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Implementing Circular Business Models in the Norwegian Construction Industry: Barriers and Enablers

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Implementing Circular Business Models in the Norwegian Construction Industry: Barriers and Enablers

Master Thesis

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Abstract

This thesis provides potential enablers to overcome the current barriers to implement circular business models in the Norwegian built environment. Based on interviews with 20 participants from 16 different organizations from the construction industry, five barriers to a circular transition are identified: (1) *lack of knowledge and limited access to information sharing,* (2) *financial factors associated with implementing circular methods,* (3) *lack of incentives and support,* (4) *lack of regulation and Governmental actions* and (5) *culture.* Findings from this study provide insight into how the construction industry can overcome the barriers by (1) *entering new collaborations*, (2) *establishing a proactive organization cultur*e and (3) *redesign planning production and supply.* Implications for theory and practice are discussed.

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List of Abbreviations

Acronym	Full Term
C2C	Cradle to Cradle
CBM	Circular Business Model
EPD	Environmental Product Declaration
EU	European Union
NSD	Norwegian Centre for Research Data
ROI	Return of investment
SME	Small Medium Enterprises
UN	United Nations
WGBC	World Green Building Council

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Emma Wagner
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1. Introduction

The purpose of this study is to explore the current barriers to implement circular business models and how they may be overcome in the Norwegian built environment. Through an explorative study of 16 Norwegian companies, we aim to provide a deeper understanding of the circular economy in the built environment.

In recent times, awareness towards the circular economy has increased nationally and internationally as a way to overcome the current production and consumption model which is based on "take-make-dispose" principles (Ghisellini, Cialani, & Ulgiati, 2016). Several international and national documents signal action towards a circular economy from Governments. The European Green Deal has communicated greater focus towards a circular economy for tackling climate change (European Comission, 2019). In Europe, the principles for circular economy are being adopted as guidelines for the redesign of its economy (McDowall et al., 2017) and the New Circular Economy Action Plan for Cleaner and More Competitive Europe outlines its aim to scale up the circular economy (European Comission, 2019). The Norwegian Directorate for Public Construction and Property has announced in its Environmental Strategy 2019-2020 more significant commitment towards a circular economy in the construction industry. Greater involvement in this area can help longevity of new buildings, reduce waste production and increase the use of recycled materials (Nikolaisen, 2019). The climate report from the Norwegian Government (2017) contains a strategy for how Norway can meet the emission budget from the European Union (EU) for 2021-2030. The Government is working to fulfil the Paris obligation with the EU. Based on this, individual actors develop their company strategy.

To transition to a circular economy, enable sustainable innovations and succeed on a larger scale, the rules of the game must be changed. The current mindset in the business world is that investing in a business and the environment is an either/or choice (Lendager & Lysgaard Vind, 2018). It is perceived as more cost-effective and convenient to dispose rather than reuse materials (Carra & Magdani, 2016). Thus, companies must create a win-win situation for the environment, business and

everyone involved. Lendager and Lysgaard Vind (2018) argues that the world economy has been dominated by the linear approach for a long time. However, more people are beginning to understand that it must be replaced with a circular mindset so that the utilization of energy and resources can be handled in more sustainable manner. The construction industry is the world's largest consumer of raw materials and generates waste accordingly (Malik & Maheshwari, 2018). What is today referred to as waste has high potential for reuse and recycling. If the built environment steers away from the linear approach and sees the value and potential of the discarded materials, the amount of waste will be significantly reduced, and the need for new materials will decrease (Lendager & Lysgaard Vind, 2018). Implementation of circular economy principles requires changes on macro-level (nations, regions, provinces and cities), meso-level (eco-industrial parks) and micro-level (company or consumer level) (Ghisellini et al., 2016). In this study, we focus on changes at micro-level and address companies in the Norwegian built environment. We want to explore what barriers to implementing circular economy may exist and how they may be overcome. With this thesis, we hope to reduce the uncertainty surrounding circular business models in the construction industry and create awareness about the opportunities that exist. The content of this study applies to the construction industry as a whole as our data includes both residential- and commercial buildings.

1.1. Background and Purpose of Research

In 2018, the world faced Earth Overshoot Day on August 1st and on the July 29th in 2019. Earth Overshoot Day is the day of the year when humanity's ecological footprint[1] exceeds the earth's biocapacity, and this day comes earlier every year. If the human population continues in this direction, it is estimated that we will need 1.7 planets to keep up with our current behavior and even more with the growing community (Larsen, Bjerring Olsen, & Emanouilov, 2020). In 2020, the Earth Overshoot Day lands on August 22nd as a result of the Coronavirus Pandemic, which

[1] The Ecological Footprint is a method that measures human demand on natural capital (the quantity of nature it takes to support people or an economy). It is a metric that measures how much nature we have and how much we use (Network, 2020).

has decreased humanity´s ecological footprint. However, true sustainability that allows all to thrive on earth can only be achieved by design, not disaster (Global Footprint Network, 2020). One solution to prevent future overshooting is to start retaining our current resources in circulation for as long as possible. This requires companies to change radically by moving away from the linear economy of taking, make and dispose, and towards new business models, products and value chains (Lendager & Lysgaard Vind, 2018).

According to the United Nations report launched in June 2019, the world's population is expected to increase by 2 billion people by 2050, from a current population of 7.7 billion to 9.7 billion in the next 30 years (United Nations, 2019). Consequently, this will increase the pressure on the earth's resource capacity, which will be further pressured by increased urbanization. Urbanization means that people move from rural areas to urban areas where, for example, work, education and housing are more accessible (Migration-Data-Portal, 2020). More than half of the world's population now lives in cities, and according to the UN, an additional 2.5 billion people are expected to move into cities by 2050. In line with the accelerating urbanization process, demand for residential, non-residential and infrastructure projects will also increase. This development will lead to challenges in terms of resource capacity, which puts enormous pressure on the construction industry. However, if the construction industry, across its value chain, manages to develop smart urbanization strategies, it can help achieve sustainable cities (United Nations, 2019).

Given the continually growing population and urbanization, and their need for housing and workplaces, the construction industry plays a significant and essential role[2]. This is one of the many reasons why more attention should be granted to this industry in the debate of sustainability and circular economy. Currently, the construction industry is responsible for 39% of global carbon emissions (UN

[2] The construction industry is accountable for almost 40% of the world’s climate emission and are facing pressure from investors, banks, regulators, contracting authorities, and consumers to mitigate their climate risk and find new solutions to reduce their carbon footprint. (Malik & Maheshwari, 2018)

Environment, 2019). Furthermore, the global volume of construction output is anticipated to increase by 70% by 2025 (Perspectives & Economics, 2013). Thus, finding ways for how to decarbonize the sector is one of the most important measures for mitigating the worst effects of climate breakdown. As the world's population is projected to increase, the global building size is also predicted to double. Thus, without substantial changes in how the construction industry operates, this development will lead to vast consumption of earth's resources and significantly increase the sector's emissions and climate impact (Adams, Burrows, & Richardson, 2019). Building materials are essential in the construction industry and are considered to be a tremendous environmental hazard, generating millions of tons of waste annually (Kubba, 2012).

Today, our economy appears to be locked into a system where everything from manufacturing to regulations and mindsets favors the linear model, “take-make-dispose” system, of production and consumption. This lock-in trend, however, is weakened by the pressure of several disruptive trends. First, the growing population and urban development have led to resource scarcity and tighter environmental standards which have encouraged companies to analyze circularity potentials (E. MacArthur, 2013). Second, information technology is now so advanced that companies can trace materials through the entire supply chain, and social media platforms enable them to get instant feedback on products and services. Third, the new generation seems prepared to choose access over ownership which is a pervasive shift in consumer behaviour (E. MacArthur, 2013). This is reflected in an increased sharing economy where we can lend or rent cars, accommodations, machinery etc. which can be called “shareable goods” (Frenken & Schor, 2019).

The development of new and more circular business propositions indicate that circular business design has moved from being on the sideline to becoming mainstream (E. MacArthur, 2013). Still, there are several obstacles that remain. Some of the barriers may fade over time, while some require new frameworks in terms of corporate governance, cross-industry collaboration and regulations. The mainstreaming phase involves moving manufacturing away from destructive linear

material consumption patterns to a more circular approach where materials are retained for as long as possible (E. MacArthur, 2013).

1.2. Problem Description and Research Question

Considering the environmental challenges outlined above, the concept of a circular economy becomes relevant. A fundamental problem in implementing circular economy principles in organizations is to rethink their current supply chains, the way they create and deliver value to their customers through their business models (Lüdeke-Freund, Gold, & Bocken, 2019). Research shows that an integral part of achieving a circular economy is business model innovation (De Angelis, 2016). The scope and purpose of this thesis are the following:

- To map out the current state of circular economy in the Norwegian built environment.
- To uncover current barriers to implementing circular business models in the Norwegian built environment.
- To investigate possible solutions to overcome the barriers to implementing circular business models in the Norwegian built environment.

In this study, the primary objective is to uncover potential for circular business models (CBM) in the Norwegian built environment and how such models may be implemented. This requires a systems-thinking approach to apply a circular economy to the construction industry, one which gives an understanding of the whole building lifecycle and the entire construction value chain (Carra & Magdani, 2016). Thus, it is essential to examine the whole value chain to expose barriers and find potential solutions[3].

[3] The actors across the value chain are, among others, real estate developer, architects, designers, engineers, contractors, suppliers and facilities managers, and they have a crucial role in creating circular solution to facilitate a transition towards CBMs (Carra & Magdani, 2016).

Given that awareness towards the circular economy in the Norwegian construction industry is expressed in various national strategy documents (Nikolaisen, 2019; The Royal Ministry of Climate and Environment, 2017) and steps have been taken to advance the circular economy, it is interesting to explore why the progress has been rather slow. Our research will, therefore, focus on uncovering enablers to implement CBMs in the Norwegian built environment. Our research question is as follows:

"How may the current barriers to implementing circular business models in the Norwegian built environment be overcome?"

Due to the different regulatory framework, we have not aimed for or been able to collect comparable data across countries. Thus, we have decided to limit our study to the Norwegian built environment, mainly companies located in Oslo, Bergen and Trondheim, as most of our data collection explicitly deal with these geographical locations. Our research is limited to 20 participants from 16 different companies in the construction industry. In the following chapters, we provide a thorough explanation of what is meant with a circular business model with a focus on the Norwegian construction industry´s value chain[4]. Through our data collection and analysis, we expect to uncover the current barriers to implementing CBMs in the Norwegian construction industry. We further hope to shed light on potential enablers to implementing circular business models in the Norwegian built environment.

[4] "*The value chain for any construction project is composed of specific variations within a fixed framework of distinct stages—design, production and conversion of raw materials into manufactured products, and construction itself. Each of these comprises its own internal stages, processes, stakeholders, and aspects that interact to bring a project to fruition. The distinctness of these processes, as well as the fixed-term, project-based nature of relationships along the supply chain, results in a highly fragmented industry structure."* -(Malik & Maheshwari, 2018, p. 2)

1.3. Outline of Thesis

The thesis is structured as follows; we first present an overview of the literature that provides a deeper understanding of the term circular economy and circular business models. This forms the basis for the data analysis and discussion of the results in this thesis. Second, we introduce the methodological approach used in this study, where we elaborate on our decision of choosing qualitative research and explorative research design. Third, we present the findings from data collection. Our findings are divided into three parts; a description of the current state of circular economy in the Norwegian built environment, a review of the uncovered barriers to achieve CBMs, and we present the identified potential enablers to implementing CBMs. Finally, we discuss the implications of data findings and propose practical measures that may be applied to facilitate the transition to a circular economy in the Norwegian built environment. Limitations and theoretical contributions are considered. At last, we provide an answer to our research question in the conclusion chapter.

2. Literature Review

In the following chapter, we will provide existing literature relevant for this master thesis. To answer the research question, we explain the concept of *sustainable development* and related sustainable development goals for the construction industry. Implementing circular business models require a change of mindset; therefore, we will investigate environmental psychology to explain people's behavior related to climate change. We further define the term *circular economy* to understand what is meant with a *circular transition* and *circular value chain.* The concept of *circular business model* is further explained, and we present previous research that documents challenges for the implementation of circular economy in other contexts to explore how the barriers may be overcome. Research shows that some obstacles require new frameworks (E. MacArthur, 2013), and we, therefore, present the *RESTART framework* developed by Jørgensen and Pedersen (2018).

2.1. Sustainable Development

The concept of sustainable development has become more central in recent years as a consequence of human resource overuse becoming more visible over time. According to the UN World Commission on Environment and Development Report, sustainable development is defined as a "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987). Sustainable development can be categorized into three core elements: economic growth, social progress and adequate protection of the environment. On the macroeconomic level, the construction industry plays a vital role in contributing to the achievement of sustainable development (Sev, 2009).

2.1.1. Sustainable Development Goals - Construction Industry

In 2015 the UN World Commission developed a joint plan with 17 Sustainable Development Goals (SDG) for peace and prosperity for people and the planet (United-Nations, 2018). Sustainable development goals cover a wide range of topics, from zero poverty and hunger to secure institutions. The industry uses a substantial amount of energy, water, materials and natural resources. Accordingly, many global challenges related to climate change, health and well-being are markedly affected by

this industry. The construction industry has a significant part in contributing to the three core elements of sustainable development (Omer & Noguchi, 2020). The various sectors in the construction industry are aware of the importance of embedding sustainability into their operations and products (Malik & Maheshwari, 2018). World Green Building Council (WGBC) has identified that green buildings can positively contribute to meet nine of the SDG´s, including SDG 3, 7, 8, 9, 11, 12, 13, 15 and 17 (WGBC, 2019). WGBC have developed an infographic that expertly details how green buildings can contribute to the SDG´ s mentioned above (Figure 1).

Figure 1: Sustainable Development Goals Construction Industry

Source: "Green building & the Sustainable Development Goals", (WGBC, 2019)

Buildings materials generate millions of tons of waste each year, resulting in significant carbon dioxide emissions in the built environment (Omer & Noguchi, 2020). Thus, responsible use of building materials (related to SDG 12) has, among others, been identified as an important area where the built environment can contribute to achieving SDGs (Opoku, 2019).

2.2. Environmental Behavior

As there is great seriousness associated with climate change, there is reason to expect a strong focus on behavioural change concerning environmental behaviour. Environmental psychology may explain people and company´s perception of environmental problems and what affects their behaviour (Fyhri, Hauge, & Nordh, 2012). It is not uncommon to perceive environmental issues as dilemmas and to feel hindered by financial factors and time (Fyhri et al., 2012). A general model for approaching ecological problems which are still used is based on a 1968 article by Garrett Hardin; *Tragedy of the commons*. The report specifically deals with the utilization of natural resources. It shows how people are not able to cooperate in managing resources because they are trapped in a game that is about maximizing dividends at the individual level, while the individual may realize that such behaviour does not work at a group level. It all ends with the resource being completely depleted (Hardin, 1968).

This understanding of shared resources has been developed using "*game theory*", which explains behaviors at the interaction level. Game theory describes what an actor chose to do in a situation where the outcome depends on what other actors decided to do (Binmore, 2007). This is called social dilemmas and can be defined as a situation where the individual´s short-term gains conflict with what is beneficial to the community in the long-term (Dawes, 1980)

Robert Frank (2004) points out that the individual-oriented understanding of what is useful to oneself may not be consistent with evolutionary understanding. Collaboration in such situations has been a problem that humanity has had to solve through its evolutionary history, and the global environmental challenges we are facing today must be addressed together. Frank (2004) believes that morality can make people cooperate, and that generous actions can provide beneficial outcomes, both financially and environmentally friendly.

In today´s economy, environmentally-friendly solutions are often perceived as expensive and inconvenient (Carra & Magdani, 2016). Since "rational" choices are

made to maximize personal benefit, it requires a fundamental change of mindset. The transition towards a circular economy is not possible without a shift in consumer behavior regarding adaption to new business models, purchasing habits, and acceptance to reusing products and materials (Parajuly, Fitzpatrick, Muldoon, & Kuehr, 2020). We further explain the term circular economy and circular business models.

2.3. Circular Economy

A circular economy is an economic system aimed at eliminating waste by ensuring that resources remain in a perpetual loop (Kriza, 2016). This consequently reduces the need for virgin materials for economic activities (Nasir, Genovese, Acquaye, Koh, & Yamoah, 2017). The ideals of a circular economy suggest that environmental sustainability can be emphasized by the idea of transforming products in such a way that the relationship between the ecological systems and economic growth are compatible (Braungart & McDonough, 2002). The implementation of circular economy practices would promote circular supply chains, enabling materials at the end of their life cycle to re-enter the supply chain through recycling, remanufacturing, re-usage or *upcycling* (Nasir et al., 2017).

MacArthur, Zumwinkel and Stuchtey (2015) argue that companies are already capturing most of the economically beneficial opportunities to recycle, reuse and remanufacture. Thus, they claim that reaching higher levels of circularity may involve compromising on an economic cost that most European companies cannot cope with. Hence, aligned with innovative business models developed by companies, policy interventions are required to reach a higher level of circularity (D. E. MacArthur et al., 2015).

2.3.1. Cradle to Cradle Design

Cradle to cradle is a design concept inspired by nature where products and materials are created according to the principles of an ideal circular economy. The design concept was introduced by chemist Michael Braungart and architect William McDonough (2002) in their book, "*Cradle to Cradle - Remaking the way we make*

things". The book was published in 2002 and immediately became an inspiration for environmentalists, businesses and leaders. The concept Cradle to Cradle (C2C) marks a shift from traditional thinking about the production of goods that dominated under the industrial revolution. It is linked to the circular economy, where all the materials are used to its full potential.

According to C2C design, if humans are to prosper on the planet truly, production designs need to imitate the nature's system of nutrient flows and metabolisms where waste does not exist. "*To eliminate the concept of waste means to design things - products, packaging, and systems - from the very beginning on the understanding that waste does not exist*" (Braungart & McDonough, 2002, p. 90). The focus is not to reduce the use of materials, but rather reuse and recycle. The products have been developed following the model to safeguard the quality of raw material through several production processes (Kriza, 2016). This means less, or no waste, where all the elements are considered high-value materials. The goal of C2C design is to develop consumables so that they can be used in biological cycles several times (Kriza, 2016). To gain a more comprehensive understanding of how the circular economy can be implemented in the construction industry, it is essential to explain linear and circular value chains.

2.3.2. Linear Value Chain

A value chain is the process by which a company add value to a product and was first introduced by Michael Porter (1985) involving five primary activities. The value chain is today referred to as a linear model in which each player specializes in a single action in the supply chain. Facilities design products to increase return on investment (ROI), then suppliers produce an asset made to fulfil a specific function for finite service life, while the asset owner contributes to the depreciation of the asset, and at last, the user has access to the asset until end of a lifetime (Carra & Magdani, 2016). The linear value chain demonstrates a "take-make-dispose" design in which resources are extracted, produced, used and then disposed of as waste (Kuben Management, 2018).

Figure 2: The Linear Model

Source: "A traditional linear value chain" (Jørgensen & Pedersen, 2018, p. 106)

This linear approach to production is not viable in the long term for several reasons (E. MacArthur, 2013). Increased population growth, urbanization and the fact that natural resources move to harder-to-reach locations cause sales revenues to be tightly connected to material input. This increases business exposure to risks. Furthermore, the linear production model incurs unnecessary resource losses in several ways. A large portion of materials used in production today become disposed before entering the economic system. Most materials that are produced today end up being eliminated at the end of their functional life cycle. It is estimated that only approximately 40% of waste is recycled and reused in Europe (E. MacArthur, 2013). Thus, there is a great need to move from a linear value chain to a circular one in the future.

For this master thesis, we focus on the supply chain in the Norwegian built environment. We, therefore, found Malik and Maheshwari´s (2018) proposed value chain for the construction industry useful (see Figure 3). We have collected data from the perspectives of real estate developers, architects, contractors, waste management company, consultants, public sector, bank and consumer council.

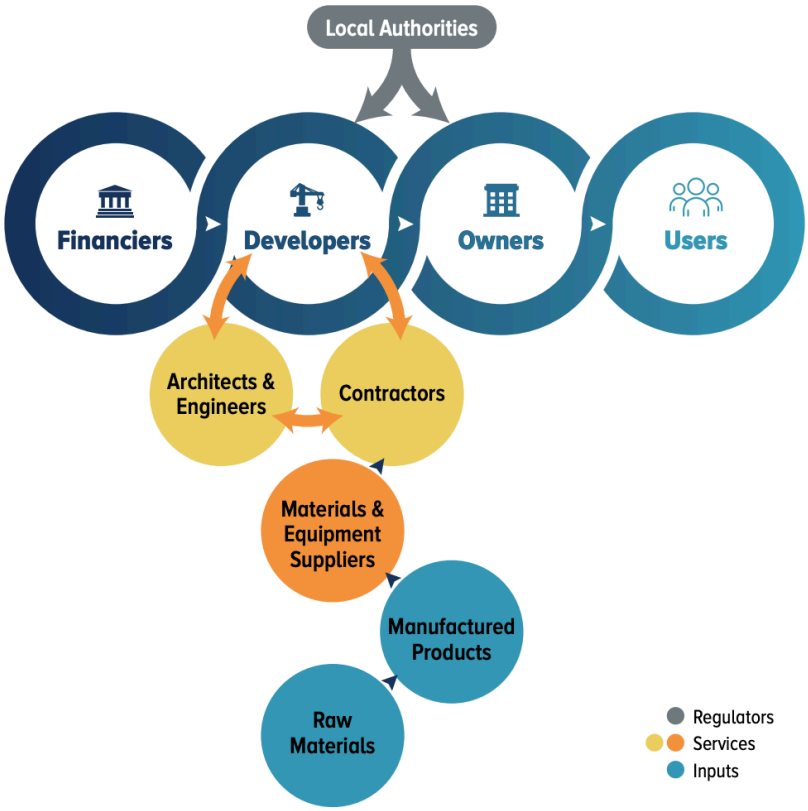

Figure 3: Construction Value Chain

Source: «What is the construction value chain?" - (Malik & Maheshwari, 2018, p. 7)

2.3.3. Circular Value Chain

As opposed to the linear model, the circular value chain is based on reuse, improvement and material recycling in a cycle where the fewest possible resources are lost. The circular value chain eliminates waste and reduces carbon footprint (Jørgensen & Pedersen, 2018). In the circular value chain, the linear structure is broken, and all actors are forced to re-evaluate their role. What happens is that old products and materials return to the value chain and get a new and higher value when reused or recycled (Carra & Magdani, 2016).

In the built environment, the circular value chain consists of three significant changes to the company's current business model. First, expanded resource mapping so that the demolitionists can get an overview of the materials available in the new construction. Second, materials and buildings are designed to be more suitable for

recycling and disassembly in the future. The third change means that all players in the circular value chain should enter into closer cooperation and be open-minded to the opportunities the circular economy brings (Jørgensen & Pedersen, 2018).

The most significant change is probably how demolition goes from being one link to several links in the circular value chain. Instead of demolishing the building, the building materials would be removed and recovered, which results in a closed loop. The need for new facilities that handle the disassembled materials for improving and refurbishment will increase. It is crucial to act strategically in demolition work, and it requires new roles and workflows to identify and implement the circular transition (Kuben Management, 2018). To attain the benefits of a circular business economy, companies need to design a profitable, circular business model. This can be done on at least five different levels shown in Figure 4.

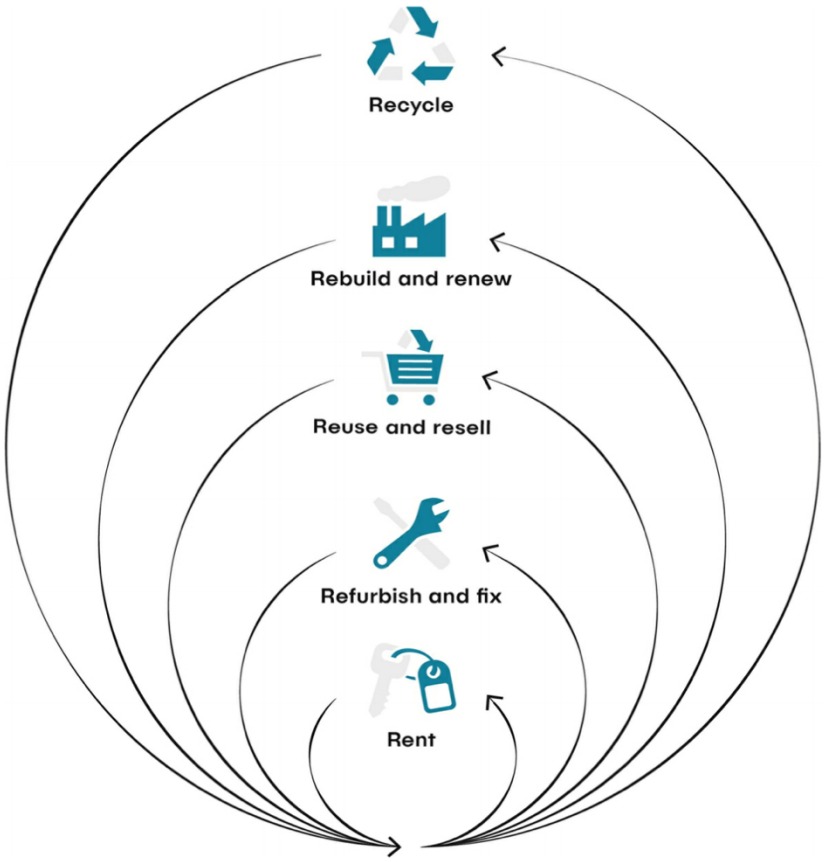

Figure 4: A Circular Economy

Source: "Different types of upcycling in circular business", (Jørgensen & Pedersen, 2018, p. 108).

The movement from a linear economy to circular ensures that resources are used repeatedly, thus preventing a large amount of resources from becoming waste (Jørgensen & Pedersen, 2018). This involves maintaining the value of the resources for as long as possible, preferably forever (Braungart & McDonough, 2002), a phenomenon referred to as *upcycling*[5]. Keeping materials in circularity, or closed loops, can reduce the need for virgin materials and contribute eliminating waste production (Carra & Magdani, 2016).

2.4. Circular Business Models

Circular business models (CBMs) represents an entirely different approach when producing and consuming goods and services (Fraccascia, Giannoccaro, Agarwal, & Hansen, 2019). It aims at reducing the extraction and use of virgin resources and the current generations of industrial and consumer waste. CBMs represent necessary activities to transition to a resource-efficient and circular economy. The following chapter elaborates on CBMs explicitly for the construction industry, but first, we define the term Business Model.

2.4.1. Business Models

A business model is a broad term, but innovation researchers Osterwalder and Pigneur (2010) offers the following definition; *"A business model describes the rationale of how an organization creates, delivers and captures value".* Most definitions of the term refer to how value is created and captured (Zott, Amit, & Massa, 2011). Value creation can be subdivided into following categories: 1) *value propositions*, 2) *how value propositions are delivered to customers by engaging actors and value delivery processes*, 3) *how value is created*, and 4) *how companies capture the created value* (Lüdeke-Freund et al., 2019). There are two different ways

[5] Upcycling is a recycling method that emphasizes the goal to retain high value of materials and keeping them in the economy so that they can be used several times (Braungart & McDonough, 2002). It means that waste or residual materials are used to create new products, so that materials achieve a higher value. Aluminum waste can, for example, become a facade on a building, while old textile can be upcycled and turned into insulation. In other words, the waste, or residues receive a higher value through treatment process, thus extending the lifespan of the materials (Kuben Management, 2018).

to define the term business model. The static approach to business models refers to the conceptualization of different activities that a company performs to generate value. Second, the transformational approach considers a business model as a concept or a tool to address change and focus on innovation, either within an organization or in the business model itself (Demil & Lecocq, 2010). Lenssen and Smith (2019) express that many existing business models seem to operate on the assumption that non-financial resources, whether natural, human or societal, are in infinite supply. Societal benefit, if it is considered at all, is an after-thought. Thus, to create a more sustainable world, we need business models that operate within the planet´s limits and are mindful of their impact on the economy, environment and society (Lenssen & Smith, 2019). The development of sustainable business models is often described as a paradigm shift that challenges the traditional business models that tend to be oriented on financial value creation. Circular economy business models can be considered as a subcategory of a more broad category of sustainable business models (Lüdeke-Freund et al., 2019).

2.4.2. Circular Business Models

Although the notion that new business models are needed to adequately address the shortages of current means of production and consumption is well recognized, De Angelis (2016) suggests that the concept of circular business models is just emerging. Thus, currently, there exists a variety of CBM conceptualizations that offer a wide range of design options for business models (Lüdeke-Freund et al., 2019). Linder and Willander (2017, p. 183) define a circular business model as a *"business model in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings"*. Mentink (2014, p. 24) has proposed another definition: *"a circular business model is the rationale of how an organization creates, delivers and captures value with and within closed material loops"*. A similar definition is put forward by Nußholz (2017, p. 12) who describes circular business models as "*the way a business creates, delivers and captures value at every chain in the system with and within closed material loops*". Mentink (2014) argue that circular business models should be considered as a subcategory of business models, which fit in an economic system of restorative or

closed material loops. This also implies that CBMs do not necessarily have to close the material loops within its internal system boundaries, but that it can also be a part of a system of business models which together close material loops to be regarded as circular (Mentink, 2014).

The primary goal of a circular economy business model is to help organizations create value by using resources through multiple cycles and reducing waste and consumption. In the best-case scenario, waste is wholly avoided or reused, and only renewable energy is used (Lüdeke-Freund et al., 2019). However, to achieve this, multiple sides of business models must be considered. Implementing CBMs require, among other things reconsideration of production inputs, how they are used and where they are derived from. This may further require the involvement of partners and experts outside the company. The demand for used materials may lead to the creation of new markets for secondary resources or expansion of existing ones. The resulting resource flows and partnerships could help establish symbiotic relationships that allow for resource use and continuous recycling. Production inputs can also be obtained from existing customers which may lead to additional contact points with the company and in such way, enrich customer experience (Lüdeke-Freund et al., 2019). Thus, implementing such closed loop production would not only reduce material waste but also provide additional opportunities for interaction with consumers who re-engage with the company to facilitate product recycling (Clinton & Whisnant, 2019).

Carra and Magdani (2016) argued, in their Ellen MacArthur Foundation report, that governance, regulations and business models play a significant role in the transition towards a circular economy. Successful implementation of CBM requires action from all the actors across the value chain from designers, suppliers, service providers, contractors and end-of-life companies by sharing materials, information, knowledge etc. (Carra & Magdani, 2016). It is vital that the actors collaborate in the supply chain.

From the perspective of CBMs, Carra and Magdani (2016) suggest that a new kind of value chain is required for stakeholders in the construction industry to transition to the circular economy. The traditional business model tends not to favor collaboration throughout the value chain because they work independently and rarely consider the different goals they have. This type of value chain generally has a set approach where products and services are the inventory of one company and the receivable of another. The risks and strengths of a company should, therefore, be viewed collectively in its value chain (Carra & Magdani, 2016). If companies across the value chain manage to collaborate and implement CBM, it will allow for greater control of resource streams through the value chain so that added value can be identified. It would also allow innovation through the supply chain such as new business opportunities in waste handling, refurbishment and reverse logistics (Carra & Magdani, 2016).

2.4.3. Circular Business Models in The Current Value Chain

There exists multiple CBMs[6] that can be grouped into three categories: *design, use* and *recovery* (Carra & Magdani, 2016). The three categories are relevant as to when they need to be implemented during the building life cycle.

The first category, circular design, aims at providing planning and design for components to improve its service life ultimately. The category includes solutions to improve maintenance, repairing and refurbishment or remanufacturing of the resources. This requires a strategic plan of the process through the entire value chain to increase the reuse and recycling potentials of products and waste streams. Also, it focuses on the development of new materials to enhance renewable energy, bio-based, less resource intensive or fully recyclable materials (Carra & Magdani, 2016).

The next category, circular use, involves several actors in the value chain. This model suggests facilities and platforms that will improve and enhance the materials value

[6] To support the transition to circular economy, all the actors in the value chain must engage. Carra and Magdani (2016) emphasizes that a successful implementation of CBMs in the current value chain require action from architects, suppliers, service providers, contractors and end-of-life companies by sharing materials, systems, energy, as well as information and services. (2016)

and life cycle. It includes facilities that can track the products, maintenance and improvement such as support and lifetime extension of the products, sharing platform with access and shared use rather than ownership (Carra & Magdani, 2016).

The last category, circular recovery, includes suppliers that can recapture materials instead of virgin materials, recycling facilities that transform waste into raw materials, maintenance and support of existing materials lifecycle. It entails remanufacturer refurbish and maintain components so that they can be sold, and recovery providers that can recover useful resources from disposed products or by-products (Carra & Magdani, 2016).

For a circular economy to function, these categories will likely need to interact, cooperate and work together. For example, a business that bases their CBM on refurbishment and maintenance of products may need to partner with a tracking facility to monitor and record where their products have been installed and then work with a logistic company to make sure expired products are returned. In this transition towards a circular economy, there are both barriers and opportunities that need to be addressed. Different stakeholders need to be involved in providing solutions and may need to work together (Carra & Magdani, 2016).

2.5. Barriers for Circular Business Models

In this section, we review previous research that has identified barriers to implement CBMs in the construction industry, which is used to supplement research findings, in this thesis.

The Ellen MacArthur Foundation in collaboration with McKinsey & Company, has identified several obstacles when implementing CBMs in the built environment. They range from current production design to cultural resistance, financial risks and regulatory frameworks (E. MacArthur, 2013). In the contemporary production design, there are technological, market and operational risks. These challenges include a lack of data and information about product performance as well as uncertainty on operational costs of the resources. Market risks are associated with customer

perception of the recycled/reused products. Customers tend to favor the newest model within a short period. Thus, products are designed with a short lifetime (Carra & Magdani, 2016). To move away from the business model based on this principle requires a change of mindset (Carra & Magdani, 2016; Lendager & Lysgaard Vind, 2018). A successful circular transition can only be achieved through collective effort that requires an exchange of knowledge and innovation across the value chain (Rizos et al., 2016).

Rizos et al. (2016) carried out a literature review and an analysis of sample 30 case studies to study barriers and enablers to implementing circular economy business models in small and medium-sized enterprises (SMEs). The studied sectors were; manufacturing, information and communication, wholesale and retail, electricity, gas, steam, and air condition supply, accommodation and food service activities, and transportation and storage. Findings from this study are relevant to our research, as many actors involved in the value chain in the Norwegian built environment are SMEs. Darko and Chan (2017) further presented a systematic review of the literature on barriers to build environmental buildings and suggestions on how to overcome these barriers. Recent research by Guldmann and Huulgard (2020) supports these articles with a multiple case-study of circular business model innovation with an overview of the obstacles that hinder adoption of circular business models to facilitate circumvention of the barriers.

A significant challenge seems to be the lack of suppliers for specific inputs required to transition to more circular production. From a demand perspective, a great problem is associated with creating a business case for customers that would generate a demand for green products (Rizos et al., 2016). Financial risks and lack of capital is another barrier that hinders the adoption of a CBM in the built environment (Darko & Chan, 2017; Rizos et al., 2016). Research finds that 20% of SMEs report difficulties with obtaining funding from traditional banks to implement necessary changes, and invest in the development of “green” products or buy efficient resource equipment (Rizos et al., 2016). Further, lack of Government support and effective legislation hinders the implementation of a circular economy. The effects of lacking legislative

framework are reinforced by the lack of appropriate market signals which do not encourage or reward efficient use of resources of transition to circular economy (Darko & Chan, 2017; Guldmann & Huulgaard, 2020; Rizos et al., 2016). The transition towards a circular economy is further challenged by the current lack of knowledge, information and awareness about a circular economy business practices (Guldmann & Huulgaard, 2020). This lack of knowledge in the society complicates circular shift and the adoption of CBMs in the construction industry, and thus exacerbate public disengagement in the implementation of CBMs. This is because individuals feel they do not obtain the right information to guide their sustainable actions (Darko & Chan, 2017).

Rizos et all (2016) literature review finds that companies may also experience cultural resistance in a circular transition. While working for an environmentally conscious company may be motivating for some employees, others may have a negative perception or even regard the implementation of green practices as an additional workload. Also, company environmental culture involves management's risk perception. Risk-averse managers may hinder the implementation of a circular economy. Resistance to change may keep business models locked in their current state and thus constitute a serious bottleneck in small companies. Review of case studies shows that company culture is often regarded as an enabler rather than a barrier (Rizos et al., 2016). These findings may be interesting to compare with results from our research in the Norwegian built environment.

The European knowledge and innovation community working towards a society founded on a circular, zero-carbon economy, EIT Climate KIC, has published a report on the challenges and potential of circular procurements in public construction projects (Dunlop & Besenbacher, 2019). Some of the barriers documented in the report are similar to the barriers mentioned above. However, the public sector has its unique challenges to a transition to circular economy. Absence of strategic pressure in the form of national-or city-level strategy documents makes it difficult to justify circular procurements in the construction sector at the performance level. City and land development play an essential role when promoting circular construction

projects and circular procurements. Thus, if the wrong decisions are made in the city planning phase, it can undermine circular buildings for decades to come (Dunlop & Besenbacher, 2019). Circular economy principles, however, are often not considered when planning cities[7]. Decisions made during the planning phase are rarely adjusted in the contract phase. This combined with lack of time, which is an issue that often comes up in the context of planning, market dialogue, the definition of procurement criteria, interim storage and on-site sorting, can pose a challenge with efficient procurement of circular buildings (Dunlop & Besenbacher, 2019).

2.6. RESTART Framework

To propose potential solutions to overcome the current barriers in the Norwegian built environment, we find the RESTAT Framework by Jørgensen and Pedersen (2018) relevant for our study. The framework is developed to guide companies through a circular transition, giving them a practical approach to making business models sustainable for the future. The framework suggests that it is possible for companies to be both sustainable and profitable at the same time. The purpose is to develop a map that can empower leaders in their quest of sustainable and profitable business models. To shift away from the linear business model, it requires companies to redesign their business model and break loose from business as usual. This means that they need to look at the sustainability problem, the new technologies and the change in customers' expectations as opportunities, rather than barriers. "*The comprehensive social and environmental issues comprised in the sustainability problem are simultaneously a threat and a source of opportunities for companies*" (Jørgensen & Pedersen, 2018, p. 14). This is reflected in the technological revolution that has enabled the development of smarter and leaner business models with less ecological footprint while remaining equally good customer experiences. Also, the

[7] According to Dunlop and Besenbacher (2019), circular building is still a rare concept in Europe. In practice, planning and procurement are usually steered by energy-efficiency and aims at reducing energy consumption rather than by going "wholly circular". The Netherlands and Denmark are considered pioneers in circular buildings, as several pilot projects has been carried out in these countries. Still, the circular building consists of individual examples and is not a systematic change towards an adoption of circular buildings.

changes in consumer preferences makes new types of value creations possible, such as sharing economy business models[8] (Jørgensen & Pedersen, 2018).

The RESTART framework corresponds with seven features of more sustainable business models which can be categorized into three groups of features; "RE", "STA" and "RT". The first category, "RE" – *redesign* and *experimentation* – relates to the increasing need for companies to redesign their models, which in turn requires controlled experimentations and try-outs within the organization. The second category, "STA" – *service-logic, the circular economy* and *alliance – includes* three fundamental developments in the current business modeling for sustainability: service rather than products (functionality rather than ownership), circular business models rather than linear, and alliances and collaborations rather than competition. The last category, "RT" – *results* and *three-dimensionality* – relates to the governance and control challenges related to implementing a sustainable business model, a crucial factor for its success (Jørgensen & Pedersen, 2018). These seven categories reflect the main changes that can make business models smarter and more sustainable and are further used to discuss our results in section 5.3.

2.6.1. "RE" - Redesign and Experimentation

The RESTART framework argues that to be both sustainable and profitable, it is vital that companies engage in a continuous redesign of their business models (Jørgensen & Pedersen, 2018). A business model may be conceptualized as consisting of three parts; *value creation, value delivery* and *value capture*. In their entirety, these three components tell a story of how a company operates and succeeds, according to Jørgensen and Pedersen (2018). The innovation of business models involves changes in the way a company creates, delivers and captures value. Business model innovation can vary in their degree of novelty. Companies that fail to innovate their

[8] Sharing economy involves sharing resources, or renting out items – whether houses, cars or smaller products. Numerous technological platforms have emerged and challenged established players in the industry. The sharing economy business model describes a service-logic that effectively bring people together who have excess resources and those who have a need for using them and are willing to pay for it (Jørgensen & Pedersen, 2018).

business models risk extinction. Today, being in motion is a prerequisite for survival and continuous growth. However, experimentation is essential to achieve successful business model innovation (Jørgensen & Pedersen, 2018).

Jørgensen and Pedersen (2018) further suggest that successful business model innovation entails an element of experimentation. Sudden and radical changes may lead to failure and can be destructive to the company. Testing, on the other hand, allows for controlled failure, accumulation of information about what works and what does not and assessment of the impact of planned changes (Jørgensen & Pedersen, 2018).

2.6.2. "STA" - Service-Logic, The Circular Economy and Alliance

Service logic implies that the products and services that the company offers to act as services that solve a problem for the customer (Jørgensen & Pedersen, 2018). The essence of circular-economic thinking is the transition from the linear value chain to a circular approach, where resources are reused. Circular business models build on three strategies, ensuring a flow of resources from post-use to the production of new products, ensuring resource efficiency and the use of fewer resources per produced unit and ensuring longer product lives by designing for longevity. Each of these strategies, either independently or in combination, can be the basis for circular business models. CBMs are particularly well suited for solving problems that are related to product life cycles and resource scarcity (Jørgensen & Pedersen, 2018).

Sustainability is a broad subject and no company has resources, and knowledge to solve the sustainability problem alone. Therefore, companies across the value chain need to work collaboratively instead of evaluating company efforts individually. This requires companies to share information and knowledge and work together for mutual gain. Developing a willingness to collaborate is becoming increasingly crucial in trying to design more sustainable business models (Jørgensen & Pedersen, 2018).

2.6.3. "RT" - result and three-dimensions

To create real change, companies must address sustainability issues that relate to the company's core business. This implies that assessing the materiality of the problems a company chooses to focus on is essential. Concentrate on material issues ensures that the company achieves tangible results and develops a unique sustainability strategy that is more difficult to imitate. Additionally, solving material sustainability issues has been proven to lead to higher financial performance. In several markets, companies are rewarded for focusing on solving issues that stakeholders genuinely care for. Moreover, focus on addressing material sustainability problems requires focused and smart use of resources, monitoring and a continuous dialogue with the company's stakeholders (Jørgensen & Pedersen, 2018).

Jørgensen and Pedersen (2018) propose that companies must be designed in a way that renders them to be both sustainable and profitable at the same time, which requires setting the right objectives socially, financially and environmentally. The organization must, therefore, be designed in a way that reflects and supports these dimensions. Organizational characteristics that support goal attainment along the three dimensions are organizational structure, boundary spanners, measurement of competence and systems and incentives (Jørgensen & Pedersen, 2018).

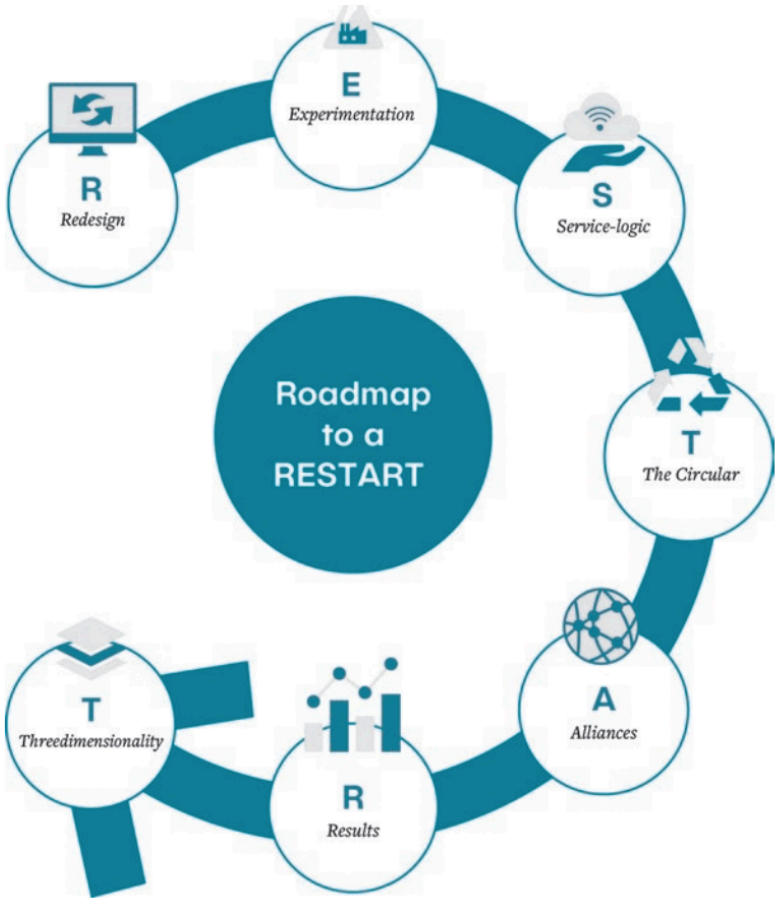

Figure 5: A Roadmap to RESTART

Source: "The Business Model RESTARTer",
(Jørgensen & Pedersen, 2018, p. 181).

The literature presented in the preceding chapter gives a deeper understanding of the circular economy, and why it might be the appropriate solution to the environmental challenges outlined in Chapter 1 of this thesis. Existing literature on barriers to circular transition helps us gain a better understanding of what might halt the implementation of CBMs in the Norwegian built environment. The RESTART framework presented by Jørgensen and Pedersen (2018) is developed to guide organizations in circular transition. We, therefore, find it relevant to use this framework when we discuss our findings in this study. In the following chapter, we present the methodological choices for this thesis, explain how the research was conducted and how data was analyzed.

3. Methodology and Data Collection

3.1. Introduction to Methodology

When we began writing this thesis, we believed that the appropriate focus for the thesis would be the leader's role in the implementation of circular business models. To investigate more closely whether leadership can be a viable focus for our research or if a different angle should be taken, we conducted a small number of interviews with a real estate company that is currently working on a project that is based on circular economy principles. After these interviews, we discovered that it would be challenging to produce valuable data about leadership given that the case project we aimed at investigating was in the beginning stages and would not be completed during the course we were writing this master thesis. We further approached the organization VILL and inquired about the circular economy in the Norwegian construction industry. The results of this dialogue guided us in narrowing our research question, which we believe is relevant to the Norwegian construction industry today.

In the following section, we revisit the purpose of this research and our research question. Then we describe the research strategy and methodology conducted to answer our research question before we present the methodological approach, which is the principle of abductive inquiry. We further discuss the decision to choose a qualitative research method and explorative research design, and we explain how the data was gathered and analyzed. Finally, we discuss the reliability and validity of our research and present ethical considerations.

3.2. Research Question

With our research we aim to accomplish the following objectives:

- Map out the current state of circular economy in the Norwegian built environment.
- Uncover current barriers to implementing circular business models in the Norwegian built environment

- Investigate possible solution to overcome the barriers to implementing circular business models in the Norwegian built environment

Accordingly, our research question is as follows:

"How may the current barriers to implementing circular business models in the Norwegian built environment be overcome?"

3.1. Abductive Approach

There are several ways to explore and investigate a research problem, and multiple choices need to be made during the process. The researcher is faced with a dilemma of choosing a suitable approach when establishing a link between theory and research (Ali & Birley, 1999). The two most common methods are deductive and inductive. A deductive approach often starts with theory developed from academic literature. The research strategy that accompanies the deductive approach focuses on testing theory that research is built on. Inductive approach, on the other hand, starts with collecting data to explore a specific phenomenon. The data is then used to generate or build on theory (Saunders, Lewis, & Thornhill, 2019). There has been disagreement among researchers which approach to apply, and the need to combine both inductive and deductive approach has arisen. This resulted in the introduction of the abductive approach (Awuzie & McDermott, 2017).

As the field of circular business models is still relatively new, we found the inductive and abductive approaches to be lacking. Thus, this research is guided by an abductive approach as we move back and forth to theory. When applying an abductive approach, the obtained data is integrated into an overall conceptual framework. In other words, information is collected to explore a phenomenon, identify themes and explain patterns to generate a new or modify the existing theory. This is further tested through additional data collection (Saunders et al., 2019). However, with this thesis, we do not develop a new theory or modify an existing one. Circular economy in the built environment is an emergent research field. Thus, in our study, current research about barriers to implementing CBMs was used to develop a better understanding of

the subject we are writing about. Further, previous research assisted us in developing our interview questionnaire. This was used to explore if previously documented barriers to implementing CBMs are also present in the Norwegian built environment. Finally, existing literature was used to develop initial themes and codes for our analysis. For example, we used barriers found in research by Rizos et al. (2016), Darko and Chan (2017), Guldmann and Huulgaard (2020) and Dunlop and Besenbacher (2019) for guidance when we first analyzed each interview. Although we found these codes useful, we also saw a need to supply this with our themes and codes as our study led to some discoveries. Through the analysis process, we continuously reevaluated the codes we used until we settled on the codes we currently have. Thus, the coding of interviews was an iterative process where we went back and forth between literature and our data.

3.2. Research Design

For this research, we chose a qualitative method because it is the best way to understand motivation, reasons and actions of our participants (Myers, 2019). This method is appropriate for our study as we aim to identify actors in the built environment perception of barriers and opportunities for implementing a circular business model. To detect inherent patterns in the data that may shed light on our research question, we sought to investigate and analyze similarities within and across different companies along the value chain in the Norwegian construction industry. By examining several units and actors, we aim to enhance the generalizability of our study in such way that our findings can apply to other settings (Saunders et al., 2019).

Hence, for our research study, it is appropriate to do qualitative research through an explorative study. Explorative research is a valuable way to ask open questions to discover and gain more insight into the topic of circular economy in the built environment. It is particularly useful when the goal is to clarify understanding of an issue and might show that the research is not worth pursuing. The benefit with explorative study is that it is flexible and adaptable to change (Saunders et al., 2019).

During this thesis, we discovered that the Norwegian built environment is becoming increasingly aware of their contribution to global emissions (Malik & Maheshwari, 2018). When investigating how the industry can reduce their ecological footprint, we found that new business models should be implemented. After a conversation with a representative from the organization VILL, we decided to study circular business models. It became apparent that by applying circular building methods, the construction industry can provide added benefit throughout the value chain, both financial, social and environmental (Carra & Magdani, 2016). In this research, we find that the industry is facing several barriers when implementing CBMs. Hence, we wanted to uncover these barriers and search for potential solutions. This research revealed that the transition could be facilitated through several enabling factors. Thus, the explorative approach for this topic proved that our research is worth pursuing.

3.3. Context of Study and Selection of Focus Units

The reason why we chose this topic is that we found it interesting, up to date, and relevant for the future. As introduced in chapter 1, the construction industry is the world's largest consumer of virgin materials (Malik & Maheshwari, 2018). With the continually growing population and urbanization, the need for residential, nonresidential and infrastructure project increases and puts significant pressure on the construction industry[9]. Therefore, we find it valuable and interesting to investigate what halts this industry to fully implement circular business models and explore what it takes to overcome these barriers. To accurately investigate the current barriers, it is essential to identify the actors that can assess and adapt their decision making to implement CBMs. However, construction projects differ by location and depend on the scale of the project (Malik & Maheshwari, 2018). This study is limited to the Norwegian built environment, with participants located in Oslo, Bergen and

[9] Population growth and urbanization leads to challenges in terms of resource capacity, which consequently puts a great pressure on the construction industry. Awareness towards a more environmental approach and circular economy has increased, however, humanity´s ecological footprint continues to exceed the earth´s biocapacity. The construction industry is today responsible for 39% of global carbon emission (UN Environment, 2019).

Trondheim. Through research and conversations with real estate developers, we identified several actors in the Norwegian built environment relevant to this study.

Based on this, we have chosen to investigate actors throughout the construction industry´s value chain in Norway[10]. Aligned with the value chain described in Chapter 2.3.2, our selection of focus units thus includes real estate developers, architects, contractors, consultants, the public sector, the consumer council, banks and waste managers. In the selection of companies for this research, the main criterion established was the presence of circular economy in the organization. This presence must have taken the form of (1) a complete circular transition, (2) an ongoing process towards circular transition or (3) a planned process or including circular economy in their strategic plan. These criteria were set in line to explore the full spectre of the actor's expectations, experiences and perceptions related to circular transition in the built environment. As mentioned in chapter 1.2, problem description, due to different regulatory framework, we did not aim or were able to collect data across countries. Thus, the study explicitly focuses on the Norwegian built environment. The collection of data in this thesis was conducted using primary sources (Saunders et al., 2019).

3.4. Sample Selection

To best answer our research question and meet our objectives, a purposive sampling approach has been applied in this research (Saunders et al., 2019). This means that the participants in our study were not selected on a random basis, but strategically to find information-rich sources relevant to our research phenomenon (Thorpe & Holt, 2007). The sampling of participants was done to ensure a variety of responses from a range of participants from different sectors in the built environment (Saunders et al., 2019). Based on this, we aimed at selecting actors that operate in the same value

[10] The actors across the value chain are, among others, real estate developer, architects, designers, engineers, contractors, suppliers and facilities managers, and they have a crucial role in creating circular solution to facilitate a transition towards CBMs (Carra & Magdani, 2016).

chain. This proved to be somewhat challenging to achieve, but we were able to gather some data from actors that operate the same value chain for this study.

Further, we wanted to conduct at least one interview with each link in the construction industry´s value chain to explore where the barriers may arise. In other words, we tried to interview every actor that is involved in the building process, from start to finish. Finally, we sat as the main criterion that the participants have a presence of circular economy in the organizations. Before our research, we had some connections in the construction industry through our professional networks. This allowed us to initiate contact with the participants in our study. During the interviews, we realized that banks and politicians are an essential part of the transition towards a circular economy. Hence, we included banks in our study. This approach to sample selection is called snowball sampling, a commonly used method in cases where it is difficult to identify members of the desired population (Saunders et al., 2019). Thus, we saw it necessary to supplement our sampling strategy with an additional approach. This was done to ensure that we have a sample that is representative to the Norwegian construction industry and allowed us to explore in-depth the topic we have undertaken.

We initiated contact with our informants through email and asked them to participate in our study. We further inquired informants by email if they consent that the name of their company is mentioned in this thesis. Most informants agreed to it, some did not. The companies and organizations that did not wish to be named in this thesis are thus anonymized. Twenty interviews have been conducted in total, with 16 different companies from the Norwegian construction industry located in Oslo, Bergen and Trondheim. When reaching out to the organizations in our study, we wanted to interview those that are at the management level as they are the decision-makers. We were able to do this as the majority of the participants in our study are executives. Among our participants we have, 4 CEOs, 3 Directors, 3 Advisers, 2 Assistant Managers, a Director of Development, a Manager, a Marketing Manager, a Chief Digital Officer, a Senior Adviser, a Business Developer, a Member of Parliament, and a Project Leader. We have 11 male and 9 female participants in our study. The

age of informants is between 26 to 60 years old and the length of service is between 2 to 26 years. A description of the participating companies is presented in Table 1.

Table 1: Descriptive Data of Participants

Organization	N	Company	Size in employees	Work Status
Real Estate Developer	6	Mustad Property EGD Property Aspelin Ramm Entra OBOS	Small Small Large Medium Large	6 Fulltime
Consulting	3	Rambøll Multiconsult	Large Large	3 Fulltime
Architect	3	VILL Grape Architects Future Built	Small Small Small	4 Fulltime
Waste Management	1	Norsk Gjenvinning	Large	1 Fulltime
Contractors	1	Contractor	Large	1 Fulltime
Public sector	3	A Municipality Parliament	Large Small	3 Fulltime
Bank	2	Sparebanken Vest	Large	2 Fulltime
Consumer Council	1	Forbrukerrådet	Small	3 Fulltime

3.4. Data Collection

The primary data collection technique utilized in this thesis is research interview. Research interview is a purposeful conversation between two or more people, where the interviewer asks short and unambiguous questions, and the interviewee answers them (Saunders et al., 2019). In this thesis, we use non-standardized, semi-structured interviews. We created interview questionnaires with a set of critical questions to guide the conduct of each interview. Themes used in our interview questionnaire are derived from the literature presented in chapter 2 of this thesis and subsequently exposed to our informants to get their point of view. Since we used an abductive approach in our research, our questions were adjusted depending on the participant we interviewed and the previously collected data.

Two questionnaires have been developed for this research. The first questionnaire (Appendix 1) focused on the leaders' role in the implementation of circular business models. It was used during the interview with a real estate company at the beginning of this thesis. After we adjusted the focus of our research, we developed a second questionnaire that was used in subsequent interviews (Appendix 2). The first part of the inquiry consisted of open-ended questions designed to examine the current state of circular economy in the built environment and the importance of generating value based on the principle of circular economy. The second part of the interview-guide aimed at gaining insight into the participants´ perception of circular economy, and circular business models in the built environment. These questions were designed to stimulate discussion about what the participant´s experience with the current barriers to implementing CBMs in the built environment and followed up with "*how may these be overcome?"* or "*what do you believe is the solution?".* Whenever the participants stated anything related to our research problem, we asked follow-up questions to confirm their statement and avoid uncertainty. Since we interviewed such a wide range of actors in the built environment, we hope we have been able to provide a more holistic view of the industry´s current situation.

The first interviews took place at the company´s office, which led us to the understanding that our first research topic was not worth pursuing. The majority of

the following interviews took place over telephone or video call through ZOOM due to the pandemic coronavirus (COVID-19). A preferable method was using videocall as we could watch the participants reaction when we asked questions and making sure they understood them. Two researchers were always present during the interviews, and we ensured that each interview was conducted in a quiet environment, with no distractions. The length of the interviews varied between 30-75 minutes, but the average length of each interview was 45 minutes.

The interviews were audio-recorded and subsequently transcribed. The interviews took place in Norwegian. Thus, all quotations used as examples in the findings chapter have been translated from Norwegian to English. When translating, we did our best to ensure that the meaning contained in the original language were reproduced authentically in translation.

3.5. Data Analysis

In this study, we analyze a set of qualitative data acquired through in-depth interviews. This allows us to recognize essential themes, patterns and relationship in the collected data (Saunders et al., 2019). Braun and Clarke (2006) propose a thematic analysis, a systematic yet flexible and accessible approach to analyze qualitative data, and is referred to as a *foundational method for qualitative analysis*. The essential part of this approach is to identify, analyze and report on themes or patterns that may occur across the data (Saunders et al., 2019)

Building on thematic analysis, we coded the qualitative data to search for themes or patterns related to the research question, which we further rearranged into categories for comparison. Such coding is used to categorize data with similar meaning and involves labelling each unit of data within a data item with a code that symbolizes that exact meaning. The purpose of this is to make each piece of data we find interesting and accessible for further analysis (Saunders et al., 2019). We developed initial themes for coding based on the literature presented in chapter 2 of this thesis. Each interview was transcribed and carefully reviewed after each interview. This allowed us to develop familiarity with our data, which is an essential element in

analyzing data as we would not have been able to engage in the analytical procedure that follows without it (Saunders et al., 2019).

After a few interviews, we recognized recurring themes, which were further categorized as main themes that we applied in our analysis. We noticed that each theme could be separated into different subcategories that became codes for our analysis. We interviewed a total of 16 companies and 20 informants, which we equally divided for independent transcription and coding. This involved analyzing data as we collected it, going back and forth between the data set and literature as we refined how we coded and categorized the data.

After the interviews were transcribed and coded, we decided to meet and review all interviews. This was done to ensure consensus on how the interviews were coded. This was done to make sure no hasty conclusions were made. The result of the analysis can contribute to enhancing the study´s internal validity if the themes and patterns in the data set correspond with the literature (Saunders et al., 2019). Our analysis shows that our findings on the current barriers in the Norwegian construction industry coincide with existing empirics. However, we discovered that some of our results add to existing literature regarding potential enablers to implementing CBMs in the built environment.

3.6. Quality of Our Research

3.6.1. Reliability

Reliability refers to the replication and consistency of research design. For research to be considered reliable, a researcher should be able to replicate an earlier research design and achieve the same findings (Saunders et al., 2019). Although reliability is most commonly used in quantitative research, Patton (2001, as cited in Golafshani, 2003, p. 601) states that reliability is a factor which a qualitative researcher should be concerned about, while designing a study, analyzing results and judging the quality of the research.

When considering the reliability of a research project, a distinction can be made between internal- and external reliability. Internal reliability refers to ensuring consistency in a research project (Saunders et al., 2019). In this master thesis, we have strived to achieve high internal reliability by providing that two researchers were present during each interview. To ensure that our understanding of informants perceived barriers and enablers to a circular economy was correct, we asked them to elaborate on each point and actively used follow-up questions. We would further repeat what the informants said and asked them to confirm if we had understood what they answered correctly. Besides, to strengthen internal reliability, each interview was analyzed and coded by two researchers. Once all the interview transcripts were analyzed and coded twice, we had a meeting to discuss the extent to which we agree about the data and its analysis. Throughout our research, we have continuously evaluated the codes we use for data analysis to ensure they capture the variation in our data.

External reliability refers to whether the data collection techniques and analytic procedures would produce consistent findings if they were repeated on another occasion or used by another researcher. Ensuring external reliability is difficult as there are several threats that need to be considered. The presence of these threats implies that researchers must be methodologically rigorous in the way they carry out research (Saunders et al., 2019). By allowing participants to choose time and place for an interview, we may have reduced the risk of participant error. Further, by offering anonymity to all our informants, we avoided factors that may induce a false response and participant bias. Researcher error relates to factors that may alter the researcher's interpretation of data. By ensuring that each interview was analyzed and coded by two researchers, the risk of researcher error is reduced. In this study, each interview was recorded using two recording devices to ensure that the audio was of high quality. Although one person transcribed the interviews, we kept a continuous dialogue to ensure no misunderstandings regarding words and phrases in the transcription.

Given that our data were collected using semi-structured in-depth interviews, we must remain open to the possibility of bias. The lack of standardization of interviews may complicate other researchers' ability to replicate our findings. However, it can be argued that qualitative research is not necessarily indented to be replicated, because the study reflects the interpretations of the participants in a particular time and setting (Saunders et al., 2019). Throughout the research, we tried to ensure that our behavior and formulation of questions did not influence the answers of our informants. To gain the interviewees trust and make the participants confident, we strived to obtain as much knowledge as possible about the organization before the interview. The topics for the interview developed have been derived from the literature to create credibility. Before each interview, we provided the informants with a short description of our research.

3.6.2. Validity

Validity refers to the appropriateness of the measures, the accuracy of the analysis of findings, and generalizability of the result (Saunders et al., 2019). Winter (2000, p. 1) provides the following definition: *"Validity is not a single, fixed or universal concept, but rather a contingent construct inescapably grounded in the processes and intentions of particular research methodologies and projects"*. When considering validity, a distinction can be made between measurement validity, internal validity and external validity. Although it has been argued that validity is most relevant for a quantitative study, it can contribute as a qualifying check for qualitative research (Golafshani, 2003). Thus, alternative versions for qualitative research have been developed. Lincoln and Guba (1985, as cited by Saunders et al., 2019, pp. 216-217) formulated "credibility" for internal validity and "transferability" for external validity.

Credibility refers to the quality of being worthy of trust and whether the results of the research reflect the experience of participants in a believable manner (Whittemore, Chase, & Mandle, 2001). Transferability refers to the generalizability of the study. By providing a detailed description of the interview questions, research design, context of the study, findings and interpretations, we hope to allow the reader to judge the

transferability of our study. However, it is essential to clarify that our research has an explorative purpose. Thus, our intention is not necessarily to generalize our findings, but rather to uncover the barriers to implementing circular business models and identify potential solutions to the obstacles.

3.7. Ethical Considerations

Having presented methodological considerations in this study, and explained how our research was conducted in practice, ethical considerations are further discussed. Our University requires that all research involving human participants is considered and approved. This research project was submitted to and approved by The Norwegian Centre for Research Data (NSD) (Appendix 3). However, our study was not oriented toward sensitive personal data. Further, participation in the study was voluntary. All the participants in our study were informed twice about their rights before to the interview, spoken and written. This was done through a written consent form (Appendix 4) sent to the participants before the interview and a verbal reminder before we started asking questions.

Further, the interviews were recorded in their full length, have not been edited and was kept at its originality. The participants´ personal information was anonymized as well as sensitive information they may have expressed. When the research was concluded, all audio recording of the interviews was deleted.

4. Findings

In the following section, we present the empirical findings from our research. To answer our research question, we have collected data from several actors across the built environments value chain through a qualitative research study. The findings are categorized into main themes and subcategories.

Before the interviews, we expected that the informants would have somewhat the same perception of the current situation in the Norwegian built environment and the barriers to implementing circular business models. However, there turned out to be a lot of variation in the responses. Variety can be attributed to personal interest, motivation, knowledge and insight on the topic. What we discovered under the theme of cooperation and planning, production, and supply were especially exciting and are further highlighted and examined in this chapter. Another interesting finding was that some of the respondents disclaimed their responsibility, pending someone else to take action. We have decided to attribute this to internal organizational culture. These findings are categorized under culture and are further classified as a proactive or reactive attitude towards a circular economy. In this thesis, we have defined proactive attitude as behavior that actively work towards implementing circular business models and establish practices necessary for it to happen. On the other hand, reactive attitude is defined as company behavior that has not adopted practices beyond what is already an established standard in the industry.

Our empirical findings are summarized in Table 2. The results are presented according to concepts and themes, including the numbers of times each theme is mentioned during the interview, a short description of each theme and example quotations. Existing literature from chapter 2 was used to develop initial themes. After a few interviews, we recognized recurring themes, which were further categorized into codes. This mainly applied to the perceived current barriers. Themes for potential enablers, though, were mainly developed based on the findings from the interviews.

Table 2: Key concepts and themes with description of each theme

Main themes	Main themes	Description	Code	No. times mentioned	Example quotations	Source
Perceived barriers to implement CBMs	REG	Regulatory framework and Government actions	Regulations	72	"The requirements could be more aimed at reuse of old materials (...) that old windows can for example be reused as room partition. Currently windows are only measured as windows"	Future Built
			Certifications	31	"It is difficult to reuse different components because there is simply no certification scheme for it. So, you sit there with everything you really need, but it's just… call it a stamp that is needed."	Mustad Property
			Public procurements	13	"(…) and they must take the lead as examples with their own buildings"	Sparebanken Vest
	KNOW	Knowledge and information about the subject	Education	26	"Knowledge of engineers and architects, the awareness. It´s not sufficient. And I think that the ones who are graduating now are not trained well enough. It starts already at school"	Multiconsult 1
			Knowledge outside organization	36	"They don't have the knowledge about it. It has received a lot of attention, but they need to gain more knowledge about what needs to be done to stimulate it and provide incentives."	EGD Property
	FIN	Financial factors	Cost	88	"No one wants to pay more for a product that is sustainable if there is a cheaper alternative"	Contractor
			Ownership	7	"(…) is it a developer who build a building and will own it? Or rent it out? Or is it a developer who will build the building, fill it with tenants and sell it? There is a big difference. In the latter case, if they sell it right away, they don't have the same perspective when making investment."	Grape Architects
	INCEN	Different types of incentives to promote circular business models		38	"It would be easier if perhaps public support schemes could cover some of the costs associated with risk (…) maybe then it would be easier to achieve more"	Aspelin Ramm
	CULT	Culture and attitude towards circular economy	Culture in the industry	28	One of the barriers is insane conservativism. A lot of the real estate companies are owned by old, conservative men who are perhaps the least innovative people in the world."	VILL

Perceived enablers to implement CBMs	COOP	Cooperation across value chain	Partnerships	21	“It is of the utmost importance to get the entire industry along. To get consultants, architects, contractors, real estate developers and the public sector on board and to create a platform where this issue is lifted up, problematized and discussed is very important”	Member of the Parliament
			Information sharing	21	"(…) I am starting a new platform where we invite other companies, lawyers and economists for example, and host smaller seminars where we discuss what we can, what is important to us and how we can increase knowledge"	Multiconsult 1
			Cooperation	40	“We are also going to work to try to use more recycled materials. We do this by connecting with architects and interior architects to examine whether there is part of the building that we can reuse in interior for example, inventory, that type of stuff”	Contractor
	CULT	Culture and attitude towards circular economy	Championing	16	“So, we told them that we can’t do it this way. We tried to get them to adopt our mindset and spent a lot of time explaining them the logic and what is already in the building, what kind of quality it is. And they actually became very enthusiastic about this circular way of thinking and they abandoned their original design manuals in several areas to enable us to make this happen”	Future Built
			Proactive culture in the organization	69	“Sustainability and environment play a key role in the company´s strategy, and it has been for many years (…) so I don’t experience any resistance when I try to implement sustainability related initiatives”	Aspelin Ramm
	PLAN	Planning, production and supply	Shared use	17	"(...) An office building that is in use from 9-16 is completely waste, but it may turn into something else at night, a cultural scene or something like that… then we can reduce the need for new buildings.”	Multiconsult 1
			Digital platforms and solutions	55	“Marketplaces or listings, a kind a finn.no, for used building materials should be established.”	Aspelin Ramm
			Leasing instead of owning	8	“In theory you could have a plot and lease all building materials that are perhaps owned by an architect firm or a material supplier (…)"	VILL

Findings from our study are further explained in detail in the following sections with quotations from the interviews. To answer our research question, we have divided our findings into three parts; 4.1: The participants perception of the current state of circular economy in the built environment, 4.2: perceived barriers to implement CBMs, 4.3: perceived enablers to implementing CBMs.

4.1. The Current Situation in The Norwegian Built Environment

The purpose of our research is to uncover the current state of circular economy in the Norwegian construction industry. Therefore, during the interviews, we intended to examine how actors in the Norwegian built environment perceive circular economy. The participants´ interpretation of circular economy can give us an indication about the degree to which they focus on it. We further investigated their perceptions on how far the Norwegian built environment has advanced in addressing circular economy. At last, we discover the construction industry´s potential to achieve sustainable development. Implementing circular business models require substantial changes in the entire industry. Before we discuss potential enablers to transition to a circular economy, we wanted to study if actors along the value chain believe that the construction industry can contribute to meaningful change.

4.1.1. Definition of Circular Economy

Our analysis indicates that there are variations in how participants in our study perceive the term circular economy. Some actors have a broad definition that includes social, environmental and economic sustainability, while others have a narrower definition that is limited to resource efficiency.

"Circular economy is about using resources more efficiently. It´s about reducing consumption, using both renewable raw materials and reused goods. It is about increasing lifespan of materials and designing for reuse."

- Municipality

"Circular economy, in my understanding, is about reusing materials."

-EGD Property

"What I think is crucial is resource utilization at the highest possible level."
-Future Built

4.1.2. Circular Economy in Norwegian Built Environment

We find indications that the Norwegian construction industry is currently following a linear business model. Even though there is awareness towards circular economy, the industry is yet to make progress when considering the implementation of circular economy. Further, we present evidence that there is significant variation in terms of how circular different actors in the industry are.

"Virtually, it does not exist. I think that circular economy is a term that nobody understands. It is a trendy term that people use, just like sustainability. Every industry in Norway can say that they work towards specific sustainability goals, and then they do not need to change their business at all. The circular economy is kind of like that. Nobody knows what it is or what it means for their business. Or what they ought to do with it. I would say that so far, we haven´t done anything in terms of a circular economy, at all. We are maybe at the start of something." -VILL

The majority of the participants in our study would argue that a circular economy in the Norwegian built environment is either not existing or is at the beginning stages. The response varies depending on the participants´ professional background and knowledge. The organization VILL is a multidisciplinary collective working towards a circular construction industry and argue that circular economy in the current built environment does not exist. Other actors, like Norsk Gjenvinning, would say that the industry is ready for change, while EGD Property argues that the current conditions are a hindrance. Aspelin Ramm further emphasizes the variation between the different actors in the built environment.

"I think the industry is ready for circular economy and willing to make a change and be sustainable. We have to figure out who should do what" -Norsk Gjenvinning

"(...) too bad, too weak. The conditions are not suitable to do it well enough." -EGD Property

"There is a big span, those that are serious about it are maybe getting to a point where we can call them sustainable, and then you have smaller actors that are not there yet. So, you have everything from A+ to fail, I think."
-Aspelin Ramm

4.1.3. Built Environment and Sustainability

Participants in our study agree that the construction industry should be obliged to contribute to sustainable development and that they can do so.

"I think that the construction industry must, not just can, but must contribute with its fair share. The building mass amounts to a large share of the world's climate emissions, and it consumes a great amount of the world's natural resources." -OBOS

"We are the biggest culprits; we leave the biggest footprint of CO^2 emissions, so, for us, it is something that we focus a lot on." -EGD Property

"If the construction industry does not join in (...) then we will not achieve the sustainability goals, to put it simply. It is Norway's largest mainland industry, of course building and construction industry has a huge responsibility, and that there is great opportunity to achieve something." -Aspelin Ramm

There is an overall agreeance among the participants that the construction industry can, and should, contribute achieving at least some of the SDGs. Some of the informants would go as far as to mention all of them, while others would suggest the ones, they find most relevant for the construction industry.

4.2. Barriers

The 20 interviews resulted in a total of 339 statements associated with the current barriers to implementing circular business models in the Norwegian construction industry. We categorized these statements into five subcategories, which were further analyzed for a more detailed interpretation to identify and investigate potential underlying structures. The most frequently reported barriers in the interviews were *lack of knowledge and limited access to information sharing, financial factors associated with implementing circular methods, lack of incentives and support, lack of regulation and Governmental actions and culture.* These statements are presented in the following section concerning each category.

4.2.1. Lack of Knowledge

The analysis generated a total of 62 references related to a lack of knowledge and limited information sharing between industry actors operating in different layers of the value chain in the Norwegian built environment.

"Several companies want to work more sustainably and with circular economy, but do not have the insight necessary, insight regarding what is important, where to spend money (...) there are still so much we don't know. (...) we are very good at having environmental ambitions on behalf of our buildings, but don't know how to pursue it." -Mustad Property

"They don't have the knowledge about it. It has received a lot of attention, but they need to gain more insight into what needs to be done to stimulate it and provide incentives." -EGD Property

"It is because the requirements are too low, and I think this is because the decision- makers lack knowledge. Many companies aren´t very interested in it, so they don't demand it either."-Entra

"Most of the companies in the industry know that something has to be done, but it stagnates when it comes to knowledge. We are still in very early stages. People understand that something needs to be done but they don't know how to do it." - Aspelin Ramm

The lack of knowledge result in uncertainty. The participants in our study know a great deal about the topic, but they believe that they do not have sufficient knowledge. Some of the informants go as far as stating that no one in Norway can call themselves experts on the topic. Along with the uncertainty, it also turns out to be some skepticism regarding circular building methods.

"(..) if someone calls themselves an expert on this, that makes me sceptical because we have too little experience with this." -Aspelin Ramm

"I notice that there is a bit of skepticism among the decision-makers. They do not know what this is or what the possibilities are. So, they probably don´t want to risk using reused materials and thus set lower requirements." - Contractor

We also observed that customer lack knowledge, which is reflected in the demands they make to the providers of the buildings. Thus, slow progress towards circular economy may be due to a lack of demand for circular buildings on the customer side. Which in turn, may cause project managers to plan buildings that predominantly use old construction methods.

"So, it wasn't really because they did not want to, they just had not seen the opportunity. And I think that is why it is so important to educate people (...) it's not that important to have new doors (...) other things should be prioritized instead." -Future Built

Contrary, the waste management company we interviewed, who manage to obtain the knowledge and information, and work towards circular economy, seems to take it for granted that the rest of the industry do the same.

"... if you work a lot with something you often assume that everyone else is doing the same and possesses the same information as you." -Norsk Gjenvinning

4.2.2. Financial Factors

The analysis generated a total of 95 references related to financial factors. Our study suggests that financial considerations associated with implementing circular solutions represent a barrier. To successfully implement CBMs, it requires that our society can generate value in a completely different manner than we do today.

"Our stakeholders are concerned with profitability. And the question is what the costs at short-term and long-term are, what do we get for it. Could we leave it though it is expensive? Many people working with sustainability at a lower level, are keen to show that it is possible to combine circular economy and economic growth. Good if it is possible, but what if it is not. We did not save the globe because it was not compatible with economic growth – how does that sound in 100 years? Yes, awful, we prioritized economic growth." -Mustad Property

"Banks and financial institutions represent a great challenge. We have built our entire economic system around a linear understanding of how to buy, sell and borrow. So, it is challenging. And think that creating a change here might be the most difficult part." -VILL

"If you take, for example, commercial property. Investments in commercial property are made when approximately 70% of the property is rented out. So, you take up a loan and calculate expected income on it so that the loan is paid back in approximately ten years with profit (...) and when the building gets demolished everyone is in shock. But it gets demolished because the loan is paid back and everything on the economic side of it is in order. And then they start to think "How

can we make money in the next 10 years?". And right now, it is by building apartment complexes, so the building gets demolished. It is this kind of economic mindset on the broader perspective that needs to be changed." -VILL

"In Bergen, hundreds of thousand square meters will be demolished. 10 years old commercial buildings will be demolished when the lease has expired, which will be and converted into housing and new offices." -EGD Property

The real estate developers seem to build based on what the building will be used for and who will use it for the time of the lease. When the developer has a 10-year lease with a company with specific requirements, the building needs to be changed for the next tenancy when other requirements come in.

"(...) is it a developer who build a building and will own it? Or rent it out? Or is it a developer who will build the building, fill it with tenants and sell it? There is a big difference. In the latter case, if they sell it right away, they don't have the same perspective when investing." -Grape Architects

"So, being able to transform the building is important and an important business area for us. Rehabilitate buildings. We have built poor buildings over the last 20 years and are now working on completely renovating buildings that are 10 years old, which is completely meaningless." -Grape Architects

"We can set requirements for reused materials (...) but, if we are going to finance a project, then we need to know that the project will be profitable and that it can be repaid." -Sparebanken Vest 2

There seems to be a great deal of uncertainty related to changing the current construction method, especially when reusing or upcycling materials from existing buildings. Banks express that they are positive about financing projects that use recycled materials, but they have to assess the risk associated with each project before granting funding. Hence, if the developer is not certain that a project will be

profitable, it can be difficult for banks to finance such projects. This can make it hard for smaller companies with less equity to pursue sustainable and circular building projects.

"There is too much uncertainty about how demanding it is and to what extent one can succeed." -Sparebanken Vest 1

"If we are going to issue a loan, we must consider the probability that we will be paid back as large or good enough. So, if there is a project that needs to be funded that we are very uncertain about whether or not is going to go well, then it is not necessarily something that can be funded by a bank." -Sparebanken Vest 2

4.2.3. Government Action

Our research has identified the lack of Government support and effective legislation as another barrier to implement circular business models in Norway. The analysis generated a total of 116 references related to the regulatory framework and Government action. The absence of legislation and mandatory regulations hinders the construction industry from choosing circular building methods. According to our findings, we have divided Governmental actions into lack of *regulations, certification system* and *public procurements* as barriers to implementing circular business models.

Regulations

Lack of regulation appears to be a widely recognized barrier. Among the regulations that were brought forward is regulation on technical requirements (TEK17) for construction work. This regulation set the limit for the minimum characteristics that must be present to be legally erected in Norway (Direktotratet for byggkvalitet, 2020).

"What is quite clear is that the regulations are often adhered to. Suddenly you want to build an upcycling house, but it´s not allowed. So, you have to change a pretty tough industry and make them believe in you and invest with uncertainty, but that's not allowed in the municipality either. Then there is a lot of resistance at once."

-VILL

The informants in this study experiences an industry with a desire and will to change the current way of building. The industry seems to be facing a lot of resistance in the regulations that it makes it either too difficult or expensive to implement CBMs.

"Especially considering that there are so many laws and guarantees that will not be approved when re-using materials, and if it gets approved, the cost of being approved is too expensive." -Municipality

"There are obstacles in regulations for using recycled materials. (...) technical guidelines where there are some requirements you must fulfil (...) materials must be CE marking, but you will only receive this on new products and not on used ones. This is simply a major obstacle to achieving it." - Municipality

Our findings also suggest that the requirements lack necessary details when it comes to specifications about how materials can be reused. It appears that circular thinking is currently absent from regulations. This causes the requirements for materials and how they can be reused to be defined very narrowly. This may prevent the materials from being reused to their full extent.

"The requirements could be more aimed at the reuse of old materials (...) that old windows can, for example, be reused as a room partition. Currently, windows are only measured as windows." -Future Built

Certification System

Our results further suggest that the current certification system for reusing construction materials is an obstacle. The informants in this study share the impression of the current certification system as cumbersome, and it requires a lot of research, trial and error.

"Everything must be certificated and tested and approved for use. There exists no such scheme for used materials." -Rambøll Management Consulting

"It is difficult to reuse different components because there is simply no certification scheme for it. So, you sit there with everything you need, but it's just… call it a stamp that is needed." -Mustad Property

"(…) you have a lot of requirements for documentation of construction materials that we see are a bit peculiar. Much of this goes well for building parts that are of recent date, but if the materials are a bit older you no longer have the documentation needed." -Future Built

"There are extremely stringent requirements for material selection and how sustainable it should be in relation to what it can withstand. (…) Upcycling is very good, but not all materials can be reused because of the requirements that are currently in place (…) the conditions are not present to allow us to do this well enough. The requirements are too strict for materials that can be used in new construction projects." -EGD Property

There seems to be an industry-wide agreeance that the lack of certification scheme slows down the transition to circular business models significantly. Although several of the participants want to adapt circular building methods, it seems that lack of certification schemes hinders them from pursuing it.

Public Procurements

According to our results, Government actions in terms of public procurements in the construction industry proves to have an essential role in setting the premises for other actors in the industry. The Government and public authorities thus have the power to influence and pave the way for the rest of the built environment by setting a good example.

"The market will always follow the criteria that are set (...) so, the public procurement must promote and demand sustainable solutions." - Rambøll Management Consulting

"For example, now, the Government is about to start to demolish and upbuild the Government quarter, perhaps the authorities or the Government or those who make the decisions could go ahead as a good example and reuse construction materials rather than demolish and then build new" -Contractor

"The authorities must be tougher than they are today and make demands on the owners of commercial buildings." -Sparebanken Vest 1

"Norwegians have high trust in the Government and banks, unlike many other countries." -Grape Architects

"(...) and they must take the lead as examples with their buildings." -Sparebanken Vest 2

This indicates that the Government and public actors play a significant and important role in the transition towards circular business models. By setting good examples, they can influence both actors in the built environment and the consumers to choose more circular options.

4.2.4. Lack of Incentives

The analysis generated a total of 38 references related to different type of incentives to promote circular economy. The participants in this study argued that lack of Governmental incentives or support hinders the construction industry from transitioning towards a circular economy. The companies we have interviewed have emphasized the lack of incentives that could promote circular and environmental solutions. Incentives provided by the Government can be used as instruments to influence people´s behavior. Moreover, the companies we have spoken to highlight

that Governmental incentives could be a useful tool to stimulate the transition towards a circular economy.

"It would be easier if perhaps public support schemes could cover some of the costs associated with risk (…) maybe then it would be easier to achieve more."
-Aspelin Ramm

"In fish farming, for example, it is challenging to get approved for a farming license. So, there was developed a scheme called development scheme. This scheme gives you a fish farming license if you can demonstrate that you will use an innovation in the fish farm. And that is one way to obtain a license where it is difficult to obtain it, but you can obtain it if you use certain methods." -Member of Parliament

No matter how good intentions one has for circular buildings, it is ultimately about profitability. Hence, several actors emphasize the importance of incentive schemes that facilitate the construction industry to choose circular alternatives.

"I hope that the authorities see the opportunity or value of working with incentives that make it more interesting to choose circular options because after all, our main task is value creation for our owners." -Mustad Property

"Another incentive could be that when you regulate a plot, you could get a higher utilization if you had built on it circularly. You could get faster case processing on regulatory and building matters on plan and building with the authorities. Maybe cheaper electricity." -Grape Architects

"It is also important that there are more incentives that encourage to choose circular models. It can, for example, be tax relief, not have street rent for containers. I believe that incentives are better than sanctions." -Norsk Gjenvinning

4.2.5. Conservative Culture

Another barrier identified in this study is culture. The analysis generated a total of 28 references related to culture and attitude related to circular economy. The companies we have interviewed describe the current culture in the construction industry as conservative and unwilling to embrace changes.

"One of the barriers is insane conservativism. A lot of the real estate companies are owned by old, conservative men who are perhaps the least innovative people in the world." -VILL

"But it is a conservative industry. Nobody does anything, or very few people do, unless they have to." -Entra

"(...) and preferring alternatives that are tested and safe. It happens in the transaction to the contractor because it the contractor who can guarantee for this building. That nothing is leaking etc. So, they want to do what they have always done and known, and that is usually yesterday's solution." -Grape Architecture

Our findings indicate that there are different perceptions of how generations perceive the threat of climate change. This is a factor that may influence actors in the built environment's willingness to transition to circular economy in their projects.

"And I experience there that there is a big span between younger and older people's perception of this. Younger people realize that this is point number one on the agenda, while elder people are more conservative and say that this is not important, just bark, lot of fashion words and that the commute soon will turn. There is a huge span between these two attitudes. This area contains many conservative people, and at Ullern and Oslo Vest are many older and resourceful people that are afraid of changes and want everything to maintain the way they are. When I say that the younger know more and realize that the climate crisis is an actual crisis, but the elderly want to some degree to believe that it will pass." -Mustad Property

4.3. Enablers

The 20 interviews generated a total of 247 statements related to potential enablers to overcome the current barriers the Norwegian construction industry are facing implementing circular business models. We have categorized them in the following categories: cooperation, culture, and planning, production and supply. Planning, production and supply are also grouped into three subcategories: digital platforms, shared use and leasing instead of owning. These three categories are further analyzed for a more nuanced interpretation and after that divided into subcategories.

4.3.1. Proactive Organizational Culture

We find organizational culture to be a significant enabler to transition to a circular economy. Our analysis identified a total of 85 references related to culture and attitude towards circular economy as an enabler. Our results suggest that the internal culture influences company´s attitude towards circular economy. In our study, we have defined the participant´s attitude towards sustainability as either proactive or reactive. We have limited a proactive attitude as behavior that actively work towards implementing circular business models and establish practices necessary for it to happen.

"So, when we build new buildings today, you have to think 100 years perspective and not 10 years ahead. What most developers have been sinners on, including ourselves, is that we have built buildings that will last as long as the lease lasts. When the lease is finished, the building is paid off; you will find new tenants and new functions. So, it has been a use-and-dispose society on a very large scale which we can no longer witness; we have to think new and different." -EGD Property

"Sustainability and environment play a key role in the company´s strategy, and it has been for many years (...) so I don't experience any resistance when I try to implement sustainability-related initiatives." -Aspelin Ramm

"We have a culture of taking care of things. It hurts our employees when usable items are thrown away, it is about personal commitment." -Aspelin Ramm

"Ten years ago, we said that we would lead in sustainability, so naturally we have to do projects that make us go a little further than others. But we have a lot of pride in our culture; all our employees feel that they have sustainability in their bones, they pride themselves for it and are committed to making the right choices." -Entra

"After all, the entire mission of OBOS is social sustainability (...) We have always done environmental projects. So, we have been working with our culture to create openness to dare and fail, take some chances, be ambitious (...) and this time, we have adopted a new strategy called sustainability."-OBOS

"The best thing to do is to integrate it in the already existing systems (...) the idea is that climate budget will get integrated into the system as a part of the management tool. That there is an owner, financing, a timeline and a reporting system. I think it is important that it's not just an Excel sheet that some employee has" - Municipality

Several informants share that they implemented sustainability initiatives in their company strategy a long time ago and increased focus towards circular economy.

"We do this in our portfolio. We try to keep an overview of everything that is left of furniture, inventory, room dividers and everything else that can be reused in other projects. It does not make a difference in the larger context. (...) the outcome of this is more related to culture building and raising awareness among those who work with us rather than having a direct impact on the environment. But it feels good not to throw away stuff." -Aspelin Ramm

"We have created an internal group (...) and they have created a book, or a living document, a tool that we use internally to educate, and raise greater awareness. A sort of checklist what to ask for and include in future projects" -Grape Architects

Smaller companies, like EGD Property, seem to have also taken a proactive stance towards circular economy. However, since they do not have any employees in the company, they focus more on which actors in the industry they cooperate with.

"We have no employees, but associate with several good players which projects we are going to be involved in. We are also above average concerned about sustainability to both social and environmental. However, for us as investors, it is crucial that it is economical." -EGD Property

On the other hand, reactive stance is defined as company behavior that has not adopted practices beyond what is already an established standard in the industry. However, it does not necessarily mean that they have a negative outlook on circular economy.

Championing

Moreover, companies who have a proactive stance towards circular economy set requirements to their clients and actively work for circular economy in the projects they undertake. They actively champion for circular economy in their projects.

"So, we told them that we could not do it this way. We tried to get them to adopt our mindset and spent a lot of time explaining them the logic, and what is already in the building, what kind of quality it is. And they became very enthusiastic about this circular way of thinking, and they abandoned their original design manuals in several areas to enable us to make this happen." -Future Built

"We received a request for an interior assignment. All the interior was to be replaced, and they asked for a price. We went to inspect the building with many other architect firms. And then we told them that if we agree to take on this project, they will have to do a lot more than just fiddle with the interior (...) And it's a risky game, but they chose us" -Grape Architects

"We discussed what we were going to do with our current building once we move to Construction City. And one of the ideas was to tear everything down and build a new one. But then we put our foot down; my first objection was that this is about circular economy. Why are we doing it? We have to look at the building as a resource and add to it. We start there. And I think that we have been good in this regard and a lot has been done to build on reused materials and already existing buildings." -OBOS

"They kept pointing out problems (...) But then we took a detailed look into it, and we solved all the difficult points, and we did this with every point. And in the end, we were able to keep the façade of the building, which was good for the economy, good for the climate and the building retained much of its character. There is something about not throwing things away, but instead trying to think about what can be reused. And not just think what fashionable right now." -Future Built

Further, OBOS has redesigned their business model focusing on socially sustainability, which will contribute giving everyone the opportunity to enter the real estate market.

"You need to change the business models. We have created a new business model for buying homes. We have launched what is called part-ownership, which you partially own yourself, the rest is rented from OBOS. You own a minimum of half of the property yourself, and the from OBOS. It allows you to own the home at half the price. Instead of renting an apartment for 12 000 NOK per month, you could rather spend half of it on renting from us and spend the rest on paying down your loan. Then you can save it and get a value increase. You should not be afraid to move out after three years when the lease is over. I believe in this kind of way of working, it is about getting a much wider customer base, and building for all members of our society."
-OBOS

On the contrary, companies who seem to have a reactive approach towards a circular economy seem to await other actors to take action. This is in contrast with our findings regarding organizations who have a proactive attitude towards circular

economy and champion for it in negotiations with their clients. Furthermore, these actors appear to not fully acknowledge the importance of their role in this transition.

"(...) the developer places too little demands. They could be a driving force for things to get better. That we can go a little further in the circular economy (...) the requirements must come from above. They are the ones who must set requirements for those who will perform the service..." -Contractor

"(..) banks do not have insight about the details, we are not engineers. It's the professional communities that play the most important role. We are not the ones who set the demands (...) of course the banks could have some influence with their requirements, but it would be a lot better if it came from the Government. Easier to get all the banks to introduce coordinated changes to their credit framework."
-Sparebanken Vest

4.3.2. Cooperation Across the Value Chain

Our findings indicate that cooperation with different actors across the value chain and partnerships can be a significant enabler to implement circular economy. The analysis resulted in a total of 82 references related to cooperation across the value chain. The companies we have interviewed that have been able to adopt circular economy mindset and work methods in their organization are characterized by their willingness to collaborate and cooperate with other actors and enter into partnerships.

Collaboration

The companies that have engaged in collaborations with other actors have been able to overcome some of the barriers that currently exist in the industry. The extent which they have been able to overcome these barriers differ. None of the actors we have interviewed have entirely transitioned to circular economy.

"I have faith in different types of collaboration than what is currently traditional and accepted. Real estate developer talks to the architect, the architect talks to consultants and contractors and whatever happens after that the contractor

takes care of. And then the waste management company comes in at the very end when everything is already torn down." -Aspelin Ramm

"To create a platform for interdisciplinary testing of these things and be completely open for things to go terrible and to create a completely different model where it is acceptable to try new things and fail. And if two of the solutions that were tested goes well, then we may have already succeeded. So, I believe creating an innovative culture in your own company may be a great challenge to many." -VILL

"It is of the utmost importance to get the entire industry along. To get consultants, architects, contractors, real estate developers and the public sector on board and to create a platform where this issue is lifted, problematized and discussed is very important." -Member of Parliament

Partnerships and Co-Creation

Moving on, the collaborations and partnerships that these companies have engaged in, differ from what has traditionally been done and considered a partnership.

"We also see that in some of our projects, we have got different actors who are competitors to work together and provide each other with building materials because one's waste is the others´ construction materials. So suddenly they can work together without ruing it for each other." -Future Built

"We are also going to work to try to use more recycled materials. We do this by connecting with architects and interior architects to examine whether there is part of the building that we can reuse in the interior, for example, inventory, that type of stuff."

- Contractor

"We have a collaboration with Lendager Group because they have good expertise in how to use the building structure and materials over again" -Mustad Property

"As a real estate developer, we have some projects together with Norsk Gjenvinning. This is new constellation as we are not used to collaborating with waste management companies. Up until now, we have always been on opposite sides of the value chain. But if you think a circular value chain, then it's not a chain anymore it's a circle. And then suddenly real estate developers and waste management companies are right next to each other." -Aspelin Ramm

Partnerships and collaboration between actors in the construction industry make it possible to overcome existing barriers. Among these barriers are access to reusable construction materials. Partnerships like these can help fill knowledge gaps that different actors have.

"(...) I kind of believe that if you early on bring in waste expertise we can manage because waste managers know a great deal about waste opposed to us. It is funny, almost anecdotal. Me and a representative from waste management were walking around, and I see square meters and floor plan....and she sees cubic meters of cement. It's a quite different perspective (...) they have completely different glasses on which I think can be useful to make progress." - Aspelin Ramm

"(...) smaller companies approach us, they either don't have the capacity or knowledge, and we help them (...) I am starting a new platform where we invite other companies, lawyers and economists for example, and host smaller seminars where we discuss what we can, what is important to us and how we can increase knowledge. We invite to smaller breakfast seminars and webinars, and everyone is welcome." -Multiconsult 1

4.3.3. Planning, Production and Supply

The analysis generated a total of 80 references related to planning, production and supply. Our findings suggest that the planning phase of each project is crucial to whether a project becomes sustainable and circular. The choices made during the planning phase determine which materials to use and what qualities the building will have, whether it is circular or not.

"The built environments are an industry that has to take a lot of responsibility, and then it is about all the choices you make from the start of planning." -Grape Architects

According to our observations, the real estate developer contracts different contractors to give them an offer, and very often, the developer selects the contractor who turns out to be the best and cheapest. A ripple effect of this is that the contractor has prized themselves so low that they do not have the opportunity to choose circular or sustainable solutions.

"You choose the cheapest contractor who eventually realizes that they have priced themselves too low, and therefore choose the cheapest and simplest solutions, as they are used to playing it safe. Many good intentions stop along the way because the contractor has prized themselves too low. And the cheapest solution or product is usually not sustainable. Thus, sustainability requirements must be set during the planning phase." -Grape Architects

"If you look at the profitability of the industry players along the value chain, many of the contractors in the middle of the chain are the ones with the by far lowest margins. With uneven distribution of margins, I believe you are not able to draw a sustainable line across the value chain." -Multiconsult 2

Our analysis shows that this linear approach makes it challenging to pursue circular building projects. The results in this study suggest that to overcome this barrier, something needs to be done early on in the planning phase and requires a change of mindset among the different actors.

"We are working to see the linear value chain as a circle. That after an operational phase comes something more, it can be an early phase of a renovation project or something similar. Do not always think that it should be torn down before starting over. This is probably the overall approach." -Multiconsult 2

"The requirements are minimum, so if we are going to build a new building and want every element to be built to be moved, we have to take into account that the requirements will increase." -Multiconsult 1

Digital Platforms

Our findings suggest that that technology can make it possible for a completely different approach in the value chain in the long run. The analysis generated a total of 55 references related to digital platforms and solutions. By using digital platforms, actors across the value chain can engage in different collaborations both in the short- and long term. This can connect actors that do not usually work together. For example, real estate developers and waste managers can collaborate at an early stage of a construction project.

"A lot of what we are trying to digitalize is to get things better. It is about better utilization of resources, where I believe technology can help make us or other actors more efficient and even better, but also look at other solutions and attack the problem differently. (…) *We are working on the assumption that the value chain is not sustainable, and we believe that digital solutions can help us to make ties either across or outside the value chain - work across all business areas."* -Multiconsult 2

"If you are going to use materials from other building projects then timing must coincide well (...) we need a system in place that will make this a well-functioning market and not what it is today where it is a bit random what you manage to find. And yes, you need to be on a lookout to find the right parts at the right time." -Future Built

"You have to spend some time trying to find these markets for reused materials" - Contractor

"Marketplaces or listings, a kind of finn.no, for used building materials should be established." -Contractor

The results propose that both consultants, contractors and real estate developers are longing for a common platform to communicate, share and exchange information, as well as access to reusable materials.

"We need to educate the industry, the suppliers, so that when you order a product, you can request EPD (environmental product declaration), which is a table of contents of the products. (…) when you ask for it, the industry becomes aware that they need to have it. They cannot deliver if they do not have EPD, so they get an EPD and become aware of what their products contain." -Grape Architects

Shared Use

Another potential enabler we discovered for circular transition in the built environment is shared use. The analysis identified 17 references related to shared purpose. Our research indicates that better utilization of existing buildings can contribute to reducing the need for new buildings. By creating multi-functional buildings that could have several purposes, the developer can satisfy multiple needs without compromising the economic side of the project.

"We have to rethink how these buildings can be reused again while creating the life we want for our city. A building with a new purpose, maybe a 24-hour use would be the solution. An office building that is in use from 9-16 is completely waste, but it may turn into something else at night, a cultural scene or something like that… then we can reduce the need for new buildings."

-Multiconsult 1

"The BA house (newspaper BA) was supposed to have lots of meeting rooms, so I influenced them to build a political pub. Thus, they can use it as a meeting room until lunch, then a canteen during lunchtime, and after that, it functions as a regular café, then pub which is open until midnight. The room is open from 8 AM to 12 PM. That is co-operation in practice." -EGD Property

"In a construction project at Skjold in Bergen, we have purchased the entire first floor for testing a new business model. There will be six different tenants in the 400 sqm premises who share all common functions. Those tenants consist of sushi bar, gourmet burger, interior, real estate agent, chiropractor, interior- and clothing store. The clothing store is inside the real estate agency, the sushi bar is connected to the gourmet burger – they have shared dining rooms which is a café, shared toilets and meeting rooms." -EGD Property

By creating multi-functional buildings and sharing access to premises, the developer can have multiple tenants at once. Hence, the construction industry can overcome financial barriers to implement circular business models. This will also be an advantage for the tenants as they can share the rent expenses. It further contributes to creating social sustainability. Consequently, choosing circular could be the most attractive choice.

"It gives you a completely different economy, you have premises that are light in the morning and evening, this creates social sustainability because there are people present in the building at all time – in collaboration. And most important, it is economical. Tenants experience it as half rent. In practice, the rent is about halved because they share all the features, you don't have to pay for empty rooms like wardrobes, toilets, meeting rooms etc. - this is the future." -EGD Property

Leasing Instead of Owning

The analysis generated a total of 8 references related to leasing instead of owning. Different from the current situation in the built environment, an enabler to circular transition is that durable materials and products can be leased. Our findings indicate that business models based on leasing services rather than selling products can potentially aid the transition to circular economy in the built environment by making it possible to preserve materials for longer. Leasing services can incentivize suppliers to think long term about the quality of the products they provide.

"Instead of buying lamps from Phillips, they buy lightning as a service from Phillips. (...) the supplier is responsible for delivering lightning service and the maintenance it requires. I believe these types of models are relevant in the context of sustainability. It hasn't been done in Norway yet. But it is important to make people take responsibility for their products and supplies." -Grape Architects

"In theory, you could have a plot and lease all building materials that are perhaps owned by an architect firm or a material supplier (...) and then claim it back and reuse it. Sort of like selling and leasing services, service floors, service walls, service roof. You could in theory put together a house without having to pay for it." -VILL

Finally, this can generate new opportunities for companies in the construction industry, especially manufacturers and suppliers, who can expand their client base.

5. Discussion

The purpose of this research is to uncover what barriers the Norwegian built environment is confronted with when implementing circular economy business models. We aim to bring forward different factors that can help the industry transition to a circular economy. To answer our research question, we have conducted a study involving 16 various organizations in the Norwegian built environment and 20 in-depth interviews (see Table 2). The empirical analysis of our data is discussed in the following section. We evaluate the current state of circular economy in the Norwegian built environment before the uncovered barriers are addressed. Finally, we present the potential enablers our research has identified.

The construction industry is currently responsible for 39% of global carbon emission, and with the constantly growing population, the need for housing will increase (UN Environment, 2019). Circularity and environmentally friendly approaches are more relevant than ever, but the industry seemingly has not been able to transition to a circular economy yet. The informants in this study agree that there is a lot of focus on circular economy in the built environment. Still, the industry is very complex as it involves many different actors. The findings in our research indicate that some actors do not take responsibility as they are waiting for others to take action. Every actor is dependent on each other in the construction industry´s value chain, and the same applies to a transition to circular economy. To successfully implement circular business models in the Norwegian construction industry, everyone must contribute.

5.1. The Current State of Circular Economy in The Norwegian Built Environment

Consistent with Lübecke-Freund et al. (2019) and De Angelis (2016), our analysis indicates that there currently does not exist a comprehensive understanding of the term circular economy in the Norwegian built environment. There is a significant span in how different actors along the value chain perceive circular economy.

After analyzing the responses from the informants in our study, our findings identified several recurring patterns. In combination with existing empirical findings, these identified patterns imply that the Norwegian built environment is currently following a linear model where each actor in the value chain specializes in a single activity (Carra & Magdani, 2016). The majority of the participants in this research have firsthand experience from their current business value creation. Several of the informants also refer to other company´s projects, which indicates that they have insight into both their partners and competitors value creation. We found that there is a strong focus on developing new sustainable business models, but little action. In accordance with Lübecke-Freund et al. (2019), the development of circular business models is considered as a great paradigm shift that challenges the traditional business models. Some of the participants almost disclaimed their environmental responsibility, which can be explained by Bindmore (2007) game theory. This theory describes what an actor chose to do in a situation where the outcome depends on what other actors decided to do. Our further research shows that circular economy has moved into the mainstream as it has become a part of the actors' organizational cultures and company strategies, which also corresponds to the Ellen MacArthur report (2013). However, this report was written in 2013, and according to our 20 informants, the Norwegian built environment has just begun a transition towards circular economy with several obstacles to overcome.

Furthermore, many of the informants that participated in this study have management roles in their respective companies, and they have essential insight into the Norwegian built environment. All the informants did, to some degree, agree that the construction industry should take part in achieving several of the Sustainable Development Goals. Next, the World Green Building Council (2019) have identified nine SDGs the construction industry can contribute to meet. In our study, we find support among informants that the construction industry can positively contribute to sustainable development. Several of the actors have included sustainability as a part of their company strategy and are actively working to reduce their footprint.

5.2. Identified Barriers Along the Value Chain

Many of the barriers identified in our findings coincide with previous research on implementing circular business models. Our study has identified five recurring themes related to barriers to implementing CBMs; knowledge, culture, regulations, incentives and financial factors. These findings are discussed in the following section.

Knowledge appears to be a substantial barrier that hinders actors in the construction industry from transitioning to a circular economy. We found that the informants perceive circular economy to be a relatively new phenomenon that is slowly receiving more interest. Players in the industry, as well as regulators, appear to be uncertain about what changes need to be made to transition to a circular economy. Consequently, the lack of knowledge seems to cause the actors to be hesitant about implementing changes in their organization that require significant investments or enforcing regulations that are too strict. These findings correspond with Darko and Chan´s (2017) research that found lack of knowledge as the top global barrier to implementing circular business models. Lack of expert knowledge about circular economy makes it difficult for actors in the Norwegian built environment to pursue circular economy projects. We also find that lack of knowledge is also present among consumers, which may be explained by the fact that individuals often feel that they do not have the right information to guide their sustainable actions (Darko & Chan, 2017). Thus, absence of circularity in buildings may not necessarily be a result of unwillingness or lack of access to funding, but rather lack of awareness among customers and clients about the options that are available in the market, this a lack of awareness results in lack of demand for circular buildings.

Another barrier that we have uncovered through our research is the conservative mindset in the construction industry. The circular economy requires that players in the industry steer away from “business as usual” mindset. Some of the informants in this study experience a building environment dominated by a conservativism that builds on inherited values and opposes changes that threaten to destroy them. In Rizos et al. (2016) study, the conservative economic sector was documented as a barrier to implement circular economy in SMEs. Our findings, therefore, suggest that

a conservative mindset dominates the Norwegian built environment as well. Further, some informants in our study indicate that differences between how generations perceive the threat of climate change is an essential factor. This extends back to Garret Hardin´s article (Hardin, 1968) where people are trapped in a game that is about maximizing dividends at the individual level. Robert Frank (2004) further points out that what is useful to oneself may not be consistent with evolutionary understanding. However, he believes that morality can make people cooperate. Customers willingness to pay more to live in a sustainable building may be influenced by how urgent they perceive the threat of climate change to be. This, in turn, may have an impact on decisions real estate developers make in the methods and products they chose to use in property development projects. As elders also tend to have more financial resources than younger people who often are less financially secure, the elders may dominate the real estate market. According to informants in the present study, building with circular methods can involve more substantial costs, which are usually transferred to buyers or tenants. However, if the customers are not willing to pay more to live in a sustainable building, it is difficult for real estate developers to justify using more expensive or comprehensive methods. Thus, building with less costly materials is prioritized over circular solutions.

Regulations are another barrier that we have found in our study. Consistent with previous research (Darko & Chan, 2017; Guldmann & Huulgaard, 2020; Rizos et al., 2016), the regulatory framework in Norway seems to halt the construction industry in a circular transition. The participants in this study share the interest and willingness to change to a circular economy. Many of the players have taken independent steps to innovate their business models to become more circular. Nonetheless, it is stated that regulations are a barrier, which indicates that regulations are holding back those that are willing to change. Despite their efforts, the players in the construction industry are still operating in a regulatory landscape that supports the linear business model. Therefore, appropriate policy interventions are needed to adequately support businesses in this transition (D. E. MacArthur et al., 2015).

Through our research, we have found numerous barriers related to financial factors, profitability and access to capital. However, the participants in our study did not state that access to funding is a crucial barrier. Fyhri et al. (2012) argue that it is not uncommon to perceive environmental issues as dilemmas and to feel hindered by financial factors and time. Another explanation may be that most of the real estate companies we have spoken to are categorized as large, while Rizos et al. (2016) study involves SMEs. Nonetheless, after interviews with Sparebanken Vest, we discovered that banks are somewhat reluctant to issue loans to projects that involve high level of uncertainty. There is a great deal of uncertainty related to new construction methods, especially when reusing or upcycling materials from existing buildings. Banks consider the risk associated with each project and if they are willing to lend the capital needed to fund it. Hence, if the developer cannot provide sufficient evidence that the project will be profitable, banks are reluctant to finance these projects. This makes it difficult for smaller companies with less equity to pursue sustainable and circular building projects which could support findings in Rizos et al. (2016) study. In line with Darko and Chan´s (2017) review, we find that the multiple players in the Norwegian built environment perceive circular economy not to be profitable. This may explain why some are reluctant to transition to circular and sustainable building methods. On the other side, some informants suggest that when circular options become the natural choice, the cost will even out. In the current economic system, the profitable option is to demolish old buildings, build new and lease or sell it.

Finally, our results suggest that ownership is a crucial factor in determining if circular or sustainable solutions are considered. If a developer intends to sell a building or lease it, they are less likely to have long term perspective regarding the building. Our findings show that most commercial buildings are on a 10-year lease, and the developer is interested in ensuring that the building lasts as long as the lease. When the contract has expired, the building is paid off, and new tenants are found. Thus, they are not as focused on adopting circular methods. For instance, one of our informants shared an example where a foundation owned the building they renovated. The foundation intended to keep the existing building and were concerned with reusing as many materials as possible. This approach is supported by Grape

Architects, who also believe that there is a difference in how players invest in materials used in the building process. If the developer intends to keep the building, resell it or lease it is an essential factor. EGD Property agrees that this is an issue that must be addressed.

5.3. Potential Enablers to Implement Circular Business Models

Through our study, we identified multiple potential enablers to implement circular business models. The identified enablers are categorized into three main themes; culture, cooperation, and planning, production and supply. Planning, production and supply are further divided into subcategories: digital platforms, shared use and leasing instead of owning.

First, our findings suggest that internal culture in organizations is an essential factor towards circular economy. In this study, internal culture is regarded as the organization´s attitude towards circular economy and sustainability. Our results are supported by the study carried out by Rizos et al. (2016), an analysis that found organization culture to be an enabler for SMEs (see Chapter 2). Our research finds that culture is an enabler in SMEs and large companies. Thus, our evidence supplement findings by Rizos et al. (2016) as organizational culture turned out to be an enabling factor for large companies as well SMEs. It was also emphasized as an enabling factor several times by the representative from OBOS, which is defined as a large organization. Jørgensen and Pedersen´s (2018) RESTART framework suggests that to innovate business models successfully, and transition to circular economy, businesses can redesign their organizations in a way that renders the company to become both sustainable and profitable. Organizations should set the right objectives in terms of social, environmental and financial sustainability, measure and monitor their efforts and communicate them to those who need information (Jørgensen & Pedersen, 2018).

In our study, we distinguish between two types of sustainable attitude among the companies we have interviewed, *proactive* and *reactive*. We have defined a proactive attitude as behavior that actively work towards implementing circular business

models and establish practices necessary for it to happen. On the other hand, reactive attitude is defined as company behavior that has not adopted practices beyond what is already considered an established standard in the industry. In line with the “RT”-feature of the RESTART framework (Jørgensen & Pedersen, 2018), we find that the organizations we have interviewed that display proactive sustainable attitude are can successfully mobilize and motivate employees to comply with their sustainability vision. Some of the measures observed in our study are integrating sustainability at the core of the organization's strategy, which is the case with Aspelin Ramm, Entra, OBOS, Future Built and the Municipality we interviewed. These companies have also emphasized that their organizational culture is driven by the ambition to build sustainable. The company's sustainability ambitions are well communicated across the organization so that employees can quickly implement sustainability initiatives. The “RT”-feature of the framework highlights that to succeed with sustainable business model innovation, leadership and organization design can facilitate it (Jørgensen & Pedersen, 2018). One way to do so is by integrating sustainability in management tools, as we have observed was the case with the Municipality, OBOS, Grape Architects and Entra. Leadership can create support for organizations objectives by making work meaningful to employees through voluntary action (Jørgensen & Pedersen, 2018). At Grape Architects, employees that were particularly interested in sustainability formed an internal group and worked towards promoting sustainability internally.

Second, the findings in our study show that the sharing economy is another enabler for the construction industry to build sustainable and circular buildings. Consistent with D. E. MacArthur (2015), sharing economy in the built environment could facilitate a circular transition. The basic premise of circular economy is that no resource goes to waste (Kriza, 2016). The RESTART framework goes further and suggests that resources go astray long before they end up as waste (Jørgensen & Pedersen, 2018). The fact that there is a need for more efficient utilization of objects that are already in circulation is also consistent with our findings. Multiconsult suggests that building multi-functional buildings or increasing functionality of already existing buildings is an opportunity to become sustainable and circular.

Nonetheless, to the best of our efforts, we could not find any evidence that this opportunity is taken advantage of in the construction industry today. Most buildings are severely under-utilized and stay empty after regular working hours. However, we have observed some examples where companies are beginning to embrace the sharing economy. One of the companies we have spoken to, EGD Property has already started to implement the sharing economy principles into their business practice. They currently have two ongoing projects where they are redesigning their business model by incorporating shared access to premises in their building projects. This proves to be an advantage financially for the developer and the tenants because most of the features and expenses are shared. In this way, the building is well utilized. The developer then has the opportunity to choose circular building methods without compromising the financial aspect of the project. Consistent with the "RE"- and "RT"-features of the RESTART framework (Jørgensen & Pedersen, 2018), EGD Property has redesigned its business model in a way that they can be both sustainable and profitable. Hence, shared access to premises offers the construction industry to build environmentally-, financially- and socially sustainable buildings.

This also applies to OBOS´ new business models for buying homes called "part-ownership". This business model, where you partially own the property and rent the rest from OBOS, allows people to own their home for half the price. More people get the opportunity to enter the real estate market, which can reduce economic differences in society as well. Social progress is one of the core elements of sustainable development (Sev, 2009). What OBOS stated is also consistent with Omer and Noguchi (2020), who suggest that the construction industry plays a vital role in achieving sustainable development. Further, empirical evidence finds a shift in consumer behavior which indicate that the new generations seem prepared to choose access over ownership (E. MacArthur, 2013). Multi-functional buildings are closely related to technology, which is another important finding in our study. Digital platforms or apps are already being used to share other products such as cars or private homes (Jørgensen & Pedersen, 2018). Thus, similar platforms could be launched to facilitate sharing of premises as well. This can add value and spur

innovation by encouraging collaboration among groups that do not usually work together, for example, non-profit organizations and banks.

Our analysis indicates that technology is essential to streamline resource flows in the current value chain and facilitate a transition to circular economy. Often improvements of existing solutions have the most significant effect (Jørgensen & Pedersen, 2018). Several informants in this study share this impression in the current system. Our findings indicate that it is difficult to reuse construction materials in new projects because of the unavailability and the complexity of the process. If the developer intends to reuse materials from buildings to be demolished, they have to search for available materials in the market. Further, the timing of the project must coincide with the demolition. If not, the materials need to be stored until they are used, which involves additional costs. Technology has the potential to improve this process. Several actors that we have spoken with, such as Aspelin Ramm and Future Built expresses a need for a system that can enhance the dialogue between industry actors. Multiconsult argues that a digital solution can make this possible. Digital platforms offer the construction industry a convenient way to access used- or recycled materials. Today´s information technology is so advanced that companies can trace materials through the entire supply chain, identify products and material fractions and track the product status during its lifetime. Besides, technology can mobilize users almost instantaneously (E. MacArthur, 2013).

As Aspelin Ramm suggests, an online marketplace that tracks and advertising materials that are currently in existing buildings could improve the reuse of existing resources. Then, when a building approaches the end of its lifetime or is to be redesigned for new tenants, materials and inventory could be purchased for further use by another developer. This enables circularity for existing building materials. However, for digital platforms to work successfully, information about the products and materials need to be made available (Carra & Magdani, 2016). Grape Architects suggest that if companies start demanding EPD (environmental product declaration) on products, it could lead to increased awareness in the industry. Labelling products

with EPD make it easier to trace products and have electronic information about the products till the end of its life.

Further, our findings suggest that shifting from product-logic to service-logic may be necessary to successfully transition to circular business models in the Norwegian built environment. In line with the STA-feature of the RESTART framework, results from our research suggest that offering products as services, even when the service is a physical product, can lead to improved capacity utilization and less resource waste (Jørgensen & Pedersen, 2018). None of the companies we have spoken to have currently implemented such logic in their business practice, and such service-logic appears to be uncommon in Norway. However, both Grape Architects and VILL propose that a service-logic where building materials are leased as a service instead of being owned by the developer is an essential step towards circular economy in the Norwegian built environment. In this type of business model, the manufacturer retains ownership of the product while the customer uses it. In this way, the manufacturer is responsible for maintenance, and the customer pays for the time they are using the service (Jørgensen & Pedersen, 2018). Service-logic has the potential to change how products are delivered to customers. It incentivizes the manufacturer to consider the lifespan of the product they offer and benefit the user with a continuously up-to-date service (Carra & Magdani, 2016). VILL go as far as suggesting that almost every feature of a building, including floors, walls and ceilings could be offered as a service, rather than a product.

Finally, we find that working together across the value chain is an essential factor for a successful transition to circular economy in the Norwegian built environment. Our study shows that actors are increasingly entering into collaborations with companies that previously have not been considered natural collaborators. These findings are consistent with the “RT”-feature of the RESTART framework. To improve sustainability performance and make use of the benefits of circular economy, companies have to develop a willingness to collaborate with others across the value chain (Jørgensen & Pedersen, 2018).

Through the interviews, we have found that companies such as Future Built encourage cooperation between companies that have traditionally been competitors. In construction projects, one actors waste could be a valuable resource for another actor. Thus, to achieve circularity, actors with different objectives should come together to find mutually beneficial solutions (Jørgensen & Pedersen, 2018). It can be challenging to collaborate when it involves giving competitors access to internal processes. In today's business environment, companies are more inclined to compete with each other rather than collaborate (Jørgensen & Pedersen, 2018). However, following Jørgensen and Pedersen (2018), our findings indicate that no company has the knowledge, resources or competence to solve the sustainability problem alone. Thus, collaboration appears to be necessary.

Our study provides several examples that support this. The real estate developer Aspelin Ramm has recently broken with the traditional model and entered into a partnership with the waste manager Norsk Gjenvinning. In the existing linear model, these actors would be at the opposite side of the value chain (Carra & Magdani, 2016), Still, in a circular value chain, direct cooperation between real estate developer and waste management is logical because the two actors are suddenly situated right next to each other. Through collaboration like this, Mentink (2014) suggests that actors can close material loops together and achieve circularity. Consistent with what Lüdeke-Freund et al. (2019) present in their review, such partnerships can contribute to better utilization of existing resources. However, as Jørgensen and Pedersen (2018) point out, and our findings with Aspelin Ramm indicate, such collaborations require an effort by all the parties involved. Moreover, EGD Property emphasizes the importance of cooperating with public authorities. The technical regulations that are imposed must correspond so that one can reuse materials that are being demolished. Actors in the construction industry should actively seek to enter partnerships with other actors to identify opportunities to create and distribute value along its entire value chain (Jørgensen & Pedersen, 2018).

Limitations

The purpose of this study was to find potential solutions to implement CBMs in the Norwegian built environment based on existing literature and 20 in-depth interviews with 16 companies in the industry. One limitation of this research is that we have conducted interviews with only 16 companies in the industry which may limit the generalizability of our findings. This limitation is further reinforced by the geographical distribution (Oslo, Bergen and Trondheim) of the companies we have interviewed. We understand that this can limit our ability to draw conclusions about the barriers that the Norwegian built environment is facing when implementing CBMs. However, this study did not intend to generalize empirically to the entire Norwegian built environment but rather uncover the current barriers to implement CBMs and identify potential enablers to overcome them. By interviewing 16 different companies in the Norwegian built environment we hope to have shed light on this issue. A range of both overlapping and different nuanced experiences the informants have shared in this study, combined with previous empirical findings (see Chapter 2), can help to understand the problem this thesis undertakes and our findings.

Second, the purposive sampling technique used in our research may represent a limitation. Purposive samples cannot be considered statistically representative of the target population (Saunders et.al. 2019). The selection of participants was made with the criteria that they are transitioning towards CBMs or already work with the principle of circular economy. All the 16 companies we interviewed engaged in sustainability and show willingness to transition to circular economy business models. Although our study has an explorative purpose and our intention is not necessarily to generalize our findings, there are limitations to how far our results can be generalized to the entire Norwegian construction industry. Even though we have managed to gather data from several companies within each sector, we have only one representative from the contractor and the waste management sector. This is another limitation as were not able to discuss these findings with comparable data from another representative from these sectors.

Theoretical Contribution

The identified barriers and enablers to implement CBMs in the Norwegian built environment in this thesis build on and extend existing literature. Our contribution to previous research on CBM for the built environment is threefold. First, our research can confirm that the current value chain in the Norwegian built environment is considered as a linear model where each party specializes in one single activity (Carra & Magdani, 2016).

Further, by integrating insight from 20 participants from the Norwegian built environment and existing research on barriers to implement CBMs, this master thesis contributes to shed light on what halts the Norwegian construction industry in a circular transition. We have presented the five most recurring barriers from the study which also support previous empirical evidence on the topic. To the best of our knowledge, previous literature has not described ownership in construction projects as a potential barrier. Thus, we add to current literature that there are different approaches to material use when the real estate developer keeps the building for themselves versus when they lease or sell it. Future research is needed to determine whether and how might factors, such as ownership, influence how the real estate developer engage in circular building methods.

This thesis also contributes to the literature on framework and guidelines to implement CBMs in the built environment. Our results have identified three potential enablers to facilitate a circular transition for the industry which are aligned with previous empirics. There is especially one finding that we discovered during interviews that adds to the current literature, shared use. Creating multi-functional buildings that facilitates shared use and increased utilization of buildings, goes, as far as we know, beyond current research on sharing economy.

Practical Implications

In this thesis we have explored barriers and possible enablers to circular economy in the Norwegian built environment. Thus, our research brings forward important insight about the transition to circular business models. Based on our findings, our recommendations are as followed.

Companies that strive to transition to circular economy should focus on organizational culture. Consistent with previous research, we find that culture is important to mobilize and motivate employees to comply with the organization's sustainability vision. Considerably more time and effort should be granted in communicating the sustainability vision to employees. To ensure a circular transition, organizations can monitor and measure their efforts by implementing circular economy in their internal management tools.

The construction industry can further explore new ways to deliver their products. Our findings indicate that offering products as services can help increase lifespan of materials and retain them in circulation for a longer time. Real estate developers can set demands to manufacturers and suppliers that products are offered as a services-based contract. This can incentivize manufacturers to think about the products they offer in a long-term perspective.

Further, companies can engage in new collaborations and foster partnerships with other players in the construction industry. To capture the benefits of circular economy, organizations should abandon the old business practices that protect their business model from competitors and develop willingness to cooperate. Players in the industry with different objectives need to come together and explore ways to achieve common goals. Our study finds that organizations that enter partnerships with other companies in the industry are able to generate more value in a sustainable manner. Lack of knowledge is another barrier discovered in our research to implement CBMs. No organization has all the resources needed to innovate and fully transition to circular economy. Thus, entering new partnerships can fill the knowledge gap and through cross-organizational collaboration these barriers can be overcome.

Furthermore, the Authorities can engage directly with actors in the construction industry and adjust the regulations and incentives thereafter. The possibility of establishing a platform for interdisciplinary dialogue between actors in the construction industry can be explored. Through our research, we have documented increased awareness about circular economy in the Norwegian built environment, but lack of knowledge about circular solutions is still present. Thus, a platform that facilitates interdisciplinary dialogue and development of circular solutions in the industry is necessary.

Finally, we find that digitalization needs to be aligned with circular transition in the construction industry. Technology can be used to streamline resource flows and enable reuse of materials. Actors in the construction industry have a strong desire to reuse materials, however, the lack of appropriate digital infrastructure that facilitates this is perceived as a substantial barrier.

Conclusion

The built environment is a complex industry with numerous actors involved in the value chain. The industry is currently following a linear model, generating huge amount of resources and is responsible for 39% of the global carbon emission (United Nations, 2019). Circular economy principles have been presented as a possible solution to eliminating waste by ensuring that resources remain in a perpetual loop.

This thesis aimed to investigate the current barriers to implementing circular business models in the Norwegian built environment and identify potential enablers. Previous research and findings from interviews conducted with a wide range of organizations in the construction industry (see Table 2) contributed in outlining the current barriers to implement CBMs. Findings from this study provides valuable insight to the current state of circular economy in the Norwegian built environment, barriers and enabling factors to implement CBMs. Several studies about circular business models have been conducted, yet we have not been able to find a comprehensive study on implementation of CBMs in the Norwegian built environment. In light of the RESTART framework provided by Jørgensen and Pedersen (2018) we discussed the enabling factors to implement CBMs in the construction industry.

Findings from this research indicate that there is great awareness in the Norwegian built environment regarding the need to transition to a circular business model. The industry seems willing to make the changes necessary, however, lack of knowledge about how to make changes hinders them to pursue it. Based on the responses from the informants in our study, we perceive that the industry agrees that circular economy is the appropriate answer to the environmental challenges they are facing. Through this study, five recurring barriers to implementing CBMs in the built environment was uncovered: (1) *lack of knowledge and limited access to information sharing*, (2) *financial factors associated with implementing circular methods,* (3) *lack of incentives and support*, (4) *lack of regulation and Governmental actions* and (5) *culture*.

We further inquired informants in this study about how the perceived barriers may be overcome, which brought forward several enabling factors to implement CBMs in the built environment. Collaboration and partnership across the construction industry´s value chain prove to generate value in a sustainable manner and improve resource utilization. Also, by establishing a proactive organizational culture, the organizations can mobilize and motivate employees to adopt circular and sustainable attitude. To achieve a circular transition, companies should redesign their business models. This includes mobilize internal digitalization processes to produce value in a sustainable manner. The industry should reconsider the entire life cycle of a building, from planning, production, supply to use. Our findings indicate that shifting from product-logic to service-logic can extend the products´ lifetime and reduce the need for virgin resources. Finally, the study suggest that the industry can apply sharing economy principles in their business model to become more sustainable. In the construction industry, this can be done by creating multi-functional buildings that accommodates the need of more than one tenant at a time. Thus, tenants can share functionalities and facilitates in the building. In this way, buildings are utilized at its fullest and prevent the need to build more buildings.

Appendices

Appendix 1:

First interview questionnaire

General:

1. Can you tell us about your role in the company?
2. Can you tell us about the project?

Leadership:

1. In your opinion, what is a leader's role in a change process?
2. How would you describe your leadership style?
3. How do you as a leader interact with employees when managing change?
   How do you think employees should be managed in a change process?

6. What leadership practices do you think are particularly important when managing change?

Circular economy:

1. How important are the theories from "Cradle to cradle" framework in this project?
2. What are the benefits you are hoping to achieve by transitioning to circular economy?
3. Can you tell us about some of the challenges to implementing circular economy?

business model in Mustad Property?

4. What are some of the factors that would help facilitate the transition to circular economy?

Stakeholders:

11. Are the other actors that you believe will be important to succeed with this project/transition to circular economy?

Appendix 2:

Second interview questionnaire

About the informant:

1. Can you tell us about yourself and your role in the company?

First part

Sustainable Development:

2. In your opinion, can the built environment contribute achieving the SDGs?
    a. *Comment: We probably have to explain the SDGs to the informants*
    b. Can you explain why/why not?
    c. In what way can the built environment contribute achieving the SDGs?

Business Models in the Built environment:

a. How important do you believe that the players in the built environment generate value in a sustainable manner?
b. Can you elaborate?

4. How important do you believe it is that innovation related activities in the built sector is sustainable?
    a. Can you elaborate?

Value Chain:

5. How would you evaluate the linear value chain in the built environment?
    a. Why do you believe it is efficient/not efficient?
    b. How do you believe it can be changed?

Circular Economy in the Built Environment:

6. Can you describe what the term circular economy, and your reflections around it??

7. How would you describe state of circular economy in the Norwegian built environment?

8. To what degree do you believe that circular economy is important for the future of the built environment?
    a. Can you explain why?
    b. Can you give us examples?

9. Do you have any good experiences with circular solutions/methods, and would you like to share them with us?
    a. What factors do you believe contributed to its success?

10. To what degree do you experience that the transition to circular economy in the built environment has been successful?
    a. Can you explain why?
    b. Can you give examples?
    c. What was efficient/not efficient?
    d. What do you experience is the biggest barrier when implementing circular business models in the built environment?

11. What do you believe is the biggest barrier related to transition to circular economy in the built environment?
    a. Can you elaborate?
    b. How can you prevent these barriers to arise?
    c. Can you tell us about a situation you were successful in overcome such barriers?

12. Is there some players that are central in a successful transition to circular economy in the built environment?

13. What do you believe is important factors to successfully implement circular business models in the Norwegian built environment?
    a. *Are there any incentives you believe could be implemented to stimulate a transition to circular economy?*

Appendix 3:

Consent form to the informants

Vil du delta i forskningsprosjektet

"Hvordan kan de nåværende barrierene for implementering av sirkulære forretningsmodeller i norsk bygge industri løses"?

Dette er et spørsmål til deg om du ønsker å delta i et forskningsprosjekt hvor formålet er å undersøke hva er barrierene for overgangen til sirkulær økonomi i norsk byggesektoren. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Dette er en masteroppgave hvor vi skal undersøke hvilke barrierer som finner sted ved implementering av sirkulære forretningsmodeller i norsk byggesektoren. I oppgaven skal vi kartlegge dine meninger om sirkulærøkonomi i byggesektoren og din oppfatning av hva barrierene for implementering av sirkulære forretningsmodeller kan være.

Hvem er ansvarlig for forskningsprosjektet?
Handelshøyskolen BI er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Utvalget til å delta i dette prosjektet er valgt med tanke på hvilke aktører er involvert i verdikjeden i byggesektoren og andre aktører som har erfaring og kunnskap om temaet. Dette er for å sikre at vi samler inn relevant data i forhold til forskningsspørsmålet vår.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet, innebærer det at du har et personlig intervju med oss som vil ta deg ca. 40 minutter. Du vil bli spurt om dine refleksjoner rundt sirkulær økonomi, hvordan byggesektoren leverer verdi til samfunnet i dag og dine oppfatninger om mulige barrierer for implementering av sirkulære forretningsmodeller. Vi tar lydopptak og notater fra intervjuet.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Det er vi, Emma Wagner og Andrea Müller, som utfører prosjektet og vår veileder, Birgit Helene Jevnaker som vil ha tilgang til opplysningene. Du vil bli anonymisert slik at du ikke risikerer å bli gjenkjent, dette gjelder også i selve masteroppgaven.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes senest 1. September 2020. Da skal masteroppgaven innleveres. Siden datamaterialet er anonymisert så vil dokumentene bli oppbevart, men opptakene vil bli slettet.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Handelshøyskolen BI har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
Handelshøyskolen BI ved Birgit Helene Jevnaker på epost: birgit.h.jevnaker@bi.no (Veileder).
I tillegg kan vi nås på epost. Emma Wagner kan nås på epost: emma.wagner@student.bi.no, og Andrea Müller kan nås på epost: andrea.muller@student.bi.no

NSD – Norsk senter for forskningsdata AS, på epost (personverntjenester@nsd.no) eller telefon: 55 58 21 17.

Med vennlig hilsen

Prosjektansvarlige
Emma Wagner
Andrea Müller

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet «Hvordan kan de nåværende barrierene for implementering av sirkulære forretningsmodeller i norsk bygge industri løses», og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i intervju

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 1 juli.

(Signert av prosjektdeltaker, dato)

Appendix 4:

Approved project from NSD

NSD NORSK SENTER FOR FORSKNINGSDATA

NSD sin vurdering

Prosjekttittel

"Hva er barrierene for implementering av sirkulære forretningsmodeller i norsk byggeindustri, og hvordan kan de løses"?

Referansenummer

713221

Registrert

29.03.2020 av Emma Wagner - Emma.Wagner@student.bi.no

Behandlingsansvarlig institusjon

Handelshøyskolen / BI Oslo / Institutt for ledelse og organisasjon

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Birgit Helene Jevnaker, birgit.h.jevnaker@bi.no, tlf: 46410622

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Emma Wagner, emmwagn@gmail.com, tlf: 47687049

Prosjektperiode

01.05.2019 - 01.07.2020

Status

26.06.2020 - Vurdert

Vurdering (3)

26.06.2020 - Vurdert

NSD har vurdert endringen registrert 26.06.2020.

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 26.06.2020. Behandlingen kan fortsette.

Zoom har blitt lagt til som databehandler. Datamaterialet vil anonymiseres ved prosjektslutt.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Tore Andre Kjetland Fjeldsbø

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

19.05.2020 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet den 19.05.2020 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:
https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.07.2020.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

• lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
• formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
• dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet

• lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Tore Andre Kjetland Fjeldsbø

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

30.03.2020 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet den 30.03.2020 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:
https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.07.2020.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering

er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

• lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
• formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
• dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
• lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
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NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

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