing amount of European and national standards
	Lack of a global framework for implementation	
Economic	Uncertain economic viability	Possible economic advantages (cost efficiency, new revenue streams, gaining profit)
	Potential costs of circular activities (repair, remanufacturing, etc.)	Increased price volatility on virgin materials
	High investment costs / costs of project	
	Lack of financial resources / difficulty securing funding	
Value chain	Value chain adaptation	
	Value chain collaboration / lack of partners	
	Supply chain dependencies	
Market/social	Consumer behavior/perception	Socially increased environmental awareness
	Silo-thinking of industries	
	Uncertain market demand	Social recognition
	Tough market competition: Linear vs circular	
Technological	New technical capabilities/lack of knowledge and skills of employees	Emerging technologies that support CE business (e.g. industry 4.0)
	Lack of/introduction of new technology	
	Product design- and quality requirements	
Organizational	Conservative company culture and/or general reluctance to change	Competitiveness / differentiation
	Lack of engagement, priorities, and/or time	Company value growth
	Lack of knowledge and experience related to CBMs	
Environmental	Uncertain environmental benefits	The global trend to minimize the environmental footprint (willingness to contribute)
	Sustainability trade-offs and/or problem shifting	
	Lack of Key Performance Indicators (KPIs)	

Table 19: : Framework of drivers & barriers. (Source: Own creation).

7.2.1 Institutional

In subsection 3.1.1, it was demonstrated how industry (bottom-up) and government (top-down) incentives must occur simultaneously in order to implement the CE on a broader scale. The theoretical framework of this thesis revealed how a majority of authors identify institutional barriers (top-down) as clear impediments. The survey results in the WondRest project, on the other hand, demonstrate the exact opposite: Institutional barriers do not appear to have a significant negative impact on the project's potential. The latter is partly at odds with what came out of the interviews: More political incentives are needed to encourage investment in the CE and sustainability, as the existing lack of such incentives exacerbates the already uncertain economic viability of an already uncertain business climate.

One point worth mentioning is the numerous countries represented in the various articles. As previously stated, the articles represent a total of 19 countries spanning five continents. As a result, there are a plethora of different regulating bodies, each of which (as previously said) follows distinct standards to encourage investment in circular economy and sustainability. It is easy to conclude from the examined literature that there are significant flaws in political incentives around the world that encourage businesses' attention to the circular economy and sustainability. Although international organizations such as the European Union have launched a number of initiatives to support the circular economy and sustainable industry during the last ten years, it may appear that these initiatives are still too new to be useful in assisting businesses in their transition towards CBMs.

Looking at measures that support the CE and sustainable industry in Norway, subsection 3.1.3 revealed that, in addition to its need to comply with the European Union's frequent laws and directives, Norway seriously began its efforts towards industrial sustainability in 2015 with the formation of the *Expert Committee*. This recent investment in Norway bolsters the preceding argument: It takes time for major political efforts to create upheaval. In light of this, it is interesting to note that both the literature and the survey findings point to the desire/obligation to *follow an increasing amount of European and national standards* as a key motivator for investing in CBMIs. This shows that, while policy initiatives to support a circular society are still too new to have a significant impact on businesses, an increasing

number of them are choosing to be proactive in their actions because they perceive the value of the investment in the long run.

Finally, in light of the findings of this thesis, it is necessary to underline the support provided by the Norwegian Research Council. The Research Council provides financial support to Wonderland and their representatives, covering millions of NOKs that firms in countries with no financial support would have to fund on their own. The critique of political incentives that encourage sustainable investment must therefore be viewed in light of this support, which may appear to have had an effect when the WondRest representatives answered the survey. The results of the external projects, on the other hand, support the findings of the literature review and the interviews: There are few political incentives to support a sustainable and circular economy, both globally and in Norway particularly. In other words, even though incentives come from the industry (bottom-up), there is still a shortage of incentives coming from governments (top-down).

7.2.2 Economical

Based on the literature review, it was evident that economic barriers are among the most significant barriers to CBMIs. This is corroborated by the survey, which found that both *potential costs for circular activities* and *high investment costs / project costs* received high average values.

The literature identifies *uncertain economic viability* as a key barrier. Existing theory (particularly EMF) indicates a lot of potential for economic viability for organizations seeking to incorporate circular activities into their value chains. On the other hand, there is a clear absence of actual success stories, which raises natural concerns about the CE's feasibility. We see this in the survey results from the external participants, where *uncertain economic viability* is ranked as one of the most significant barriers in their particular projects.

Given this, and the fact that there have been few success stories, it would be logical for the WondRest participants to see this as a key barrier. Nonetheless, the survey results show that Wonderland and its partners rank low on this barrier compared to the two highest-ranked economic barriers. This brings us to an interesting discovery from the interviews:

The WondRest participants have an optimistic mindset and see the economic potential of a future circular business model. Despite all participants recognizing the uncertain economic viability of such a business model, they opt to focus on the prospective benefits rather than the potential drawbacks. In other words, rather than seeing the barrier as an impediment to the project, the participants opt to perceive it as a motivator.

In light of this, it is worth mentioning the two highest-ranked barriers at Wonderland: *Potential costs for circular activities* and *high investment costs/project costs*. If the preceding argument holds, it will be reasonable to argue that these two barriers should have lower average values as well. However, there is a significant distinction between these three barriers: Uncertain economic viability is mostly about the market viability of the end product, which the participants have made clear they believe in through their belief in the future circular market model. Potential costs for circular activities, on the other hand, are costs associated with (as an example) the establishment of larger recycling facilities that the company must undertake as part of the value chain. Without financial assistance, this will be a high cost for the firm(s), emphasizing the significance of a simultaneous top-down and bottom-up approach.

Similarly, project expenses are concerned with the costs that may occur when one becomes more knowledgeable about the decisions and changes that must be made in the value chain. Given the insecure business environment that Wonderland and its partners are moving into, this is an undeniable barrier in the project. Furthermore, the results from the survey show that the barrier, *lack of financial resources*, ranks low relative to the two highest-ranked economic barriers. This emphasizes the significance of the Norwegian Research Council's assistance. Political forces play a critical role in lowering the number of barriers to circular business innovation, particularly regarding economic concerns (as these are the fundamental factors that must be in place for a company to survive).

7.2.3 Value chain

In addition to being an innovation project focusing on introducing CE in practice, the WondRest project is a project with a strong focus on the existing value chain and the partners' common opportunities. The inclusion of the entire existing value chain is pointed out by most interviewees as being one of the most important success factors in the project. At the same

time, this creates new challenges, as seen by the survey's high results for the barrier *value chain dependencies*.

The latter refers to reliance on existing and potentially new partners. Because the WondRest project represents the complete value chain, the partners rely on one another for the project's success. On the one hand, the inclusion of all partners throughout the entire value chain generates new concepts and ideas from varied perspectives, as evidenced by the various workshops, meetings, and presentations. Wonderland has the opportunity to observe challenges from their partners' many views, and concerns that might not normally be discussed are discussed. On the other hand, while each partner company specializes in bringing a certain component to the beds, it may place some constraints on the project in terms of material composition. In this regard, the importance of innovation must be emphasized: In order for the WondRest initiative to improve, all partner organizations must strive to improve themselves. This includes asking questions such as "how can we receive, produce, and deliver components to the bed that minimizes our total environmental footprint?".

This leads us to another critical point: The importance of external material suppliers. As the project is still in its early phases, various research is yet to be performed. This includes mapping numerous external suppliers (some of whom are foreign suppliers), as well as the complete environmental impact from the extraction, manufacture, and transportation of these external resources and/or goods. Understanding and involving these actors will be critical success elements for the project's progress and result. In other words, incorporating the entire value chain is a critical success factor, as long as all actors are prepared to think big, think new, and not limit themselves to established production patterns and simplistic solutions.

So far in the project, the participants appear to agree on the significance of thinking big and thinking innovative. At the same time, the participants admit, through their questionnaire responses, that large changes to the existing value chain are difficult (*value chain adaptation*). This is, of course, related to the ambiguity surrounding new future partners in the value chain and if these partners exist at all. In light of this potential dilemma, the participants exhibit the ability to think optimistically, think long-term, and believe in the future circular business model through the interviews. This confirms the success factor

indicated in subsection 7.2.2: The participants choose to turn the issue around by seeing opportunities rather than impediments in the project.

7.2.4 Market/social

According to the findings of the literature review, one of the two most significant barriers to CBMIs is *consumer behavior/perception*. *Uncertain market demand* and *tough market competition* closely follow, indicating that market factors play a significant influence when organizations examine new, circular business opportunities. Knowing the customer's needs and desires is essential for a financially sustainable business plan. As Teece (2010, p. 172) described, these wishes and needs will be based on management's hypotheses about what the customer wants. In a circular economy, the terms 'hypothesis' and 'assumption' are strengthened, as there is obvious uncertainty regarding customers' future wishes and needs for sustainable and circular products.

The latter aspect is emphasized by Wonderland's highest-ranked obstacle (and the partners' second-highest ranked) from the survey: *Uncertain market demand*. Given the unstable business environment that Wonderland and its partners are aiming towards, there is no doubt that market demand for a sustainable, circular bed is fraught with uncertainty. At the same time, it is necessary to note the current state of the WondRest project, which (as previously said) can be considered to be in the start-up phase, a phase in which thoughts and ideas have grown till now. Customer demands and the requirements for a circular product will be tested first in work package H4. As a result, it can be firmly argued that a better understanding of market needs will emerge later in the project. This argument is strengthened when considering the low average values of the external actors' barriers to *uncertain market demand*. Three of the five participants that responded to the survey stated that their project has reached the execution phase or even further. This *could* imply that some of these external projects conducted market research and were confident in the need for their product, causing them to give low values to this barrier.

Although *uncertain market demand* is an obvious barrier in the project, the participants, again, show an optimistic mindset and the ability to turn a potential barrier into a potential opportunity. This is underscored by all future market and demand scenarios offered with tremendous passion by the various interview participants. In many ways, one of the

interviewee's statements reflects this optimistic approach and willingness to accept the existence of uncertainty while still addressing the problem: *"It is uncertain whether the customers know exactly what they want. That is why we need to develop products, and educate the public on why to choose circular and sustainable solutions – we need to create the demand".*

Furthermore, it is interesting to see how the barrier, *consumer behavior/perception,* has received quite high values from both Wonderlands' and the partners' representatives. This barrier is primarily about society's overall "take-make-use-throw"-mindset, as well as people's attitudes regarding circular and sustainable products, the latter of which is strongly related to the previously discussed barrier. When it comes to linear thinking in society, the majority of the interviewees say that the present "take-make-use-throw"-approach reigns supreme. The Circularity Gap Report of 2020 demonstrates this, revealing that Norway has one of the highest consumption rates in the world. In light of this, it is worth noting that the driver *socially increased environmental awareness* obtained high average ratings from both Wonderlands' and the partners' representatives. This implies that, while both Wonderland and its partners believe that society's current use-and-throw mentality is a problem for circular enterprises, there are signs that buyers are increasingly demanding sustainable products. This serves as a motivation in the WondRest project since the participants anticipate that this tendency will continue in the next years. Political factors are crucial here because rules and regulations must make it simpler for the majority of people to adopt more sustainable choices.

Moreover, it is worth noting that the barrier, *silo thinking of industries,* earned such low average values from both Wonderland and the partners. This is consistent with the findings of the interviews: For long decades, the strong relationship between Wonderland, the partners, and other surrounding companies in Rauma municipality has maintained strong communication and cooperation. This is highlighted as an essential contributor to both Wonderland and the partners involved in the WondRest project, emphasizing the importance of openness and communication. In this regard, it is worthwhile to examine similar findings from external initiatives, where this barrier ranks among the greatest. This shows, as Wonderland's representatives also mentioned in the interviews, that there is a general lack of information sharing in the industry. Given the lack of research and actual CE applications in society, it might be claimed that increased information sharing could be a significant

contributor to reducing existing uncertainty, leading to more enterprises deciding to invest in circular solutions.

Finally, it is important to emphasize the barrier, *tough market competition*, which refers to the difficulties of competing against linear companies. As several interviewees pointed out, there is stiff rivalry from both domestic, but especially foreign, bed manufacturers. This is because there is a lack of common regulations that contribute to all competitors producing and delivering goods on the same terms. This includes, for example, varying criteria for environmental certifications as well as varying regulations for minimum wage and working conditions. As the interviewees point out, it is still too expensive to choose recycled materials in production compared to virgin materials. Simultaneously, fewer criteria for employees' minimum wages are imposed in numerous competitive countries, implying that rival products can be produced for much lesser sums. Similar to the preceding subsection, political incentives, requirements, and norms play a major influence here, both at the national (Norway) and international levels (EU).

7.2.5 Technological

The reviewed literature suggests that *inadequate rules and policies to support CE* is the main existing barrier for firms transitioning towards circular business models. As profit opportunities are central in top-management decisions, the lack of obvious economic prosperity may have left many top management CE initiatives absent. A potential outcome of this is the absence of technological capabilities and necessary machinery to promote CE, as the top management hesitate to invest in these areas. This is clear from the technological barriers, highlighted in the reviewed literature as some of the biggest barriers in CBMIs.

In light of this, it would be natural to assume that Wonderland and their partner companies also saw technological barriers as some of the biggest challenges in their project. Nevertheless, the results from the survey, and later confirmed through the interviews, show that these barriers are not seen as the most significant in the project. Two things, in particular, stand out as explanatory causes in this case. First, the project is in its early stages, and technological barriers are frequently encountered ‘hands-on' later in the project period.
In this context, the relatively high average values of the external projects on technological barriers are intriguing. As previously stated, three of the five external projects have

progressed to the execution phase or even further. Hence, it can be assumed that several of these projects have experienced hands-on technological barriers, which is in line with the findings from the literature.

The second aspect that may explain the low average values of technological barriers in the WondRest project is the participants' positive attitudes and high ambitions. The latter is a key component to emphasize because the participants' abilities to think big and innovative help them understand that large technological changes may be required to accomplish their great ambitions. Furthermore, a majority of the participants focus on the opportunities that lie in future, potential technology, and not the challenges this may entail. A *majority* is a keyword here, as it is clear that some partners consider *product design and quality requirements* as a relatively large barrier in the project. We can observe this from the survey results, where this barrier earned high average values from the partners. This is explained by the fact that partner firms like Recticel, Plasto, and Måndalen Trevare have production lines tailored to certain materials with specific quality requirements. In other words, the addition of (say) recycled and/or reused components could provide problems for existing production lines. In this respect, this thesis points out some dominant choices of direction that need to be taken in order to proceed in the project.

First of all, a decision has to be made on whether the final product should consist mainly of biological nutrients (consumables), technical nutrients (durables), or a combination of the two. This choice is regarded as vital, as it entails some important constraints and conditions for the possibility of future business models. To recap, a product consisting of biological nutrients can safely be returned to the biosphere as these nutrients are naturally biodegradable. Technical nutrients, on the other hand, are not naturally biodegradable and should be designed in a way that makes them reusable.

Because of the complexity of materials in Wonderland's beds, deciding the 'optimal' material selection in a sustainable and circular bed is a difficult choice to make. Wonderland's reference bed consists of both naturally degradable (wood), and non-degradable materials (plastics, latex, steel). A vital question that needs to be asked when assessing which materials to keep, or replace, is whether the choice of a specific material decreases or increases the *comfort* and *quality* of today's beds. Reaching a 50% reduction in a bed's total environmental footprint would be a substantially easier task if the factor, *customer satisfaction*, was

irrelevant. As this factor stands out as the (probably) most important factor when deciding what materials to include, it puts some clear constraints and limitations on the existing possibilities in terms of material selection.

In this respect, some technical nutrients undoubtedly provide a significantly greater quality than their naturally degradable alternatives. Hence, they may be regarded as favorites in terms of quality and comfort. This goes, as an example, for the plastic components and the metal-pocket springs, whose strong, robust, and durable properties make them stand out as favorable options when designing a high-quality bed. On the one hand, producing a bed consisting of fully renewable and/or recyclable materials that can safely be returned to the nature may sound like the optimal idea from a sustainability perspective. On the other hand, the EMF proved with its butterfly diagram that, if handled correctly, technical nutrients may very well provide great value from a CE perspective. This is substantiated by the *Power of the Inner Circle*, which states that, regardless of nutrient type, generating tight circles can create considerable savings on both materials, labor, energy, capital, and environmental externalities.

As previously stated, governmental forces play a significant role in assisting enterprises that choose to invest in a circular and sustainable manner, in this case by purchasing recycled/reused materials and components. Companies rely on the fact that 1) recycled/reused materials are much less expensive than virgin materials, and 2) the new materials are compatible with the current production line. Points 1) and 2) are currently unresolved difficulties for several of the partner companies. At the same time, it is vital to note that greater knowledge and experience could play a significant role, as it is still uncertain what circular opportunities exist and what the actual costs will be.

7.2.6 Organizational

The qualitative results in this thesis, and the discussion, have pointed out several success factors that can be linked directly to psychological success factors within the organization. This applies, to name a few, to high ambitions, an optimistic mindset, and the ability to think big and innovatively. These factors seem to have influenced the survey's results, in which both Wonderland and its partners rated organizational barriers as low on a general basis.

The barrier *conservative company culture* is a prominent illustration of this, with Wonderland's participants giving it the lowest average value of all the barriers. This underlines the findings from the interviews: Wonderland, as the initiator of the WondRest project, has a strong desire to improve, think new, and observe new business opportunities in the circular economy. This is possibly the most crucial success factor in the WondRest project, as Wonderland has declared a desire to flourish in this new business climate since the project's inception. To succeed, they made it crystal clear that they wanted to integrate the whole present value chain, with each partner company being made aware of their contribution to the project's success. This appears to have impacted the project partners' motivation, as evidenced through the various observations.

Wonderland and its partners' strong desire to improve and succeed with new business ideas is evident through the high average values of the organizational drivers in the survey. Both *competitiveness/differentiation* and *company value growth* are pointed out as being important motivating factors by both Wonderland and the partners, indicating that the project participants have knowledge of and understand the importance of continuous improvement and business innovation to stay competitive.

In terms of knowledge, there was widespread agreement in the interviews that the project has provided the participants with new knowledge concerning CE. At the same time, it was mentioned that there is a shortage of knowledge, which may be attributed to the novel research environment of CE, as well as the uncertain business climate into which Wonderland and its partners enter. On the one hand, this lack of information and expertise can be viewed negatively, as there are many unknowns and uncertainties in the project. At the same time, as Wonderland and its partners have demonstrated throughout the project, there is a similar dearth of knowledge and expertise for all organizations who desire to embark on such a circular business innovation journey. This brings up the possibility of gaining a competitive edge, as Wonderland and its partners, as stated in their project goals, want to be seen as an example of how a circular business idea may be implemented successfully. In other words, rather than being viewed as barrier to the project, the lack of knowledge and expertise is leveraged as a competitive advantage.

7.2.7 Environmental

According to the survey results, there is no mistake about what is the most crucial driver in the WondRest project: *The willingness to minimize the environmental footprint*. This is further supported by survey findings from the external projects, where this driver obtained the highest average values. This *may* indicate that companies (in Norway) that want to switch to circular value chains have environmental issues as a major motivating factor for this change (however, as the results are based solely on a total of six various projects (WondRest + five external), this findings is not regarded to be generalizable for a larger population of cases.) This reinforces the image formed by the interviews and observations: Wonderland and their partners are driven to be responsible by making environmentally conscientious decisions, both now and in the future.

This desire seems to have reflected the environmental barriers in the survey, where all three barriers have received low average values from both Wonderland and the partners: *Uncertain environmental benefits, sustainability trade-offs*, and *lack of KPIs.* Based on the empirical findings, three specific aspects stand out as likely reasons of these low values:

1) SINTEF and NTNU's roles as knowledge providers
2) The participants' continuous search for new knowledge
3) The participants' psychological success factors.

The former was clear from both the observations and the interviews; SINTEF and NTNU's theoretical foundation have proved crucial to bring about abundant discussions about the bed's future circular possibilities. Point 2) comes into play here, as these abundant discussions would never have been possible if the participants themselves were not motivated and willing to acquire this knowledge. Moreover, point 2) is closely related to point 3), where precisely the participants' high-level commitment, high engagement, and optimistic mindset allow them to perceive future prospects in the face of barriers.

On the other hand, we observed that *uncertain environmental benefits* received the highest average score of these three barriers. This is due to the fact that the project is still in its early stages, with only one environmental analysis completed thus far. The performed LCA did provide a rough assessment of the entire environmental footprint of one reference bed. However, as the analyzes contained several simplifications, it can be argued that more

thorough analyzes are required to conclude on the exact environmental footprint of today's reference bed. This may subsequently help to assess which components in today's bed that should be given extra attention when choosing the types of materials for a future, circular, bed.

The choice of which materials to include is further decided by the choice of the circular business model that Wonderland and its partner companies aim for. Oppositely, the choice of materials in the bed may be a deciding factor when assessing a future business model. As presented in subsection 3.2.3, there are various strategies and business models to choose among when transitioning towards circular business models & circular value chains.

First of all, Wonderland and its collaborating companies need to decide whether the bed's input should be based on a *Circular Supplies* or a *Resource Recovery* business model. The former business model focuses on providing completely sustainable, recyclable, and/or biodegradable resource inputs, while the latter is concerned with recovering resources and energy. Taking the presented theory, empirical background, and observations/interviews into account, it can be argued that both *Måndalen Trevare*, *Plasto AS*, and *Recticel AS* should take inspiration from one of (or a combination of) these business models for the future bed to consist of the optimal (in a CE perspective) materials. This is because all three companies produce and deliver sizeable components that make up the bed, and providing either fully renewable, recyclable, biodegradable or recovered materials will unquestionably influence the bed's total environmental footprint.

As for Måndalen Trevare, their delivery of wooden components eases their possibilities of delivering fully renewable and biodegradable inputs to the bed, as wood is a natural biodegradable product. Plasto, on the other hand, delivers non-biodegradable plastic components and may thus aim for a business model in the direction of resource recovery, where recovered plastics are reused and remanufactured. As for Recticel, their production of mixed synthetic/natural polyurethane foam to the bed's mattresses consists of a wider variety of materials, some of which may be classified as naturally biodegradable, others not. As for this, and for some hygienic factors that need to be considered, the possibilities for circular options are somewhat restricted. However, this does not limit the possibility of designing for *repurpose* or *recycle,* in addition to reducing the total waste creation, using pure, quality materials and renewable energy throughout the production process.

Furthermore, the materials that eventually make up the bed will play a crucial role in the final choice of the circular business model that Wonderland seeks. In this respect, the theory chapter (3.0) presented further three circular business models that need to be assessed in the light of Wonderland's future opportunities:

1) *Product Life Extension*
2) *Product as a Service*
3) *Sharing Platforms*

To recap, the former is based on the principle of extending products' lives by implementing activities such as repair, remanufacturing, and upgrading to the current value chain. A discussed idea during both attended workshops was whether a module-based bed could be a possible solution. By assembling the bed to consist of replaceable 'modules', or parts, Wonderland could (potentially) introduce new activities (e.g., repair, remanufacture, upgrade) to their business model, keeping the finalized bed in a consecutive cycle for a longer period of time. Theoretically, this could create additional revenue streams as Wonderland ensures their beds to stay economically useful for a longer period of time. At this stage of understanding, the Product Life Extension business model stands out as a favorable alternative. However, the extent to which it is possible to create a fully module-based bed is still unknown.

The second and third alternative business models are respectively related to *Product as a Service* and *Sharing Platforms.* While the former is based on a pay-for-use system of leased (or rented) products, the latter is based on collaboration among the product users (see subsection 3.2.3). Although both alternatives can be discussed as possible options, there is doubtlessly a need for a more thorough market analysis to decide whether such business models could be economically viable. A potential business model will only be successful if it fits *customer needs*, a factor that needs to be explored further (and is planned to be explored) in the WondRest project. In this regard, Møbelringen, along with other furniture merchants, plays a crucial role in promoting and facilitating circular and sustainable products in their collections. In this respect, the Product Life Extension business model stands out as the business model that differs the least from the linear model of today, as customers maintain ownership of their products (here: Beds).

Regardless of what strategy the project aims for, some important principles are vital to bear in mind when deciding. The ladder of circularity is highly relevant in this respect, as it may be used as a guidance in the decision process. Moreover, in order to choose the most desirable option on the ladder, the design phase is arguably the most crucial phase when opting for circular products. This is because this phase may facilitate, among others, the use of fewer materials and components, a long service life, the use of reused materials, and the possibility for decomposition. Lastly, as stated, the results indicate that more thorough analyzes of each firms' existing value chains are required in order to 1) detect the bottlenecks in the value chains in terms of environmental damage and 2) to figure out the optimal circular business model for each firm.

7.3 The Consequences of a Novel Research Field

As stated in section 3.4, the reviewed literature provided one fundamental finding: The CE is a fairly novel area of research, and there is no universal definition of the CE, its principles, objectives, or outcomes. This is regarded as a fundamental finding, as the CE is the core concept that permeates this thesis. This general disagreement seems to have affected the practical implementations of the CE concept, as policymakers will hesitate to promote CE actions as long as there exists uncertainty related to its outcomes and objectives. Hence, without top-down support, firms will, in turn, hesitate to take action as a result of an uncertain business environment. The lack of CBM initiatives, especially the lack of CBM success stories, is highlighted in the literature by a large number of authors pointing at the various difficulties that firms experience when trying to innovate towards circular solutions. Hence, this thesis see the following domino effects as a result of the novel research field of CE:

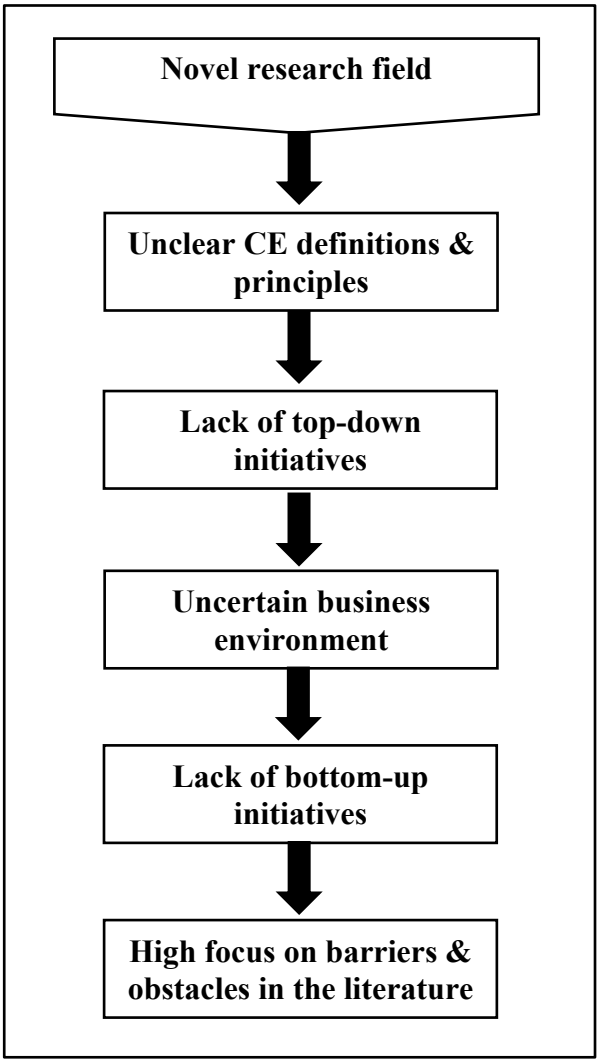

Figure 37: The domino effect occuring as a result of a novel CE research field. (Source: Own production).

8.0 Conclusion

8.1 Concluding Summary

This thesis aimed to answer the following research question: **How can a manufacturer in an established value chain transition its linear business model to a circular business model?** To achieve this, two sub-questions were designed. These two sub-questions examined the drivers, barriers, and enablers/success factors in a specific project, the *WondRest project,* which aims to implement a circular business model in an established value chain.

As presented in chapter 6 - *Results & Findings*, this project contains a wide range of drivers, barriers, and enablers/success factors. Nonetheless, the discussion demonstrated that, while specific drivers, barriers, and/or enablers can be identified as the most influential, it is the *interconnections* between them that either drive or hinder organizations in their CBMIs: From top-down, policymakers need to promote environmental, social, and economic awareness in the society, in addition to facilitating the economic prosperity of CE actions in the industry. As a result, 'circular services' might become a profitable choice for both the supply and demand sides, enhancing enterprises' desire to integrate circular solutions in their value chains. Furthermore, given the current CE research and business environment, firms need to regard barriers as opportunities rather than hindrances: Create the drivers and enablers within the existing value chain by creating engagement and motivation, see long-term opportunities, and include each partner in the present value chain for enhanced collaboration.

Hence, based on the results from this thesis, we can conclude that the following four factors need to be in place in order for a manufacturer in an established value chain to transition its linear business model to a circular business model:

1. **Include all present value chain actors** in the transition process, and ensure that all actors play an important part in the whole process.
2. **Create and obtain knowledge & experience** that allows for the identification and discussion of circular options within the present value chain.
3. **Develop and maintain a beneficial mindset** that allows participants to see barriers as opportunities rather than hindrances.
4. **Strive for continuous improvement;** prepare to think big and innovative, and do not let established production patterns limit the creativity of new ideas and solutions.

8.2 Suggestions for Future Research

Future research of interest includes performing a similar research study at the later stages (or at finalization) of the WondRest project. This could yield interesting findings to see whether or not the indicated drivers, barriers, and enablers change during the project period. This is especially relevant for future barriers such as *customer behavior/perception* and *lack of partners,* as upcoming events in the project will create a greater consensus on the barriers' existence. Moreover, for the results of this thesis to be regarded as generalizable, similar case studies must be conducted in order to either prove or disprove the generalizability of the findings. In this respect, an inductive research approach on a similar case study could prove valuable to evaluate if the results are consistent with the outcomes of this deductive approach (alternatively, how much the results differ). Lastly, as stated numerous times throughout this thesis, there is an urgent need for more research on the CE in general. This could aid in minding the current theoretical gap, which, as previously stated, is crucial for the CE to blossom in society.

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Circular Business Models in the Manufacturing Industry - a Mixed Method Approach

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