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## **BARRIERS OF CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR**

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## **ABSTRACT**

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The purpose of this thesis is to create an understanding of the circular economy barriers in the construction sector. Furthermore, the thesis aims to discover how the barriers form, how they could be overcome and what kinds of actions policy makers should take in order to accelerate the paradigm shift from a linear economy to a circular economy.

The qualitative research was conducted between October 2018 and June 2019. The primary data consists of 12 semi-structured interviews that were conducted with 9 interviewees from 5 different construction companies and three specialists from Sitra, GBC Finland and Rakennusteollisuus RT Ry.

The findings of the research reveal, that the most pressing barriers are lack of legislation, lack of knowledge, lack of demand and bad image of the recycled materials. To make the paradigm shift, an interstitial issue field gathering members from different fields and over the industry borders is needed. Moreover, as construction sector is a heavily regulated sector, tightened legislation is also required. The shift requires intense collaboration between industry members, policy makers, trade unions, municipalities, financial organizations and universities/schools.

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Tämän pro gradu-tutkielman tarkoituksena on löytää ne esteet, jotka hidastavat tai estävät rakennusalan siirtymistä kiertotalouteen. Lisäksi tutkimuksen tavoitteena on selvittää, missä nuo esteet muodostuvat, miten esteet voitaisiin voittaa sekä millaisia keinoja lainsäätäjien tulisi käyttää edistääkseen ajattelutavan muutosta lineaarisesta taloudesta kiertotalouteen.

Laadullinen tutkimus tehtiin Helsingissä lokakuun 2018 ja kesäkuun 2019 välisenä aikana. Tutkimuksessa hyödynnettiin 12 haastattelusta koostuvaa primääristä aineistoa, joka kerättiin yhteensä yhdeksältä haastateltavalta viidestä eri rakennusalan yrityksestä, sekä kolmelta asiantuntijalta. Asiantuntijat edustivat Sitraa, GBC Finland:ia sekä Rakennusteollisuus RT Ry:tä.

Tutkimuksen tulokset osoittavat, että kaikkein painavimmat esteet ovat lainsäädännöllisiä esteitä, puutteelliseen tietoon tai koulutukseen liittyviä esteitä, kysynnällisiä esteitä sekä kierrätysmateriaalien huonoon imagoon liittyviä esteitä. Ajatusmallin muutokseen tarvitaan interstitiaalinen ongelmakenttä, joka kerää jäseniä eri institutionaalisista kentistä yli toimialarajojen. Koska rakennusala on voimakkaasti säädelty ala, tarvitaan lisäksi tiukentunutta lainsäädäntöä. Muutosta varten tarvitaan tiivistä yhteistyötä eri toimijoiden välillä: mm. yritysten, lainsäätäjien, kuntatilaajien, koulujen sekä rahoittajaorganisaatioiden välillä.

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## 1 INTRODUCTION

Circular economy (CE) is a contested, relatively new concept within both the academia and businesses. Because of its novelty, there is a lot more to be discovered in the field. For example best business practices, possible changes required in business culture, drivers and barriers of CE are topics that have been only partly examined.

In January 2018, the European Commission (EC) implemented a new circular economy package, which consists of measures that support the EC's Action Plan for Circular Economy started in 2015. The package presented new goals and measures regarding CE, e.g. that by 2030 all the plastics in EU area must be made from renewable materials. (European Commission 2018a) The Ministry of Environment in Finland is focused on CE and Sitra (Finnish innovation fund) has published already two national roadmaps to CE, the first national CE roadmaps in the world (Sitra N/A).

Despite of the ongoing discussion on circular economy among politicians and academics, there is still a long way to go to reach full circularity (Kirchherr, Piscicelli, Bour, Kostense-Smit, Muller, Huibrechtse, Hekkert 2018). The barriers that prevent companies from moving towards circular economy is a topic that has not yet been fully discovered. To be able to shift from the linear economy to a circular one, those barriers need to be recognized and overcome.

The academics and politicians often seem to consider that there are many technological barriers which need to be overcome before companies can become circular. This probably is at least partly true, however, in the Kirchherr et al (2018) study it was discovered that the technological barriers are not significant, and instead cultural barriers are the most pressing barriers that prevent firms from obtaining circular economy initiatives. The research was extensive and focused on

different companies, policy makers and academics in European Union but there was no specification for example among different industries. Thus, it cannot be certain that the barriers are the same for different business sectors.

This thesis research investigates the barriers of circular economy, but the focus is on a specific sector: the construction sector. Currently construction and demolition waste represent 25-30% of all waste generated in EU area, making it one of the largest waste streams (European Commission 2018b). The construction sector is also an economically important sector in EU area, as it accounts for 9% of the EU's GDP and provides 18 million jobs. On the other hand, the construction sector is responsible for 35% of EU's total greenhouse emissions. (European Commission 2018c)

Since the construction sector accounts for a significant amount of EU's waste, there are also a lot of possibilities to reduce the amount of waste. The construction waste is for example bricks, glass, concrete, wood etc. that could all be recycled or reused (European Union 2018b). By reusing, recycling, refurbishing and remanufacturing the materials that are now considered as waste in construction, there would be significantly less waste. Moving towards CE in construction sector would reduce CO2 emissions, increase profits and add more jobs to the field. It would also affect other sectors, since the volumes are so massive. Construction sector provides spaces and influences people's way of living. A key for tackling climate change is to change the way of living and this shows, that construction sector can play an important role in tackling climate change. Moreover, in its Waste Framework Directive (2008/98/EC) EU has set a goal that 70% of the construction and demolition waste should be reused, recycled or otherwise utilized (European Union 2018b). Thus, it is expected from EU that construction sector should undergo measures to increase the amount of circularity.

Despite of the high potential of construction sector in circular economy and the objectives set by EU, it seems that among companies not much has been done yet

to achieve circularity. The web pages of the 10 biggest construction companies (by turnover) in Finland were searched to find out if there are mentions about circularity. The companies are YIT Oyj, Lemminkäinen Oyj, SRV Yhtiöt Oyj, Skanska Talonrakennus Oy, NCC Suomi Oy, Lujatalo Oy, Are Oy, Pohjola Rakennus Group Oy, Fira Group Oy and Peab Oy to find out if they have taken some measures to go towards circular economy. Out of those 10, only 3 had somehow mentioned circular economy in their web pages and only 2 of them had taken clear measures to achieve circularity. This observation is in line with the Kirchherr et al (2018) research, which stated that despite of the ongoing discussion on circular economy not many companies have yet implemented the circular economy thinking.

As it is clear that there is a high potential for circular economy in construction industry, but the companies operating in the industry do not seem to have adopted circular economy initiatives to a great extent, the study will investigate the barriers that lie behind taking the initiatives. Examining the barriers in an industry with a high potential for circular economy might overall provide help for policy makers and companies alike to better understand, how to accelerate the movement towards circular economy together.

The theoretical framework of this thesis derives from institutional theory. The focus is on discovering the institutional barriers that are hindering the sector's movement towards CE and at the same time clarifying what kinds of actions would be needed to make the shift towards CE. The level of analysis that is used to examine the institutional barriers is the institutional field analysis. The distribution to different institutional fields is based on Zietsma, Groenewegen, Logue and Hinings' article (2017) on institutional fields. Each barrier that was discovered during the analysis of the research material is thus associated with a certain institutional field. Institutional field analysis was chosen, since it helps to understand in which institutional fields the barriers form and, consequently, which fields would be helpful in advancing or accelerating the movement towards CE.

## **1.1 Scope of the thesis**

The scope of the thesis is on the barriers to circular economy transition among construction sector. The focus is on how the construction companies overall react to circular economy and what kinds of barriers they see in transition towards it. With this in mind, the aim is to find solutions to accelerate the transition towards circular economy. The people that will be interviewed will be of higher level management or other key people that have a clear understanding of the companies' sustainability related matters. Thus, the scope will be mainly on the management. Also any other sustainability related measures, that are not related to circular economy, were be left out.

## **1.2 Research questions and research gap**

Construction sector is an economically important sector in the EU and it has a key role in the EU's "Europe 2020" goals. The environmental impact of construction sector is notable, since it uses a significant amount of energy and resources. Therefore, the sector is currently advancing climate change. Thus, since EU aims to slow down climate change, it is in the EU's interest to make the sector more sustainable, since the direct impact of making the change is remarkable. EU also sees the potential of CE in making the sector more sustainable as it contributes to better construction and demolition (C&D) waste management. (European Commission 2016a) The economic importance of the sector, EU's willingness to make it more sustainable and its potential for CE creates demand for more research on how the sector could become circular. Thus, this study will fill the research gap of what kinds of CE barriers lie behind a specific business sector, that has been shown to have a business case for circular economy, but in which measures are yet to be taken.

CE is often associated with the 3R framework (reuse, reduce, recycle) that takes into account three different aspects of CE (Kirchherr, Reike & Hekkert 2017, 226).

The previous research on C&D waste and CE has been mainly focusing on the recycle principle and it has not taken into account all the 3 principles of CE (Ghisellini et al (2018, 624). Thus, there is a lack of research on CE in construction sector which would take into account all the three aspects.

Finally, the study contributes to the field-level research on barriers of a paradigm shift (from a linear economy to a circular economy). The institutional fields control the industries and guide their behavior. According to Hoffman (1999, 367), “Environmental problems must be solved through changes in the institutional arrangements that govern industry and social action”. The conditions of a field may change and new ideas arise as a result of a crisis, technological disruption or changes in regulation (Battilana & D’Aunno 2009, 38-39).

Thus, it is important to discover what kinds of institutional fields that are controlling the paradigm shift from a linear to a circular economy and how to make changes to the existing fields.

Based on these research gaps, the following research questions were formed:

**RQ 1. What are the barriers to circular economy in construction sector and how do they form?**

**RQ 2. How could the barriers be overcome?**

**RQ 3. What kinds of measures could the policy makers take in order to accelerate the movement towards circular economy?**

## **2 LITERATURE REVIEW**

The literature review of this thesis takes a closer look at circular economy (CE) and presents some of the characteristics of construction sector. The literature review begins with defining CE, moves on to discovering previous research on circular economy barriers and enablers, and finally discovers sustainability and CE in construction sector.

### **2.1 Circular Economy Definition**

Circular economy (CE) is a contested, emerging concept within academia, policy makers and businesses. The concept has been arising since the 1970's but has grown in importance during the past couple of years when the number of academic research publications on the matter has increased and some governments have started to adopt it. China was one of the first countries in the world to adopt CE into the country's national legislation in 2009. (Geissdoerfer, Savaget, Bocken, Hultink 2017, 759; Murray, Skene & Haynes 2017, 374) Despite of the growing interest towards CE, among businesses it is not yet emphasized (Bocken et al 2017, 487-489).

CE is an alternative model of the current linear economy, where the products and materials are produced, used and then disposed at the end of their life. In CE, instead, they will be refurbished, reused, recycled or remanufactured in order to close, narrow or slow down the material loops. (e.g. Geissdoerfer et al 2017 759 & 764, Homrich, Galvão, Abadia, Carvalho 2018, 534) Thus, in its simplest form, CE can be defined as a closed (recycled or reused products from waste), narrowed (improving the value of the product or material by remanufacturing or refurbishing it) or slowed down (increasing the efficiency along the lifecycle) loop of products and materials (Bocken et al 2017, 487)

CE is strongly linked to sustainability and could be one of the solutions for achieving sustainable development (Geissdoerfer et al 2017, 766). Geissdoerfer et al (2017,766-767) see CE as one of the many possible sustainability strategies. The scholarly definitions of CE often refer to the 3R principle: reducing, reusing and recycling (Kirchherr et al 2017, 226). The 3R principle-model for CE can be seen in Figure 1.



Figure 1 3R principle of circular economy

Most of the CE literature finds that its purpose is to decrease the amount of waste and energy usage (environmental benefits) while at the same time increasing the amount of profit (economic benefits). Unlike sustainable development (SD), which is considered to consist of three dimensions: the social, environmental and economic dimension, the CE is often considered to bring mainly the above mentioned environmental and economic benefits. (Geissdoerfer et al 2017 764-765) The environmental value of CE is emphasized strongly, and it has been shown that CE business models create environmental value. (Manninen, Koskela, Antikainen, Bocken, Dahlbo, Aminoff 2018) Manninen et al (2018) created a framework to test the environmental value of CE and in their qualitative case study where they utilized the framework, it could be seen that CE business models create environmental

value throughout the whole supply chain. According to an estimate by Ellen MacArthur Foundation (2015), implementing CE in the EU could decrease the amount of CO<sub>2</sub> emissions by 48% by 2030, compared to 2012 level. Moreover, implementing CE would bring new jobs and create 1.8 trillion euros of economic benefits by 2030. (Ellen MacArthur Foundation 2015, 12-14)

Although most of the CE literature seems to exclude the social dimension, for example Korhonen, Honkasalo, Seppälä (2018, 39) argue, that if executed properly, CE will also bring social benefits on top of the economic and environmental ones. The inclusion of social dimension in CE is also taken into account for example in Korhonen, Nuur, Feldmann and Birkie (2018) and Murray et al (2017). In much of the previous research and conceptualization of CE the focus has been on the environmental and economic dimensions and the social dimension has been missing. Therefore, it is important to include the social dimension to CE. (Murray et al 2017, 376) To include the social dimension, Murray et al (2017, 377) thus define CE as *“an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being”*.

As some studies acknowledge the inclusion of the social dimension to CE, but many do not, the definition for CE seems to be constantly changing. Thus, there is not yet a widely recognized definition like that for sustainable development from the 1987 “Our common future” publication, also known as Brundtland report, where it was originally defined as the *“Development that meets the needs the need of the present without compromising the ability of future generations to meet their needs”* (World Commission on Environment and Development 1987). Since then, sustainable development has been referred to as the “three pillars”-model, where the social, economic and environmental pillars are equally important, “but not limited to each other”, to achieve sustainability (Millar, Mclaughlin, Börger 2019, 12).

Some researchers have discussed that CE as a tool for sustainability cannot be fully linked to sustainable development because of the strong emphasis on environmental sustainability, but no clear links to economic or social pillars. They argue, that CE has not been shown to be a tool to reach sustainability, but it is however a better model than linear economy. Even so, it has not been proved that circular economy model would be a better alternative for linear economy in achieving sustainability and the CE fails to meet SD goals (Millar et al 2019) Yet, the governments and industries find CE as an important tool for reducing the amount of greenhouse gas emissions and therefore it would contribute to the fight against climate change (Haas, Krausmann, Wiedenhofer, Heinz 2015, 765-766).

Even though there is no widely accepted definition for CE and not all the researchers agree on the inclusion of the social dimension, they do acknowledge the CE's relationship with sustainability. Geissdoerfer et al (2017, 766-767) see the relationship as a beneficial one, as CE could be one out of the many solutions for achieving sustainability.

Although CE remains as a contested concept, and its link to SD is yet to be discovered, it still strongly interests both businesses and governments alike, since it enables environmental sustainability without making sacrifices to economic or social development.

## **2.2 Concepts under CE umbrella**

As the previous chapter pointed out, CE is an umbrella concept that has no widely recognized definition and is linked to multiple other concepts, for example waste management (Merli, Preziosi & Acampora 2018, 719) and eco-efficiency. Eco-efficiency is linked to CE through the "reduce" principle by increasing the efficiency in production and thus reducing the amount of raw material extraction and usage of primary energy at the beginning of the loop. (Ghisellini, Cialani & Ulgiati 2016, 15).

Multiple concepts, that could help companies to take CE into their strategy and create a closed-loop economy, have also been developed under the CE umbrella. Some of the most common concepts that are often considered to be part of the CE umbrella, are cradle-to-cradle design, industrial symbiosis and sharing economy and thus they will be shortly presented.

Cradle-to-cradle design views human industry's products similarly to nature's cycle. The components of the products are separated as nutrients that then flow within a metabolism, either biological or technological. The biological nutrients flowing within biological metabolism are biodegradable, do not contain anything that could be harmful to the nature and can be fully returned to the nature after human use. The technological nutrients flowing in the technological metabolism can be fully reused or remanufactured so that the original value of the product does not decrease. (Braungart, McDonough, Bollinger 2007 p.1343) Products designed according to the cradle-to-cradle principles thus go in line with the CE's continuous loop.

Industrial symbiosis (IS) is created, when two or more companies from different industries cooperate in a way, that one can utilize the residues of the other in their production or processes. It creates a symbiosis, where the companies benefit from one another by sharing materials, water, energy or by-products and as a result produce less waste. As in IS the aim is to reuse waste and share materials between the cooperating companies, it also creates a closed loop for the materials and therefore is often put under the umbrella of CE. Industrial symbiosis is one possible outcome of a successful CE strategy implementation. (Homrich, Galvão, Abadia, Carvalho 2018)

Korhonen, Honkasalo and Seppälä (2018) consider sharing economy as the social dimension of CE. Sharing economy creates a new way of consumption, in which products, spaces or services are shared instead of keeping them solely to the owner. The sharing economy can be any product, service, space or material that a group of people share. When more and more is shared, the less there is a need to

build new buildings or produce new products. As a result, less virgin material is being extracted and the amount of waste will be reduced. Since waste reduction is linked to CE, the sharing economy can be also put under the CE umbrella. (Korhonen, Honkasalo, Seppälä 2018, 41)

### **2.3 Barriers and enablers of CE**

The barriers that prevent companies from moving towards circular economy is a topic that has not yet been fully discovered. To support the implementation of circular economy within companies and in the society, it is important to have a clear understanding of what kind of barriers they are facing and how to overcome them. With a better understanding of the barriers, it is easier to provide solutions on how to move towards CE. (Ritzén & Sandström 2017, 8)

Ranta, Aarikka-Stenroos, Ritala and Mäkinen (2017) explored the drivers and barriers from a region-specific point of view and Kirchherr et al (2018) made an extensive study that discovered the barriers based on the views of firms, academics and politicians in the EU area. Ghisellini, Ripa and Ulgiati (2018) made a literature review of CE and construction and demolition waste to find out about the impacts of adopting CE in the construction sector and to find the barriers that are preventing the adoption of CE for construction and demolition waste.

There are multiple theoretical frameworks applied to CE barriers and drivers. In de Jesus and Mendonca's research the barriers and drivers of CE leaned on innovation theory and categorized the barriers and enablers based on the concept of "hard power" and "soft power". Thus, the study divided the barriers and enablers into "hard" (economic, technological, market related) and "soft" (social, cultural related). The study concluded that the hard barriers are inhibiting the transition to CE the most and that the soft drivers are the most important accelerators (de Jesus & Mendonca 2018, 77-78 & 85)

Ranta et al (2017) based their research framework for circular economy barriers and drivers on institutional theory. They studied the barriers and drivers of circular economy both in general and regionally among 6 large companies from Europe, China and USA. The drivers and barriers were categorized based on institutional theory to regulative, normative and cultural-cognitive pillars. (Ranta et al 2017, 71)

Tura, Hanski, Ahola, Ståhle, Piiparinen & Valkokari created a new framework for CE drivers and barriers. The framework is based on previous literature on CE barriers and drivers as well as empirical research in four companies. The framework could be utilized by both businesses and scholars to better understand the factors that either promotes or prohibits CE. (Tura et al 2019, 96) The framework divides the barriers and drivers into seven different categories: environmental, economic, social, institutional, technological and informational, supply chain and organizational factors (Tura et al 2019, 92).

In much of the previous research, the circular economy barriers have often been considered as mainly technological, which means that the technology needed for CE does not exist yet and that the successful implementation of CE requires new technical solutions (Kirchherr et al 2018). However, some studies (e.g. Kirchherr et al 2018, Ranta et al 2017, 70) have shown that there are not noticeable technical barriers and the technology needed for CE implementation already exists.

Da Rocha & Sattler (2009) conducted a case study on factors that influence the reuse process in the demolition sector in Brazil. By using supply chain management approach they recognized four types of opportunities and seven types of barriers that either enhance or hinder the reuse process. The barriers that they recognized were lack of trust in the quality of reused products, inconsistency of the quality and quantity of the products, lack of knowledge, regulation and taxes, and too many stock points where to store the demolition materials. (Da Rocha & Sattler 2009, 109-111)

Kirchherr et al (2018) conducted an extensive study of 47 expert interviews and 208 surveys from businesses and politicians and divided the barriers into technological, cultural, market and regulatory barriers (Kirchherr et al 2018, 267). The study clearly showed that the technological barriers are not important unlike many studies before have considered. Instead, the most significant barriers were cultural, regulatory and market related barriers. In fact, the surveyed companies considered that they already have the technology that is needed for CE. The cultural barriers were the most significant ones and three out of the five most powerful barriers were cultural. Also, market and regulatory barriers were important, as it was shown that there is no demand for CE yet and that the current regulation prohibits companies from moving towards CE. (Kirchherr et al 2018, 267-269)

#### **2.4 Sustainability and CE in Construction Sector**

As discussed before, the construction sector is an economically important sector in EU area, as it accounts for around 9% of the EU's GDP and provides 18 million jobs (European Commission 2018c). From an environmental perspective, the sector is responsible for the largest waste stream in the EU and buildings in the area are responsible for 35% of EU's total greenhouse gas emissions. (European Commission 2018b, European Commission 2018a)

By its nature, the construction industry is a resource-heavy and unsustainable sector, since it requires a large amount of natural resources and produces a significant amount of waste. On top of this, the buildings in the EU take a share of 40% of the final energy consumption in the area. (European Commission 2018b) Construction sector is responsible for almost half of all the raw material extraction of the world. Not only does the sector use a notable amount of the world's natural resources, it also produces a large amount of waste at the end of the line. According to European Commission, currently construction and demolition waste represent 25-30% of all waste generated in EU area. Many of these waste materials, such as

bricks, concrete, wood and glass could be recycled or reused. (European Commission 2018a)

As the waste stream from C&D waste is the largest in the EU area and the construction sector is responsible for a significant amount of the greenhouse gas emissions, the European Commission is willing to make the sector more sustainable. They believe that a sustainable construction sector would contribute to achieving the EU's emission reduction goals. In 2008, the European Commission set the Waste Framework Directive 2008/98/EC with a goal for recycling/re-using 70% of all the C&D waste by 2020. This was followed by the Commission's Construction 2020 Strategy in 2012. It was discovered, that the sector is facing a number of structural problems that requires policies to support the change towards sustainability. (European Commission 2012, 2-3, 13)

The European Commission has published Construction and Demolition Waste Protocol and Guidelines that aim to gain more confidence in processing C&D waste and build trust towards recycled construction materials in the industry. The protocol and guidelines have gathered some of the best practices in C&D waste management from the EU that can be utilized in other countries as well. Some EU countries already recycle 90% of their C&D waste but others only 50%. (European Commission 2018c)

As institutional theory has been adopted by a large number of research papers in explaining the process of moving towards circularity both from a business model and conceptual perspective, it will be utilized also in this study. The framework will be based on institutional fields, which are discovered more in detail in the next chapter.

When it comes to circular economy in the construction sector in the EU, The Netherlands has been often considered as one of the forerunners and they are

following EU:s guidelines on C&D waste closely. There has been a landfill ban since 1997 for those C&D materials that could be recycled and due to this, 95% of C&D waste materials are currently recycled or reused in the Netherlands. However, downcycling of the materials is common in the Netherlands and EU as a whole, which means that they lose much of their original value when being recycled. (Jahren & Tongbo 2014,189; Coelho & de Brito 2011, 384, Adams, Osmani, Thorpe, Thornback 2017, 18) Furthermore, in the European Commission's C&D Waste Protocol from September 2016 there are a number of "best practices" examples from the Netherlands. The high recycling rate can be seen for example in how almost all the old asphalt is used for making new asphalt. It is also common to recycle wood, although most of it is used for energy production. The Netherlands also recycles flat glass, PVC windows, gypsum, PVC pipes and roofing material (bitumen). However, there are still many other materials that are more difficult to recycle and therefore are not being recycled yet. (European Commission 2016b,37-38)

Despite the high recycling rates of C&D waste in the Netherlands and European Commission's focus in CE, there is a lack of knowledge and awareness about CE in the construction industry (e.g. Adams et al 2017, 18-19; Ghisellini et al 2018, 637). It seems that in the construction industry CE is often discussed only from the recycling perspective: according to Ghisellini et al (2018, 624), most (69%) of the current literature on CE & C&D waste is focused only on the recycling principle and neglecting the reuse and reduce principles (3R principles of CE: reduce, reuse, recycle). Only 3% of the reviewed studies take into account all the three principles.

Even though CE per se is a new concept in the construction sector, sustainability issues, especially from the environmental viewpoint, are not. Life cycle assessment (LCA) and material flow analysis (MFA) are examples of sustainability-related frameworks that are widely used in the sector and could be linked to CE research in construction (Pomponi & Moncaster 2017, 712). Usage of environmental certifications is also common: LEED and BREEAM are globally two of the most

popular green building indicator systems in the sector (Aaltonen, Määttänen, Kyrö & Sarasoja 2013, 331). Globally, the World Green Building Council (World GBC) with its network of 70 countries supports the movement towards green buildings and aims to make the buildings and construction industry more sustainable (World Green Building Council 2019).

GBC Finland, the local member of the World GBC network in Finland, has a goal of taking sustainability as a natural part of all operations in the buildings and construction sector. They aim to increase sustainability-related knowledge in the sector and ensure that there are enough information and tools to implement eco-efficient solutions in the sector. GBC Finland has adopted CE as one of the centers of their 2018-2020 strategy: it aims to concretize what CE in construction sector means and encourages the businesses in the sector to develop and introduce new CE solutions. (GBC Finland 2019a)

As a core of GBC Finland's CE strategy is the so called "Circular Economy Sprint", "Kiertotaloussprintti" in Finnish which started in March 2018. In the Circular Economy Sprint the aim is to bring together businesses, scientists and municipality advocates to create understanding and solutions of CE in the buildings and construction industry. The sprint began by defining objectives for CE and by building solutions that would help in achieving those objectives. In 2019 the aim is to implement those solutions into the buildings and construction business. (GBC Finland 2019b)

GBC Finland defines, that in the buildings and construction industry *"the circular economy refers to an operating model adopted by the industry and policies supporting the model"*. They emphasize the industry's CE role in the promotion of sharing economy and renewable energy. One of the key objectives of Circular Economy Sprint was to create objectives and give concrete suggestions on measures that could be taken in the industry to move towards CE. A group of experts took part in defining these measures. Seven different CE targets were defined: to

have a shared objective for contributing to circular economy in the industry, to have a legislation which drives towards CE, to reshape the industry's practices towards CE, to have life cycle thinking as a starting point in infrastructure and building construction, land use and zoning contributing to CE, to develop the purchasing and procurement processes towards CE and finally to have all the spaces in an efficient use. (GBC Finland 2018)

As the GBC Finland's focus on CE shows, the buildings and construction industry is willing to take steps towards CE. The guidance and means that GBC Finland is providing to the businesses are important and to be able to fully implement CE in the industry it is crucial to understand what types of barriers may lie behind the industry's movement towards circularity.

### **3 THEORETICAL FRAMEWORK**

The theoretical framework of this thesis will be linked to institutional theory, and more specifically to the concept of institutional fields. The institutional fields theory will be thus the main theory that aims to explain the reasons behind why these certain barriers exist and to help in grouping them.

#### **3.1 Institutional Theory**

Institutional theory is a field of organizational sociology that gained popularity in the 1980's (Scott 2008, 427). The institutional theory provides an institutional perspective to organizational behavior. It aims to explain the similarity in different organizations' behavior by concluding that the patterns and decisions of the organizations are shaped by institutions. (Friedland & Alford 1991, 243) Organizations seem to adopt similar practices since they are considered generally

acceptable and are thus afraid to diverge from the generally accepted rules and norms (Diogo, Carvalho & Amaral 2015,114).

There are multiple different approaches to institutionalization and institution and thus there is no unified definition. It is important to understand that the approaches in institutional theory vary and that the lack of a universal definition is not a weakness. (Scott 1987, 493 & 509) DiMaggio & Powell (1983) aimed to explain companies' similarity in their responses to organizational change through the forces which guide them. They divided the isomorphic mechanisms behind organizational change to three different forces: mimetic (responses to general uncertainty), coercive (related to politics and legislation) and normative (how professionalization shapes the organizations). In empirical setting, these three forces may be mixed with each other but their setting originates from different sources and they all may also lead to different outcomes. (DiMaggio & Powell 1983, 150-152)

Following the above mentioned DiMaggio's and Powell's distribution of mechanisms to isomorphic change, Scott divided the institutional processes to normative, regulative and cultural-cognitive elements (Scott 2008, 428). These three elements, also known as "three pillars of institution", are considered as the essential building blocks of institutions. The regulative pillar is associated with rules and regulations that shape the behavior. The regulative values are considered as high values, whereas normative and cultural-cognitive values are seen as lower-values. The normative pillar is the social dimension of institutional theory: it concerns the norms and values that are seen as socially acceptable and appropriate. (Scott 2014, 59-60 & 64) Finally, the cultural-cognitive pillar's elements are "the shared conceptions that constitute the nature of social reality and create the frames through which meaning is made" (Scott 2014, 67).

The Scott's division to the three pillars of institution has been utilized in multiple CE-related research, for example in the previously mentioned Ranta et al (2017) study. Ranta et al utilized Scott's framework in their study on CE barriers and drivers, since

they regarded that by dividing them to regulative, normative and culturally cognitive pillars it allows them to better distinguish which institutional indicators are behind those barriers and enablers (Ranta et al 2017, 71).

Other examples of CE-related studies that have utilized Scott's three pillars of institution-model are for example Levänen, Lyytinen & Gatica's (2018) case study on CE business models and of the institutional environments that shape them in Finland and Chile, and Stål & Corvellec (2018) research on circular business models and their incomplete implementation in Swedish apparel firms. By developing a framework that combines the concept of business model and institutional theory, Levänen et al utilized the Scott's three pillars-model to explain the institutional drivers and voids for circular business models of batteries recycling in Chile and Finland. By combining institutional theory and business model concept in CE context, the framework enables an analysis of the interaction between business activities and institutions. (Levänen et al 2018, 154)

Similarly, Stål & Corvellec combined the three pillars-model with business model concept to understand why companies introduce circular business models but do not fully implement them. According to the results of their research, different institutional processes (regulative, normative and cultural-cognitive) at the same time both guide companies to adopt circular business models and on the other hand hamper them. (Stål & Corvellec 2018, 637-638)

As these examples show, institutional theory has been utilized in CE-related research in describing the institutional processes that enable or hamper the adoption of circularity in businesses. The framework of this thesis will be built on the concept of institutional field, which is presented in the next chapter.

### 3.2 Institutional Fields

Institutional field is one of the most important levels of analysis on institutional theory (Zietsma, Groenewegen, Logue, Hinings 2017, 391). According to Scott (2014, 219) an organization field, is the most important concept in “understanding institutional processes and organizations”. It is a broadly accepted, but also a contested concept, as so many other concepts under institutional theory are (Scott 2014, 219). DiMaggio & Powell (1983,148) define that an organizational field consists of “those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products”. The structure of an organizational field is institutionally defined (DiMaggio & Powell 1983, 148) and organizations often belong to several different types of fields (Scott 2014, 224).

The roots of field theory are in physical sciences, where it originates from the 18<sup>th</sup> century’s fluid mechanics. The concept of a field has emerged for example in electromagnetics (electromagnetic field), where it is related to relations between elements and changes in their states. (Martin 2003, 3-4) The field theory has been applied to social sciences in different ways, and although there are some limitations to its application on social sciences, there are also remarkable advantages. Three main directions of field theory in social sciences are socio-psychological fields, fields of stratification and domination, and fields of interorganizational relations (institutional fields). (Martin 2003, 14)

The framework of this thesis will be based on Zietsma, Groenewegen, Logue and Hinings’ article (2017) on institutional fields, as the field-level of analysis will be helpful on understanding in which types of fields the barriers are formed. Zietsma et al (2017) systematically reviewed previous literature and empirical research on institutional fields and identified two types of fields: exchange fields and issue fields. Three subtypes for each field were also found: industry, professional and social movement exchange fields, and competitive, interstitial and bridging issue fields.

The subtypes and their key characteristics can be seen in Figure 2.

Exchange fields are fields that consist of the focal field members and their exchange partners such as customers or suppliers. The members of an exchange field share the same norms and values as they are mutually depended on the conditions that their common exchange partner set. (Zietsma et al 2017, 396-397) Issue fields are formed around a certain issue, not exchange partners. The focal population in the issue fields is often diverse and the members of the fields share a common interest in a certain issue and the “focus of orchestration of issue fields is to negotiate, govern, and/or compete over meanings and practices that affect multiple fields”. (Zietsma et al 2017, 400)

The subtypes of exchange fields are based on the nature of the focal population. Industry exchange fields consists of members from the same industry. The boundaries of industry exchange fields are loose, meaning that it is easy to enter the field. The exchange among the interaction members is coordinated and the members compete but also follow each other on business practices and technologies for example. The competition causes the population of the industry exchange field to adopt new innovations regularly but also to diffuse those innovations fast. (Zietsma et al 2017, 398)

Professional exchange fields are comprised of professionals of the same occupation and their interaction partners, for example the companies they work in or policy makers. There is a strong control of practices and norms among the field members, boundaries are strong and not easily accessed by new entrants. The level of homogeneity is high and thus innovations are not as common as for example in industry exchange fields. The structure of the field is hierarchical and it adopts change slowly. (Zietsma et al 2017, 398-399 & 412)

The last subtype of an exchange field, the social movement exchange field, is formed by a shared agenda or an ideology. They consist of all the members that

share the same agenda and/or aim to advance that agenda or ideology. The boundaries of social movement exchange fields are loose, practices and norms are varying, and the structure is not hierarchical. How new practices diffuse varies remarkably. (Zietsma et al 2017, 399-400)

The actors of issue fields are normally more diverse than those of exchange fields, since they share a common issue. Yet, the issue may have a different meaning for different actors and conflicts are more common than in exchange fields. Competitive issue fields consist of a group of actors that together aim to change an existing exchange field. They are contested by nature and can consist of a social movement population that seeks to challenge an industry exchange field for example on environmental issues. The boundaries of competitive issue fields are changing when the practices and jurisdictions of the field are contested. The different actors compete over dominance of the certain issue. (Zietsma et al 2017, 400-401)

Interstitial issue fields are the positions that intervene or overlap with different types of institutional fields. The issues of the interstitial fields concern several different kinds of institutional fields. Because of the great number of different field members in interstitial issue fields, there is not much competition on dominance and the fields are typically easy to enter, boundaries are loose. Over time a shared identity emerges, the institutional infrastructure of the interstitial issue fields stabilizes, and the field may become an exchange field. (Zietsma 2017, 401)

Bridging issue fields exist around issues that are cross-jurisdictional by nature. The bridging issue field is comprised of actors of at least two interacting fields. Typically, bridging issue fields have a boundary organization that connects different fields on a common issue and thus the boundaries are formalized. The bridging issue fields often exist for a longer time period unlike interstitial and competitive issue fields which are normally temporary. (Zietsma 2017, 402)

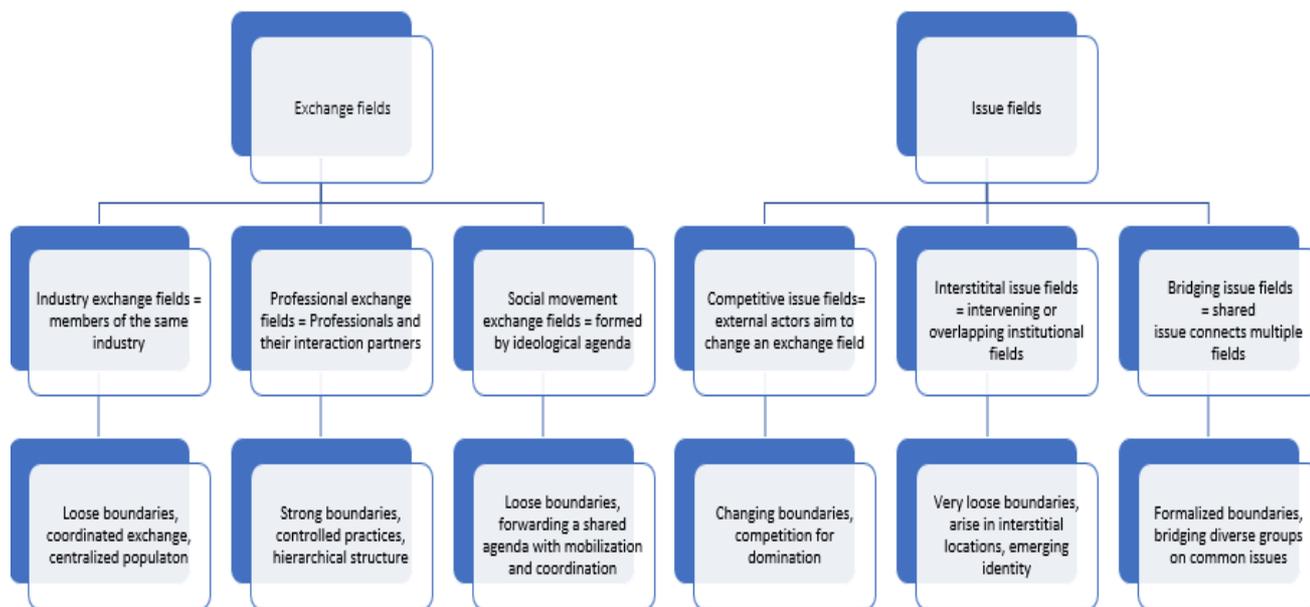


Figure 2 Subtypes of exchange fields and issue fields and their key characteristics (Based on Zietsma et al 2017, 396-402)

According to Zietsma et al (2017,410), when change within a field is happening, “field elements are tugged and pulled between the interests of competing actors and are likely to be characterized by disjunctions, oscillations, reversals of directions, and other processes like these.” As the actors of an industry exchange field tend to both follow each other and compete, change is common, as the actors search for new, superior practices and norms (Zietsma et al 2017, 410).

Zietsma et al conclude, that many contemporary issues such as climate change, cannot be resolved within one field, but the issues must be analyzed in multiple fields, and thus interfield cooperation is needed. Their work on institutional fields may be used to understand how field to field interactions can create shared agenda, meanings or norms which may either hamper or further change. (Zietsma et al 2017, 424) In this thesis the framework will be utilized to build on the idea on how barriers to change from linear economy to a circular economy are formed.

## **4 RESEARCH METHODOLOGY AND DESIGN**

This chapter presents the reasoning for choosing the research method, explains how the interview questions were chosen and designed, takes a closer look at the data collection and analysis and finally discusses the reliability and validity of the thesis.

### **4.1 Research approach and research methods**

The purpose of the thesis is to find and discover the barriers and challenges that slow down or hinder the movement towards CE. Thus, qualitative research was chosen since qualitative research allows you to make in-depth studies (Yin 2016, 6) and the purpose of the thesis was to gain a profound view on the participants' thoughts and perceptions on CE barriers in the industry. The research approach in qualitative research is inductive, since the purpose is to "develop concepts, insights, and understandings from patterns in the data rather than collecting data to assess preconceived models, hypotheses or theories" (Taylor, Bogdan & DeVault 2016, 8).

The chosen research method was qualitative, semi-structured interviews. Unlike structured interviews, the qualitative, semi-structured interviews provide the possibility for conversational discussion. They consist of mainly open-ended questions that allow the participants to answer in their own words. The qualitative interviews do not follow a strict script and the structure of the interview may vary depending on the participant. (Yin 2016, 142-143) According to Barriball & While (1994, 330) the semi-structured interviews allow the researcher to explore and acquire more information, and they should be used, when the purpose is to examine the opinions and impressions of the interviewee on "complex and sometimes sensitive issues". The reasoning for choosing qualitative interviews as the research method was to get a deeper understanding on a sensitive and complex issue: why the construction industry is falling behind in circular economy. The interviews

enabled a discussion-like approach to the issue and arguably increased the interviewees' awareness and interest on CE.

Some of the interviewees wished that the interviews could be conducted as group interviews, since they felt that in group interviews, they could provide more broad information on the barriers and supplement each other as some of the participants had less knowledge on CE than others. According to Yin (2016, 149), "group interviews are desirable when you suspect that people may be more readily express themselves when they are part of a group" and thus as the participants wished so, it was decided that two interviews will be conducted as group interviews: one of the group interviews had three participants and one two participants. They were contacted face-to-face at the companies' headquarters. The group interviews were conducted by giving turns to each participant to ensure that all the interviewees in the group interview gave their view on each of the questions.

On top of the two group interviews, seven one-on-one interviews were conducted. Two of the seven one-one-one interviews were conducted as video-call interviews through Skype and five of the interviews were conducted face-to-face in the headquarters of each interviewed company or organization.

## **4.2 Design of the qualitative interviews**

The design of the qualitative interviews differed slightly depending on whether the interviewees were professionals working in construction companies or specialists from NGO's. The interviews were conducted in Finnish as all the interviewees were Finnish-speaking. The company interviews were executed first and therefore they were designed before designing the questions for the specialist-interviews. As the interviews were anonymous, there were no demographics-related questions.

In all the interviews the purpose of the interview questions was to first discover construction sector and its relationship with sustainability in its entirety, examine each company's or NGO's attitude towards sustainability and CE, find out about the potential road blockers and contributors to CE and finally define each interviewee's view of CE or the future of construction sector. In the company interviews there were also some examples of the potential barriers to CE (based on previous literature on CE barriers) and each interviewee was asked to give their opinion on whether they consider this specific barrier as a threat in construction sector too or if it had been overcome.

Since the specialists had broader information about construction sector and CE than the company representatives, they were designed slightly differently. Unlike the company professionals, the specialists were asked about organizations they believe either hinder or advance the movement towards CE and more about the current situation of the construction industry in relation to sustainability/CE. The focus was not on discovering each NGO's relationship with sustainability or CE, but on finding out where construction sector is currently at in relation to CE.

There was also a varying amount of free discussion related to the topic of CE in all the interviews. This free discussion was formed spontaneously during the interview due to each interviewee's high level of interest in CE. In some cases, the free discussion also formed some spontaneous new questions from the interviewer side.

#### **4.3 Target sample**

The target sample of the thesis was professionals from large for-profit businesses and specialists of NGO's operating in construction industry in Finland. Altogether 12 people were interviewed. The interviews were conducted between November 2018 and March 2019 and the length of the interviews was between 25 and 100 minutes. All the interviews were audio-recorded and later transcribed.

Nine of the interviewees were from five different for-profit companies in construction sector and three interviewees were specialists from different institutions in construction industry: one was from Green Building Council Finland, one from Sitra and one from The Confederation of Finnish Construction Industries (RT). Four of the five for-profit companies were large construction companies in Finland and one of the companies was a large consulting company operating in construction business. The definition of a large company was based on Statistics Finland's definition on the size of a small or medium-sized enterprise (SME). According to Statistics Finland, an SME is a company which has less than 250 employees and a revenue of maximum 50 million euros a year (Tilastokeskus). As all the interviewed for-profit companies were bigger than this, they were defined as large.

When approaching some of the first interviewee candidates, the candidates asked if the interviews could be conducted anonymously due to the sensitivity of the topic. For the results of this study it was not necessary to reveal the names of the interviewees or the companies. Thus, it was decided that the research can be executed anonymously, since it would most likely result in more honest answers. Also, other factors that could reveal the identity of the interviewee – for example title, age or any other demographics-factors, were left out.

Although the demographics-factors or any other company-related factors than their size cannot be revealed in order to not recognize the interviewees, some information can be reported about the sample in order to evaluate its representativeness. Some of the interviewees were environmental managers or otherwise in contact with environmental/sustainability issues. There were also for example project managers, planners, development managers and consultants – a wide range of people from different positions were interviewed. There was a same amount of men and women in the sample: 6 men and 6 women were interviewed. As the company interviewees represent some of the largest companies in the construction sector, it can be estimated that the sample represents the view of construction sector in Finland among large companies.

The objective was to get 4-6 case companies, 2-3 interviewees from each company, and at least two specialists from different NGO's. As altogether 12 people from 5 different for-profit companies and three NGO's were interviewed, the objective in terms of the total number of interviewees was met. However, from two for-profit companies there were only one interviewee. This was due to the problems related to long response times from the company side and it was difficult to get even one interviewee from the companies. Almost all the interviewees had to be asked about the interview possibility for multiple times before they responded.

The reasoning for selecting only large companies for the sample was that they most likely will have at least some knowledge on circular economy, unlike very small companies might have. They were also considered to have a more diverse background and a more versatile view of construction sector in Finland than small companies. The specialists were interviewed to see if their views on CE barriers differed from the views of the for-profit company interviewees and to gain information from a more diverse background. Moreover, it was considered that the specialists could provide more neutral information about CE than the company representatives.

#### **4.4 Validity and reliability**

According to Yin (2016, 88), the validity in qualitative research is related to the trustworthiness of the study and its findings' applicability to the real world it has studied. Understanding the validity of the knowledge in a qualitative study is essential for anyone doing qualitative research (Myers 2013, 36).

As already mentioned in the previous chapter, it was decided to keep the study anonymous to get more truthful answers. The topic of CE barriers might be difficult to company professionals, since they are representing their companies and might

not therefore give truthful answers. Thus, the anonymity of the research was important factor for the trustworthiness of the answers.

In some cases, it seemed, that the interviewees did not understand the concept of CE in its entirety. Although in the beginning of the interview it was always explained in short what CE is about and asked if interviewee understood the concept, it seemed that some associated CE mainly with recycling. For example, one interviewee who was working with zoning and planning, commented that *“Zoning is not associated with circular economy, since zoning is only about what kinds of areas will be zoned. It’s not about building itself yet.”* However, as one of the targets of GBC Finland is the contribution of land use and zoning to CE (GBC Finland 2018), it seems that the interviewee in question did not understand CE in its entirety and associated it only with material flows and recycling.

The interviewees’ lack of understanding on CE could have therefore affected the validity of the research. However, most of the interviewees seemed to quite clearly understand the concept of CE and the level of understanding was not considered as an important factor for getting reliable results, since a low level of understanding on CE could be also seen as a barrier to CE. Overall, if only CE/sustainability specialists had been interviewed for the thesis, the viewpoint to the barriers would have been quite unilateral.

The semi-structured interview design allowed discussion and an informal setting, which was essential for ensuring the validity of the results. They also enabled the researcher to ask clarification or additional questions if it was not clear what the interviewee meant. Structured interviews would not have provided the same possibility to clarify and discuss. Thus, the design of the interviews ensured that the results are applicable to real world.

#### **4.5 Analysis of the qualitative interviews**

In a qualitative analysis the purpose is to combine the observations of the data to form rules or patterns, which can be applied to the whole data. The data can contain some anomalies, but the purpose is to find similarities: if several informants provide similar answers regardless of each other, the data can normally be considered trustworthy. (Alasuutari 1999, 40-41)

The transcriptions of the interviews consisted of altogether 120 pages of text. The transcriptions were written similarly to the interview-situation: all the pauses and reflections were also written down. The transcriptions were coded to find meaningful patterns in relation to the objectives and research questions of the thesis. Similarities, differences and topics in the participants' narratives were identified and interpreted. The utilized coding technique was content analysis, According to Mayring (2000, 4), in developing categories for a qualitative inductive content analysis, the idea is to "formulate a criterion of definition, derived from theoretical background and research question, which determines the aspects of the textual material taken into account". The coding was executed manually by highlighting the different categories with different colors.

In the coding of the data it was kept in mind that the purpose is to find the institutional fields that exist in the construction sector and thus the categories were chosen accordingly. The coded data was first categorized into six different categories: interviewees' understanding of CE, characteristics of companies operating in construction sector, circular economy or sustainability in the construction sector currently, barriers to circular economy, enablers/contributors to circular economy, future of construction sector and the role of EU/regulations. As changes in regulation is one enabler for field-level conditions (Battilana & D'ahunno 2009, 39), the role of regulation was kept as its own category.

After coding the data into the above mentioned six categories, the data was coded again. This time the contents of the data were underlined and highlighted with different colors again to find out similarities in the data. This was utilized to see which barriers appear most often, how could the barriers be overcome, what are the typical characteristics of construction companies and what kinds of steps towards CE have already been taken. The research questions were kept in mind when coding the data for the second time.

Finally, the data formed categories that were then used for analyzing the results. The categories are also used when presenting the results of the study in the next section.

## 5 RESULTS

This chapter will present the results of the analysis. It will present the coded data based on the categories that were made, which are essential in understanding the characteristics of construction sector as well as to find the institutional fields in which the barriers are forming, and which institutional fields would be needed to advance the movement towards CE. The first section focuses on the characteristics of construction sector, the second section centers upon the sustainability and CE of construction sector, third section focuses on the barriers, fourth on the drivers and the fifth and final section on the future of construction sector.

### 5.1 Characteristics of construction sector

All the interviewees considered, that large companies in the construction sector resemble each other. The large companies have similar operations, they are driven by the same laws and regulations and the investors ask for consistency, which have made them to become fairly similar to each other. Interviewees also mentioned that the emphasis of the sector has traditionally been work safety, which has dictated the business operations. As the company interviewee 9 put it, *“Safety has always been the most important issue in the construction sector, naturally, because in the past there have been many work accidents. The priority has always been “safety first”, also from the perspective of sustainable development.”*

However, according to the interviewees, the size and the ownership structure of the companies (whether they are domestic, international or Nordic) makes them different. Most of the companies in construction sector are small companies (Rakennusteollisuus RT Ry) and the interviewees mentioned that the small companies operate differently from the large companies and that there are also more differences among small construction companies than among large construction companies. According to Interviewee 4 from the consulting company, *“Among SME’s the operations and practices vary a lot. The smaller the size, the*

*more differences there are in the business practices". Interviewee 3 brought up, that small companies are more flexible than large companies and that "specialization starts with the small companies".*

The ownership structure brings more similarity to businesses that are under a similar ownership. The specialist from GBC Finland said, that *"Large companies like NCC, Skanska, are under a Nordic ownership and in my opinion this ownership has brought similar business culture to them. If you compare those under a Nordic ownership to those that are under a Finnish or a Russian ownership, there are some cultural differences. Yet, the Finnish legislation and conventions drive them to similar solutions".*

Thus, despite of some cultural differences among companies under different ownership, the construction sector in its entirety is a heavily regulated sector governed by legislation and contracts, which makes the companies similar. Interviewee 8 also mentioned the strong bond between the businesses and their stakeholders which makes the companies similar *"Everything that happens in the sector is immediately linked to many stakeholders: building control, material suppliers, contractors..."*

Interviewees noted, that construction sector is quite conservative and adapts to change slowly. RT's specialist commented, that *"We are no forerunners. We do not make any big leaps or much extra. Everything comes from legislation, that is where we look for new solutions".* Similarly, company interviewee 6 mentioned, that *"The issues that we all are dealing with are similar and I have not heard that there are any great differences among the companies or that there would be some forerunners".* All in all, the interviewees considered, that none of the companies in the sector really stand out, although the specialist from Sitra noted that *"Every sector in the society has forerunners, and so does construction sector. Yet, the sector is slightly conservative and does not move forward rapidly".*

To conclude, the key characteristics of construction sector are it is heavily regulated and thus driven by regulations, it is conservative and adapts to change slowly. There are no forerunners worth mentioning and work safety has been traditionally important in the sector. Companies, especially large ones, are similar to each other by their company culture and operations. The sector has many small businesses and they differ from each other a lot, although they are also under the same rules and regulations which guide them.

## **5.2 Sustainability and CE in the construction sector**

According to the interviewees, environmental issues are and have been an important part of operations in the construction sector. Four of the five interviewed companies had sustainability as a part of their strategy. Nevertheless, when it was asked if the companies already had sustainability as a part of their operations or strategy and if they had taken any steps towards CE, it could be seen that the steps were still quite small, and legislation determines how much the companies do.

Overall the construction companies seemed to have a more positive view on the sustainability of the sector than the consulting company or the specialists, which might be related to the companies seeing their own operations in more positive light. For example, interviewee 4 from the consulting company said, that *“I haven’t seen any giant leap towards sustainability in the sector in the past ten years. We have a couple of big companies that have their own environmental managers and they think about responsibility a bit, but it’s still very much secondary. We still have an enormous amount of waste. If we put emphasis on environmental viewpoint, it’s probably something like 1%”*. Contrary to this, interviewee 7 mentioned, that *“sustainability has been a part of all our projects for a long time already”*.

As already discussed in the previous section, construction sector is heavily regulated and thus there are also several environmental regulations, that guide the

companies' operations. The regulations come from EU level. Like RT's specialist said, *"It's good to remember, that Brussels monitors our legislation"*. Businesses have also taken actions beyond legislation, which means that they understand the benefits of sustainability. *"Many feel that environmental matters are extra work. Building is so heavily regulated, and every extra decree or norm causes extra work. Sometimes in the construction sector it might be difficult to see how certain norms contribute to the issue they are said to contribute to. Traditionally environmental matters have been thought as a burden, but more and more companies are turning them into a business advantage"*, as GBC Finland's specialist put it. The fact that 4 of the five companies had sustainability somehow as a part of their strategy, shows that interest towards sustainability is growing.

Circular economy was still something quite new to the companies, although some of them had taken small steps towards CE. Three companies had had projects, where CE played a role and others had cooperated with CE businesses. Many talked also about so called material efficiency, which is important in the construction sector since it is a materially intensive sector. Sitra's specialist mentioned, that a lot has changed in just 2-3 years and that the sector is actively developing circular economy criteria for their own sector. 60 specialists from the construction sector have taken part in the Kiertotaloussprintti (circular economy sprint) project, so it clearly shows that interest towards CE has arisen. RT's specialist mentioned a couple of examples of businesses in the construction sector that have already changed their operations towards CE: a company called Rudus makes CE-certified crushed stone from recycled concrete and tiles, Tarpaper Recycling makes asphalt material from roofing felt waste. The city of Helsinki has a "mass coordinator" (massakoordinaattori in Finnish), whose job is to utilize the stone aggregates and granular soils from the city's construction sites in other construction projects in the city. Thanks to this, the city has saved millions of euros and tons of CO2 emissions (Saarinen 2018). According to RT's specialist wood is the least recycled waste material in the construction sector, almost all the other materials are recycled at least to some extent.

Although some small steps towards CE have been taken, as GBC Finland's specialist put it, *"circular economy in construction sector is clearly something for the future, not today's everyday business"*. This was also confirmed by almost all the other interviewees, for example Sitra's specialist, who brought up that *"Some steps towards circular economy have definitely been taken, since waste reduction can be considered a part of CE. Yet, there is still quite a long way to go to have it in all the operations of the companies. Globally only 9% of used materials end up being used again and buildings have a massive amount of materials in use."*

### **5.3 Barriers of CE**

In the 8<sup>th</sup> question (9<sup>th</sup> question in the specialists' interviews), the interviewees were asked: "Despite the construction sector's clear potential for CE it seems to be quite an unknown concept in the sector. What do you think are the reasons why great steps towards CE are yet to be taken?". Since the company interviewees were thought to have less knowledge on CE than the specialists, on top of this question they were also asked if they think certain barriers appear also in the construction sector and if so, how do they occur. These barriers were: technological barriers, lack of demand, company culture, costs, bad image of recycled materials and lack of knowledge/education. Those barriers were chosen based on the previous research on CE barriers to see if similar barriers appear in construction sector too.

The barriers that appeared in almost all the interviews were: legislation, lack of knowledge/education, lack of demand and bad image/client's fear of using recycled materials. Also lack of time in the projects, lack of storage space for the waste materials, lack of interest in environmental issues, company culture, lack of networks and guidance on CE, conservative character of the sector, lack of availability of reused materials and lack of economic incentives were mentioned as barriers. No one considered lack of technology as a barrier, which is in line with the recent studies on CE barriers that were discussed in the literature review.

Most of the interviewees mentioned the legislative barriers as the most pressing barriers. Since construction sector is a heavily regulated sector, legislation is also needed to guide the sector towards CE and take new practices into use: *“When things are not compulsory, the movement is slower”* (interviewee 9). Moreover, the current waste legislation often prevents the usage of construction and demolition waste as building materials. In addition, only CE-certified materials can be used in construction, so the recycled materials would need a CE certification before they can be used.

The legislation barrier contributes to other barriers too. It has especially contributed to the bad image of waste materials in the sector. As interviewee 8 put it, *“The waste image is hard to overcome. People are afraid that the technical features of recycled materials are worse than those that have been made from virgin materials and that they have some harmful substances in them. But this fear comes simply from legislation: it is not allowed to use recycled stone aggregates or granular soils under buildings. People are afraid, that these recycled materials might have something harmful in them. It’s a huge fear that also policy makers share.”* Since legislation does not often allow the usage of the recycled materials, people are afraid to try out anything new. Clients are afraid to order the buildings that use recycled materials or materials made from waste, especially when they are so called “one-time builders” and make that huge investment only every twenty years or so. GBC Finland’s specialist speculated, that *“There is a lot of discussion on the bad quality of the air inside and construction defects that companies have to deal with daily. That’s why they would rather use solutions that have been tested already and don’t want to take any risks. So, in a way, the sector’s ability or unwillingness to take risks is also a barrier”*. It was also discussed that the material cycles in the construction sector are so long that it is important to avoid risks: *“It’s not like deposit-based bottle return system where new materials can be easily experimented”*.

Almost all the interviewees mentioned lack of knowledge or education as a barrier: *“Ignorance or simply the fact that there is no information available”* (interviewee 3), *“Lack of knowhow and cooperation is the most pressing barrier”* (interviewee 6),

*“Lack of education is always a problem. Circular economy as a term is unknown to many”* (interviewee 8), *“One of the biggest problems is that we don’t know what is in use and where it is in use”* (Sitra’s specialist). Related to this was also communication: companies have had some CE projects, but do not communicate about them so no one knows that there have been some successful attempts to make the sector more circular. The lack of knowledge exists both on client and company side: *“Also municipality clients would need education and knowhow, as well as certainty, that this will work”*. More research on recycled materials would be needed to better understand what could be made from waste. As the sector is not willing to take risks, the safety of the materials should be ensured by research and certifications.

Lack of demand was considered as a barrier by most of the interviewees. Interviewee 9 did not see demand as a barrier as such and considered that the lack of demand is more related to the legislation which restricts the demand. RT’s specialist did not mention demand as a barrier either. Nevertheless, all the other interviewees saw that there is not much demand for CE in the sector and it is a problem: *“As we often say in the industry, when clients don’t demand it, or consumers don’t demand it... We would need the kind of market pull and demand so then the companies that want to do it can develop it further”* (interviewee 1). If there is no demand for CE, companies are not interested in developing it either: *“When there is no demand for it from the client side, the contractors don’t have any need to do it before law forces them”* (interviewee 4). Interviewee 7 is working with apartment building and mentioned, that *“People simply aren’t that interested in environment or ecology. What they want is durable quality and value for their money”*. GBC Finland’s specialist noted that clients are not necessarily ready to pay extra for new innovations.

Two interviewees mentioned lack of time as a barrier. Interviewee 2 had been working at construction sites and said, that *“At construction sites the attitudes are partly bad. Often the management doesn’t have time to supervise what’s being done*

*to the materials, especially in bigger projects. There's always a hurry. It's simply faster to throw everything in the dumpster than offer the surplus materials to someone. It could be that in the long run it would improve the profitability, but projects have tight schedules and if you have to acquire extra resources, it will delay the project".* Time was also a barrier in another sense, since four interviewees said that one of the characteristics of construction sector is that everything takes a lot of time. According to interviewee 1 *"Time is not right yet. In a way the market or the state governance is not ready for it yet"*. RT's specialist also said that changing the legislation takes time.

Sitra's specialist mentioned, that the construction sector is quite conservative and similarly, interviewee 8 considered that the sector's traditional, linear way of thinking is a road blocker. Three interviewees discussed that the lack of economic incentives is a barrier since money is what guides construction industry. A network for CE does not exist: according to interviewee 6, *"The forming of the needed network and a market for CE in the industry takes time and is certainly one thing which slows down the movement"*. Some saw that also the company culture is a road blocker and that change management inside the companies is necessary to make the sector circular.

Finally, three interviewees mentioned also the lack of availability of recycled materials as a barrier. As interviewee 7 put it: *"If there are no recycled tiles or other recycled materials available, how can we then use those?"*. Interviewee 8 also mentioned, that since there are not much of those materials available, their prices are quite high and as building is expensive in any case, it is yet another reason why the clients are not willing to try out the recycled materials.

## 5.4 Drivers of CE

The interviewees were asked which actors would advance the movement towards CE. To make the sector circular, a systematic change would be needed: *“When we discuss circular economy, we need all possible means of guidance: administrative, economic, informative as well as voluntary means. It starts from the systematic change: planning and execution”* (Sitra’s specialist).

The most commonly mentioned drivers were “carrot and stick” - both rewards and punishments would be needed. In addition, increased education and knowledge, partnerships and networks, communication, demand from clients and consumers, data banks on the materials and R&D on how to make new materials from waste would be needed to advance the movement towards CE. Specialists were also asked which organizations advance and on the other hand which organizations hinder the movement towards CE.

*“Carrot and stick. Increased legislation and regulations, and on the other hand economic incentives, would be needed to accelerate the movement towards CE”* (interviewee 9). This comment recapitulates what all the interviewees considered as an important driver: to become circular the sector needs more rules and regulations but at the same time also economic incentives that would draw companies to become circular. Interviewee 1 mentioned, that regulation is an effective driver in the construction sector: *“If you look at the results that we have received in work safety in just 15 years thanks to regulation, you can see that it is a really effective driver”*. As the sector is strongly driven by money, the incentives should be financial. Interviewee 9 gave an example of a financial incentive: *“For example currently you can apply for a grant to enhance your energy efficiency”*. Similar grants could be permitted also for CE projects. According to interviewee 1 taxation is also an effective incentive, so there could be both environmental protection taxes and deductibles when reused or recycled materials are in use.

When it comes to legislation, GBC Finland's and RT's specialists both mentioned, that the Ministry of Environment plays an important role. In a way it can both advance and slow down the movement towards CE: *"The Ministry's greatest endeavor is to advance CE but at the same time take care of safety"* (GBC Finland's specialist). According to RT's specialist *"In the Ministry of Environment there is the Department of the Built Environment and the Department of Environmental Protection. And the cooperation there... One is trying to advance, the other... I am not saying they are doing it on purpose, but they often appeal that we are trying to release something which is going to cause an environmental threat"*.

More education and knowledge on CE would be needed. *"The more people know, the more they are interested and the more sustainable they become. And that way the market for it will be created"* (interviewee 3). Partnerships and networks are also important drivers. As interviewee 6 put it, *"We need more education on the matter and those partnerships and networks"*. R&D on the materials would be needed: the waste materials should be tested and developed to make them usable. To discover how the materials could be reused and recycled safely is crucial, since the sector is not ready to take any risks. According to Sitra's specialist, *"One important step towards CE is to generate data about the existing building stock"*. Similarly, according to GBC Finland's specialist detailed databases on the building stock, what materials there are and what those materials contain, would be needed.

As there currently is no demand for CE from the consumers' or clients' side, increased demand would also accelerate the movement towards CE. After interviewee 8, *"We need demand from the client and consumer side but also a permission from the officials to utilize the reused materials"*. Public clients, municipalities, are in an important role in making the sector circular: *"Without demand from the municipality side, the sector won't turn around"*, as GBC Finland's specialist put it.

Finally, more communication on CE is needed. Companies should communicate to

others about the solutions that have already been developed. Communication is also related to knowledge: if companies communicate about their solutions, also knowledge on the matter increases. Knowledge will create interest and finally the market for CE.

#### **5.4 Future of construction sector**

The specialists were asked how they see construction sector in the future. The same topic was also discussed with most of the interviewees, although there was no specific question about the future in their interviews. The reason why only the specialists were asked about it was that they were considered to have a more profound understanding of where the industry is going.

*“I don’t know if we can ever make it to a fully closed loop. If you think, that 1-2% of what we build in a year are new buildings and we would have to get all the material for those from demolished buildings, it might not be possible for safety reasons. But in the future, wherever it’s possible, the first thought would always be that which demolition site or demolition material bank could provide the materials for this new building”* (GBC Finland’s specialist). There is no question on whether this future scenario could be true. Construction sector is currently consuming a significant amount of natural resources and we will be running out of them soon. As interviewee 6 said, *“At some point prices of the virgin materials will go up so much that companies have no other options: they simply can’t afford to demolish everything and then build everything from virgin materials again”*. Thus, at some point in the future the sector will be forced to reuse and recycle C&D waste materials.

Sitra’s specialist told an example of this kind of situation from Brazil. When they were building the arenas for both the FIFA World Cup and the Olympics at the same time, they ran out of the virgin sand that they use for making concrete. Due to this, they were forced to develop recycled sand. Thus, they were forced to develop a

product from recycled materials, since they had no other options. As GBC Finland's specialist put it, *"We have to learn to recycle our existing materials, there are no other options"*.

Legislation is in an important role in the future too, since it needs to let and encourage the sector to use C&D waste to make new materials. Sitra's specialist sees, that in the future legislation will guide the sector even more than it is guiding it now: *"One future scenario could be that you are not allowed to build anything new unless you use that secondary (recycled/reused) material. There could for example be a certain percentage, let's say 40%, for how much of the new building must come from recycled products or materials"*.

RT's specialist thinks, that it is hard to predict what the future will look like, since the sector is making products that last for 50-100 years. Interviewees 1 and 3 see a lot of new business opportunities for the sector in the future. Interviewee 1 talked about the surplus materials of the sites and how they could be business opportunities to some: *"In a way if you could put your surplus materials from the construction sites to some sale where you would get X percentage of the sales price, it would be risk-free for you and on the other hand you wouldn't need any material storage anymore, which are a bit of a waste currently since the materials start to go bad quite fast. So, I think there will be demand for these kinds of businesses quite soon"*. Interviewee 3 talked about the possibilities of modularity: *"Entire parts of building or façade would be modular so that they could be reused somewhere else"*.

The interviewees from the consulting company consider, that there is a massive potential for the sector in CE. Interviewee 4 sees that *"Building construction is one of our most potential customer segments in terms of circular economy"*. As consultants they see CE's business opportunities for them as they could help companies to become more circular.

In the future, construction sector could be in a key position for CE: the volumes are so big, and the sector has an influence on how we live. As Sitra's specialist put it: *"I see construction sector in a key position for the future. Since the question is how we are going to live in the future in this built environment, the industry plays a significant role here. So, I hope that with the help of all these means of guidance we can make the construction industry move towards CE, because we must make those changes, on one way or another. I hope that all these projects and undertakings will accelerate the movement. Thus, I see that the industry will shift from linear to circular economy and hopefully as fast as possible"*.

## 6 DISCUSSION

The companies' growing interest towards sustainability and CE demonstrates that the sector is willing to become circular. To accelerate the movement towards CE, the barriers mentioned in the previous chapter need to be overcome.

Institutional field theory is utilized for understanding where and how the barriers are formed. Three field types where the barriers are formed were recognized: industry exchange fields, professional exchange fields and bridging issue fields. The lack of interest, lack of time and bad image/fear of using recycled materials barriers exist in two different field types. The barriers that are formed under each field type can be seen in Figure 3.

Industry exchange fields	Professional exchange fields	Bridging issue fields
Lack of knowledge/education	Lack of demand	Regulative barriers
Lack of interest	Bad image/fear of using recycled materials	Lack of economic incentives
Company culture	Lack of interest	Bad image/fear of using recycled materials
Lack of networks	Lack of time	
Characteristics of the industry: lack of time & conservativity		

Figure 3 Barriers and the field types in which they are forming

The most pressing barriers that are hindering the industry's movement towards CE are the regulative barriers. They are formed in a bridging issue field, where the issue in case is safety in construction sector – an issue that many different fields share. Safety is heavily regulated and different field members are putting an effort to ensure the safety in the sector: the professional exchange field of buyers wants to ensure that the buildings they buy are safe, the industry exchange field of construction

sector wants to ensure the safety of the consumers and their employees and governance wants to ensure the safety of citizens. The regulative barriers are formed by safety-related regulations, where legislation prevents the usage of recycled or reused materials since they have not been studied enough and there is a fear that those materials are not safe. Safety is important in the construction industry and in this bridging issue field safety is always put first.

The lack of economic incentives barrier forms in the bridging issue field as well. The members of the bridging issue field are not ready to give any economic incentives on CE-related projects if they are afraid that the recycled materials might create a safety threat. The economic incentives would have to come from the officials or financing organizations. The bad image/fear of using recycled materials barrier forms partly in the bridging issue field and partly in the professional exchange field of the buyers. As safety is a common concern among the members of the bridging issue field, it creates a fear that there might be something harmful in the recycled or reused materials. The field aims to avoid any possible safety threats and if there is any probability of a safety threat, the fear of letting out something harmful is greater than the advantages that it might bring.

Five different barriers that are related to the industry are considered to form in the industry exchange field of construction industry: lack of knowledge and education, lack of interest, company culture, lack of networks, and lack of time and conservativity which are both characteristics of the industry. The industry exchange field comprises of the construction companies. They share similar interests and coordinate exchange with their own interaction partners (suppliers, clients, consumers etc.), but at the same time compete. In the industry exchange field, the field members also cooperate with each other.

The lack of knowledge/education barrier forms in the industry exchange field, since the field members share the same knowledge. The field members do not know which materials are in use as there are no shared databases or information on the

materials. The employees of the industry exchange field members have attended the same education and thus share the same knowledge – or lack of it – on CE. The industry members share the same interests since they share the same clients, who all demand similar things: construction projects that are executed fast but carefully. Therefore, the lack of interest-barrier forms in the industry exchange field, although it partly forms also in the professional exchange field of the buyers.

As it was discovered in the first section of the results chapter, the companies and their company culture in the construction sector are alike, especially among the large companies. There is more divergence between small and large companies. However, as this study only focused on large companies, it can be assumed that the company culture-barrier is also formed in the industry exchange field. Any barriers related to the characteristics of the industry, in this case the conservativity of the industry of the sector and lack of time, are also formed in the industry exchange field. In addition, the lack of time barrier forms partly in the professional exchange field of the buyers as well, since the buyers demand the contractors for tight schedules in the projects.

The lack of networks barrier forms in the industry exchange field, since CE is not well-known in the industry yet and thus there are no CE-related networks. In addition, the high level of competition among the members of the industry exchange field makes the members less willing to create networks with each other.

The lack of demand, bad image/fear of using recycled materials, lack of time and lack of interest barriers form in the professional exchange field of the buyers (clients of the contractors). Typically, professional exchange fields have strict rules and they do not adopt change easily, unless there is a legislation which forces them to change (Zietsma 2017, 411) This unwillingness to change among the members of the field creates demand for similar things from the contractors and changing this demand is difficult, since the professional exchange field members are not ready to change their habits easily. As they demand for similar things from the contractors, they also

demand for tight schedules for the projects, which has affected to the formation of the lack of time barrier.

Lack of interest barrier also forms in the buyers' professional exchange field, since they simply are not interested in CE, especially if CE solutions would be more expensive than linear solutions. The construction projects are expensive and cost a lot of money for the buyer: therefore, in the professional exchange field the members try to avoid costs. The safety of the buildings and the air inside are important for the buyers, thus they are not willing to try out recycled materials that have not been tested enough. Consequently, they are afraid that the recycled materials might contain something harmful and this contributes to the formation of the bad image/fear of using recycled materials barrier.

As it was mentioned in the previous chapter that more cooperation and networks would be needed to shift the sector towards CE, it means that cooperation over field borders would be needed. Therefore, to make the construction sector circular, an interstitial issue field around the CE issue would be needed. An interstitial issue field would help the sector to move away from the industry exchange field. For example Quarshie, Salmi and Wu (2019) made a research on an interstitial issue field that has formed around biodiversity protection issue. The field includes members both from exchange and issue fields that together collaborate to change the biodiversity loss issue. According to Quarshie et al (2019, 4) the characteristics of an interstitial issue field are "...actors' embeddedness (within their own field), the coexistence of multiple logics, and actors' joint interest in the issue, which is necessary for collaboration and change to take place."

When conducting the research, it could be seen that an interstitial issue field around CE is already starting to emerge in the construction sector. A good example which shows that the field is starting to form is GBC Finland's "Kiertotaloussprintti" (discussed in chapter 2), which gathered together 60 specialists from NGO's and businesses to together develop the CE criteria for construction sector. Companies

also showed interest towards the issue, which reflects to the emergence of the interstitial issue field.

The required field members for formation of an interstitial issue field around the CE in construction sector can be seen from Figure 4.

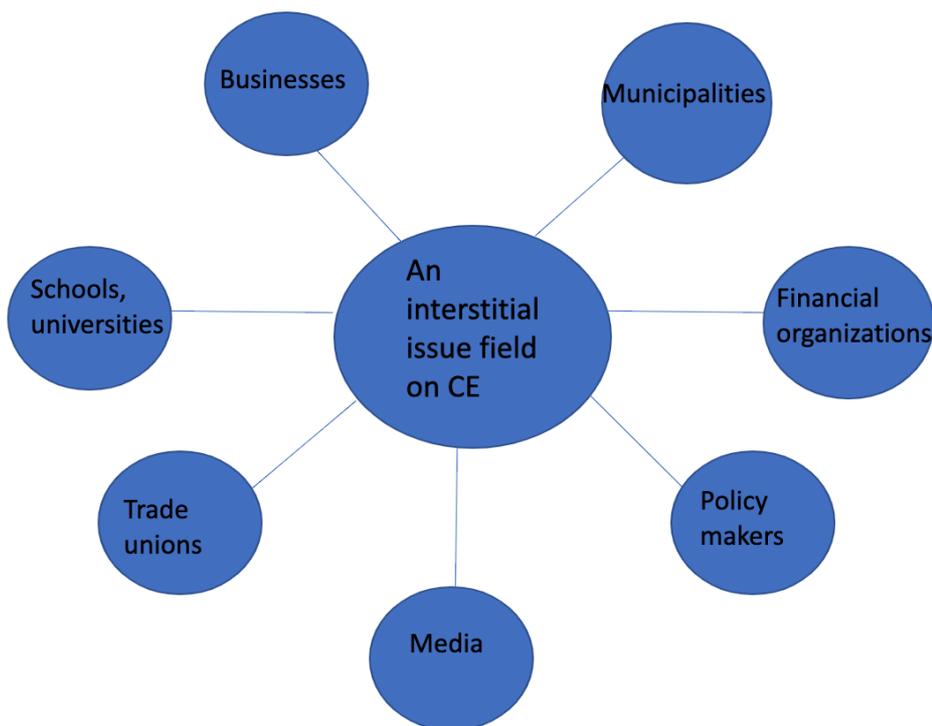


Figure 4 The members of an interstitial issue field on CE.

An interstitial issue field comprises of field members of different fields that share an interest on a common issue (Zietsma 2017, 397). In the construction sector's case this issue would be the circularity of the sector. Eventually the sector will have a strong motivation to become circular, since it is a heavy user of virgin materials which will become scarce and expensive in the future. On the other hand, as the sector is currently using a significant amount of virgin materials and it has a great influence on how people live, the policy makers will be willing to make the sector circular as well. Advancing of CE in the construction sector affects also other sectors, which generated interests on CE of construction sector among those field members that are currently not directly related to construction sector.

A cooperation over the industry borders is required. Municipalities are needed to create demand for circular solutions from the contractors. Financial organizations, such as EU's financing elements, Business Finland and Academy of Finland are needed to finance and support the circular solutions and innovations. Policy makers are needed to create the "carrots and sticks" and open the regulations so that recycled materials can be used in buildings. As one future scenario that was discussed in the previous chapter is that it would be regulated how much recycled materials must be used in buildings, this is the type of legislation that is needed.

Media is needed for communicating about the solutions and innovations that have been made. Trade unions work in the interface between policy makers and the industry members and thus they are needed too. R&D is needed to be able to create safe and tested reused and recycled materials. Schools, universities and other educational units are required to increase the knowledge on CE among the industry experts and employees. And finally, of course the businesses are needed to create the solutions together with other members of the interstitial issue field.

## **7 CONCLUSIONS**

The purpose of the study was to find out about the barriers of circular economy in the construction industry. To better understand how these barriers are formed, the institutional field theory was utilized. The institutional field theory also helped to understand what kinds of fields would be needed to overcome those barriers.

### **7.1 Theoretical contributions**

“RQ1. What are the barriers to circular economy in construction sector and how do they form?”

There are multiple barriers of CE in the construction industry. However, technological barriers do not exist in the construction sector, which is in accordance to for example Kirchherr et al 2018 and Ranta et al 2017. The technology is already there or it could be easily developed if there was demand for CE and legislation would encourage the sector to take the shift towards CE.

The barriers were considered to form in different institutional fields (based on Zietsma, et al 2017) that have been presented earlier in the theoretical framework chapter. Three field types where the barriers are forming were recognized: the industry exchange field, professional exchange field and the bridging issue field.

The most pressing barriers are regulative barriers, that prevent the usage of recycled or reused materials. On the other hand, the regulative barriers are related to lack of regulation. Construction sector is a heavily regulated sector and legislation is needed to make the shift. For example, work safety in the sector has significantly improved due to regulation. This discovery was in accordance to Kirchherr et al

(2018) research, which concluded that the regulative barriers are among the most pressing ones, since regulation prohibits the companies from moving towards CE.

Other pressing barriers that Kirchherr et al (2018) study identified were the market barriers, which are related to lack of demand. The results of this study show, that in construction sector the lack of demand is also a pressing barrier, which exists, because the professional exchange field of the buyers is not demanding for circular solutions. On the other hand, consumers are not demanding for CE either. Lack of knowledge and education is another barrier that hinders the movement towards CE. The barrier is forming in the industry exchange field of the construction industry. The lack of knowledge barrier has been recognized for example in the Da Rocha and Sattler study (2009), who also noted, that there is a negative attitude towards the reused products both from policy makers and clients. Similarly, this study discovered that reused and recycled materials have a bad image, since it is not completely known what is in the materials.

Construction sector's ability to take risks is low and due to this the sector is not willing to take any risks that the possibly harmful substances in the recycled or reused materials might cause. The sector is struggling with health issues daily due to problems with the air inside and is thus not willing to take any risks that might affect the quality of the air. Finally, the sector is a little bit conservative compared to many other sectors.

“RQ 2. How could the barriers be overcome?”

To overcome the barriers, an interstitial issue field should be formed. The sector's shift from linear economy to a circular one requires cooperation between multiple field members. R&D on the materials is needed so that safe reused and recycled materials can be invented. The sector's low ability to take risks requires safe materials.

As typically the members of a professional exchange field will not change until legislation forces them to change (Zietsma 2017, 411) the legislation should be changed to accelerate the movement towards CE. There should be both economic incentives and punishments, “carrot and stick”, as the interviewees mentioned.

Previously mentioned Quarshie et al (2019) study shows an example of an emerging interstitial issue field. The interstitial issue field that has formed around biodiversity conservation has brought together different organizations from different fields. They have different motives and institutional logics but share a common goal of slowing down the biodiversity loss. (Quarshie et al 2019, 2) The field members are together pushing their agenda (biodiversity loss) to become mainstream thinking. However, as the field is still emerging, the coordination between field members is not coherent yet.

The importance of collaboration for accelerating the movement towards CE in construction sector has been acknowledged e.g. in Esa, Halog & Rigamonti (2017) study. They considered that CE can be successfully implemented in meso, micro and macro levels. According to their research, creating a collaborative network is a key for achieving CE on the macro level and that it requires increased monitoring and coordination throughout the construction process. (Esa et al 2017, 1153)

A popular example of a successful interstitial issue field is Maguire, Hardy and Lawrence (2004) research on the interstitial issue field, which formed around the HIV/AIDS issue in Canada. The issue gathered together individual, policy makers and pharmaceutical organizations and succeeded too collaborate despite of differing logics and motives. Maguire et al also provided practical implications for individuals in emerging interstitial issue fields on how they can also affect shaping the field’s practices, rules and norms, and that their skills may be crucial for achieving the common goal.

These examples strengthen the conclusion, that an interstitial issue field is required in order to make the paradigm shift from a linear to a circular economy.

“RQ 3. What kinds of measures could the policy makers take in order to accelerate the movement towards circular economy?”

Policy makers should understand that the construction sector affects the way people live and that the sector needs to shift towards circularity. Since the sector is so materially intensive, its shift to CE would reduce world’s CO2 emissions notably. A successful implementation of CE policies requires a mix of different policies that take into account the production, use phase and end of life of the products. Policies must be made in all levels: national, international, local and regional, to accelerate the movement towards CE. (Milios 2018, 872-874)

The results of this study also show, that the policy makers need to make a mix of different kinds of politics. Firstly, they need to reduce the regulation by opening the market for recycled and reused materials in the sector. Secondly, they should create economic incentives that would encourage companies to use recycled materials but also regulation that forces them to do so. Thirdly, the legislation should be tightened by for example setting minimum constraints for the usage of the recycled materials in buildings.

## **7.2 Practical implications**

There are many practical implications that the research material has provided. These implications here are mainly directed for businesses. All the practical implications presented here are based on the interview material.

First of all, the companies should collaborate more. They should aim to find partners that are already operating in the CE business (for example making materials from waste) and collaborate with those. Finding the right partners is a key in moving towards CE. Secondly, the companies should communicate about their solutions outside, so that others also know where they have succeeded and what could be tried. Thirdly, a little bit of extra courage is needed. Although construction sector is not a sector that is willing to take risks, here a little bit of courage is needed. Companies should look for circular solutions and actively offer those to their clients.

One important practical implication that was mentioned by both Sitra's and GBC Finland's specialists, would be a database on the existing building stock. This database would contain information on the existing buildings and the materials that they contain. This kind of a database would be helpful when eventually the building is demolished as it would ease the reuse/recycle process of the materials when the material types are known beforehand.

### **7.3 Limitations and future directions**

The study was a qualitative study and the sample size was fairly small: altogether 12 people participated in the interviews. Due to lack of time the sample size could not be bigger. Although there were both specialists and companies that took part in the interviews, the number of interviewees is one limitation. Also, the study focused only on large Finnish construction companies. A future study could be focused on companies in different geographical locations or small construction companies. Most of the companies in the construction industry are small businesses, which would justify the need for a research on the small businesses.

Another limitation is that the study was only focused on the construction sector and thus the results cannot be generalized to other sectors. The barriers that exist in the construction sector might not exist in other sectors. However, as construction sector uses a significant amount of world's natural resources, it is important to understand the barriers of this specific sector. In addition, other sectors that are highly regulated might face similar barriers to those that construction sector studies. Future studies could focus on comparing the barriers of construction sector with another sector, such as electronics. It would be interesting to see if the barriers are similar and form in similar institutional fields.

In this study it could be seen, that some of the company representatives saw the industry's operations in a more positive light than the specialists. Since the sector produces a significant amount of waste and no great steps towards CE have been taken, in the future studies it could be investigated, whether the views of companies and specialists differ from each other significantly and why do they differ.

Finally, more studies on circular economy barriers that utilize the institutional field theory would be needed. The current research on circular economy barriers has mainly utilized the Scott's "three pillars of institution model" and thus more research that utilizes the institutional field theory would be welcome. The future studies could form around a specific field and study the characteristics of the specific field.

As an interstitial issue field around the CE issue on construction sector will eventually be emerging, more research on the field itself would also be an interesting direction for future research. Quarshie et al (2019) studied how the field members of the interstitial issue field of biodiversity protection can manage with the uncertainty and incoherence they face during their efforts on increasing the protection of biodiversity. Similarly, a research on how the members of an emerging field on CE on construction cope with the new issue field or how they see their role in advancing CE, could be conducted. Overall studying the characteristics of the field members would be an interesting direction for future studies.

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## APPENDICES

### Appendix 1 Interview questions in Finnish, companies

#### Haastattelukysymykset, kiertotalouden esteet

Kiertotalous on vaihtoehtoinen malli nykyiselle lineaariselle talousjärjestelmälle. Kiertotaloudessa materiaalien ja tuotteiden elinkaari ei katkea, vaan käyttöikää pidennetään uudelleenkäyttämällä, uudelleenvalmistuksella tai kierrättämällä. Kiertotalouden tavoitteena on vähentää syntyvän jätteen määrää ja siten säästää luonnonvaroja. Kiertotalouden ideana on se, että raaka-aineita ja materiaaleja käytetään mahdollisimman kestävästi ja tehokkaasti.

1. Kuvaile hieman rakennusalaa yleisellä tasolla. Ovatko rakennusalan käytänteet yhtenäisiä ja yritykset usein samoilla linjoilla asioissa vai löytyykö eroavaisuuksia paljonkin? Miten mielestäsi rakennusalalla yleisesti nähdään ympäristöasiat?
2. Miten yrityksessänne nähdään kestävä kehitys? Koetteko sen olevan teille ajankohtainen asia vai enemmän tulevaisuutta?
3. Onko yrityksessänne jo otettu askelia kohti kiertotaloutta? Jos, niin kertoisitko hieman tarkemmin millaisia?
4. Kuuluuko kiertotalous yrityksenne strategiaan tai uskotko että se tulee lähivuosina kuulumaan siihen?
5. Jos kiertotalous kuuluu yrityksenne strategiaan, miten työntekijät suhtautuvat siihen ja näkyykö se heidän arjessaan?
6. Miten kuvailisit yleisesti rakennusalan potentiaalia kiertotalouteen?
7. EU:n jätteen vähennystavoitteet koskevat myös rakennusalaa. Uskotko, että näillä tavoitteilla on vaikutusta yrityksenne siirtymiseen kiertotaloutta kohti?
8. Rakennusalalla on paljon potentiaalia kiertotalouteen, sillä syntyvän jätteen määrä on merkittävä. Silti kiertotalous tuntuu olevan vielä melko tuntematon asia rakennusalalla. Mitkä mielestäsi ovat suurimpia syitä sille, ettei rakennusalalla ole vielä otettu suuria askelia kohti kiertotaloutta?
9. Seuraavassa toivoisin esimerkkejä niistä esteistä, joiden koet hidastavan kiertotalouteen siirtymistä. Jos et koe kyseisen esteen olevan ongelma rakennusalalla, kuvaile hieman millä tavoin se on jo selätetty. 1. Onko ongelmana kiertotalouteen siirtymiselle tarvittavan teknologian puute? 2. Entä kysyntä? 3. Tai se, että yritysten sisäinen kulttuuri on niin vahvasti kiinni lineaarisessa taloudessa? 4. Ajatellaanko rakennusalalla, että kiertotaloudesta tulisi ylimääräisiä kustannuksia? 5. Haluavatko asiakkaat uutta, eivät kierrätettyä tai uudelleenvalmistettua? 6. Onko ongelmana tiedon puute, ts. se että tietoa kiertotaloudesta ja sen eduista on vielä niin vähän?
10. Minkä asioiden kokisit edistävän kiertotalouteen siirtymistä rakennusalalla?
11. Mitä mieltä itse olet kiertotaloudesta?

## Appendix 2 Interview questions in Finnish, specialists

1. Kuvaile hieman rakennusalaan yleisellä tasolla. Ovatko rakennusalan käytännöt mielestäsi yhtenäisiä ja yritykset usein samoilla linjoilla asioissa vai löytyykö alan sisältä paljon eroavaisuuksia esimerkiksi arvoihin, työskentelytapoihin tai innovatiivisuuteen liittyen?
2. Mikä on organisaation rooli kiertotalouden edistämiseksi?
3. Miten rakennusalan nähdään yleisesti ympäristöasiat?
4. Miten rakennusalan nähdään kiertotalous? Nähdäänkö se jo nyt oleellisena osana liiketoimintaa vai enemmän vielä tulevaisuuden asiana?
5. Onko isojen rakennusliikkeiden välillä eroja kiertotalouteen suhtautumisessa?
6. Miten kuvailisit rakennusalan potentiaalia kiertotalouteen?
7. Onko rakennusalan mielestäsi jo otettu askeleita kohti kiertotaloutta? Millaisia?
8. EU:n jätteen vähennystavoitteet koskevat myös rakennusalaan. Uskotko, että rakennusalan näillä tavoitteilla on vaikutusta siirtymiseen kiertotaloutta kohti?
9. Rakennus- ja purkujätettä syntyy eri arvioiden mukaan n. 25-40% kaikesta EU:ssa syntyvästä jättemäärästä, minkä takia kiertotalous voisi olla toimiva ratkaisu rakennusalan. Tästä huolimatta rakennusalan ei ole vielä otettu merkittäviä askeleita kiertotalouden suuntaan. Mistä tämä johtuu? Mitkä asiat mielestäsi estävät kiertotalouteen siirtymistä rakennusalan?
10. Mitkä organisaatiot estävät kiertotalouteen siirtymistä rakennusalan?
11. Mitkä organisaatiot puolestaan edistävät kiertotaloutta rakennusalan?
12. Kiertotaloussprintin "Toimenpide-ehdotuksia kiertotalouden toteuttamiseksi kiinteistö- ja rakennusalan"-julkaisuun on kerätty toimenpiteitä, jotka edistäisivät kiertotalouden toteuttamista rakennusalan. Miten tällaisia ehdotuksia mielestäsi saataisiin vietyä eteenpäin suoraan rakennusliikkeisiin?
13. Millaisena näet rakennusalan tulevaisuudessa?

### Appendix 3 Interview questions in English, companies

1. Describe the construction a little bit on a general level. Do you think that the practices in the sector are unified or are there lots of differences? How do you think that the sector overall sees environmental issues?
2. How does your company see sustainable development? Is it a current issue for you or something more of a future?
3. Has your company taken steps towards CE already? If so, could you describe what kinds?
4. Is CE part of your company's strategy or do you think it will be part of it in the near future?
5. If it's already part of your strategy, how do the employees feel about it and can it be seen in their daily work?
6. How would you describe construction industry's potential for CE?
7. EU:s waste minimazing goals also concern construction sector. Do you think that these goals affect your company's movement towards CE?
8. The construction sector has a lot of potential for CE, since the amount of waste is significant. However, CE still seems to be quite an unknown issue in the sector. What do you think are the biggest reasons why the sector hasn't yet taken big steps towards CE?
9. In this part I would like to here examples of those barriers that you think slow down the movement towards CE. If you don't think it's a barrier, let me know how it's been overcome already. 1. Is the problem a lack of technology? 2. How about lack of demand? 3. How about the company culture, which is too stuck in linear economy? 4. Does the sector believe that CE would create extra costs? 5. Do the customers want new, not reused or recycled? 6. Is the problem a lack of knowledge, i.e. that there is so little knowledge on CE and its advantages?
10. What do you think would accelerate the movement towards CE?
11. What do you think of CE yourself?

#### Appendix 4 Interview questions in English, specialists

1. Describe the construction a little bit on a general level. Do you think that the practices in the sector are unified or are there lots of differences for example on values, practices or innovativeness?
2. What's the role of your organisation in advancing CE?
3. How does the sector see environmental issues?
4. How does the sector see CE? Does it see CE as an essential part of its operations or is it more of something for the future still?
5. Are there differences in attitude between large construction companies?
6. How would you describe the sector's potential for CE?
7. Do you think that the sector has already taken steps towards CE? If so, what kinds?
8. EU:s waste minimizing goals also concern construction sector. Do you think that these goals affect the sector's movement towards CE?
9. According to different estimates, around 25-40% of all the waste in EU is C&D waste, which shows that CE could be a good solution for the industry. However, big steps towards CE are yet to be taken. Why is that? What do you think could speed up the shift towards CE?
10. Which organisations prevent CE in construction sector?
11. Which organisations advance CE in construction sector?
12. The "Kiertotaloussprintti's" "Toimenpide-ehdotuksia kiertotalouden toteuttamiseksi kiinteistö- ja rakennusalalla" publication has collected measures that would advance CE in construction sector. How do you think these measures could be taken straight to the companies?
13. How do you see future of construction sector?