Eliisa Sivula

Barriers and Enablers to Circular Business Model Innovation:

Finnish Forest Industry

School of Management
Master’s thesis in Economics and Business Administration
Strategic Business Development

Vaasa 2021

UNIVERSITY OF VAASA
School of Management
Author: Eliisa Sivula
Title of the Thesis: Barriers and Enablers to Circular Business Model Innovation: Finnish Forest Industry
Degree: Master of Science in Economics and Business Administration
Programme: Strategic Business Development
Supervisor: Paula Linna
Year: 2021 **Pages:** 106

ABSTRACT:

The **aim** of the study is to broaden the research area of circular business model innovation (CBMI) for the Finnish forest industry, and furthermore identify key barriers and enablers together with their impacts upon CBMI.

The **theoretical background** of the study is examined through two key research areas: CBMI, and barriers and enablers. The building blocks of CBMI (circular economy, business models and business model innovation) are briefly introduced to give a clear image of the current state of the literature. The two research areas are seamlessly merged into a coherent framework and fulfilled through examining empirical data.

A multiple case study is chosen as the **methodological frame,** from which empirical data is assembled and then examined. Two case studies are formed from a sample set of ten Finnish forestry companies. The companies are divided into two coherent clusters: Small and Medium Enterprises (SMEs) and Multinational Corporations (MNCs). With an abductive logic that infers reasonable explanations for observed data, the cases are further analyzed for the purpose of discovering new findings as well as comparing the situation to the current research theories.

The **key findings** of the study include multiple contributions to CBMI research. The process of CBMI was identified as facing multiple challenges due to both external and internal barriers affecting the Finnish forest industry. The barriers hindered the CBMI process by creating additional delay and uncertainty, as well as problems within planning, piloting and the scale-up phase. To a certain extent, the CBMI process is still prone to challenges due to the structures of the linear world of today. Secondly, the similarities between the two cases strengthen research on the Finnish forestry industry and shed light on CBMI types and designs among SMEs and MNCs. Overall, the study further matured the research area of CBMI in the Finnish forest industry, and offers ideas on further avenues of interesting research.

KEYWORDS: Circular economy, Circular business model innovation (CBMI), Barriers and enablers, Finnish forest industry

VAASAN YLIOPISTO
Johtamisen yksikkö
Tekijä: Eliisa Sivula
Tutkielman nimi: Barriers and Enablers to Circular Business Model Innovation: : Finnish Forest Industry
Tutkinto: Master of Science in Economics and Business Administration
Oppiaine: Master's Program in Strategic Business Development
Työn ohjaaja: Paula Linna
Valmistumisvuosi: 2021 **Sivumäärä:** 106

TIIVISTELMÄ:
Tämän tutkielman tarkoituksena on ymmärtää Suomen metsäteollisuuden kiertotalousmallien innovointiprosessia, joka on hiljalleen saavuttanut suosiota sekä kirjallisuuden että metsäteollisuuden parissa. Kiertotalousinnovaatio on yrityksille uusi ja kiehtova konsepti, jota pyritään yhä enemmän implementoimaan osaksi yrityksen strategista päätöksentekoa. Nouseva mielenkiinto kiertotalousmalleja kohtaan ei ole kuitenkaan vielä lieventänyt suurta epävarmuutta, jota yritykset kohtaavat implementoidessaan uusia kiertotalousmallin mukaisia innovaatioita. Tätä epävarmuutta selittää osakseen se, että nykyisen tutkimuksen valossa ei vielä täysin ymmärretä kaikkia innovaatioprosessin implementointiin kohdistuvia haasteita. Tutkimalla prosessiin kohdistuvia haasteita ja mahdollistajia, tutkielma pyrkii luomaan metsäteollisuuden yrityksille paremmat mahdollisuudet uusien kiertotalousmallien onnistuneeseen innovointiin ja implementointiin.

Tutkimuksen teoreettinen viitekehys rakentuu kahdesta osasta: kiertotalousmallien innovointiprosessista sekä prosessissa koetuista haasteista ja mahdollistajista. Ensimmäiseksi kirjallisuuskatsaus tarkastelee kiertotalous ilmiötä liiketoimintamallikirjallisuuden valossa. Kiertotalous-ilmiö käsitellään lyhyesti, lisäksi tarkasteluun kuuluu lyhyt teoriapohjainen esittely liiketoimintamalleista. Tarkastelu rakentaa pohjaa kiertotalousmallien innovointiprosessin analysoinnille, joka tämänhetkisen kirjallisuuden valossa on hajanainen. Toinen kirjallisuuskatsauksen osa käsittelee juuri mainitun prosessin haasteita sekä mahdollistajia. Teoreettinen viitekehys haasteille ja mahdollistajille jakautuu kirjallisuuden perusteella seuraaviin kategorioihin: yhteiskuntataso, arvoketjutaso, organisaatiotaso sekä työntekijätaso.

Tutkimus toteutetaan viitekehyksen puitteissa monitapaustutkimuksena kymmenen suomalaisen metsäteollisuusyrityksen kanssa. Tutkimus koostuu kymmenestä haastattelusta valittujen yrityksien välillä. Lisäksi yritykset on jaoteltu pk-yrityksiin ja suuryrityksiin, analysoinnin edistämiseksi sekä vertailun mahdollistamiseksi.

Tutkimustulokset koostuvat avainhaasteista ja mahdollistajista. Tärkeimmät kiertotalousinnovointiprosessin haasteet ovat teknologiarajoitteinen regulaatio, läpinäkyvyyden puute arvoketjuissa, heikkoudet kustannuspuolella sekä henkilökohtaisen kompetenssijakamisen puute organisaatiossa. Vastaavasti tärkeimpiä mahdollistajia ovat poliittinen läsnäolo regulaatioiden muokkaamiseksi, ekosysteemiajattelu ja sisäisen että ulkoisen organisaation läpinäkyvyyden lisääminen teknologian avulla, lokaalinen toiminnan harjoittaminen, kiertotalousmittariston kehittäminen sekä sitoutuneen johdon ja henkilöstön varmistaminen. Lisäksi tutkimuksessa selviää innovointiprosessin suuresti hidastuvan sekä vaikeutuvan haasteiden johdosta. Tämä osaltaan selittää miksi kiertotalousmallien implementointi epäonnistuu tai sitä suurelta osin vielä vältetään.

AVAINSANAT: kiertotalous, liiketoimintamallit, innovaatiot, metsäteollisuus

Contents

Pictures

Figures

Tables

Abbreviations

CE	Circular Economy
BM	Business Model
BMI	Business Model Innovation
CBM	Circular Business Model
CBMI	Circular Business Model Innovation
CEBM	Circular Economy Business Model
SME	Small and Medium Sized Company
MNC	Multinational Corporation

1 Introduction

The European forest sector is currently facing creative business destruction and a change towards circular bioeconomy strategies (Kajanus et al., 2019). In the past, the industrial use of forests has been heavily criticized due to unsustainable forest usage (Kajanus et al., 2019). Forest-based business is thus facing turbulence in terms of market shifts (Amato et al., 2020). With the right approach, the forest industry is a great resource for sustainably sourced renewable materials. Hence, the incentives for forest businesses to create and innovate sustainable services, products and activities is growing (Korhonen et al., 2018). The demand shift can already be seen from the increased levels of new niche companies focusing on sustainable actions (Amato et al., 2020). The structural change and competitiveness among conventional forest companies, and niche companies focusing on improving sustainability, creates disruption and incentives to change the overall industry business models (BM) (Amato et al., 2020; Korhonen et al., 2018).

The policies regarding sustainable business, especially in the European markets, drive forest companies towards new BM innovation (Kajanus et al., 2019). The increased focus on sustainability issues is present in the European Commission's 2030 agenda for sustainable development, as well as in the policies regarding the European 'green deal' (European Commission, 2021a). Forest industries face increasing regulation and governance regarding sustainability, which entails changes to forest harvesting, material extraction and distribution (Wolfslehner et al., 2020). Evidently these internal and external forces create impetus for forest companies to change their activities; evidence shows that the Finnish forest industry is partly leading the way on change, and is known to be one of the key advocators of global bioeconomic forestry due to its rapid circular BM development (Näyhä, 2019). Nevertheless, the development of new circular BMs such as bioeconomy is challenging, and often faces implementation barriers which hinder the adaption of new models (Amato et al., 2020). The purpose of this thesis is to deepen the knowledge of these barriers, and clarify enablers and strategies to overcome them.

1.1 Motivation for the study

Due to companies increasingly aiming to introduce more sustainable paradigms to replace traditional models, the circular economy concept (CE) has gained relevance and is therefore introduced as a solution for sustainable issues in business logic (Geissdoerfer et al., 2017). Furthermore, the benefits of CE for both economic and sustainable development has piqued the interest of academics and policy-makers (Rizos et al., 2016). The ideal prospect is to decrease waste and negative environmental impact without risking economic growth and wealth. CE needs to encompass parallel economic, social and environmental factors (Lüdeke-Freund et al., 2019), and thus arguably it is only by integrated actions across the three domains that industry can truly achieve progress on the path of sustainability. The change can be done by shifting activities away from the linear 'take-make-waste' paradigm to a circular activity system and resource flow in which erstwhile waste becomes seen as a valuable resource (Bocken et al., 2016).

The change begins by redesigning BMs and creating new ones (The Ellen McArthur Foundation, 2017), which is referred to in strategic management literature as circular business model innovation (CBMI) (Guldmann et al., 2019). However, the realization of dynamic change in BMs is often more challenging to identify than imagined (Chesbrough, 2010). In fact, even when the change seems to be inevitable for the survival of our world of today, our systems and processes seem unchangeable as businesses keep failing to adopt or adapt to new BMs (Guldmann & Huulgaard, 2020; Linder & Williander, 2017). It is suggested that companies are not willing to change their linear BMs to circular because of the inherent increased risk, and barriers experienced when experimenting with new circular models (Guldmann & Huulgaard, 2020; Linder & Williander, 2017). Furthermore, research indicates a lack of perception on company level about circular BMs and CBMI (Blomsma & Brennan, 2017; Guldmann & Huulgaard, 2020).

As the forest industry is undergoing a disruptive change from traditional models and structures to new global markets, with a focus on circularity and bioeconomy

(Hetemäki & Hurmekoski, 2016), the interest in emerging new BM designs integrated with circular processes and operations is growing amongst SMEs and well established large corporations (Amato et al., 2020). However, despite the rising interest of new CBMI, the successful implementation of CBMI is struggling, which arguably indicates a lack of knowledge regarding barriers and challenges of CBMI amongst companies. (Amato et al., 2020). Furthermore, regardless of this emerging interest for new CBMI in the forest industry, the empirical research about the barriers and challenges, as well as enablers and strategies to overcome these barriers, remains scattered (Amato et al., 2020).

Considering the context, this study is compelled to research the domain of **circular business model innovation** (CBMI), also known as new circular BM experimentation and implementation, by identifying **barriers** which are decreasing the adoption of and adaptation to circular activities. Furthermore, as the means of supporting CBMI is evidently missing or at least inadequate, the thesis searches the possible **enablers** of CBMI for those most likely to mitigate the impact of the identified barriers. The Finnish forest industry is chosen as the industry frame to study CBMI barriers and enablers, for two primary reasons. Firstly, the Finnish forest sector's value-adding development, structural changes, diffusion of services and new products all combine to indicate a rapid change and development of new innovations in the near future (Hetemäki & Hurmekoski, 2016). Secondly, the Finnish forest industry is one of the forerunners of circular bioeconomy (Näyhä, 2019), which provides an interesting opportunity to benchmark the topic of successful CBMI. Overall, the Finnish forest industry provides a compelling industry framework against which to analyze CBMI barriers and enablers.

1.2 Research Gap

There are few empirical cases of CBMI research focusing on barriers with a comprehensive literature review across multiple industries (Guldmann & Huulgaard, 2020; Linder & Williander, 2017; Rizos et al., 2016), and the remaining research on CBMI barriers consists of individual company-specific case studies (Mont et al., 2017; Tura et al., 2019). A synthesis on barriers regarding BM innovation and CE is therefore missing. Moreover, there is existing literature on CE barriers which draws its findings from other sustainable innovation research fields, such as remanufacturing, product-as-service, environmental technologies and green supply-chain management, but not from CE itself. Therefore, conclusions are often based and validated through other sustainable fields, which leads to uncertainty when examining specifically the CE barriers across BMs (Guldmann & Huulgaard, 2020). Forest-based CBMI is heavily under-researched as well (Amato et al., 2020), and therefore conclusions on the barriers experienced by the Finnish forest industry cannot be made without additional research.

More knowledge of entry barriers across various industries and companies is needed so that businesses have the means to understand the possible challenges regarding CBMI (Guldmann & Huulgaard, 2020). Special focus needs to be placed on the influence of individual barriers regarding the process of experimenting and implementing with new BMs for CE. The current literature is limited to understanding a specific industry, with specific barriers regarding CBMI. For example, the legislation regarding CE designs such as recycling, reuse or remanufacturing widely varies across continents and industries (Tura et al., 2019). Therefore, broader conclusions cannot yet to be made which could be adapted throughout the research field. Moreover, extended studies and future research on examining the connection of CBMI and enablers will provide guidance for risk reduction and incentives to defeat the existing barriers for companies implementing circular BMs. Extended research on analyzing the connections and influences of barriers and CBMI opens the path towards finding strategies and solutions for overcoming the barriers, which when implemented accelerate the generation of a sustainable future (Guldmann & Huulgaard, 2020).

The thesis aims to provide further clarity, through identifying barriers and enablers for companies experimenting with CBMI, by conducting a multiple case study across established companies within the Finnish forest industry. More specifically, the focus is to understand the underlying effects key barriers have towards CBMI implementation process. Furthermore, as key barriers have been detected, possible enablers which help to overcome the barriers are analyzed. The research gap is presented in figure 1 below to illustrate the lack of theoretical and empirical evidence regarding CBMI barriers and enablers in the context of forest industry.

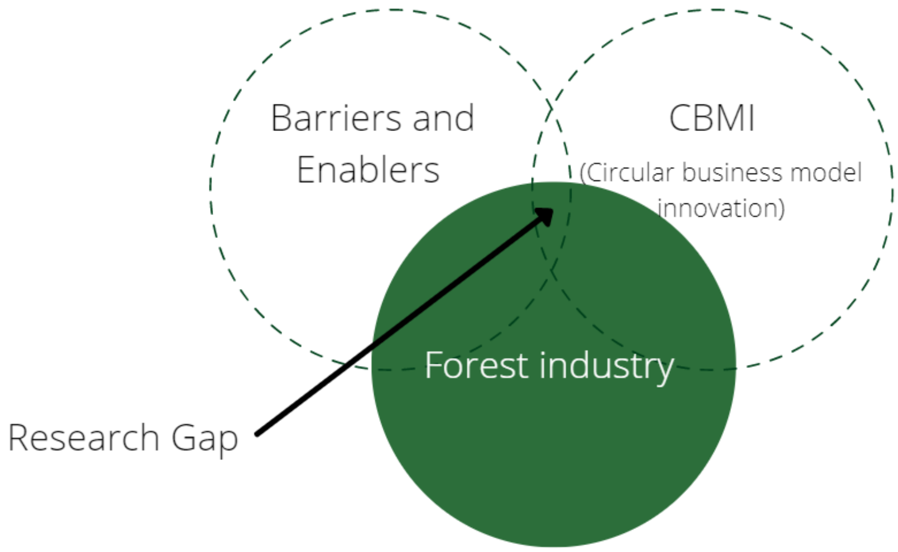


Figure 1. Illustration of key research areas and the research gap

1.3 Research questions and objectives

The research motivation and gap, elaborated above, create a foundation for the research questions and objectives. The motivation for the study stems from the concerning lack of knowledge about which barriers discourage CBMI implementation in the forest industry, and to what extent. Since the Finnish forest industry is facing disruptive BM change, empirical studies of the markets and potential enabling factors are highly beneficial. Thus the thesis has two research questions for coherent analysis of the study. The first research question is themed around barriers, while the second research question concerns enablers and associated implementation strategies.

RQ1: What are the key barriers to circular business model innovation (CBMI), and how do these barriers affect the process of CBMI?

RQ2: What are the key enablers and strategies in defeating CBMI barriers?

The research questions are formed in the context of the Finnish forest industry. By conducting the study for this specific sector, the empirical evidence can benefit from the pioneering models of the relevant markets, since the Finnish forest sector is claimed to be ahead of the wider change and in a way grooving the path for many other industries and markets (Amato et al., 2020). The presence of forestry in the Finnish industrial markets is important, with growing political and economic focus shifting to forestry due to its significance as a key sector in battling climate change (Näyhä, 2019). The objective is to conduct an empirical multiple case study of Finnish forest-based companies in order to sufficiently examine and inform the research questions. The study focuses on two cases; small and medium sized enterprises (SMEs), and multinational corporations (MNCs) to get a wide range of evidence regarding challenges to and enablers of CBMI.

By addressing the research questions and objectives mentioned above, the thesis establishes concrete managerial and theoretical implications. Firstly, the thesis provides theoretical contributions to the literature of CBMI by identifying key barriers for the CBMI process and analyzing their impact on the implementation process in a forest industry sector. In addition, concrete enablers and strategies for overcoming barriers are introduced to further mature the literature on CBMI. Secondly, the thesis contributes to the managerial implications by providing companies with insight into the enablers and drivers for overcoming the barriers identified in the process of BM innovation, therefore giving companies access to improved strategizing when it comes to CBMI. Furthermore, the key findings of the study can be used to provide businesses with improved implementation processes for CBMI. It is intended that the theoretical and managerial foundations of CBMI are further matured by the contributions of this thesis.

1.4 Structure of the thesis

This thesis is organized into five chapters, headed by the introduction in which context, motivation, purpose, and structure is established. Chapter two describes the theoretical foundations of the area of analysis by first conducting a thorough literature review on CE, BMs and CBMI, and then introducing the topic of CE barriers and enablers extracted from the literature. The aim is to clarify the key theoretical concepts, and thus provide an overview of the current state of the literature. Chapter two concludes with a synthesis of the key focus areas, CBMI, and barriers and enablers, to provide a framework for the empirical data. The framework is filled in using the empirical data and is further used in drawing coherent analytical results for the topic at hand.

Chapter three presents the methodologies used to conduct the research, providing detail of the methods used, comprising the research philosophy, and research strategy and method. Furthermore the section offers comprehensive evidence of the multiple case study selection process and data analysis methods, as well as the validity and reliability of the study.

The fourth chapter illustrates the findings of the SME and MNC cases, and is dedicated to analyzing the core data in a structured manner following the initial synthesis presented in chapter two. Firstly, a brief overview of the Finnish forest industry is presented to help give context to the case companies. Following this, the key findings of the multiple case study are presented and analyzed through an individual within-case analysis and as a cross-case analysis. Finally, discussions and interactive analysis between the theory and empirical data is presented.

The thesis is completed with a conclusion drawing together the relevant implications for the managerial and theoretical fields. In addition, the concluding chapter presents the further study suggestions and possible limitations of the study. The structure of the thesis is presented in the following figure 2 below.

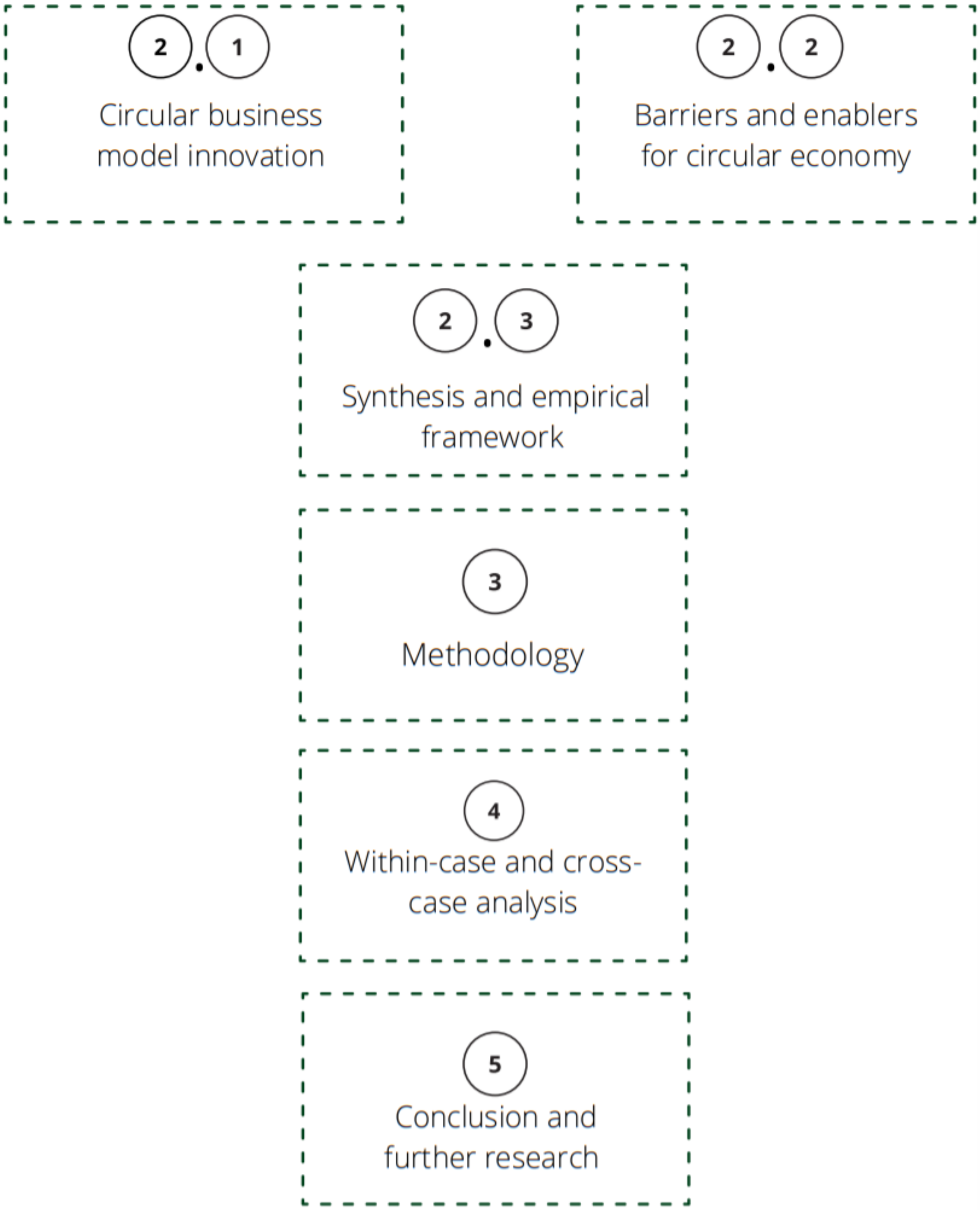


Figure 2. Structure of the thesis

2 Literature Review

The chapter begins with the examination of CE in a BM setting and transitions to analysis of the CBMI concept. The second section of the literature review analyses barriers to and enablers of CBMI. Chapter two concludes with a synthesis of the two research perspectives and provides a framework through which the empirical study is analyzed.

2.1 Circular economy and business models

Due to the growing pressure of a global climate crisis and increased shortage of resources, there is an inherent need for substantial changes to how business is conducted. CE is a concept which emerged to conquer the linear economy model and supply chain by creating a new outlook on managing resources and waste (Blomsma & Brennan, 2017). The idea of CE originated in the industrial ecology research in the 1990s, followed by the popularization in business setting by Ellen McArthur Foundation (Bocken et al., 2016). Because of the wide use of the term CE, it is been suggested by many researchers that the CE is an umbrella concept (Blomsma & Brennan, 2017; Bocken et al., 2016). In addition, there are related schools of thought with similar concepts in action such as industrial ecology, cradle to cradle, performance economy, biomimicry and blue economy (The Ellen McArthur Foundation, 2017).

The idea of CE originates from nature and the concept of natural circulation of materials energies and resources (The Ellen McArthur Foundation, 2017). This can be applied to business systems, resources and processes by making them flow in a circular way with the intention of minimizing waste as much as possible (Bocken et al., 2016). The origins for the framework of CE came from the concept of industrial ecology. Frosch & Gallopoulos' (1989) research gave insight into how industrial waste can be used as a raw material for different processes. The idea of industrial ecology was to reduce the environmental impact of industry and create more sustainable ways of operating. Even in the 1990s the study advocated change in economic behaviors and shifted the way society sees waste. The hope was to minimize the barriers hindering beneficial changes in industrial systems towards a sustainable ecosystem, with the help of government policies and creation of different strategies for waste reduction (Frosch & Gallopoulos, 1989). The concept of industrial ecology and circularity was adapted to CE, and since the 1990s the underlying idea remains valid even though further approaches have emerged and more specific strategies and BMs for CE have been created (Bocken, Olivetti, et al., 2017).

The Ellen McArthur Foundation (2017) created a framework for businesses to utilize the concept of CE in an everyday business environment. The framework relies on redesigning the economic growth view of today’s world. The focus is on shifting the consumption habits of society by generating value and growth in a sustainable manner. In other words, attention is on circulating resources and removing waste from the systems and processes, instead of the widely-used ‘take-make-waste’ approach. The three key principles of the CE framework are: the elimination of waste and pollution; the circulation of products and materials; and, the redevelopment of natural systems (The Ellen McArthur Foundation, 2017).

The framework presented in figure 3 below illustrates the flow of resources and energy through the technical and biological frames in a set of circular motions, enabling value creation. Following the technique of the model, companies are able to regenerate capital for society, investors, nature and other stakeholders (Bocken et al., 2016; Lüdeke-Freund et al., 2019; Ellen McArthur Foundation, 2017).

The distinction between the technical and biological cycles is important. The act of consumption is based on the biological cycle, where the function of biologically-made materials is redesigned into the system by composting and anaerobic ingestion (The Ellen McArthur Foundation, 2017). The characteristic of a biological cycle design is the natural wear of the consumed element (Bocken et al., 2016). The second cycle, which relies on the recovering and restoring of an element is called the technical cycle, and demonstrates the systems which are connected to the act of using a product rather than consuming, referred to as "products of service" (Bocken et al., 2016; The Ellen McArthur Foundation, 2017).

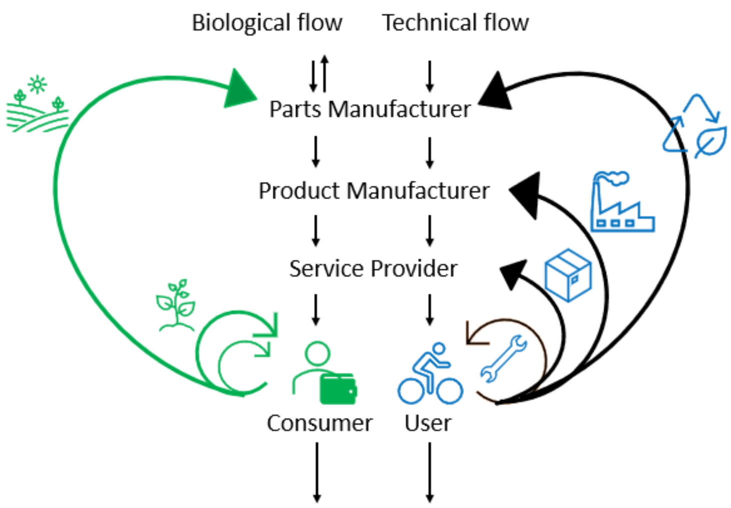


Figure 3. Butterfly Diagram adapted from Ellen McArthur (2017) and Lüdeke-Freund, Gold & Bocken (2019)

Teece (2010) defines BMs as the design of a company's value creation, delivery and capture. The intention is to describe the business value proposition and give a clear picture of the financial and organizational factors of the business. Furthermore, the model showcases the company's ability to compete in the chosen market and create profit through customer value creation. Similarly, Magretta (2002) sees BM as a story on how companies operate their business. Mostly, BMs are referred to as the fundamental logic of the company operations and an illustration on how to create value for stakeholders (Casadesus-Masanell & Ricart, 2010; Zott & Amit, 2010).

BM frameworks consist mostly of value proposition, revenue models and cost models (Teece, 2018). The different elements are aimed to be aligned with the overall organization and the environment. The intention is to benefit from the core capabilities of the company. Johnson et al. (2008) construct the BM from four different elements, namely customer value proposition (CVP), key resources, key processes, and profit formula, with the profit formula consisting of revenue and cost streams, margin model and resource velocity. A more generic approach by Casadesus-Masanell & Ricart (2010) divides the essence of a BM into two parts, the concrete operational choices of the management, and the outcomes of set choices. The intention of the simplified approach is to give clarity to the often-complicated managerial BMs which are hard to communicate downstream in the company. An overview of the key components of a BM are illustrated in table 1 below.

Table 1. Business model dimensions and categorization (Lüdeke-Freund et al., 2019).

Business Model Dimensions	**Subclasses**
Value Proposition	Products, Services
Value Delivery	Target Customers, Value delivery process
Value Creation	Partners and Stakeholders, Value creation process
Value Capture	Revenues and Costs

The traditional BM, referred to as the 'take-make-waste' model by The Ellen McArthur Foundation (2017), has often been criticized due to the systemic and straightforward linear approach when building up business logic (Schaltegger et al., 2016). The fundamental concept of a linear BM is to create value for customers, attract payments, and create profits within the company value chain (Teece, 2010; Zott & Amit, 2010). However, because of the pressing need for implementation of more sustainable actions in the business environment, in tandem with linear BMs solely providing little competitive advantage (Teece, 2018), contributors across the literature have been reinventing the BM into a more sustainable form (Schaltegger et al., 2016). In fact, the sustainable business model (SBM) has been introduced as the new primary way of creating sustainable competitive advantage (Geissdoerfer, Vladimirova, et al., 2018).

The underlying difference between the concepts is the way the linear BM approaches value creation through customer-centric and profit-oriented mindset (Teece, 2010). This difference is illustrated through Geissdoerfer and Naomi et al. (2018) defining the

SBM as a "business model which incorporates pro-active multi-stakeholder management" which moreover focuses on monetary as well as non-monetary value creation with a long-term perspective. Furthermore, SBM introduces an addition to the focal value chain in which company, customers, partners, and profit-centric business is emphasized by incorporating a multitude of stakeholders and non-financial performance indicators into the framework of business logic (Bocken et al. 2013).

The interpretation of the CE domain in SBM literature has not achieved an established place among researchers (Geissdoerfer, Naomi, et al., 2018; Geissdoerfer, Vladimirova, et al., 2018). The scholars indicate that the circular BM is a subcategory of SBM. The relationships between the domains are presented in the figure 4 below. However some evidence shows that circular BMs are not yet fully integrated with the principles of sustainable development (Geissdoerfer et al., 2017). For example, the lack of issues regarding the social dimension of sustainability is often criticized (Geissdoerfer, Naomi, et al., 2018; Geissdoerfer, Vladimirova, et al., 2018). The following section 2.1.3 analyses the conceptualization of circular BMs further.

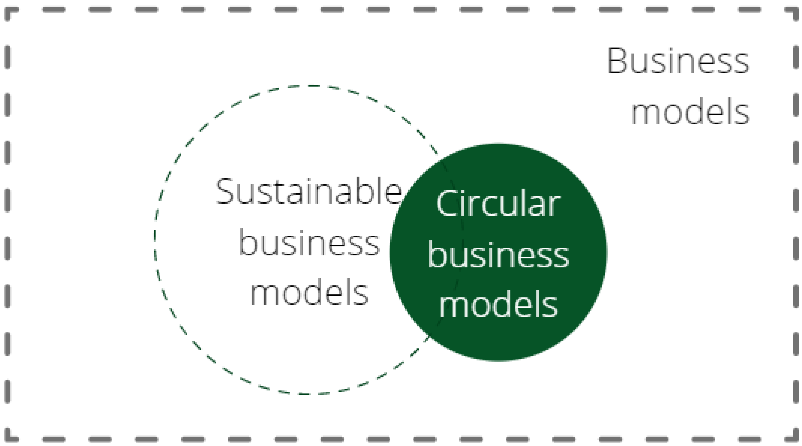


Figure 4. The interrelation of CBM, SBM and BM (Geissdoerfer, Vladimirova, et al., 2018)

2.1.1 Circular business models (CBM)

Companies operate in a BM world where value and supply chains are managed through a process of value creation (Bocken et al., 2014). The CE approach allows companies to rethink their BMs and the way the company delivers, captures and creates value (Schaltegger et al., 2016). CBM can be viewed as a subtype of SBM research (Bocken et al., 2014; Schaltegger et al., 2016). The purpose of CBM is to integrate CE principles into value creation. This is achieved by containing resources through multiple cycles (repurposing and reusing materials) and decreasing waste generation - or preferably avoiding it completely (Lüdeke-Freund et al., 2019).

Furthermore, research on the CE business models (CEBM or CBM) is scattered across different schools of thoughts and different concepts with similar advocates emerging frequently (Lüdeke-Freund et al., 2019). Scholars of various other disciplines, such as industrial ecology or closed-loop supply-chain management, also take a stance on the creation of CBM. Different types of CEBM can vary from waste management - such as repairing, maintaining, reusing and recycling - to cascading and repurposing. Understanding how to utilize and extract value from the models with different strategies is relevant in CEBM research (Lüdeke-Freund et al., 2019).

In the process of understanding the dynamics of utilizing CBM, the thesis will first analyze the current relevant literature on CEBM to provide comprehension of the broad aspect and fundamental differences of the various models of CE (Lüdeke-Freund et al., 2019).

Bocken et al. (2016) describes the ideal CE model as one considering the circulation of the materials and resources in a way which allows a continuous loop of activities to be born. However, in practice CBMs encompass several different perspectives. The relationships of circular loops can be examined from three different approaches: closed loops; slowed loops; and narrowed loops. Depending on the company approach, the strategies and BMs are designed either to slow down the material loops or close them completely. BMs which slow resource loops primarily concentrate on maintaining long product life in addition to possible repurposing and reusing of resources. In contrast, the idea of a closed resource loop is to create value from the waste and by-products of traditional BMs by recycling. In addition to the two popular CBM, a third approach emphasizes the narrowing of resource loops, aiming to use fewer resources altogether when creating products and services, subsequently minimizing waste production. The three different approaches illustrated in figure 5 help to distinguish different BM strategies into single categories later on.

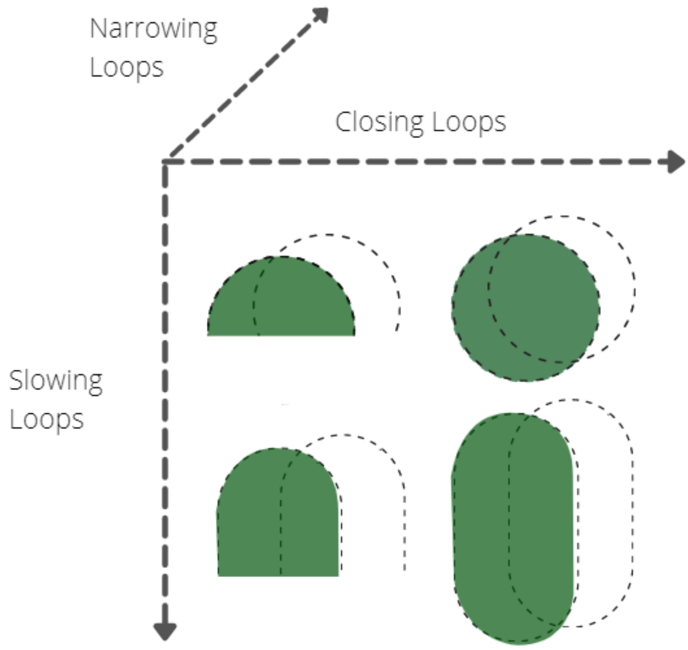


Figure 5. Circular business models adapted from Bocken et al., (2016)

In addition to Bocken's et al. (2016) three approaches to CBM, Geissdoerfer and Naomi et al. (2018) introduce dematerializing resource loops and intensifying resource loops. The research emerges from the adaption of increasingly sustainable CBM and emphasizes that for additional value to be maximized, the elements of economic, environmental and social capital must all be considered together. Firstly dematerializing breaks the ownership dilemma by renting as opposed to owning capital assets. Similarly, the idea of intensifying resource loops tests the idea of sharing user phases. The overlapping area in figure 6 illustrates the circumstances where the three principles of sustainability are met with CBM which are closing, slowing, narrowing, dematerializing, and intensifying resource loops.

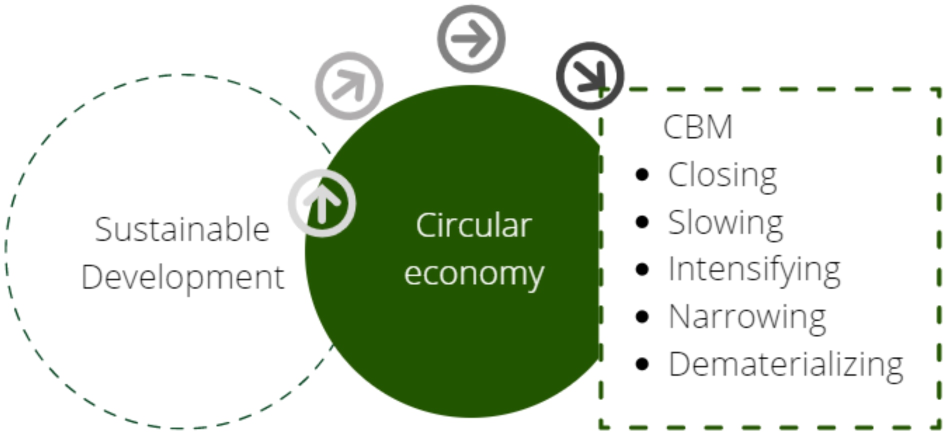


Figure 6. Framework adapted from Geissdoerfer, Naomi, et al., (2018)

Similarly, Lewandowski (2016) proposed a framework for CBM with the adaption of an Osterwalders & Pigneurs (2010) BM canvas. In addition to the traditional BM design, two adaption parts are introduced which are take-back systems and adoption factors. The added take-back system refers to the idea of material loops which in return is one of the cornerstones of CE. Much like previous studies, this BM function concentrates on the design of reusing, refurbishing, recycling of components and materials. The second addition to the traditional BM design are the adoption factors, divided into internal and external factors. This part emphasizes the need for designing supportive organizational capabilities (internal factors) as well as the need for new supportive technology, politics and regulations, and sociocultural behavior (external factors). However, in order to create a coherent framework, the traditional building blocks of the framework need to be aligned with the CE principles (The Ellen McArthur Foundation, 2017) as well as coherent with the two additional functions as new design (Lewandowski, 2016).

To understand the different possible CE models of the case companies, a brief categorization of different kind of CBM found in the literature is beneficial. A study by Lüdeke-Freund, et al. (2019) categorized the most prominent CEBM in the current literature based on their approach and contribution to the CE cycles. The six different distinguished patterns are repair and maintenance, reuse and redistribution, refurbishment and remanufacturing, recycling, cascading and repurposing, and finally biochemical feedstock extraction.

Repair and maintenance actions are paired with the strategy of slowing loops because of their nature of extending the product and component life-cycle by keeping them in excellent condition (Bocken et al., 2016). The act of repairing or maintaining can be accomplished by the customer, the manufacturers or the service providers (Lüdeke-Freund et al., 2019). The second model, reuse and redistribution, concentrates on utilizing a product for the original use after possible minor changes. Circular models such as secondhand activities fall under the examined group. The third model, refurbishment and remanufacturing, closely follows the approach of the previous strategy by replacing and changing dysfunctional parts to extend the product life. The fourth model is recycling (Lüdeke-Freund et al., 2019). Recycling is often used as an overview of CE, however as research shows it is only one of many types design that caters for the concept of CE. Recycling is designed to suit products which are no longer viable for repair, reusing or remanufacturing, and therefore used for either upcycling or downcycling depending on the quality and functionality of the product (The Ellen McArthur Foundation, 2017). The mentioned models are designed for the technical cycle (see butterfly figure 7 below) and always contains the presence of a user phase (The Ellen McArthur Foundation, 2020).

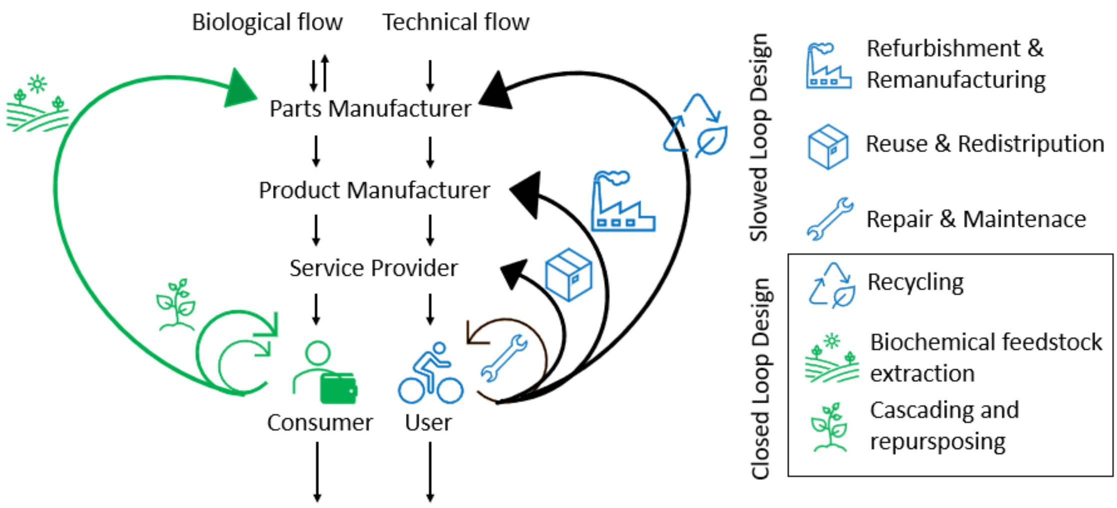


Figure 7. Butterfly diagram with extended categorization adapted from Ellen McArthur (2017) and Lüdeke-Freund, Gold & Bocken (2019)

In the perspective of biological cycles, the two models identified are cascading and repurposing, and biochemical feedstock extraction (Lüdeke-Freund et al., 2019). The models relay on the action of natural disruption and degradation to produce a natural flow of energy and resources (The Ellen McArthur Foundation, 2017).

Furthermore, the CEBM patterns explained above can be divided into different designs based on the Bocken's et al. (2016) previous categorization of slowing and closing loops. The models for slowed-loop cycles are repair and maintenance, reuse and redistribution, and refurbishment and remanufacturing. The fundamental commonality between the models for slowing loops is the value emerging from the expectation of retaining products as long as possible. In contrast, models that are designed for closed loops (recycling, cascading and repurposing, and organic feedstock) concentrate on extracting value from retaining materials rather than products (Bocken et al., 2016; Lüdeke-Freund et al., 2019; The Ellen McArthur Foundation, 2017).

2.1.2 Concept of Business Model Innovation

Innovation is a central concept of most businesses, since companies' ability to innovate is paralleled with success factors such as growth, profitability and competitive advantage (Pisano & Teece, 2007). The theory of economic development and value creation from technological change and innovation initiated from Schumpeter's (1934) studies on entrepreneurial actions and innovation. Leveraging Schumpeter's "creative destruction", which is often referred to as significant technological change, entrepreneurs were able to create value with innovations regarding new methods, processes and products, markets and new supply sources (Pisano & Teece, 2007). Markets are constantly full of new innovators with the intention to exploit and develop new economic success (Amit & Zott, 2001). In fact, economies and societies are counting on innovators and new innovations to drive that change (Pisano & Teece, 2007). However, innovation alone is not sufficient to leverage new value creation; hence other sources are needed for sufficiently exploiting the potential new markets especially BM design and innovation (Amit & Zott, 2001; Pisano & Teece, 2007).

Chesbrough (2010) argues that new technological innovation does not hold value, yet the act of commercialization of that innovation through BMs does, which provides evidence for the Pisano & Teece (2007) theory of innovation through value creation and capture. The fundamental difference when analyzing past BMs is that they are not always sufficient in manifesting value from new technologies (Chesbrough, 2010). For this reason the commercialization of an innovation in some business cases fails, but in others flourishes. The perspectives on existing BMs need to be changed in order to shift focus on the exploitation of new opportunities of technological innovations. In the literature this is referred to as BM innovation (BMI). It is the act of leveraging new BMs and experimentation with them for the purpose of capturing and creating value through the ever-changing business field. Moreover without the ability and means of changing BMs to suit new business opportunities, companies are in risk of losing their business (Chesbrough, 2010). BMI is argued to be a side-stream within the domain of

BM literature; however some researchers have adapted it to a unified separate concept together with the BM research (Geissdoerfer, Vladimirova, et al., 2018).

The value of new innovation and technological advancements is captured through BMI (Chesbrough, 2010). Furthermore, BMs can be argued to either develop from companies' existing models to more advanced forms (Chesbrough, 2007; Teece, 2010) or emerge as a completely new form of a BM (Geissdoerfer et al., 2016; Johnson et al., 2008).

The BMI literature however is scattered with different perspectives on the matter, with dissenting thoughts. The structuring of different approaches is assessed based on a comprehensive literature review by Foss & Saebi (2017) and Geissdoerfer, Vladimirova & Evans (2018), as well as the analysis of several related articles. The literature on BMI is blooming and has gained popularity in the management literature within the past 15 years, which is also the time frame for the conceptualizing of different approaches. The comprehensive literature study by Foss & Saebi (2017) identified four overlapping approaches in the BMI literature: (1) conceptualization and classification of BMI; (2) BMI as a process; (3) BMI as an outcome; and (4) BMI and organizational consequences/performance. The following paragraph will present these approaches in a more detailed matter.

Conceptualization of BMI focuses on defining the BMI with a purpose of giving clear dimension for companies to create new BMs (Foss & Saebi, 2017). The second approach presents more clarified stages regarding the organizational processes and changes in BMI. The third approach makes the outcome of the change process in BMI the priority segment of the research; the literature here often focuses on outcomes in specific industries. The final perspective on BMI focuses on the organizational performance and the implications for performance of both BMI processes and outcomes. Based on the prominent concepts of BMI literature (Foss & Saebi, 2017), a framework can be interpreted with prominent definitions and the key concepts of the BMI research. (See table 2)

Table 2. BMI research areas among scholars

Research Focus	BMI Definition	Explanations
(1) Conceptualization of BMI	Teece (2010) Johnson et al (2008)	Reengineering of existing BMs. BMI as a phenomenon.
(2) BMI as organizational change process	Osterwalder & Pigneur (2010), Berglund & Sandström (2013), Bocken et al. (2018), Chesbrough (2007)	BMI is a process of re-learning and experimenting. Described as a dynamic process which can be extended to the value-chain level
(3) BMI as an outcome	Sanchez & Ricart (2010), Sjödin et al. (2020)	BMI is researched through outcome-based relationships, contextualized and framed by specific factors such as industry, service or markets.
(4) BMI and organizational consequences / performance	(Zott & Amit, 2007), (Aspara et al., 2010)	Studies the links between BMI process and performance outcomes. Links the ideas of the (2) and (3) research area into one.

After analyzing the BMI research areas, an area of focus for the thesis is chosen to further support the study questions and objectives. For the purpose of the study BMI is seen as an organizational change process and therefore follows the research literature of the second (2) focus area (Foss & Saebi, 2017). The following section goes into more detail on the BMI process literature.

2.1.3 Business model innovation as a process

Innovation and new learning are shown to stem from action rather than design (Bocken et al., 2018). The fundamental idea is to understand the process of re-learning and shifting one's actions by daily interactions and environmental change. Organizational beliefs and activities may only change by doing (Halme, 2002) and hence BM experimentation is important process of organizational learning (Bocken et al., 2018). Furthermore, BM experimentation is a key process in achieving change and successful implementation of innovations (Chesbrough, 2010). The role of business experimentation is to provide learning opportunities as well as signal and convince organizations of the direction of the innovation (Aagaard et al., 2020).

Osterwalder et al. (2014) constructed a process of BM experimentation which is drawn from the ideas of lean startup business development (Ries, 2011) and customer development process (Blank, 2013). The process begins with generating a 0-hypothesis with the help of BM tools such as BM canvas (Osterwalder & Pigneur, 2010). Next, the idea is further designed and build to encompass testing. The third step is to measure and test the model's performance and finally learn and gather insight to further develop and implement a new BM.

The experimentation process is further developed by Bocken et al. (2018) adding more detailed analysis on the timeframe and uncertainties which accompany the process. The detailed process of experimentation is visualized in figure 8. Below, illustrating the frequency in which the uncertainties and resource investments change in relation to time. The experimentation time correlates positively to the number of resources in use. Hence the longer the experimentation, the greater the further investments of resources required. On the other hand, the uncertainties related to the experimentation decrease while the process moves forwards (Bocken et al., 2018).

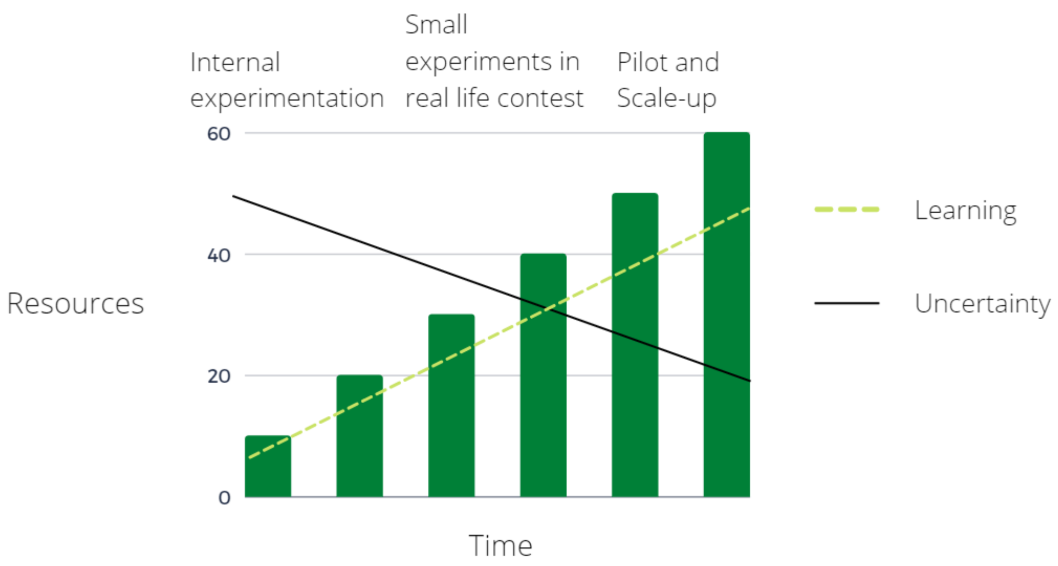


Figure 8. Experimentation and innovation process by Bocken et al. (2018) and Osterwalder et al. (2014)

An important perspective in the study by Berglund & Sandström (2013) revealed that the BMI process does not only happen on the firm level. The study criticizes the BMI research for the lack of consideration within the multiple and value-chain levels. Companies are most likely to face interdependencies on multiple levels since change happens with relations to various actors rather that within a single entity. The study introduces an open-system BMI which allows for multiple actors to be evaluated in terms of the BMI process. The concept of open-system thinking is especially important in terms of CBMI (Bocken, Boons & Baldassarre, 2019), which is further discussed in the section below.

2.1.4 Circular business model innovation (CBMI)

Guldmann & Huulgaard (2020) define CBMI firstly as a change from linear BM to CBM or secondly as an act of building a new CBM from the start. The process entails configurating different CE components to BM design by reinventing the value capture, delivery, creation and extension of the value proposition. The change from linear model to a circular one intakes massive change in multiple areas such as company structure, networks and business logic. As stated above, CBMI can be divided into actions of changing already established BM or crafting a completely new one from CBM components. The first BM change occurs in incumbent companies while the latter is mostly considered to take place in start-ups or new companies where the whole business is created with a CE mindset.

The CBMI is considerably more challenging innovation type since the nature of the change is mostly dynamic and rapid (Guldmann & Huulgaard, 2020). The change towards CBM consists of reconfiguring all company cycles from the initial manufacturing, product upgrades, remanufacturing to recycling. In other words, the different life cycles of the product or service need to be innovated, managed and reshaped (Guldmann & Huulgaard, 2020).

The way of conducting CBMI is through a process of business experimentation and relearning (Aminoff & Pihlajamaa, 2020). Weissbrod & Bocken (2017) describe experimentation as the first and foremost capability in achieving radical innovation change. Since experimentation emphasizes learning by doing, especially through challenges and opportunities, it provides a compelling guidance for the implementation of CE innovations (Aminoff & Pihlajamaa, 2020). Firstly, experimentation accelerates the successful implementation of sustainable business activities for both larger and smaller firms (Weissbrod & Bocken, 2017). Secondly the process is known to facilitate stakeholder and customer engagement (Bocken, Boons & Baldassarre, 2019), which is especially important factor for sustainable and CE models (Aminoff & Pihlajamaa, 2020). This further supports Berglund & Sandström (2013) study on open system BMI, which emphases the importance of efficient network knowledge sharing between different entities and actors.

Furthermore, according to Bocken, Schuit & Kraaijenhagen (2018) BM experimentation stimulates internal and external engagement, supports testing, and helps collaboration with business partners to achieve sustainable actions faster. Based on relevant research

Bocken et al. (2018) constructed an experimentation cycle for CE which includes identification of purpose, value proposition experiment, value delivery experiment, value creation experiment, value capture experiment, and finally field experiment. Field experiment, in other words a pilot, is always needed before scaling to actual markets. The circular business experiment cycle is presented in the figure 9 below (Bocken et al., 2018).

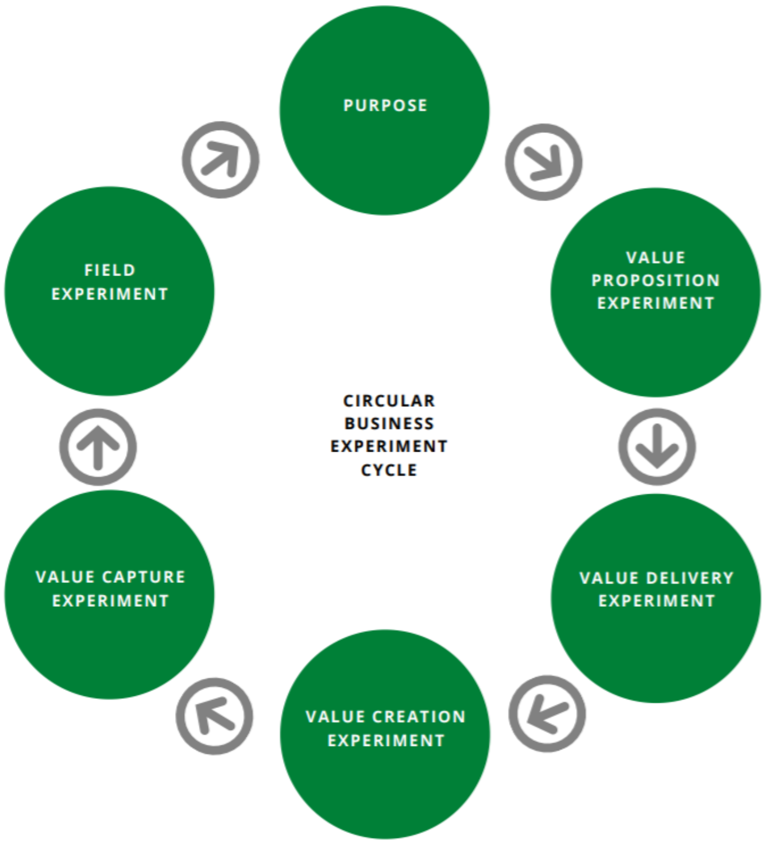


Figure 9. Circular business experiment cycle by Bocken, Schuit & Kraaijenhagen (2018)

Similarly, Aminoff & Pihlajamaa (2020) studied the front end of CE innovation by analyzing the learning and innovation funnel. The CE experimentation process included identification phase, scoping, construction of a business case, development, testing and validation phase and finally launch. The study revealed a significant importance of a correct implementation of triple-loop learning experimentation in the process of overcoming CE innovation barriers and challenges. More on overcoming barriers is in section 2.2.2.

As a remark, experimenting with CBM needs further research since the studies present significant limitations, and cases of CBM experimentation are often disclosed with reservations on the confirmability of the effects of experimentation when it comes to real-life scenarios (Aminoff & Pihlajamaa, 2020). Furthermore, there is a lack of frameworks regarding CBM experimentation and the current literature is heavily influenced by linear business experimentation. More comprehensive frameworks which study the relevance of sustainability and CE are needed in the experimentation research (Aminoff & Pihlajamaa, 2020; Bocken et al., 2018; Guldmann & Huulgaard, 2020; Linder & Williander, 2017).

2.2 Barriers and enablers for circular economy

The realization of key CE principles among BMs is still widely missing in today's corporate world (Adams et al., 2017). The lack of CBM adaption is partly explained by the lack of knowledge and evidence in retaining profitable revenues compared to linear BMs (Adams et al., 2017; Guldmann & Huulgaard, 2020). Furthermore the BM experimentation and support systems regarding CE are still highly uncertain and presented or perceived as risky (Amato et al., 2020; Aminoff & Pihlajamaa, 2020). The change towards CE designs requires greater innovation management by managers. As change towards something new inherently leads to risk-taking and breaking through barriers, the need for the skills and means for understanding and conquering barriers is growing (Ritzén & Sandström, 2017).

Established BMs generally carry less immediate risk than new BMs as the activities in the new models are yet not tested and assessed by markets (Linder & Williander, 2017). Moreover, when comparing linear and circular BMs, research shows that the cumulative risk increases when incorporating circular activities within the company. The reason lies in the longer time tension and revenue streams of circularity. Circular business often suffers from time-extended revenue, cost and value structures, creating increasing risk. Therefore, adoption of a CE or CBM requires BMI with sufficient - and thus significant - attention to barriers and enablers to ensure the appropriate risk reduction is achieved (Linder & Williander, 2017).

According to research, the occurrence of barriers across industries and companies is not dependent on size or other structural attributes (Rizos et al., 2016). However, structural elements can affect the type of challenges companies face, since some attributes correlate with certain barriers more than others (Rizos et al., 2016). In addition, evidence shows that the different types of CBM correlate to different barriers experienced, which indicates that specific BM types acquire precise actions regarding risk reduction (Aminoff & Pihlajamaa, 2020; Vermunt et al., 2019). Therefore, the implementation of a specific BM design has significant impact on how barriers affect the overall process, and why. As stated by the research of Linder & Williander, (2017) overall CBM inherently includes higher risks than implementation of equivalent linear BM. This contributes to a need in which different solutions and enablers are emphasized in relation to the linear BM. Linear BMI can utilize established risk-reduction management, tools which CBMI either fails to use or seemingly cannot adapt in practice. Hence, more research is needed to avoid and reduce risk in the context of CBMI.

2.2.1 Business model innovation barriers

Since BMI is a concept which assists companies in seizing new business opportunities and allows companies to stay on top of their industry by constant upgrades to the business logic, most companies should be practicing BMI (Chesbrough, 2007). However, many companies have failed in this job and allowed innovation and newcomers to beat old BM logic. (Chesbrough, 2007; Teece, 2010.)

A study by Chesbrough (2010) focused on understanding the managerial barriers which prevented companies from leveraging BMI in their BM experimentation. In short, BMI process entails designing, piloting and refining, and in the end implementation of a new business logic. Barriers hinder this process and can emerge at any point of the BMI process (Linder & Williander, 2017). As Chesbrough (2010) states, to begin a process of

BMI, a new business logic construction is required. Initial challenges can occur within the construction phase, which hinders or intervenes in the experimentation and implementation of a new model from the very start. The inadequacy of an existing model is overlooked due to the foreseen risks of the new BM (Chesbrough, 2010).

Amit & Zott (2001) state that new value-creation sources often differ from both processes and action perspectives compared to traditional streams of value creation. This can lead to resistance while adapting possible new BMs into action, since managers can struggle to incorporate the overall changes of activities in the company. Furthermore, the fear of conflicting with a company's existing BM and revenue streams can prove to be a barrier that hinders the change towards a new business logic altogether. The risk of cannibalizing the original products of the company is high, and therefore creates reluctance among managers (Amit & Zott, 2001). Moreover, the initial gross margins of disruptive technology are often lower than margins of the old technology which can decrease the attractiveness of the new technology (Chesbrough, 2010). Changing a BM entails risks which most managers are understandably hesitant to take on. BM experimentation entails high uncertainties with markets, technology, and adaption ability to deal with chaotic environments (Chesbrough, 2010; Linder & Williander, 2017).

Literature has identified specific barriers within industries moving towards CE BMs (Ormazabal et al., 2018; Ritzén & Sandström, 2017; Rizos et al., 2016; Singh & Ordoñez, 2016). Following the literature on CE barriers enables a framework of the most important barriers to be constructed. The barriers are identified within a mixture of different but related research fields, such as closed-loop manufacturing, product service-systems and remanufacturing. The underlying functions identifiable from research examining different industries and case-studies are the lack of sufficiently competent or adaptable systems both outside of and within companies. Recurring themes within the studies are lack of network supports, financial difficulties, lack of market mechanisms, lack of knowledge or limited awareness (Ormazabal et al., 2018; Ritzén & Sandström, 2017; Rizos et al., 2016; Singh & Ordoñez, 2016). Furthermore, the themes can be categorized into financial, structural, operational, attitudinal and technological segments (Ritzén & Sandström, 2017).

Since the CE barriers from related sustainability fields correspond with the empirical data of CBMI barriers, leveraging from the previous studies by analyzing the appearance of different barriers is an appropriate approach (Guldmann et al., 2019; Vermunt et al., 2019). A multiple case study by Guldmann & Huulgaard (2020) constructed a framework of possible barriers companies face during CBMI. The identified barriers were classified into four levels: market and institutional level; value-chain level; organizational level; and employee level. The different levels were adapted from previous literature on CE barriers, mixed with case data, and the four levels can be analyzed according to their external and internal functionality. Similarly, Vermunt et al. (2019) categorized barriers for CBM as occurring internally or externally in relation to the focal company.

External barriers which occur in the market and institutional and the value-chain levels consist of regulations and product-life management difficulties, aspects which hinder the adaption of CE principles. For example, the incentives to manufacture new products are stronger than activities for recycling or remanufacturing. Taxation of virgin materials compared to recycled is a significant issue for companies. In addition, Linder & Williander (2017) emphasize the financial risk which emerges from tied-up capital. Additional external barriers found are funding difficulties, existing investments for traditional BMs, securing product quality sufficiently, and the fear of inconsistent cash return-flow (Guldmann & Huulgaard, 2020). A significant amount of pressure is experienced with ecosystem-level change of CE experimentations.

Engagement difficulties along the value chain hinder the experimentation of CE innovation (Aminoff & Pihlajamaa, 2020). As partnerships and networks are highly important in CE, the adaption of synergies is encouraged (Amato et al. 2018). However, within the value chain, reluctance to include beneficial value-adding network relationships was detected. For example, companies hesitate to encourage prominent involvement of customers within the company's activities since the knowledge of them can be limited and their activity functions unfamiliar (Guldmann & Huulgaard, 2020). Another risk which companies face is the lack of knowledge about market demands, in part a result of inability to connect innovation to the market demand (Aminoff & Pihlajamaa, 2020).

Internal barriers can be detected at the organizational and employee level (Guldmann & Huulgaard, 2020). Such barriers can be a narrow sustainability-strategy focus, low management support, profitability concerns, cannibalization of own products and services, and lack of knowledge among organization and employees. Furthermore, traditional linear BM thinking and linear structures create an atmosphere which can be hard to navigate around CBMI (Guldmann & Huulgaard, 2020). A study conducted by Adams et al. (2017) identified that the awareness of individuals regarding CE within the manufacturing industry is generally increasing, yet there are still a significant challenges regarding economic, organizational and technical know-how. This can be explained through the absence of clear CE models in build environments and value chains.

According to Aminoff & Pihlajamaa (2020), companies have a tendency to be risk-averse, which contributes to the creation of problems when experimenting with CE innovations. For example, new technology entails complexity, which in turn exposes companies to risk. Similarly, the long timespan of innovation processes, and consequent inability to accumulate short-term profits, may lead to challenges caused by risk-averse financial management behaviors and regulatory conditions.

Table 3 maps the key barriers extracted from the research literature to clearly categorize them; most barriers are at the organizational level, and secondly at the value-chain level. The fewest barriers were in the market and institutional level. Some operational barriers identified in the literature were clearly determined as possible to overcome in practice (Guldmann & Huulgaard, 2020). In contrast, the barriers regarding CBM experimentations - such as technical, functional and economical vulnerabilities - created more significant difficulties (Linder & Williander, 2017).

Table 3. Barriers to CBM assorted from literature

CE Barriers	Detail description	Key researchers
External Barriers		
Institutional	Regulations, lack of legislation and government support such as training, funding, taxation.	(Rizos et al., 2016); (Kuo et al., 2010); (Mont et al., 2017)
Financial	Increased financial, operational and legal risk, lack of funding opportunities, lack of financial risk tools in CBM.	(Linder & Williander, 2017) (Ritzén & Sandström, 2017) (Rizos et al., 2016) (Mont et al., 2017) (Kissling et al., 2013)
Network	Collaboration challenges, lack of interest within the network, scattered supply-chains and customers, constant trends.	(Mont et al., 2017) (Adams et al., 2017) (Kissling et al., 2013)
Technology	Frequent design changes, unpredictable flow of materials and components, low status of elements and materials, lack of technical skills for repairing, reusing etc.	(Rizos et al., 2016) (Ritzén & Sandström, 2017)
Internal Barriers		
Organization	CBM design unclear or perceived as undesirable, cannibalization of original products, lack of management skills and in-house knowledge, difficulty implementing a new BM, limiting supply chain position	(Guldmann & Huulgaard, 2020) (Adams et al., 2017)
Employees	Lack of resources among employers, resistant of change	(Guldmann & Huulgaard, 2020) (Rizos et al., 2016)

As previously analyzed, the implementation of a different CBM type affects the type of challenges companies face (Vermunt et al., 2019). Similarly, the occurrence of different challenges is tied to the level of BMI in motion. In other words, the risks encountered by a company while experimenting with CBM, and in contrast after implementation, differ within their nature. A need for separation between CE BM validation and CE BM operation risks is therefore valid (Linder & Williander, 2017).

2.2.2 Enablers and overcoming barriers

Understanding the two different mindsets for BMI failure - the confusion of a right BM design, and the barriers associated with the attempts of implementing a new BM logic which in theory has a valid ground – informs greater understanding of the enablers affecting different stages of BMI. In both cases, the potential enabler is the commitment to the process of BMI, which entails both experimenting and scaling-up a new BM (Chesbrough, 2010).

BMI and experimenting with new BMs requires the ability to endure and operate in a hectic environment with high-uncertainty risks (Chesbrough, 2010). A guideline which is introduced as "dominant logic" by Richard (1998) seeks to find balance in the dynamic and emergent environments by filtering out unnecessary information and obtaining the information which correlates with the values, behavior, strategy and performance of the company. Hence "dominant logic" seems a valid mindset and a process for fostering BM change. However, Chesbrough (2010) states that "dominant logic" may also lead to unnecessary risk avoidance, a significant issue when new risks are an inevitable consequence of BM experimentation.

Furthermore, Chesbrough (2010) states that maps and configurations are proven to be beneficial and supportive mechanisms for designing a new BM. The desired outcome of BMI requires planning as well as experimenting. The tools provide a basis upon which companies can feel comfortable to experiment and analyze different BM logics. Theoretical tools which help in the process of BMI include Osterwalder & Pigneur's (2010) BM canvas and IBM's component 'BMing' tool.

However, the act of mapping out new BMs is - by itself - inadequate to overcome barriers affecting BMI (Chesbrough, 2010). In addition to BM tools, managers need guidance for the process of BMI and experimentation. Such process guidelines can be found in effective experimentation literature (Weissbrod & Bocken, 2017), discovery-driven planning (McGrath & MacMillan, 2000), and effectuation theory and change management (Brettel et al., 2012; Nunes & Breene, 2011). The enablers for BMI combine the need for experimental action and change leadership, which in turn creates new data and knowledge for the enhancement of innovation (Chesbrough, 2010). Although companies can approach BMI from either of two activity streams, experimenting and operating, in the end successful BMI implementation requires simultaneous action across both streams.

When BMI enablers are analyzed through CE models, the tools and processes require further analysis and specification to suit closed-loop and slowed-loop designs (Bocken et al., 2016). Since the risks of circular BM design are higher than linear BM, due to extended timelines and distribution of revenues (Linder & Williander, 2017), the tools and enablers which help support linear BM innovation are often invalid in CBMI. In addition, there is a lack of suitable frameworks for CE experimentation (Bocken et al., 2018). Some suggested enablers for CBMI include topics such as managing unknown futures and retained ownership, but these concepts need further research (Linder & Williander, 2017). The few studies across industries which are dealing with enablers for CBM, and associated innovations, are discussed below.

The study of Adams et al. (2017) listed some important enablers for CBMI across industries. The most relevant enablers are design tools and guidance, value measuring in products and materials, political financial incentives in using secondary materials, best practice, awareness of CE, development of enabling technologies, development of secondary markets, viable take-back schemes, and a clear business case. Similarly, a study conducted by Julianelli et al. (2020) defined critical success factors of CE technical cycles and reverse logistics. The five critical success factors are material planning and management, industrial sustainability, information and communication technology, promoters, and relationships. Relevance of the five success factors can be valued-based on the incorporation and realization of CE principles within reverse logistics. Furthermore the study argues in favor of the potential increase in value creation through the five success factors and possibilities of enhancing BMI through actualization of circular supply-chains (Julianelli et al., 2020). Other related fields which contribute to identifying possible drivers for CBMI are found for example in product-service offerings and remanufacturing. Such drivers can be cost savings, high possibility for differentiation, enhanced customer relationship, improved margins, and positive environmental impact (Chakraborty et al., 2019).

In contrast, Rizos et al. (2016) studied seven enablers and their importance among SMEs. The study revealed that the most prominent enabler according to the test companies was the culture of the company managers and staff. The second and third enablers, which are networking and support from the demand network, are closely related to the first one. Therefore, within SME the clear enabler seems to include the openness and willingness of the networks to operate in a green environment. Some other enablers identified include financial attractiveness, recognition, personal knowledge, and government support.

A study conducted by Aminoff & Pihlajamaa (2020) revealed a triple-loop learning-curve as a solution for overcoming barriers affecting CE experimentation. The triple-loop learning technique applied within the experimentation process presented guidelines which supported the successful implementation of the CE innovations. Guidelines which help to overcome external and internal barriers include careful selection of process participants, motivational activities, assurance of tools and resources between different stakeholders, challenging the innovation design, and other workshops and facilitators.

2.3 Synthesis – A Framework of CBMI barriers and enablers

The synthesis links the above explained research areas by combining the key concepts within the literature to one coherent framework. The two concepts are CBMI processes, and barriers and enablers of CBMI. The framework is built from the ideas of the two concepts, and empirical data then used to examine and complete the illustration.

The first part of the literature review examines the concept of CBMI through current relevant research. As CE among BMI is under-researched, it provides a compelling study area for further empirical studies (Aminoff & Pihlajamaa, 2020; Bocken et al., 2018; Guldmann & Huulgaard, 2020). This thesis chose BMI process perspective as the relevant research stream of the study. Therefore, a unified working definition is provided based on current research of BMI: **BMI is the process of implementing a new BM design, or similarly modification of an existing one, in terms of trying to achieve or maintain market position** (Chesbrough, 2010; Geissdoerfer, Vladimirova, et al., 2018; Teece, 2010). Hence BMI is an activity which accelerates and supports BM experimentation and re-learning (Aagaard et al., 2020; Chesbrough, 2010).

Next, the BMI concept was further examined in a CBMI domain. Promising avenues regarding improvement of CE experimentation, such as front-end innovation learning and triple-layer experimentation checks, were found in a few empirical studies. (Aminoff & Pihlajamaa, 2020; Bocken et al., 2018). However, CBMI process is a relatively new research stream and hence is often scattered within literature, so requires further examination (Aminoff & Pihlajamaa, 2020; Bocken et al., 2018; Linder & Williander, 2017). The lack of sufficient knowledge and tools for overcoming the challenges faced within CBMI, as well as the misinformation about circular BMs, illuminates the narrow adoption and implementation of CBMs (Bocken et al., 2018; Guldmann & Huulgaard, 2020; Linder & Williander, 2017; Weissbrod & Bocken, 2017).

As a second perspective this thesis examines the barriers and enablers affecting CBMI. This second perspective sheds light onto the most prominent barriers companies might face while conducting CBMI. At first sight the range of barriers companies face within new BM experimentation and implementation seems infinite when analyzing scattered empirical evidence through different industries and research fields (Guldmann & Huulgaard, 2020; Ritzén & Sandström, 2017). However, according to research the key barriers can be categorized into four levels: market and institutional level, value-chain level, organizational level and employee level (Guldmann & Huulgaard, 2020). The framework uses this categorization to further examine the empirical data.

Finally, general enablers are identified among the research, from which the most coherent is the commitment of leadership to CBMI; however a comprehensive set of enablers and strategies for overcoming CBMI barriers are yet to be empirically acknowledged (Linder & Williander, 2017). From the key categorization of barriers, CBMI and enablers, a coherent framework can be built. Figure 10 below is used to structure the examination of the empirical data, and subsequently completed after the empirical study.

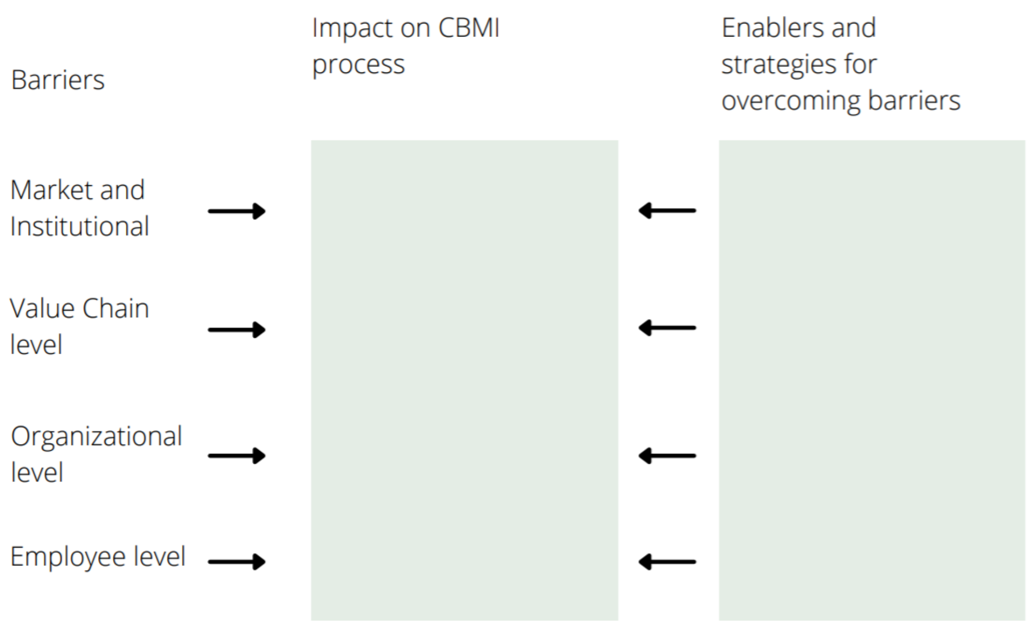


Figure 10. A study framework to analyze key findings of the empirical study; completed after the findings section.

3 Methodology

Chapter three presents the research methodologies applied in this thesis. To conduct a thorough analysis of the research methodologies, an analysis of research philosophy, design and method, followed by a case selection process, and data collection, are all presented. The chapter concludes with an evaluation of the validity and reliability of the study.

3.1 Research philosophy

The relevance of philosophical issues in business research is significant since the underlying assumptions and reflection of research stems from the philosophical concepts and positioning (Eriksson & Kovalainen, 2008). Therefore, exploring and analyzing the philosophical position of the study is important, and provides assistance when examining the research strategy and methods. The fundamental understanding of research connections and study decisions occurs through philosophical concepts.

Eriksson & Kovalainen (2008) introduce two key concepts, ontology and epistemology for research's. Ontology, which refers to the existence and reality of the surroundings, is a key philosophical assumption which can be referred to in qualitative research as a fundamental concept. In addition, ontological assumptions in qualitative research derive from the understanding of subjectivism and subjective behavior, which in turn affects experiences over time. In contrast, epistemology concentrates on the theory of knowledge, more precisely what is knowledge and how we "know" something. The concept of epistemology provides boundaries to research knowledge and the limit of the knowledge at hand. Both concepts can be viewed within this thesis through a subjective lens which emphasizes observations and different interpretations in social situations. The direction is chosen with the realization that societal and organizational actions happen in a subjective manner in case studies. Understanding the components of both subjective ontological and epistemological concepts provides the means to evaluate the case study with the realization of a nonobjective truth and knowledge which surrounds the research. In other words, the high possibility of several conscious truths creates high likelihood of diverse outcomes from the data, which in turn sets requirements for careful questioning throughout the analytical process.

3.2 Research strategy & method

Yin (2009) describes a case study as a highly-used method of analysis, which and foremost serves as a tool for understanding a multitude of (interacting) social phenomena. Hence, the case study method is popular especially among social sciences (Yin, 2009). Case study research provides a means to understand and evaluate characteristics of real-life events in a systematic and holistic way (Yin,2009; Eriksson & Kovalainen, 2008). Furthermore, case studies are utilized in seeking out the diverse and complex experiences of a phenomenon. Among business research, case studies became a popular method as the fundamental capability to format matters in a comprehensible and managerial way became appealing (Eriksson & Kovalainen, 2008).

The strengths of case studies are reviewed here. Firstly, coping with range of variables and data points can be achieved through the case study method (Yin, 2009). Yin (2009) states that case studies can use multiple sources of evidence such as documents or reports, interviews and observations to draw conclusions on. In addition, three different research approaches can be extracted from case studies; exploratory, descriptive and explanatory research. This thesis study is fundamentally exploratory, since it aims to explore CBMI within the Finnish forest industry in the context of barriers and enablers, and thereby further enlighten the topic since the research of CBMI barriers and enablers in the Finnish forest industry is notably deficient.

Since fundamentally a case study is an in depth “empirical inquiry” investigating a real-life phenomenon (Yin, 2009), and this study aims to elaborate upon the phenomena of CBMI by examining the different possible barriers and enablers, extensive case study research is a necessary and natural fit for extracting the available knowledge. Extensive case studies are appropriate for extracting empirical data, which in turn opens a possibility for cross-case analysis among results, and can act as a base for theoretical groundwork (Eriksson & Kovalainen, 2008).

The comparison between single and multiple case studies is relevant for understanding the variations in case study methods. Multiple case study research arises from the need for wider incorporation of cases and data (Eriksson & Kovalainen, 2008) with the intension to conduct “cross-case” analysis and conclusions (Yin, 2009). In contrast, a single case provides in depth evaluation of a specific issue or a unique phenomenon (Eriksson & Kovalainen, 2008). For the purpose of gathering a wide range of evidence regarding company barriers and enablers, a multiple case study approach is chosen. This allows for a deeper investigation and analysis of different perspectives within the cases, since the research question is positioned in a way which allows for multitude of answers and categorization. Furthermore, multiple case studies allow for both within-case analysis and cross-case analysis for the purpose of concluding a theoretical base of barriers and enablers affecting CBMI in the Finnish forest industry. Choosing the number of cases is however influenced by the understanding of limited resources and the avoidance of purely marginal extra cases. The case size and design are thus carefully balanced to provide support and relevance to the research topic and questions. The case size and selection process are further discussed in section 3.3.

Next, the research method and understanding of the equivalent options within data gathering and analysis require explanation. Two research and data collection methods can be the determined: qualitative and quantitative. Briefly, quantitative methods seek to gather evidence through numeric data (Sonyel, 2017) and qualitative methods rely on non-numeric data (Eriksson & Kovalainen, 2008). The study is conducted in a qualitative format. Substantial availability of different qualitative data collection sources, such as interviews, observations, textual data and visual materials, is beneficial when analyzing complex situations and phenomenon (Eriksson & Kovalainen, 2008). Furthermore, empirical data can be categorized into primary and secondary data. Researchers personal acquiring of data is referred to as primary data, while in contrast secondary data consists of already existing data (Eriksson & Kovalainen, 2008).

3.3 Case selection process

The selection process was conducted through purposeful sampling (Yin, 2015: Patton, 2002) in which a set of characteristics are chosen to meet certain criteria. The idea is to strategically determine a sample set which allows contrasting as well as supporting results to emerge. The selection was based on relevant characteristics such as size and circularity of the company, as well as evidence of conducting CBMI in the Finnish forest industry. Based on these criteria a search of relevant and purposeful parties was conducted. The conclusion of the sample-selection process was a collection of ten different company interviews.

From the sample set of ten, two different clusters - SMEs and MNCs - were formed. The cases are divided by the size of the company, firstly to identify the small and medium sized enterprises (the SMEs), and secondly the large multinational corporations (MNCs). The division between the cases is further strengthened by the companies operating time or established longevity. The SME cluster entails companies which have been operating within the past 10 years. In contrast, the MNC cluster contains companies which have been operating within the past 80 years and have strong historic roots in the Finnish markets.

Next, the characteristics of the sample companies are further elaborated. The companies and entities are operating in a forest industry domain or other relevant production of wood-based products or services. Additionally the companies chosen have been acknowledged to lean or operate towards CBMs to ensure their experiences with CBMI implementation. All the sample companies were experiencing and conducting circular business activities at the time of the cases, and therefore were also familiar with CBMI either explicitly or implicitly.

The selection of interview participants included top managers and leaders of the company, as well as experts on sustainable business development. The interviewees' backgrounds ranged from business and administrative though to technical aspects such as engineering. Therefore, the interviewees' backgrounds also provided some wider perspectives for the research topic. Additionally, all interviewees within the companies were individually familiar with CE and sustainable BMs to further ensure an informed input to the analyzed subject; they collectively provided a significantly informed and relevant population.

3.4 Data collection

Data collection was arranged through semi-structured interviews on Zoom. Interviewees' professional titles varied from "head of sustainability and circular economy" to "product/business development managers" and "CEO". The MNC interviewees' roles were specifically dedicated to sustainable and circular strategy, while in the SME cluster the roles included CEOs and overall product and business managers. This was a natural occurrence since smaller firms rarely have dedicated circular business developers, while larger firms can afford to establish such specific roles.

Participants were contacted through LinkedIn and email. The ten interviews were conducted across a time period of three months, and organized through one-on-one sessions apart from one interview which consisted of two participants. The length of the interview varied between 20 to 80 minutes depending on the time available to each participant. On average the interviews took approximately 47 minutes. The interview language was Finnish as all participants were native Finnish speakers. The individual timeframes of each interview are set out in tables 4 and 5 below.

Observation of the expressions and body language of the participants could be conducted with limitations due to the two-dimensional properties of a camera call. However, small observations and a general atmosphere of the interviews could be assessed, with the exception of couple of interviews where the interviewees did not turn their cameras on. Additionally, the interviews were recorded with the permission of the participants and later transliterated word-for-word to individual files. Furthermore, relevant quotations from the interviews were translated to English by the author.

Table 4. SMEs cluster interview details

Interviewee	Date	Case	Length of the interview
E	3.2.2021	SME (1)	33 min
G	5.2.2021	SME (1)	31 min
I	12.2.2021	SME (1)	60 min
K	11.3.2021	SME (1)	48 min

Table 5. MNCs cluster interview details

Interviewee	Date	Case	Length of the interview
A & B	16.12.2020	MNC (2)	60 min
C	28.1.2021	MNC (2)	20 min
D	29.1.2021	MNC (2)	60 min
F	3.2.2021	MNC (2)	50 min
H	9.2.2021	MNC (2)	31 min
J	18.2.2021	MNC (2)	80 min

The interviews were structured into the following five categories: introduction; circular projects; external & internal challenges; enablers and risk management; and lastly perception towards BMI. Briefly in the beginning all interviewees were asked about their experience with CE followed by a description of current entity CBM or projects. The interview content varied due to the varied length of the interviews and how different context-dependent questions emerged individually. However, the structure of the interview stayed the same throughout the data-gathering, and a list of coherent interview questions can be found at Appendix 1.

3.5 Data analysis

The logic of deduction, induction and abduction is central in terms of research inquiry and theory building (Eriksson & Kovalainen, 2008). The purpose of research is to create and share knowledge which in return is often modeled through one of the three social science logics. Deductive logic draws conclusion from hypotheses; hence reasoning is done through theories. Inductive logic on the other hand concentrates on deriving speculations from generalizations, social norms and cases, resulting in drawing theories from empirical evidence. The third approach is merely a combination of the two approaches explained above. The logic of deduction and induction is often used parallel which can result in combining different logics of theory development (Eriksson & Kovalainen, 2008). For this thesis, the findings are analyzed mostly through abduction logic, since there are no straight connections to either deduction or induction. The study draws support from the relevant research presented in the literature review, whilst the empirical data is gathered to build a new framework which can be used for reference in the future. Therefore, abduction logic is seen as the most fitting choice for this thesis.

The data analysis followed the Eisenhardt method (1989) by adopting two phases of analysis: within-case and cross-case analysis. The data analysis starts with a thorough within-case analysis which is driven from the importance of understanding volume data (Eisenhardt, 1989). The within-case study starts by conducting written individual analysis of the two cases based on empirical data and secondary data, and hence provides the most insight into the individual data sets of SMEs and MNCs. The transcripts also provide a way to get familiar with each company entity and separate data files.

The second phase the thesis uses to analyze data is the cross-case analysis. The cross-case analysis includes comparison of patterns in a structured and statistically clear way. The importance of well-structured cross-case analysis is significant: it increases the accuracy and reliability of the theory in question, and probability of data being well interpreted. The tactics of cross-case analysis can help in entailing broader findings and deductions (Eisenhardt, 1989) between the two cases of SMEs and MNCs. The author uses MS Excel to further analyze the within-case data, as well as data coding for interpreting patterns and differences among the two clusters. The data codes are presented at Appendix 2.

3.6 Validity and reliability

The quality of a case study is determined by testing the validity and reliability of the study (Yin, 2005); hence discussion about these two elements is highly important. Firstly, validity confirms that proper measures were used in the study and ensures data accuracy in terms of connections and generalizations. Secondly, the reliability factor ensures that the case study possesses a sufficient level of quality of outcomes under repetition: when repeated, the same set of conclusions and findings can be made. This can be achieved through proper and transparent documentation and explanation of the study (Yin, 2005; Saunders et al. 2016).

The following actions were taken to ensure the validity and reliability of the study. Firstly a proper definition and technique of sample sets is made to ensure construct validity (Patton, 2002; Yin 2005). Secondly, interviewees were double-checked on the time of the interview and asked to reflect on important relational claims to ensure the internal validity of the study. Thirdly, the interviews were carefully audited, and findings were further sent back to the participants to ensure mutual understanding and correct translations of the interview data. The external validity and repetition of the study (Yin, 2005) can be partly assured by subsequent cross-referencing into wider Finnish forest industry markets. However, the study is strictly tied to Finnish forest industry markets, and hence cannot be assured as being reliably repeated in or generalized to other countries or similar industries operating elsewhere.

4 Findings

This chapter illustrates and presents the key findings and data of the empirical study. The chapter begins with a brief evaluation of the current state of the Finnish Forest industry. The findings of the SME and MNC case studies are evaluated and analyzed, comprising a within-case analysis and then cross-case analysis of the data.

4.1 The Finnish forest industry

Forest is one of the most important renewable resources of the world (European Commission, 2021b). In addition to bringing a significant economic benefit as a resource, forests are also important parts of society as a biodiversity resource. Forests naturally absorb and break down carbon dioxide, further benefiting the fight against climate change and air pollution (Finnish Forest Industry, 2021a). Hence practicing sustainable forestry and its appropriate usage as a resource is important (European Commission, 2021). The Finnish forest industry is a significant part of Finland's national economy and a highly-integrated part of the European bioeconomy (Finnish Forest Industy, 2021b; Koskela & Vehmas, 2012). Finland is 75% covered by forest, which makes Finland the number one country for forest land coverage in Europe. (Finnish Forest Industry, 2021b). Key indicators of Finnish forest industry are illustrated in figure 11 below.

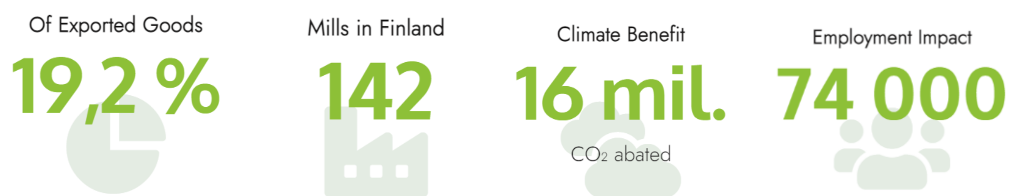


Figure 11. Finnish forest industry indicators (Finnish Forest Industry, 2021b).

As stated earlier in the study, the forest industry is undergoing a disruptive change towards new CBMs, especially in introducing new elements of bioeconomy and circularity to the industry (Amato et al., 2020; Hetemäki & Hurmekoski, 2016). A study conducted by Korhonen et al. (2018) analyzed the key drivers of forest industry in sustaining competitiveness within the corporate world of today. The results confirmed the importance of change and ability to adapt, differentiate and innovate. The evidence across the forest industry remains clear: change is inevitable for the purpose of remaining competitive across relevant markets (Korhonen et al., 2018). Changes to the direction of circularity, sustainability and bioeconomy is on its way; however the lack of knowledge remains high and incentives to change are still low within the forest industry. This can be explained by the lack of direct evidence of the benefits of radical circular and bioeconomic activities among forest industries, as well as the barriers and limitations which slow down the appeal of implementing sustainable and circular activities (Amato et al., 2020).

The study of Amato et al. (2020) reveals some key CBM designs in Finnish forest industries, such as changes to renewable and natural processes, maximation of material and energy efficiency, development of scale-up options, and adaption of a stewardship role. The study also mentions how much variety there is across CBM designs within Finnish forest industry entities, while also discovering the industry's slight preference towards closed material loop designs. Furthermore, the study reveals slowly increasing interest and adaption of more radical CBMI, such as sharing models, which still lack a clear presence in the markets. The shared network approach is also referred to in the Bocken, Olivetti, et al. (2017) study which emphases the inherent importance of networks among CBMs. More research on new and radical CBMI, such as a shared network approach, is needed within the Finnish forest industry. All in all, the change occurring towards new innovations has prompted up the presence of new start-ups and small & medium sized companies in the markets, while still having the presence of large multinational companies rooted in the industry. Next, the findings from the SME and MNC cases empirical data are discussed.

4.2 Within-case analysis

The within-case analysis identifies and presents the empirical data by illustrating the key findings of the two clusters through relevant citations and quotations. All individual cases in the SMEs and MNCs are briefly introduced to get an overview of the case companies' operations, size and the design of CBM. Both clusters are analyzed as follows: firstly, the empirical data of individual barriers and their impact on CBMI is presented; secondly, the individual enablers and strategies for overcoming the barriers to CBMI are illustrated to conclude the within-case analysis.

4.2.1 SME cluster

The SME cluster includes four companies, examined and introduced here. The first interviewee (E) of this cluster works in a Finnish wood-based material company Paptic, founded in 2015. Currently, the company produces two packaging materials made from wood. The mission is to introduce eco-friendly, sustainable and desirable material for companies requiring strong and reusable packaging material. The production of the material is created with a circular and sustainable mindset. The material production does not require additional infrastructure, hence the supply-side is fully circular. Additionally, the recycling capabilities are already designed into the process from the start.

The second interviewee (G) works in Sulapac, a wood-based material producer founded in 2016 in Helsinki, Finland. The company's product materials are fully biodegradable and microplastic-free. Sulapac's BM is designed to be fully circular throughout its value chain. The material is fit to use within existing plastic manufacturing infrastructure and is compatible with the industrial composting system.

The third interviewee (I) is from a Lumir, founded in 2010 and a provider of natural Finnish fiber acoustic material. The material is designed to absorb harmful CO_2 to further benefit the environment. The company has designed their BM to obtain desired values of sustainability and circularity at all operation stages.

The final interviewee (K) of the cluster works in Niimaar, a company which provides solutions for waste handling by designing wood-based products for recycling and décor. The company states "the principles of zero waste and circular economy are in our DNA since day one, creating designs to last generations." (Niimaar, 2021).

SME Barriers and CBMI process

The barriers affecting CBMI for the SMEs cluster are categorized into four levels: market and institutional level; value-chain level; organizational level; and employee level. Each level is individually analyzed according to the actually experienced barriers and their impact on the CBMI process.

Market and Institutional barriers

The most significant market and institutional barrier that affected the CBMI process involved regulations. All the SMEs interviewees agreed that regulations are currently a significant barrier in CBMI. Most notably, a current EU regulation called the single-use plastic (SUP) directive seemed to cause a lot of friction, and was described as follows.

> *"The legislation always generally speaking follows a bit behind. Now when moving towards circularity we have a new challenge when following another business logic, we are in other words in a state of uncertainty. – At the same time the regulations and famous sub directive is made with a haste. Now it seems like they are restricting too much the technology side. -- The purpose of a new legislation should be that it would not make bringing new materials and solutions to the markets harder when the new solutions are trying to cope with the existing bigger problems." (E)*

All companies agreed that regulations dealing with sustainability and CE goals are needed and effective, but the technological and innovation restriction are causing problems. The regulated material flows and strict restrictive actions towards those materials and products created friction in most companies. The most agreed opinion regarding legislation was the unnecessary restriction of processes and materials.

> *"…the end goal should be regulated but in a way the path and process towards the end goals should not be restricted" (G)*

On the other hand, political guidance and relief is also needed. One of the interviewees brought up that help from the government regarding circular products and processes is nonexistent, and hence it is more difficult to compete with uncircular products in a price-sensitive market:

> *"The biggest thing is that circular economy and circular models and that kind of materials are not supported at all [legally] and in practice they need to work as well as the linear materials. –– In practice the company does not benefit from moving to circular activities and materials other than actual environmental benefits and marketing acts from there." (I)*

Therefore, the lack of beneficial support systems from a governmental perspective is negatively affecting the implementation of CBMs. The interviewee also pointed out the difficulties in trying to bring the issue forward within the political stage:

> *"…But as I have also tried to talk to many ministers in Business Finland abroad and none of them seem to take any stands on the issues [circular economy support] so they are very careful in there to engage in any conversations and hence this is like a political dilemma." (I)*

Value-chain level barriers

Knowledge about the markets and value chain is key when implementing CBMI. Most participants of the case did not feel it was difficult to find people that are interested in CE or sustainability, but the challenge was in organizing the right partnerships and processes, and finding the right actors, relating to the complexity and varied structure of CBMs:

> *"The difficulty is that we have to get a large number of actors to work together and then it is very essential that every actor understands what benefits this [circular models] has for us. –– Compared to a linear model in a circular model we have to understand the value chain so much more closely, so we can lift the benefits and new roles to surface and get companies involved with it." (E)*

A significant risk regarding CE, in the context of recycling or shifting your environmental impact further into your value chain, was also raised by some interviewees. This was revealed through experiences within the value chain. The risk of limited understanding of the value chain can lead to noncircular activities and 'green-washing'. Only evaluating the company's inner circular processes, and for example recycling materials upstream but not extending the ideology further within the value chain, leads to unwanted results because the circularity of certain processes is not ensured further down the value chain. Therefore, the negative environmental impact is simply shifted upstream in the value chain, and the company may be unaware of the unproductive activities which are passed on. The challenge remains in knowing where these kinds of activities are taking place. Problems may arise also in trying to identify and assign responsibility, including questions such as which actors are taking the responsibility, and from which activities in the end the noncircular impacts actually stem. In practice it is thus extremely difficult to manage the whole value chain in a systemic way which allows for a complete circularity to exist:

> *"Thinking of only recycling as your own process is dangerous. So in a way they… you [company] have transcended your own environmental effects to the next step, but then it stops there, and it is not anymore ideal circular movement, and having possibly even worse consequences." (G)*

According to the SMEs, reluctance and friction in the value chain towards CBMI seemed to increase in both core elements of the value chain, that is the supply companies and customers. The SMEs had collectively similar supply networks, such as certified forest keepers which assured the sustainability of the materials used. Additionally, all the SME companies were positioned similarly within their value chains, hence in this cluster customers were referred to for example retail stores, brands needing packaging material, or other relevant parties such as construction companies buying wood products etc. As within CE the involvement of the whole value chain and communication between the ecosystems is vital in order to gain momentum and scale up, it can be fatal for the business if challenges within the value chain are not overcome. Furthermore the distribution of bargaining power across the value chains creates friction and raises the risk arising from implementing new practices.

A significant factor here is that the subjective assessment of the nature of markets for different paper and wooden products, as well as subjective assessment of partnership opportunities by (and for) different actors, cannot be excluded. This limits the certainty of any conclusions drawn from the data available, and this is taken into an account when making further interpretations. The following quotes are from SME companies evaluating the wood suppliers and customers in the value chain:

> *"When companies [wood suppliers] have their machines and old practices, then they for a long time try to convince themself that they can continue the same. And because of this… so that we can get them moving fast or get moving at all, we have to be able to prove them that actually sustainable and profitable business is generated here." (E)*

> *"What comes from the industry is that the customers are so price sensitive, and everything needs to be as cheap as possible, so even if you can provide qualifications [of circular benefits] but you have couple of euros more expensive product per square meter, then in practice they will always go for the cheaper option" (I)*

Additionally, a significant barrier experienced by the SMEs was the difficulty in changing the underlying industrial operations and culture set up by bigger companies. Therefore, CBMI and working together with established companies proved to be challenging from time to time. This was especially tied to either the planning phase or scale-up stage. This is illustrated by an interviewee who previously mentioned having no problem coming up with new solutions and different circular innovations and processes, but struggling in implementing them because of the overall risk-averse behavior of the industry:

> *"…The whole forest, paper, pulp industry is a dinosaur, the change… the change is very slow. Luckily, it has slowly started to change, and more and more actors are finding investing opportunities that would fit to their ecosystems. --- But they would seriously need faster culture and new approach to new products." (I)*

> *"it is very hard to leave from the comfort zone it seems like. If you think about the bigger companies when you don't get any big financial gain from changing the models, it is such a big risk for them to start tearing their structures down." (I)*

Organizational level barriers

Resources such as financial support at the institutional level were raised by interviewees as an issue of great importance. Additionally, resources for R&D and product development, CE certificates, and quality control (compared to linear models) were raised as factors which require more attention. Notably, the inherent characteristics of circular models, and their cooperative nature with other partners and companies even across industries, require more effective planning and organizing. Companies actively conducting CBMI can therefore experience increased risk from a resource standpoint:

> *"If we would not have such an elaborate product development and R&D we would already be profitable company. But we have wanted to actually and for real bring this business towards the big circularity. — Probably a little bit more we have to invest in R&D compared to a linear model." (I)*

> *"When the whole business is built on the sustainable and circular standpoint there is risk. -- At some point of the process, there is the challenge that do we want to be sustainable or do we want to exist at all. In a way the hopes and goals are at a risk of being shifted to uncircular if there is not enough profit and resources. We are lucky that we pushed through this." (E)*

Three of the interviewees specifically raised challenges regarding CE certificates. The expense of CE certificates can rise to extremes, whilst the benefits are left vague, but businesses working with CBMs are expected to afford them to provide proof of their actions. The certificates do provide proof, and a means to both communicate circular actions and reject the allegations of 'green-washing', which is a significant benefit. However, the payout required is still too great for a lot of companies:

> *"These certificates are expensive even for a bigger sized company and that takes away from the idea of the certificates in the first place. You want to inform the*

customer and consumer about your ecological product. But if you don’t afford to pay for the certificate it defeats the purpose.” (K)

“We are heading to a direction of multiple different tests, which is actually very good and benefits the reliability of circular activities. — First of all you must obviously pay for the labs and then the certification system cost, and finally the maintenance of it also costs, so if you have some kind of new material it is going to cost a lot. So you don’t only have the R&D costs but the upkeeping of different kind of certificates as well. This can slow down the efforts of bringing new materials to markets for sure” (G)

To understand better the perspective of economic barriers and increased need for organizational resources, questions related to economic measures were asked. This revealed the underlying disconnection of circular business measures. Circular projects are currently evaluated with the same perspectives and measures as a linear model due to the lack of measures tailored to CE. Sustainable and environmental measures are taken into consideration when evaluating the company or their actions overall, for example in a form of sustainable reporting. However, financial metrics regarding inner circular economic values are missing. The missing measures were identified as a possible reason interfering with CBM implementation and innovation:

“Improving measures is highly important, because a company does not exist if it doesn’t provide profit, it will cease to exist right. So in a way what you are measuring is the whole point – Even macroeconomic drivers should provide more measures for measuring circular growth.” (G)

SME examples of economic distress often included repercussions in the scale-up phase of the CBMI process. Furthermore, the financial barriers and narrow economic metrics have the ability to shut down circular projects where the value of projects is being calculated through linear metrics or unstructured circular or sustainable metrics. The scattered nature of the current metric system for CE is demonstrated below:

“A consultant had done an analysis for a company based on three environmental impact assessment systems. And when the three analysis had been done with the different metrics then the company had been ranked totally differently each time based on which valuation criteria had been used. Hence, there are so many fac-

tors to consider and the metrics are so unstructured at the moment. Development of the metric system is of upmost importance." (G)

Employee level barriers

The data revealed no coherent employee-level barriers or challenges. The discussions about employees and the commitment of individuals revealed no major issues in the examined companies. However, there may be a negative effect on the learning curve of employees in a CBM experimentation if the overall barriers regarding the project are high. This can demotivate the employees. However, no direct connection from employees and their attitudes to immediate challenges could be made:

"In a context of circular activities. The organization needs to understand where it is heading. And especially why it is heading to that direction. And I think that in our case that 'why' question doesn't need to be elaborated to our employees, because already in the process of applying to this company, they have understood it and also want to be a part of this change." (E)

Mostly the interviewees did not see a lack of individual innovation, knowledge or expertise as a barrier regarding CBMI. In fact, individual expertise was high in the SMEs; one of the interviewees reinforced this as follows:

"In practice, at our best, a circular products prototype is ready within a week from the time it was initially ideated." (I)

SME Enablers for CBMI

A clear **market and institutional enabler** for CBMI is efficient goal-setting in terms of sustainability and CE targets, rather than actual technological and material restrictions. Such goals can include pollution reduction, or specific circular use or recycling targets. In fact, all SME interviewees found certain regulations and end goals motivating and beneficial in terms of CBMI:

"Regulations do enable changes for the good of circular economy. Without regulation there is no incentive to change current value chains and industries." (K)

Increased transparency was identified as a significant enabler, especially at the **value-chain level.** Transparent activities and communications among actors help companies implement circular activities - internally and externally - more successfully. In the forest industry, the CBMI material flows are evaluated throughout the whole cycle, which increases the need for clear understanding of more complex interrelations and connections between different actors:

> *"…understanding our value chain as well as possible, has helped us going forward with our business plan" (E)*

Appreciating the dependencies of different systems, and especially understanding the company's existing symbiotic relationships at the beginning of the CBMI process, are both beneficial. The planning phase benefits from the inclusion of thorough analysis of the cycle key components and players:

> *"It is important to already in the design phase to look at the whole value chain and the product or service as a part of a bigger system. – If you think about materials, there is no superior material which fits to every system, everything is depended on the systems and how it is used." (G)*

One important **organizational enabler** for CE is the development of metrics which measure and illustrate more accurately the value of circular activities; thus for example developing appropriate and sufficiently detailed metrics to include whole ecosystems would help in pinpointing possible harmful activities or breakages in circularity. Better metrics can help leaderships make more informed choices, and actually help discover or recognize the harmful activities, whilst at the same time push efforts to develop areas which are currently not even measured. Clear metrics could also increase the attractiveness of CBMI and relieve some of the economic distress of the innovations:

> *"Some drivers are in development, but we need, for example, metrics for environmental impacts which look at the whole system and not just one or couple of actors." (G)*

Secondly the commitment to CBMI from the leadership was perceived as a significant organizational level enabler. This especially helped companies fight through hard times and economic distress since the vision, strategy and leadership of the company were all aligned, highlighting and reinforcing positive activities:

> *"The people have really picked up development and innovations towards circularity. This has happened through company culture. The more the leadership speaks about it [circular activities] the more it really becomes a part of action and people." (I)*

Additionally one of the SME interviewees mentioned the company size and the agile atmosphere as important factors in fighting challenges against CBMI. This referred to their ability - as a small group - to make agile and open decisions, and change business plans within short timespans. Hence it brought additional value when faced with uncertainty:

> *"When challenges arise and additional uncertainty or delays occur, we are able to quickly response to them. — And if something radical happens that needs quick response from our end, the implementation of it happens quickly. This is because the group is small, and operations are open inside the company." (E)*

Finally, **employees** in most companies acted as natural advocates for sustainable actions. Employees who are positive about the circular activities, and present high morals and ethics towards sustainability issues, are perceived as motivating and a strong force in battling challenges. All SME companies were proud of their individual employees, and stated that they are ready to battle the challenges and share the company values and beliefs. This could be due to the fact that companies at the recruiting stage are paying attention to hiring people who share the same values as the company, as expressed at the established organizational level:

> *"A certain guidance has already happened in the recruiting phase." (E)*

According to the data presented, a clear picture of the SME cluster can be made by populating the framework presented in figure 10 at the end of literature review. Figure 12 illustrates the key implications of barriers to CBMI processes, and strategies for overcoming the barriers, strategies based on the identified key enablers.

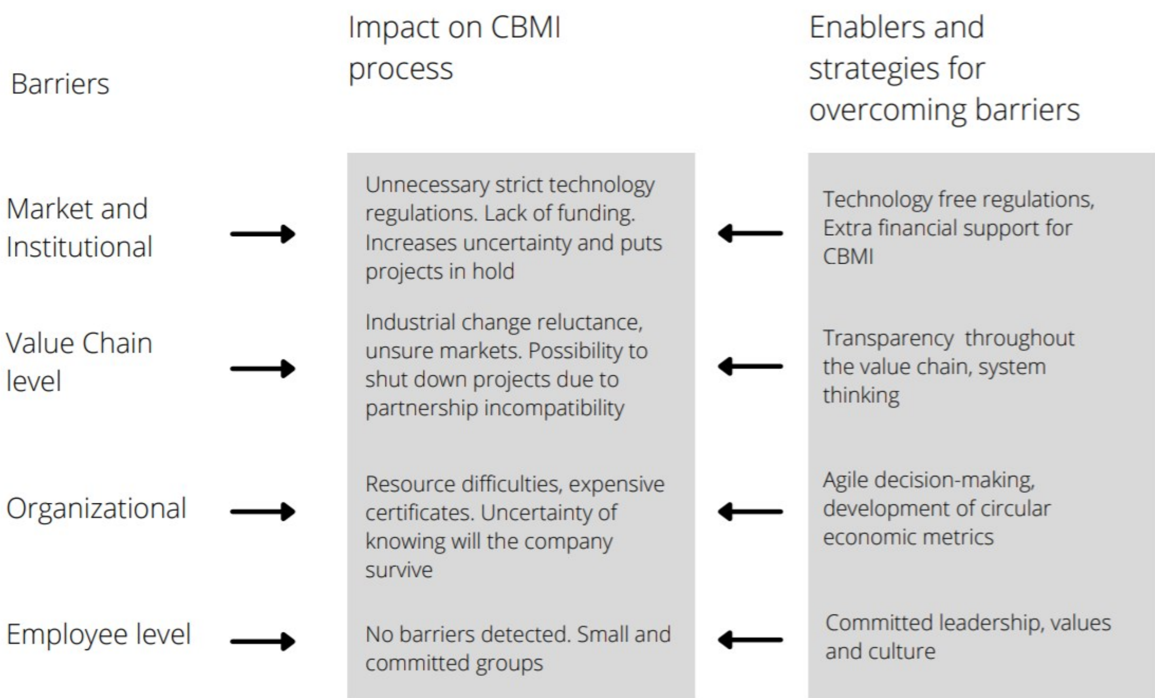


Figure 12. SMEs findings of CBMI barriers and enablers

4.2.2 MNC cluster

First a brief introduction of the MNC cluster and the case companies is presented. The first company, UPM (interviewees A & B), is a Finnish forest industry company founded in 1996 via a merger. The company has over 18,000 employees and is operating in 12 different countries. Its products range from pulp, paper, plywood, saw timber and other forestry-based materials to bioenergy, biofuels and nano-scale products. Circular practices in UPM range from efficient side-stream utilization to products made from residues and waste. UPM innovates as well as rearranging current models and projects to circular ones. For example, UPM practices closed-loop CBM designs as well as circular bioeconomy with many of their current projects.

The second company (interviewee C) is Kotkamills, founded in 1990 and employing over 500 people. Kotkamills operates in Finland with global partnerships all over the world, and manufactures and innovates sustainable and circular products created from wood. All product ranges are created with CBM and sustainable goals in mind. Their CBM follows the logic of “game changer loop” which they created to battle for circularity. The blueprint of the CBM follows the logic of closed loops, with stages such as recycling and monitoring of end-use phase.

The third company, Stora Enso (interviewee D) was founded in 1998 as two companies merged into one. Stora Enso, which employs 23,000 people, is currently a global operator and a leading provider of renewable materials and products such as packaging solutions, biomaterials, and wooden construction and paper materials. Stora Enso is focusing especially on circular bioeconomy which is one of the key CBMs of forest-based industry today. Stora Enso emphases the circularity of their raw materials and works not only to increase recycling but also to create circular processes within the whole value chain. It introduced multiple CBM designs to a variety of products, including product life-cycle design, manufacturing, distribution, potential repair, reuse, remanufacturing and recycling.

The fourth company is presented anonymously (interviewee F); operating for over several decades, it employs over 30,000 people with global operations. The company is currently in the process of increasing circular activities in their current business by designing recycling of raw materials and increasing resource efficiency by following the key CE principles. One of their key goals in working towards CE is to recycle 80% of operational waste into raw material usage.

The fifth company MetsäGroup (interviewee H) was founded in 1947 and employs around 10,000 people. Operating in a global scale in over 30 different countries, MetsäGroup is one of the leading manufacturers of wood supplies from the northern forests. Operating in the bioeconomy and renewable resource stream, MetsäGroup’s

CBM design is to keep products and material in circulation for as long as possible, hence using the tactics of lengthening the circular loops. They also emphasize the maximization of raw material usage as well as resource efficiency.

The final company Pyroll (interviewee J) was founded in 1973. Pyroll is a manufacturing supplier of paper, packaging, carton board and paper sheeting materials and products. Pyroll strives to use environmentally-friendly materials and packaging solutions. Their principles strive from the pyrollgreen product category, which is designed to maximize resource efficiency, to support usage of recycling materials, and to prefer the use of renewable materials in their product lines.

MNC Barriers and CBMI process

As for the SME cluster, the barriers facing MNCs are categorized and analyzed through the same four levels: market and institutional level, value-chain level, organizational level, and employee level.

Market and Institutional barriers

Data showed that the market and institutional barriers, especially regulations, were of significant importance when discussing CBMI in forest-based industry. All participants brought up the current SUP directive, which is undergoing further development within the EU, as a key challenge when considering sustainable activities. The political effects of such legislation on CE and regulation were also raised as being of importance:

> *"The biggest risks in regulation are maybe related to how the regulators are regulating the laws way too passionately and ideologically. –– Forgetting the realities of practices. Legislation should have enough room for ambiguity to innovate and have innovations and bring new solutions and materials to markets. When the legislation is too strict and exclusive then many good models may be left at the level of thought and they are never commercialized, because they do not get the positive wind of legislation." (D)*

A relevant point of view was discovered within the data considering authorities and material restrictions. Especially within the wood and forest economy, a lot of uncertainty is created in the approval process for new materials and their uses. New material innovation is key in CBMI of forest-based industries, but because of the lack of knowledge about new materials coming from within the industry, the authorities are also experiencing difficulties in making agile decisions about new material flows and processes:

> *"These [circular materials] are in a way really new, so there is not necessarily, even in the authority side, experience of how these kinds of material are strengthened or approved." (A)*

The effects of regulations, and the ongoing battles over the SUP directive, cause unnecessary uncertainty which then adversely impacts CBMI. Circular activities are on the verge of being further politically structured and controlled, the reason being that political entities exert pressure to control what types of products and materials hit the markets. Even though the purpose of the SUP directive is to gain more momentum towards CBMs and sustainability, the effects on businesses trying to implement feasible options is negative. The ongoing political dilemmas and guidance creates an atmosphere in which uncertainty and future scenario thinking has stopped. This puts off the innovation and implementation of CBMs:

> *" –– if considering circular economy packets and directives, green deal etc. These [legislation] are not ready and as long as they are not ready there is still a lot of uncertainty happening all over. For example the SUP directive which purpose is to help circular business model innovations to markets by regulating out unfit option for circular economy. The regulations are set to be in power by June or July, but the guidance and control is fought over and that is a political process more than rational. It is hence too difficult to estimate the effects of it and now everyone is waiting where the frames are put." (D)*

Additionally, one interviewee pointed out the geographical structure of legislation and how the EU directives, which are under construction, are modified in the interest of Middle and Southern Europe. The legislation which is being optimized for the Middle-European forest industry creates challenges for the Finnish forest industry. Furthermore, the geographical location in CBMs is of great importance in forestry, which requires physical and industrial presence and is greatly affected by the perspectives and location-based regulations applied. In other words, industrial circular models require understanding of joint and local material streams and processes, and forestry is no exception, not least as it is usually bound to its location and physical presence within the markets:

> *"Circular economy regulations come from EU… In these issues it often comes in front of me that Finland is not a similar country to middle-European countries, which are the driving forces considering the development and direction of the regulations. Considering this, sometimes the regulations affecting us here [Finland] seem from our perspective a bit odd or then they [circular models] become expensive. And therefore they bring risk." (H)*

The amount of legislation, and the rapid changes and development, also brings additional stress and uncertainty to BM implementation and circular activities. As the legislation is often set by an EU Commission which is in charge for 4 years at a time, the development and continuity of the regulatory directives affecting CE and sustainability are developed and implemented hastily and with short-term views. The process is often broken, and all perspectives and processes are not taken into proper consideration since the urgency of the situation demands rapid change:

> *" …one commission of 4 years always makes the same agendas over and over again and nothing much else, there is no time to do else. There is a lot of just figuring out messes and challenges. It would be better to have more long-term activity. " (H)*

> *" They [regulators] have such a hurry to do them [laws and regulations] so they do not have enough time to hear all parties involved and it feels like sometimes they do not even want to and that in the end adds a lot of work in the company to trash out what comes from them. " (H)*

According to the data, the strict legislation and other barriers mentioned affect the scaling and implementation phase of the BM innovation. The current legislation and banning of certain materials or processes often limits and decreases companies' ability to use certain circular process or material flows, which in turn decreases the scaling or scalability of the CBMs. The uncertainty arising from the restrictions create friction which is hard to anticipate. An interviewee presented the following example:

> *"After the experimentation and inner piloting it is considered… well is this going to create business or not? And because of regulations it can happen that is not providing enough business, or it is too marginal. –– We are forced to leave good materials and actions outside of the model because of regulations which in turn makes the volumes small and it cannot be commercialized anymore, and partners are not interested." (F)*

Value-chain level barriers

The data collected regarding value-chain barriers and challenges among partnerships in CBMs revealed several critical points affecting CBM implementation. The most prominent challenges for the MNC cluster were predicting and managing circular material flows, and problems in creating local (business) ecosystems. The importance of ecosystem thinking is illustrated by the following comments from wood supply companies:

> *"Of course there is that kind of challenges, that always they [partner companies] are not matching, so if somewhere they would need material for a certain amount in a certain work… organizing that in a sensible manner and with close transportation is difficult." (A)*

> *"Well probably the forest economy and wood supply side does not arise so much problems at least not as I can recall, but maybe in the… if thinking those sort of industrial ecosystems, there they [challenges] might arise, so if thinking about us as a main engine company and then the little actors beside them. – There the partners need to be well matched, if thinking about scaling and volumes – And it needs to be like a symbiosis and a win-win situation."(H)*

The data collected from MNCs largely emphasized the challenges regarding value-chain management in the context of CBMI. For example, issues relating to transparency and value-chain management, and recognizing the right people to work with:

“The lack of transparency is one huge challenge so how compatible the different parties of value chain are to each other. – If we would know better what our producers are doing or expecting from us and their stakeholders… It creates better fitted actions and same when going upstream in our value chain.” (D)

People are ready to work together with CBMI. However the compatibility of the actors is sometimes difficult to determine:

“Recognizing the right actors is a challenge, ––, so there possible challenges arise and that is a huge obstacle, but not so much that people then would not be ready to ponder and start doing” (F)

The ‘stiffness’ of the forest and supply industry was raised by one of the interviewees, although other companies in the MNC cluster did not consider this as a barrier. Essentially, according to the interviewee, the old roots and industrial build, as well as the inherent state of the forest and slow biodiversity changes, can create barriers for quick and agile changes:

“Being in a conservative and traditional industry business, I feel that we are ahead of our time, but in the conservative forest industry the agile thinking is pretty new thing” (D)

“Especially here in forest industry we easily think that it is naturally circular, --- We think it is a perfect circular economy case. But it is not like that, we do have to challenge ourselves. Maybe sometimes we too lazily think that this is enough what we are doing for the sake of circularity. We do have to innovate and find new solutions. So I think sometimes we are too lazy with this.” (D)

The above criticism of the slow changes were partly explained by another interviewee:

“…to increase the diversity of economic forest, we know already how it is done. The things just take a long time, so because of the nature of the environment for example producing rotten wood it is not happening, not here in Finland, in one year. It takes at least about 10 years.” (H)

Overall the challenges lead to difficulties when implementing new CBMs. When analyzing the data all interview participants agreed that value-chain level barriers would slow down the process of new innovation and even the planning of CBMs. Three of the interviewees mentioned examples where the developed innovation could not be piloted because of the lack of local compatible systems and circular value-chains. Therefore, the challenges related to the value-chain level also have the possibility to terminate CBMI already in the planning phase.

This is related closely to the location and industrial ecosystem thinking. When projects do not inherently reap the positive effects of local ecosystems and industrial symbiosis, the projects are seen as irrelevant or even unable to be implement because of the location of the business. Inability for example to find matches for side-material flows is a disadvantage. Side-streams are sometimes present at very high volumes due to the significant capacities of large MNC entities, so when the right smaller partners or the right industrial actions are not available close to the MNC company location, circular activities are harder to achieve within today's technology and infrastructure. Furthermore, reduced local industrial activities, due to globalization, are causing difficulties within the forest industry in finding viable local ecosystems and circular symbiosis:

> *"… for example as a result of globalization a lot of industrial activities have moved further away from us, and then we do not have those partners, who are key for the circular model, or in relation could produce what we need. Then it arises the question should we transport it somewhere far away with the consequence of losing energy and polluting more" (F)*

Organizational level barriers

The interviewees elaborated on a couple of important organizational level barriers which were often related to expenses and financial factors as well as to difficulties in the planning phase. Furthermore, some individual challenges appeared amongst the data, making it difficult to construct a fully-coherent structure for this element of the dataset.

In five of the MNCs, CBMI was seen as an important part of the business. However, innovations were created alongside other core business areas and operations, which made CBMI an additional factor rather than a core business consideration. Therefore, according to the data, receiving financial support from the core firm for creating CBMs or projects was a challenge, and created friction within the company. In a worst-case scenario projects were terminated due to the lack of value seen in them, as mentioned by three of the interviewees. In a nutshell, viable new circular business projects and activities were often in danger of being overruled due to narrow economic valuation:

> *"So as an example when there is a new innovation and it is successfully implemented within the lab or in a small internal pilot, then often there is still the financing factor which can prove to be challenging and that gap needs to be closed before moving forward." (A)*

Circular projects are challenged by economic motors and evaluated on their actual or projected profits in the same way as linear models. Often planning and piloting of a project can be performed successfully, but the leadership and organizational outtakes or reviews can terminate projects not seen to be making enough profit for the company. This is a challenge which all participants agreed on. Naturally, all projects need to be profitable for them to be successfully implemented across the company and markets. The 'resource gap' for securing a circular project with the same amount of economic value as a linear model is difficult to close in practice, according to all case participants. This is due to the fact that circular projects in practice require inherently more resources, at least initially, and that raises risks:

> *"One showstopper is that the project is simply seen as too expensive and that it won't reach competitive advantage. There are many great innovations that have been developed but they can easily be just too expensive that they wouldn't succeed in the market." (H)*

In addition, circular projects which require additional investments and infrastructure are also terminated due to the investment barriers. Hence CBM have additional challenges in meeting the current compatibility of existing infrastructure and processes. The odds of succeeding with a circular innovation which is already compatible with the existing industrial processes and infrastructure is higher than for an innovation which requires additional investments. Therefore, ideas which are in theory, and within small pilots, extremely successful might never be commercialized due to the challenges of current organizational infrastructures:

> *"The expenses come forward also if materials cannot be directly or with minor processing utilized. So if additional or a lot of new processes are needed, it requires also more energy and more resources etc. But then there is also new investment and infrastructure expenses, and then if the material or end product doesn't generate enough money, that kind of more complicated process cannot be performed. And that is an additional challenge." (A)*

Most MNCs did agree that CBMs inside the company are still evaluated with the same metric systems as linear models. Even though some sustainable and circular metrics have been developed, they are more used in marketing and stakeholder reporting than in inner project evaluations. All in all it was concluded that the challenge for CBMI is not actually the actual or projected increased resource needs, but how the resources used or returns achieved are valued. The perspectives on CE economic evaluation compared to linear models are captured below:

> *"For circular economy, one of the biggest challenges is that we lead with certain thought processes and paradigms where the linear leadership models are based – so when we are measuring profit and also the efficiency of new models the linear metrics and economic measures that traditionally companies have, do not support circular value. This is a problem" (F)*

Planning a clear BM in the perspective of CE can be a challenge as well. One of the interviewees pointed out challenges that arise when forming new CE BMs and the importance of the planning phase:

> *"It is very hard if something has already been planned and executed and then we try to make it compatible for circular economy. The circular perspectives need to be considered straight away in the beginning of the process." (D)*

If companies do not appropriately design for circularity in the planning phase, the implementation of the model will not operate at the most beneficial level:

"Then you will not get much anything out of the project. – Bad design and incompatibility, that is what will eat away margins for succeeding." (D)

Additionally, testing courage and agility in CBM experimentation was raised as an organizational barrier in the forest industry. This somewhat contradicted the previous comments of the importance of planning, as it elaborated the idea that the planning stage is not a phase to be stuck on for a long period of time:

"A challenge in these circles is the missing experimenting culture. We are planning too much, and the planning is taking too long. We should more quickly get into the mode of trying different kind of solutions and how would they push through in the value chain and markets. And even then, from the feedback try to develop the processes. We need to think more agilely and understand more agile processes." (D)

When drilling down to more reasons causing lack of agility, one interlink with regulations was found. The way regulations are formed encourages compliance, creating an atmosphere which discourages innovation and risk taking when implementing new models. Therefore, it can cause hesitation and longer planning periods when trying to ensure thorough compatibility with the regulations, especially with emerging and as-yet uncertain regulations:

"It starts from the regulations and how you cannot make mistakes – Hence I do believe that it might also be because of it that we avoid risk taking and plan extensively" (D)

Furthermore, based on the data, scattered needs for resources create friction within the company and industry. The data analysis revealed an inconsistent pattern for resource needs within CBMI. Based on the individual experiences and in relation to financial independence, companies had different views on resource distribution when implementing CBMs. However, most participants did agree that CBMI required a lot of additional resource compared to linear models, mostly related to extensive planning and R&D work as well as the need for expensive certificate processes:

> *"The start of the project often requires the most resources. – This is how I see it, that the first start requires an extensive pondering and planning. And often then in the beginning the bumps in the road are found and, also it will become immediate financially if it will work or not" (F)*

Employee level

The overall consensus on the employee level barriers was limited. Employees were considered to have high moral approaches to and understanding of the work they are doing, with generally positive thoughts about CBMI at the employee level:

> *"When I think about employees and individual colleagues and how they think, they do have the ethics and morals to do the extra work for it [circular and sustainable activities] because it is meaningful. – When you go to the employees and ask them what they think of their work they say they are happy to do it and find it meaningful" (F)*

However, two interview participants mentioned challenges in individual competences regarding CBMI, specifically related to information transfer and capturing the right competences for CE:

> *"We have the will and want, but sometimes the competences are not enough. And if you look at an industrial perspective, we have 25,000 people working in 30 different countries so in that perspective there is huge amount of variation, and I do believe we have in some parts such as west Europe, USA the competences in place, but does it hit through the whole organization yet? - I don't think so." (D)*

> *"It is important to share internally the best practices, in a way that allows everyone to get the best knowledge into practice." (A)*

As stated above, individual knowledge can often be scattered, and the larger organizational structure of MNC-sized companies may prevent agile and efficient knowledge-sharing to automatically happen. The challenges at the employee level can easily become challenges at organizational level within a large company.

These issues can be extended into the ecosystems level within the company's value chain where bigger challenges start to emerge. Therefore, the lack of competence and ecosystem thinking in regarding the whole value chain across industries is a risk when trying to implement circular models. The barriers apparent at different levels can easily cross over levels and interact.

MNC enablers for CBMI

The biggest risks regarding **markets and institutional level** barriers were evidently based on regulations and laws. Drivers and enablers discovered to counteract this barrier often reflected the same concerns about legislative competencies. All participants agreed on potential helpful actions, as the example below describes:

> *"The focus should be more on what goals are pursued and not how. I believe that the markets, companies and competitors will solve how to get the needed end result and in a cost-effective way. In a way, the politicians and regulators do not necessarily know what the way is. They do not possess that kind of knowledge on technological development or innovations and what is possible in practice wise." (D)*

The argument here is that the content of current regulations should be changed with a clear focus and mutual understanding between the practitioners and politicians. Furthermore, the placement of new material restrictions and industry boundaries should be done in a way which does not allow disadvantages to form regarding, for example, geographical locations. The statement below regarding the political presence and position in the forest industry demonstrates this viewpoint, and raises an important enabler in defeating institutional barriers:

> *"It is extremely important to be at the right tables at the right time. The regulations are done in a national and EU-level and it is important that we get our and the industry's voice heard." (C)*

Likewise, discussion of more long-term and sustainable political talk and sufficient knowledge-sharing within the relevant circles could help to mitigate the barriers:

"I think that some form of upbringing and sharing of knowledge, that is something that we need to push more. More research is done within the forest and that has awakened some. – That can be helpful." (H)

The issues related to **value-chain level** mostly included problems with forming partnerships deeper within the value chain. Understanding the deeper connections, those beyond the company's initial partners, is key. The lack of transparency and ecosystem thinking also hindered new CBM implementation and innovation. The key enabler raised from the data was to create and use more tools to cope with ecosystem thinking and improved transparency of value chains even across industries. Technological and digital innovations were suggested as a great opportunity and driver for enabling more actors in the markets to engage in more transparent processes. Furthermore, replacing linear value system perspective with comprehensive ecosystem thinking was detected as a significant driver for CBMI. Ecosystem thinking as an enabler is explained below:

"Circular economy at its core is about ecosystems, which enable us to maximize the benefits together. This is what everyone should practice more. -- Holistic understanding and competences about the circular economy and the ecosystem infrastructure is too narrow," (D)

"I have wondered a lot about the industrial symbiosis and how to get to a win-win situation. So in theory you could not live without each other. In practice obviously more complicated. – We are a significant actor in the value chain and the infra is in our control but how to think more on the smaller actors and their relationship to us is important" (H)

Transparency throughout the whole ecosystem is described in the following quotations:

"X-raying the whole value chain is vital so we can get matching value chains in the point of view of circular economy. Nowadays the different actors are just guessing, what the next actor in the value chain needs. Something like a radical transparency would be healthy and already maybe this kind of experiment is happening, but it needs to be more." (D)

"…better transparency, common goals and interfaces, away from the transactional relationship and more towards mutual partnerships, then I think we would get the value chain flows compatible." (D)

Digitalization was seen as one core enabler for achieving better transparency:

"Radical transparency would be helpful. -- One important enabler can potentially be digitalization and more sufficient data availability. (D)

To further elaborate on the ecosystem thinking, two interview participants even suggested widening the range of ecosystems to include a greater variety of industries. Forest industries and their materials often benefit from a range of industries including medicine, energy etc. Therefore, to enhance CBMI, companies within the forest industry must explore material and product flows across industries and different platforms to find ways to utilize and circulate materials and practices even more:

"Collaboration between different industries is important – considering innovation as well the cooperation is beneficial because otherwise, we would not even know all the possibilities and needs other industries might have." (A)

On an **organizational level** all participants spoke strongly about the importance of inner sustainability and CE goals. At the moment all companies engaged in similar goal-setting within the leadership functions. Many referred to their year 2030 goals and considered them as a driving force and an important guideline for CBMI:

"One positive force in a way is a really clear state of mind and strategic direction, like we have with the 2030 goals." (A)

"In strategic decision-making circular economy has been a strong point already for a long time and have been the main competitive advantage, and that can be seen in the everyday work and how people do not even question it in any form." (D)

Furthermore companies provided advice in assuring better implementation of CE through comprehensive planning. One part of enabling better implementation of CBMs comes from the extensive planning and the long-term vision of the company:

> *"Everything needs to be designed for circularity and with a long determination. I think this would tremendously help the implementation process." (D)*

> *"We have a very specific list of materials for example what can we and what can we not take to our business models and operations. -- With this we obviously indirectly try to make sure that the harmful substances would not start to circulate in the first place." (A)*

The importance of the planning phase was further strengthened by the following statement of an interviewee:

> *"We are trying even more systematically to do this [planning] and increase the eco design thinking -- Is it that up to 80% of products or services environmental repercussions are laid out already in the design phase. I think this is one general and important internal factor which suits multitudes of industries. The circular effects need to be taken into account already in the planning phase." (A)*

The development of metrics which would measure more correctly the value of circular activities was also raised as a possible solution for decreasing some of the pressure of economic distress:

> *"If we could modify our measures considering our profits, efficiency etc, all the things' leaders measure, to a new model, that would help. We do measure things, but do we measure the right things which would help to change the cost orientated perspective of leadership?" (F)*

Many stated that there are no **employees** who are reluctant and negative about the issues of sustainability. A certain shift in mentality and understanding can be seen within individuals. Furthermore, individuals understand and are genuinely interested in building a better and more sustainable future for next generation. Arguably this is only growing as the years go by, and many are hopeful that it might also break apart the more challenging societal and organizational problems:

> *"We believe that everything which is done with fossil materials can be made from wood tomorrow and this is what guides us and our innovation. – I believe in moral compass. I believe that we and people know what is best for the society, environment and climate… -- It all comes from the values and ethical worldview which is pretty sufficiently rooted to our people in the company." (D)*

Figure 13 presents the key findings of the MNCs cluster in structured manner.

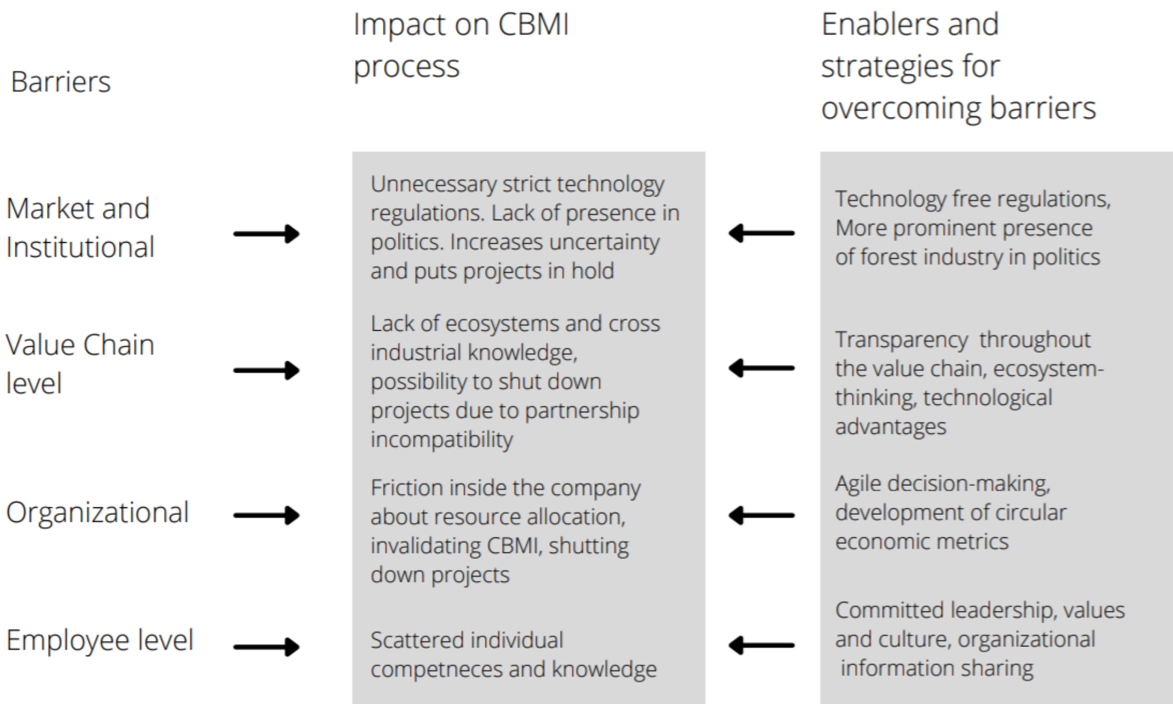


Figure 13. MNCs findings on CBMI barriers and enablers

4.3 Cross-case analysis

The cross-case analysis section will elaborate on the mutual as well as divergent factors found in the two clusters of the study, discussing the relationships from the literature perspective. This is conducted in the same order as the data and within-case analysis, starting from barriers and their impact on CBMI and following with a discussion about the possible enablers. In the end a coherent framework of mutual CBMI barriers and enablers in the Finnish forest industry is presented.

4.3.1 Circular business model innovation and barriers

Across the different companies in the SME and MNC clusters, the experiences of **barriers** interlinked, and often similar barriers were identified within the cases. The barriers found through empirical study were, for the most part, supported by the existing theories (for example, Guldmann & Huulgaard, 2020). However, some individual differentiations amongst the two clusters could be identified with varying importance for the case-study companies.

External barriers including market and institutional, and value-chain level barriers played a prominent role throughout both clusters. Mostly the identified external barriers aligned with each other and similarities could be detected across entity scales. This provides strong evidence for a viable unified framework. Common institutional as well as value-chain barriers, included regulatory barriers, lack of funding and taxation and partnership difficulties, also had clear positions within the literature (Adams et al., 2017; Guldmann & Huulgaard, 2020). However, the data revealed more detailed challenges linked to regulations and value-chains than the literature surveyed could provide. Across the data the strongest agreed barrier was the wrong type of regulation, in other words regulation creating inappropriately strict material and innovation restrictions. Similarly the most prominent value-chain level barrier was the difficulty in understanding partnership systems and other industry firms, as well as lack of transparency within the industry. Additional individual barriers, such as difficulties in maintaining political presence, stemmed from the primary barriers; these were often referred back to, revealing them as the main sources for other challenges identified. The importance of understanding the detailed roots of each barrier determined a clearer linkage to the impacts on CBMI.

Internal barriers emerging from the empirical data revealed less intersecting and more straightforward individual barriers, compared to external challenges, in both clusters. However, internal challenges as experienced within their own companies might have been more difficult for company experts to reflect upon publically, resulting in more varied data outcomes. Some organizational barriers relating to information sharing, difficulties in eco-design and planning of CBMs, and lack of commitment among the leaders was identified. These barriers varied among the two clusters, for example MNCs experienced more prominent barriers in internal knowledge-sharing whereas SMEs found information sharing easy within their smaller groups. Hence a coherent and strong empirical linkage with the mentioned barriers could not be identified. The individual barriers found through empirical data were mostly in line with individual barriers found in the literature (Guldmann & Huulgaard, 2020; Adams et al., 2017).

The most coherent and prominent finding regarding internal barriers was the lack of proper circular business metrics. The financial barriers and difficulties with resources were mentioned by all of the case participants to some extent, making the challenges presented by inadequate financial metrics the most prominent finding from the data. The finding is also significant because of the lack of evidence within the relevant literature (Guldmann & Huulgaard, 2020). The literature reviewed fails to consider the importance of internal metrics in the context of barriers affecting CBMI. Financial difficulties and resource needs are discussed in some relevant studies, but most consideration is given institutional-level financing and lack of financial support systems (Linder & Williander, 2017; Ritzén & Sandström, 2017; Rizos et al., 2016), rather than organizational finances and barriers created by inadequate organizational economic metrics.

Within the employee level, data from both clusters supported the view that employees' attitudes towards circular strategies are improving, and a shift towards circular and sustainable thinking is happening. This is further supported by the study of Adams et al. (2017) which detected increased understanding of CBMs across manufacturing industries.

A significant observation across the data revealed that external barriers were often emphasized over concerns about internal barriers. In both clusters external barriers, especially regulations, the incompatibility of value chains, and diminishing local industrial systems, were ranked as the most important barriers that need to be tackled. Furthermore empirical data revealed more prominent barriers arising from external factors than internal factors. Some individual barriers were interlinked across external and internal barriers, such as those relating to regulations and organization. The interlinks proved the existence of intersections and relationships between barriers, not least where external barriers could trickle down to internal levels, causing the risk to the operations and CBMI to increase. An example of an intersecting challenge is an inflexible and long internal planning period, which is then exacerbated by a lack of agile innovation ability within the organization caused by uncertainty in regulations at the institutional level. Thus an internal challenge, the inability to create an agile CBMI culture, is further hindered by pending and unpredictable regulations, an external barrier.

According to the empirical study the MNCs cluster experienced more barriers and challenges than SME companies, mostly relating to difficulties in implementing new operations and lack of agile management. This finding makes general sense since in larger companies, with multiple operations and BMs, change is broadly harder and slower to implement than in small firms with small management teams and short communication distances. However, the differences found could also be a result of the more extensive case dataset for the MNCs.

Circular business model innovation (CBMI)

The empirical study entailed two types of **CBMI**. The first approach considered CBMI as a modification to an existing linear model, and was interpreted as a change towards circular activity. This occurred within the MNC cluster with its deep roots in the Finnish forest industry. The second perspective entailed models which were crafted specifically for the purpose of CBMI. This type of CBMI occurred in the SME cluster where companies were smaller and founded within the last 10 years. This sectioning supports the Guldmann & Huulgaard (2020) theory of CBMI types.

When examining the CBMI process, also referred to as BM experimentation, the type of business design did not play any discernable significant role in the experimentation side. All companies agreed about the processes of experimentation and recognized a similar framework when creating a CBM from planning to piloting. The similarities can be explained since both perspectives, changing an existing model, or creating a new one, essentially experience a build of a new model. Although the barriers arising from the two different starting points do differ to a degree since the size of the firm always contributes to the challenges faced in the markets, ultimately both perspectives are faced with similar issues and processes when considering CBMI. Therefore, a similar experimentation model with both perspectives can be identified to draw conclusions about impacts.
CBMI experimentation within the empirical data followed the configured model of Bocken et al., (2018) which has characteristics of Osterwalder's et al. (2014) BM experimentation. The model begins with an internal experimentation, often referred to as the planning phase within the empirical data. The second step is small experiments or internal piloting, and finally a scale-up and real-life implementation stage. The model was used to understand and pinpoint changes to the experimentation process when considering different barriers and challenges.

A clear impact of most barriers to experimentation was the increased levels of uncertainty. External barriers had a particularly significant role in raising uncertainty levels throughout the experimentation process. Secondly, resource levels throughout the experimentation process were impacted by challenges in finding the right partners, or increased resource needs, when already within the planning phase. CBMs are complex constructs, and when already within the planning phase can face more difficulties due to cross-sector involvement, risking resource needs becoming incoherently scattered throughout the process. However, an overall pattern of increased resource needs (see figure 14) was detected from planning to implementation within the empirical data, which supported the previous literature (Osterwalder et al., 2014; N. Bocken et al., 2018). In essence, the escalating resource risks are therefore predictable.

Mostly the data revealed fewer dominant barriers related to internal factors. However, the barriers detected in the MNC cluster did have an impact on the learning curve of the experimentation process. Internal barriers related to knowledge-sharing, lack of transparency within the company as well as in the value chain, slowed down the learning curve of the experimentation, therefore lengthening the whole process as well, and thus consuming additional resources.

An overall impact which external and internal challenges caused together was the increased duration of the CBMI process. This is further supported by literature research and the evidence of inherently longer implementation process of CBM compared to linear BM (Linder & Williander, 2017). However the empirical study contradicts the literature's broad notions of an inherently longer implementation process, since the increased duration arises from the barriers rather than fundamentally longer BMI processes. In fact, the empirical study revealed that within SME companies the CBMI processes were generally extremely agile, but due to external barriers the implementation of the innovations decided upon was postponed or abandoned. However, no further conclusions can be drawn since the case studies did not compare the CBMI outcomes directly with equivalent linear BM experimentation. Figure 14 below demonstrates the impacts of the barriers to CBMI process.

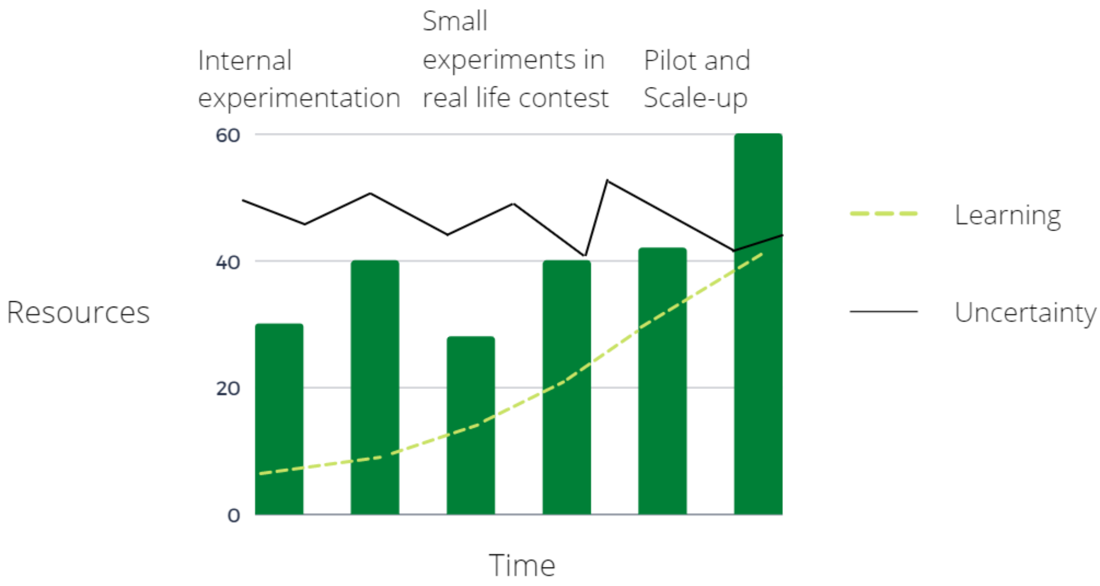


Figure 14. Impacts of barriers to CBMI process adapted from Bocken et al., (2018) and Osterwalder et al. (2014)

4.3.2 Circular business model innovation and enablers

The empirical study revealed that in both clusters a failed implementation of a CBM was mainly caused by challenges and barriers affecting the experimentation process. Therefore, the perspective of insufficient knowledge of a ‘right type’ of BM (Chesbrough, 2010) can be excluded from the analysis. Only one interview participant briefly mentioned difficulties in understanding the right type of CBM, but they did not see it as a high barrier which could not be overcome. The amount of CBMI knowledge and innovation is increasing, making it compelling for companies to identify some of the many current CBMs from global markets, according to the data. Therefore the analysis focuses on enablers that minimize the challenges in the implementation of CBMI processes.

As stated in the literature, experimenting with new BMs requires a high level of uncertainty management (Chesbrough, 2010), or at least a raised appetite for risk. As detected from the empirical study, CBMI process can have even higher levels of uncertainty due to unseen regulations and new guidelines emerging continuously. A multitude of other relevant barriers regarding high uncertainty levels were detected, such as lack of value-chain knowledge and cross-industrial partnerships, long experimentation periods, and financial distress. To counterstrike the high level of barriers the empirical study revealed some key enablers to overcome these challenges. In both clusters the key enablers detected were: addressing regulations (regulatory reform) to establish improved regulations dealing with relevant end goals instead of material and innovation restrictions; transparency and ecosystem thinking; sufficient technology for information-sharing across industries; and development of relevant and appropriate circular metrics at both company and value-chain level.

The above-mentioned enablers can be partly linked to other relevant research on the topic. Knowledge-sharing and sufficient enabling communication technology has been detected as one of the key enablers for successful CBMI implementation (Julianelli et al., 2020; Chakraborty et al., 2019). In addition, design tools and financial incentives are also referred to as possible best practices of CBM implementation (Adams et al., 2017). However, the importance of reforming inadequate regulations, more effective advocacy pushing for better policies and minimizing future uncertainty, combined with sufficient political and business communication, is not apparent in the major literature. The idea of 'technology-free' regulations is to make the implementation of new materials in the market easier. Additionally, the importance of CE metrics and development of appropriate financial measures was not uncovered in the literature review. According to the empirical data, enabling better financial metrics was identified as one of the major drivers considering broader adoption of CBMs nationally and at the company level. Showing the rationale and value of CE through financial metrics is key in incentivizing more actors and leaders to get on board.

The importance of companies' internal strategy and overall positivity towards CE and sustainable activities was a major enabler throughout the empirical study. Both clusters emphasized the importance of right-minded people advocating effectively for CE. This is also supported by the study of Rizos et al., (2016), which emphasized the importance of internal culture in CBMI.

Overall, the interlinkages between the empirical study and literature review showcase the importance of internal strategies for overcoming barriers of all kinds. However, the variations across and practical deployment of external enablers - such as political presence and ecosystem thinking - should be further explored. Furthermore, according to the data internal enablers were used more often than external ones. This can be explained by the logic of entities having more power over internal actions and therefore it is easier to implement and thus harvest the power of internal enablers.

A framework is constructed where the data is drawn from the two clusters, SMEs and MNCs. The framework (figure 15) presents the key finding of the empirical study in a systematic manner.

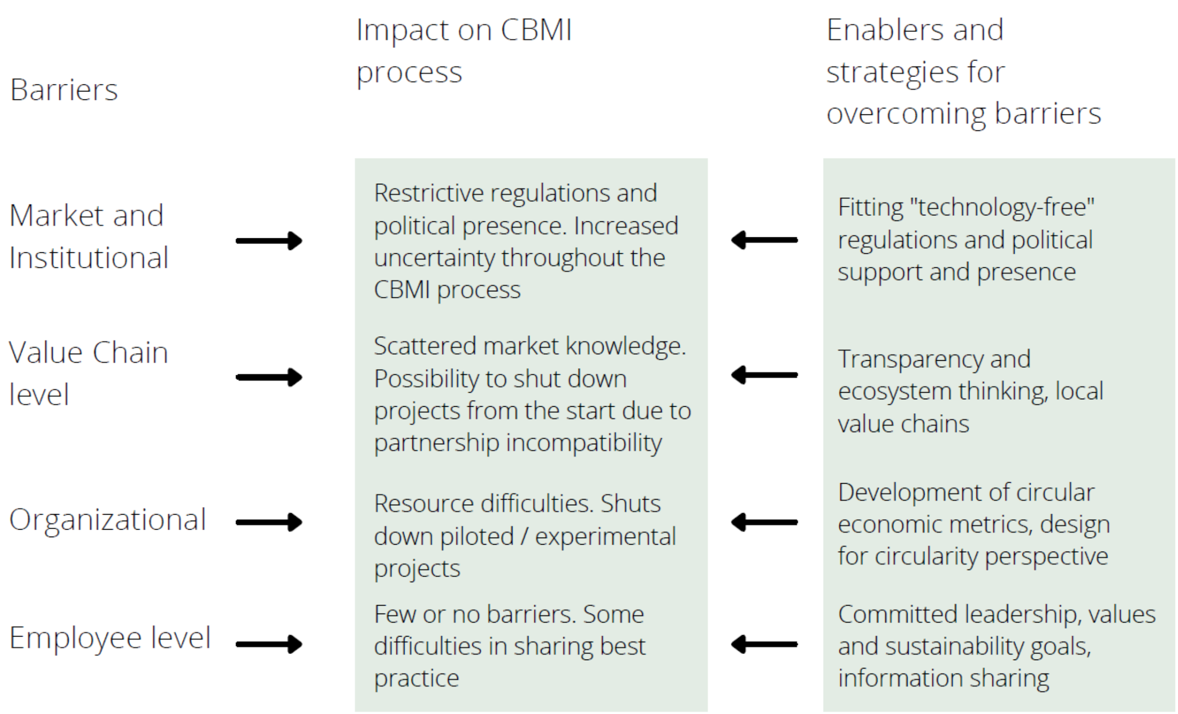


Figure 15. Framework illustrating the key findings of the SMEs and MNCs cluster

5 Conclusion

The objective of this thesis was to shed light onto the research of barriers and enablers in CBMI in the context of the Finnish forest industry, by providing empirical evidence through case studies of SME and MNC clusters. The motivation stemmed from the fact that despite the increased interest towards new CBMI, companies still struggled with implementing CBMI. The evidence of CBMI barriers and enablers in current research was missing (Amato et al., 2020; Koskela & Vehmas, 2012). More precisely the study set out to find answers to the following two research questions:

RQ1: *What are the key barriers to circular business model innovation (CBMI), and how do these barriers affect the process of CBMI?*

RQ2: What are the key enablers and strategies in defeating CBMI barriers?

The thesis started with a literature review on CE, BM and CBMI, analyzing the relevant literature and history of CE and BM innovation research (Bocken, Ritala, et al., 2017; Teece, 2018). The literature review revealed that research considering CBMI was scattered, and the presence of solid common ground was missing due to the contemporaneity of the topic (Antikainen et al., 2016; Guldmann et al., 2019). The second section of the literature review introduced current research into barriers and enablers in the context of CBMI. Within the subject literature, very few empirical studies focus on understanding the challenging forces and barriers hindering CBMI (Guldmann & Huulgaard, 2020; Vermunt et al., 2019). Furthermore, the ground for the research studies was frequently drawn from other relevant fields such as sustainability or industrial ecology research. Ultimately, a coherent table of relevant barriers was created from multiple sources with the purpose of understanding the current status of the barriers found in the literature. The barriers were sectioned into institutional level, value-chain level, organizational level and employee level barriers (Guldmann & Huulgaard, 2020). In relation to barriers and how to overcome them, research on enablers was even more scattered. However, the thesis analyzed the relevant research about different sets of enablers, even though no coherent set of variables could be detected. The literature review chapter was concluded with a synthesis of a theoretical framework, intersecting CBMI with barriers and enablers, this framework to be populated from the empirical data gathered and its analysis.

Key findings of the study included a set of barriers and enablers, relevant in the context of the Finnish forest industry, as well as knowledge of the impacts they have on CBMI. The barriers were sectioned into external and internal segments. Key external barriers included strict technology regulations, lack of support, political confusion, plus a lack of ecosystem thinking and transparency. Key internal barriers were increased economic distress due to a lack of appropriate circular metrics, difficulties in knowledge sharing, and incomplete planning and eco-design. Furthermore, the barriers impacted the following components of CBMI processes in an order of significance: time; uncertainty; resource needs; piloting and implementation phase; planning; and the learning curve. It can be concluded that the BM experimentation is impacted in every stage of the process by sets of external and internal barriers.

The relevant strategies to overcome challenges, also referred to as CBMI enablers, were proper political presence and 'technology-free' regulations, increased transparency throughout the ecosystem, introduction of cross-industry players, development of appropriate circular metrics, and committed leadership. The conclusion of the findings was illustrated in a coherent framework. Overall, the two clusters provided significantly similar empirical data, with minor differences mostly caused by the size of the company and the amount of resources in use. All mutual CBMI barriers and enablers of SMEs and MNCs can be examined from figure 15.

5.1 Theoretical implications

This thesis contributes to the theoretical research of CBMI by providing new perspectives on barriers and enablers when implementing new CBM in the Finnish forest industry, especially for enablers since no coherent theoretical ground was found in the literature for enablers in CBMI. Additionally, the thesis further develops the understanding of CBMI as a process. The implementation processes of CBMI have not yet received firm theoretical grounding within the known research, and hence the study contributions within this thesis are arguably significant.

A significant theoretical contribution found among the cases was the high level of impact the barriers alone had on the CBMI process. The most significant impact was related to how the high numbers of barriers extended the implementation time of the CBMI process. The inherent internal innovation processes of Finnish forest companies were relatively quick and efficient; however, due to the barriers the actual implementation of innovations took significantly more time, resulting in inability to extract quick profits. The literature indicates that CBMs inherently hold more risk due to the longer timespan of either profit extraction or implementation (Linder & Williander, 2017). However, the data indicated that the longer implementation timeframe and associated profitability reductions are caused by the effects of the barriers rather than being inherent characteristics of CBMs, therefore partly contradicting the study of Linder & Williander (2017). The contrasting study finding needs to be further investigated on a larger scale in order to clarify interpretations and claims for future theories.

In addition, the study reinforced current research on key enablers by finding coherent practices of leadership transparency and the importance of organizational values when implementing CBMI. (Rizos et al., 2016). However, some additional enablers and strategies for overcoming barriers which are not presented in current literature were discovered within the companies. The new contributing enablers and strategies used for overcoming barriers are reinforcing political presence to achieve 'technology-free' regulations, increasing transparency and ecosystem thinking through technological advantages as well as the presence of local activities, and finally development of appropriate and thus useful circular metrics. In particular, the findings related to the importance of local presence challenged the current research emphasis on global circular activities (Hetemäki & Hurmekoski, 2016).

Finally, this study contributed to the theoretical discussion on the Finnish forest industry, and in general how forest industry is transforming the domain of CE. Current research about forest industries revealed a transition towards CE, especially bioeconomy strategies (Amato et al., 2020). This was also supported by the empirical data of both the SME and MNC clusters, providing additional theoretical evidence for the Finnish forest industry. Additionally, the study revealed an increasing amount of new SME players entering the field, creating pressure for MNCs to change, similar to overall forest industry research (Amato et al., 2020). Other relevant contributions to Finnish forest industry research included the detected mutual need and want of SMEs and MNCs towards finding solutions for overcoming the current challenges in hopes of a more successful implementation of CBMI. Overall, both SMEs and MNCs experienced similar barriers and enablers with CBMI in the Finnish forest industry.

5.2 Managerial implications

The study reveals multiple managerial implications which practitioners can benefit from while implementing CBMI in the forest industry. Largely, it provides key insight into how the process of CBMI is conducted, and furthermore how it is affected by barriers. The study also reveals key strategies for reducing the barriers when considering the change towards CE in the Finnish forest industry. The study findings offer guidance for new practitioners within the CE and relieve some of the uncertainty regarding CBMI implementation, giving more practitioners access to better implementation experience.

Firstly, the findings present the possible barriers managers and leaders can expect to face while experimenting with CBMI, both from SME and MNC perspectives. Understanding the different struggles which create possible delays in planning, piloting and scale-up benefits the industry, and can help practitioners to work on the barriers faced when implementing CBMI. Furthermore, the study reveals a structured sectioning between external and internal barriers experienced in CBMI.

Secondly, the findings reveal important enablers and strategies for overcoming barriers which helps practitioners to reduce the implementation struggles for new CBMs. An important and significant implication of the study was understanding the localness and ecosystem thinking when operating in a circular environment. The key enablers can be used to support strategizing when companies are faced with CBMI barriers, offering a better chance of a successful implementation of CBMI. Overall, the framework presents high-level managerial implications, which different entities can benefit from by adapting them to their strategic development and decision process.

5.3 Suggestions for future research

The study revealed a lack of perception and research on CE metrics to support strategic decision-making. Hence the study endorses the importance of developing existing literature of CBM metrics. Development of circular metrics in the light of current evidence is going to play a significant role in helping companies achieve better results in implementing CBMI.

Secondly, understanding real-world CBMI and its inherent characteristics compared to linear models would benefit from further empirical evidence. Understanding the differences between CBMI and BMI process can help detect key relations when trying to move from the linear business world to a circular model. This notion can help multitude of industries with the transition to CE.

Furthermore, the development of ecosystem thinking and locality in CBM research can provide significant further information and conceptual tools for practitioners and theory builders. On the other hand, it is also important to research the negative effects of globalization for CBMs, since on many occasions these negative effects were mentioned as major concerns. Developing the theories behind this factor can provide further clarity on how circular businesses can work better in the future.

5.4 Limitations

It should be noted that the scope of individual barriers and enablers found in the frame of CBMI can be essentially infinite, and hence a case study can only look at the enablers and barriers detected within the research data. Additionally, the case scope and depth are limited due to resource availability and the restricted timeframe of the study.

Similarly the internal barriers and challenges discovered within the study can be limited due to the biases some interviewees might have regarding their status and role in their company. Understandably, some questions within the case study were avoided by the interviewees due to the sensitivity of the topic. Overall the study provides inside and additional knowledge about CBMI barriers and enablers in the specific context of the Finnish forest industry, and thus should not be used to make connections or interpretations to other fields without further examination.

References

Aagaard, A., Saari, U. A., & Saku, J. M. (2021). *Mapping the types of business experimentation in creating sustainable value : A case study of cleantech start-ups*. *279*. https://doi.org/10.1016/j.jclepro.2020.123182

Adams, K. T., Osmani, M., Thorpe, T., & Thornback, J. (2017). Circular economy in construction: Current awareness, challenges and enablers. *Proceedings of Institution of Civil Engineers: Waste and Resource Management*, *170*(1), 15–24. https://doi.org/10.1680/jwarm.16.00011

Amato, D. D., Veijonaho, S., & Toppinen, A. (2020). Towards sustainability ? Forest-based circular bioeconomy business models in Finnish SMEs ☆. *Forest Policy and Economics*, *110*(December 2018), 101848. https://doi.org/10.1016/j.forpol.2018.12.004

Aminoff, A., & Pihlajamaa, M. (2020). Business experimentation for a circular economy - Learning in the front end of innovation. *Journal of Cleaner Production*, *275*, 124051. https://doi.org/10.1016/j.jclepro.2020.124051

Amit, R., & Zott, C. (2001). *VALUE CREATION IN E-BUSINESS*. *520*(February 2000), 493–520. https://doi.org/10.1002/smj.187

Antikainen, M., Valkokari, K., & Mcclelland, J. (2016). *A Framework for Sustainable Circular Business Model Innovation*. *6*(7), 5–13.

Aspara, J., Hietanen, J., & Tikkanen, H. (2010). Business model innovation vs replication : financial performance implications of strategic emphases. *Journal of Strategic Marketing*, *18*(1), 39–56. https://doi.org/10.1080/09652540903511290

Berglund, H., & Sandström, C. (2013). Business model innovation from an open systems perspective : structural challenges and managerial solutions Christian Sandström. *International Journal of Product Development*, *18*, 274–285.

Blank, S. (2013). Why the Lean Start-Up Changes Everything. *Harvard Business Review*, *91*(5), 64–72. http://web.b.ebscohost.com.proxy.library.ju.se/ehost/pdfviewer/pdfviewer?vid=1&sid=1f485539-7ce9-4140-978b-8fb25c77cf35%40pdc-v-sessmgr06

Blomsma, F., & Brennan, G. (2017). The Emergence of Circular Economy: A New Framing Around Prolonging Resource Productivity. *Journal of Industrial Ecology*, *21*(3), 603–614. https://doi.org/10.1111/jiec.12603

Bocken, N., Schuit, C., & Kraaijenhagen, C. (2018). Experimenting with a circular business model : Lessons from eight cases. *Environmental Innovation and Societal Transitions*, *28*(February), 79–95. https://doi.org/10.1016/j.eist.2018.02.001

Bocken, N M P, Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, *65*, 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039

Bocken, Nancy, Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. *Journal of Cleaner Production*, *208*, 1498–1512. https://doi.org/10.1016/j.jclepro.2018.10.159

Bocken, Nancy M.P., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, *33*(5), 308–320. https://doi.org/10.1080/21681015.2016.1172124

Bocken, Nancy M.P., Olivetti, E. A., Cullen, J. M., Potting, J., & Lifset, R. (2017). Taking the Circularity to the Next Level: A Special Issue on the Circular Economy. *Journal of Industrial Ecology*, *21*(3), 476–482. https://doi.org/10.1111/jiec.12606

Bocken, Nancy M.P., Ritala, P., & Huotari, P. (2017). The Circular Economy: Exploring the Introduction of the Concept Among S&P 500 Firms. *Journal of Industrial Ecology*, *21*(3), 487–490. https://doi.org/10.1111/jiec.12605

Brettel, M., Mauer, R., Engelen, A., & Küpper, D. (2012). Corporate effectuation : Entrepreneurial action and its impact on R & D project performance. *Journal of Business Venturing*, *27*(2), 167–184. https://doi.org/10.1016/j.jbusvent.2011.01.001

Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. *Long Range Planning*, *43*(2–3), 195–215. https://doi.org/10.1016/j.lrp.2010.01.004

Chakraborty, K., Mondal, S., & Mukherjee, K. (2019). Critical analysis of enablers and barriers in extension of useful life of automotive products through remanufacturing. *Journal of Cleaner Production*, *227*, 1117–1135. https://doi.org/10.1016/j.jclepro.2019.04.265

Chesbrough, H. (2007). *Business model innovation : it ' s not just about technology anymore*. *35*(6), 12–17. https://doi.org/10.1108/10878570710833714

Chesbrough, H. (2010). Business Model Innovation : Opportunities and Barriers. *Long Range Planning*, *43*(2–3), 354–363. https://doi.org/10.1016/j.lrp.2009.07.010

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *60*(2), 182–183. https://doi.org/10.4324/9781351106573-2

Eriksson, P. & Kovalainen, A. (2008). Qualitative Methods in Business Research. SAGE Publications Ltd.

European Commission (2021a). Sustainable Development Goals. https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals_en

European Commission (2021b). Forests. https://ec.europa.eu/environment/forests/index_en.htm

Finnish forest industry (2021a). European Union. https://www.metsateollisuus.fi/en/european-union

Finnish forest industry (2021b). Facts About Finnish forest industry. https://www.metsateollisuus.fi/en/facts-about-finnish-forest-industry

Foss, N. J., & Saebi, T. (2017). *Fifteen Years of Research on Business Model Innovation : How Far Have We Come , and Where Should We Go ? 43*(1), 200–227. https://doi.org/10.1177/0149206316675927

Frosch, R. A., & Gallopoulos, N. E. (1989). Strategies for Manufacturing the impact of industry on the environment. *Scientific American*, *261*(September), 144–153.

Geissdoerfer, M., Bocken, N. M. P., & Jan, E. (2016). Design thinking to enhance the sustainable business modelling process e A workshop based on a value mapping process. *Journal of Cleaner Production*, *135*, 1218–1232. https://doi.org/10.1016/j.jclepro.2016.07.020

Geissdoerfer, M., Naomi, S., Monteiro, M., Carvalho, D., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, *190*, 712–721. https://doi.org/10.1016/j.jclepro.2018.04.159

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation : A review. *Journal of Cleaner Production*, *198*, 401–416. https://doi.org/10.1016/j.jclepro.2018.06.240

Guldmann, E., Bocken, N. M. P., & Brezet, H. (2019). *A Design Thinking Framework for Circular Business Model Innovation*. *7*(1), 39–70.

Guldmann, E., & Huulgaard, R. D. (2020). Barriers to circular business model innovation : A multiple-case study. *Journal of Cleaner Production*, *243*, 118160. https://doi.org/10.1016/j.jclepro.2019.118160

Halme, M. (2002). CORPORATE ENVIRONMENTAL PARADIGMS IN SHIFT: LEARNING DURING THE COURSE OF ACTION AT UPM-KYMMENE. *Journal of Management Studies*, *39:8*(December), 1088–1109.

Hetemäki, L., & Hurmekoski, E. (2016). Forest Products Markets under Change: Review and Research Implications. *Current Forestry Reports*, *2*(3), 177–188. https://doi.org/10.1007/s40725-016-0042-z

Joan Magretta. (2002). Why Business Models Matter.: Business Source. In *Harvard Business Review* (Vol. 80, Issue 5, pp. p86-92.). http://web.a.ebscohost.com.ezp.lib.cam.ac.uk/bsi/pdfviewer/pdfviewer?vid=3&sid=2233b57e-adf0-4026-aff5-fdf181260b9d%40sessionmgr4006

Johnson, M. W., Christensen, C. M., & Kagermann, H. (2008). Reinventing Your Business Model. *Harvard Business Review*, *December*, 50–60.

Julianelli, V., Caiado, R. G. G., Scavarda, L. F., & Cruz, S. P. de M. F. (2020). Interplay between reverse logistics and circular economy: Critical success factors-based taxonomy and framework. *Resources, Conservation and Recycling*, *158*(March), 104784. https://doi.org/10.1016/j.resconrec.2020.104784

Kajanus, M., Leban, V., Glavonjić, P., Krč, J., Nedeljković, J., Nonić, D., Nybakk, E., Posavec, S., Riedl, M., Teder, M., Wilhelmsson, E., Zālīte, Z., & Eskelinen, T. (2019). What can we learn from business models in the European forest sector : Exploring the key elements of new business model designs ☆. *Forest Policy and Economics*, *99*(April 2018), 145–156. https://doi.org/10.1016/j.forpol.2018.04.005

Kissling, R., Coughlan, D., Fitzpatrick, C., Boeni, H., Luepschen, C., Andrew, S., & Dickenson, J. (2013). Resources , Conservation and Recycling Success factors and barriers in re-use of electrical and electronic equipment. *"Resources, Conservation & Recycling," 80*, 21–31. https://doi.org/10.1016/j.resconrec.2013.07.009

Kotkamills (2021). Sustainability. https://kotkamills.com/sustainability/

Korhonen, J., Hurmekoski, E., Hansen, E., & Toppinen, A. (2018). Firm-level competitiveness in the forest industries: Review and research implications in the context of bioeconomy strategies. *Canadian Journal of Forest Research*, *48*(2), 141–152. https://doi.org/10.1139/cjfr-2017-0219

Korhonen, Jouni, Honkasalo, A., & Seppälä, J. (2018). Circular Economy : The Concept and its Limitations. *Ecological Economics*, *143*, 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041

Koskela, M., & Vehmas, J. (2012). Defining Eco-efficiency: A Case Study on the Finnish Forest Industry. *Business Strategy and the Environment*, *21*(8), 546–566. https://doi.org/10.1002/bse.741

Kuo, T. C., Ma, H. Y., Huang, S. H., Hu, A. H., & Huang, C. S. (2010). Barrier analysis for product service system using interpretive structural model. *International Journal of Advanced Manufacturing Technology*, *49*(1–4), 407–417. https://doi.org/10.1007/s00170-009-2399-7

Lewandowski, M. (2016). *Designing the Business Models for Circular Economy — Towards the Conceptual Framework*. https://doi.org/10.3390/su8010043

Linder, M., & Williander, M. (2017). *Circular Business Model Innovation: Inherent Uncertainties*. *196*(September 2015), 182–196. https://doi.org/10.1002/bse.1906

Lüdeke-Freund, F., Gold, S., & Bocken, N. M. P. (2019). A Review and Typology of Circular Economy Business Model Patterns. *Journal of Industrial Ecology*, *23*(1), 36–61. https://doi.org/10.1111/jiec.12763

McGrath, R. G., & MacMillan, I. C. (2000). Discovery-Driven Planning. *Harvad Business Review*.

Mont, O., Plepys, A., Whalen, K., & Nussholz, J. (2017). *Business Model Innovation For a Circular Economy*.

Näyhä, A. (2019). *Transition in the Finnish forest-based sector : Company perspectives on the bioeconomy , circular economy and sustainability*. *209*, 1294–1306. https://doi.org/10.1016/j.jclepro.2018.10.260

Niimaar (2021). Our Story. https://niimaar.com/

Nunes, P., & Breene, T. (2011). Reinvent Your Business Before It ' s Too Late. *Harvard Business Review*, *February*, 80–88.

Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C. (2018). Circular Economy in Spanish SMEs: Challenges and opportunities. *Journal of Cleaner Production*, *185*, 157–167. https://doi.org/10.1016/j.jclepro.2018.03.031

Osterwalder, A., Pigneur, Y., Bernarda, G. & Smith, A. (2014). Value proposition design: How to create products and services customers want. get started with... / written by Alexander Osterwalder ... [et al.].

Osterwalder, A., Pigneur, Y., Clark, T., Smith, A. & Pijl, P. v. d. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Patton, M. Q. (2002). Qualitative research & evaluation methods (3rd ed.). Sage.

Pisano, G. P., & Teece, D. J. (2007). How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture. *California Management Review*, *50*(1), 278–296. https://doi.org/10.2307/41166428

Richard, A. (1998). *THE DOMINANT LOGIC : RETROSPECTIVE AND EXTENSION Reproduced with permission of the copyright owner . Further reproduction prohibited without permission .*

Ries, E. (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Crown Business.

Ritzén, S., & Sandström, G. Ö. (2017). Barriers to the Circular Economy - Integration of

Perspectives and Domains. *Procedia CIRP*, *64*, 7–12. https://doi.org/10.1016/j.procir.2017.03.005

Rizos, V., Behrens, A., Gaast, W. Van Der, Hofman, E., Ioannou, A., Hirschnitz-garbers, M., & Topi, C. (2016). Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. *Sustainability*, *8*(1212), 1–18. https://doi.org/10.3390/su8111212

Sanchez, P., & Ricart, J. E. (2010). Business model innovation and sources of value creation in low-income markets. *European Management Review*, 138–154.

Saunders, Mark, Philip Lewis & Adrian Thornhill (2016). Research Methods for Business Students. 7th ed. Harlow: Pearson Education.

Schaltegger, S., Hansen, E. G., & Lüdeke-freund, F. (2016). Business Models for Sustainability : Origins , Present Research , and Future Avenues. *Organization & Environment*, *29(1)*, 3–10. https://doi.org/10.1177/1086026615599806

Schumpeter, J.A. 1934. The Theory of Economic Development. Cambridge, MA: Harvard University Press.

Singh, J., & Ordoñez, I. (2016). Resource recovery from post-consumer waste: important lessons for the upcoming circular economy. *Journal of Cleaner Production*, *134*, 342–353. https://doi.org/10.1016/j.jclepro.2015.12.020

Sjödin, D., Parida, V., Jovanovic, M., & Visnjic, I. (2020). Value Creation and Value Capture Alignment in Business Model Innovation: A Process View on Outcome-Based Business Models. *Journal of Product Innovation Management*, *37*(2), 158–183. https://doi.org/10.1111/jpim.12516

Sonyel Oflazoglu. (2017). Qualitative versus Quantitative Research. IntechOpen.

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003

Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, *51*(1), 40–49. https://doi.org/10.1016/j.lrp.2017.06.007

The Ellen McArthur Foundation (2017). Circular economy - concept, building blocks, school of thought and infographic. https://www.ellenmacarthurfoundation.org/circular-economy/concept

Tura, N., Hanski, J., Ahola, T., Ståhle, M., & Piiparinen, S. (2019). Unlocking circular business : A framework of barriers and drivers. *Journal of Cleaner Production*, *212*, 90–98. https://doi.org/10.1016/j.jclepro.2018.11.202

Vermunt, D. A., Negro, S. O., Verweij, P. A., Kuppens, D. V, & Hekkert, M. P. (2019). Exploring barriers to implementing different circular business models. *Journal of Cleaner Production*, *222*, 891–902. https://doi.org/10.1016/j.jclepro.2019.03.052

Weissbrod, I., & Bocken, N. M. P. (2017). Developing sustainable business experimentation capability e A case study. *Journal of Cleaner Production*, *142*, 2663–2676. https://doi.org/10.1016/j.jclepro.2016.11.009

Wolfslehner, B., Pülzl, H., Kleinschmit, D., Aggestam, F., Winkel, G., Candel, J., Eckerberg, K., Feindt, P., Mcdermott, C., Secco, L., Sotirov, M., Lackner, M., & Roux, J. (2020). *European forest governance post-2020*.

Zott, C., & Amit, R. (2007). Business Model Design and the Performance of Entrepreneurial Firms. *Organization Science*, *18*(2), 181–199. https://doi.org/10.1287/orsc.1060.0232

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning*, *43*(2–3), 216–226. https://doi.org/10.1016/j.lrp.2009.07.004

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Sage.

Appendices

Appendix 1. Interview template of the study

Background information

Company:

Name of the Interviewee:

Interviewee's role in the company:

Sum of company employees:

Company's CBM:

Case:

1) **Introduction**

Brief study and company introduction.

2) **Circular economy/projects**

Tell me about your and your company's background with circular economy.
Can you briefly describe your company's current level of circularity and interesting avenues considering circular business models for the upcoming years?

3) **External & Internal challenges**

External
What kind of institutional barriers affect your CBMI process? Can you identify some key barriers while implementing circular business/projects?
What creates uncertainty in the projects/business?
What are the key barriers considering value chain and operations together with partners? How do these challenges affect the implementation of CBM?

-

Internal

How is CE perceived inside your company?

What kind of challenges affect the implementation process on an organizational level and why?

What factors are negatively affecting to learning opportunities?

Can you describe your need of resources within CBMI process?

4) Enablers and strategies for overcoming barriers

What strategies are you using to face these challenges?

Can you describe positive influences inside and outside your company towards circular economy?

5) Perception towards business model innovation

How do you perceive circular innovations?

What hinders or amplifies circular innovations in your company?

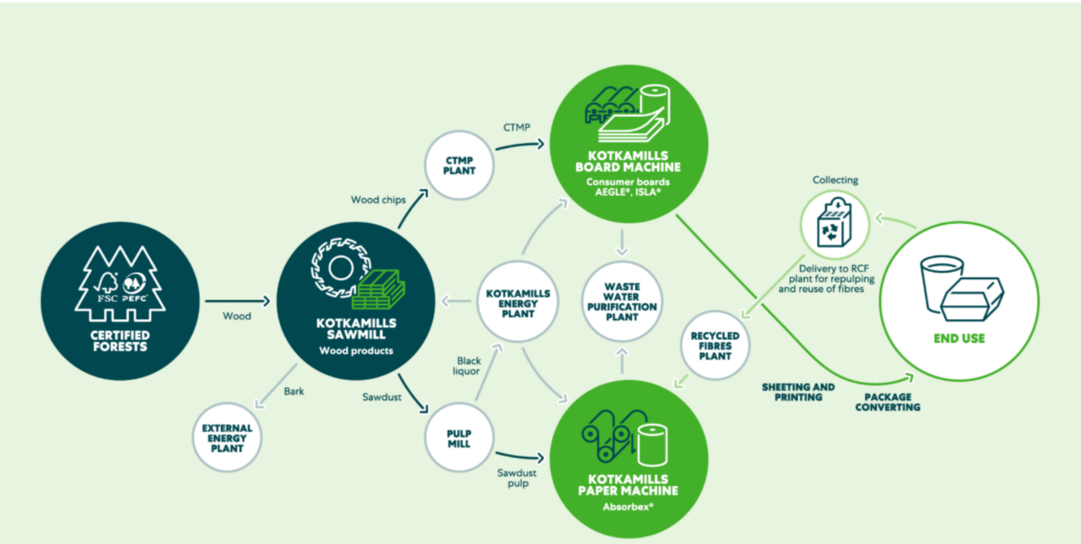
Appendix 2. Data codes

SMEs & MNCs	SMEs	MNCs

BARRIER LEVEL	CODES
Market and institutional	Laws which are not interacting well together
Market and institutional	Restrictive laws, hindering innovation
Market and institutional	EU regulations create uncertainty
Market and institutional	SUP directive is currently too uncertain
Market and institutional	Regulations hinder current model as well as new models
Market and institutional	Certain regulations help to push markets towards better solutions
Market and institutional	Support is missing
Market and institutional	Finnish forest industry is lacking political presence
Market and institutional	Regulations are set in the EU level, which means they do not always fit to Finnish forests
Value chain	Too little we understand other industries side streams
Value chain	Lack of transparency
Value chain	Lack of knowledge about side stream capabilities
Value chain	Lack of ecosystems
Value chain	Lack of local symbiosis due to globalization
Value chain	Business models are not combatable in the network
Value chain	Old industry structures
Value chain	Difficulty in determining the actions of networks chains considering CE
Organizational	Economic distress
Organizational	Lack of circular metrics
Organizational	Challenges in sharing proper knowledge and circular competences
Organizational	Expensive circular certificates
Organizational	Lack of agile experimentation
Organizational	Risk averse behavior
Organizational	Risk of lowering circular standards in hopes of gaining more
Organizational	Not everyone on the company see the value in CE activities
Organizational	Scaling difficulties due to uncertain side streams and recycled materials
Organizational	More expensive R&D
Organizational	Lack of substants competences
Employee	Lack of individual competences in some departments

ENABLER LEVEL	CODES
Market and institutional	Right political presence (for the Finnish forest industry)
Market and institutional	Technology free regulations
Market and institutional	Support systems for circular economy
Market and institutional	Long-term political actions
Market and institutional	Free markets
Market and institutional	Regulations which do not interfere with innovations
Value chain	Transparency in the value chain
Value chain	Transparency for other industries
Value chain	Unified models
Value chain	Compatibility checks
Value chain	Ecosystem thinking
Value chain	Increasing local networks and partnerships
Value chain	Guidance and information sharing through digitalization
Value chain	Industry shifts to more agile thinking
Organizational	Transparency in the company
Organizational	Development of the circular metrics
Organizational	Less expensive certifications (support)
Organizational	Agile implementation and ability to quickly react to changes
Employee	Committed leadership, company culture and values

Appendix 3. Case Company's CBM



Picture 1. Kotkamills CBM design. Source (Kotkamills, 2021)