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Circular Economy: A Qualitative Analysis of Circular Economy Project, Policy, and Framework in Trondheim, Norway

Master's thesis in Globalisation and Sustainable Development

Supervisor: Ragnhild Lund

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Abstract

The topic of “Circular Economy” has been making its way around Europe since the European Union published *Closing the loop: New Circular Economy Package* in 2015, where they stated goals for creating a more circular economy in the EU. While Norway is not in the EU, they often follow the EU’s footsteps regarding initiatives related to the SDGs. Many countries and cities have begun to publish roadmaps and goals relating to a circular economy. Norway has yet to publish a road map or set any goals, policy, or framework relating to the circular economy. My research looks at what is happening in Trondheim currently and what is coming to help grow Trondheim’s circular economy. The research is presented through interviews with people working in the field, two case studies, and a literature review. The data collected was analyzed using the 5’s, reduce, reuse, refuse, repair, and recycle to connect my finding with the circular economy. The result presents a need for change within the city of Trondheim, and that now is the time for change because they are years behind in circular economy efforts compared to the EU. Trondheim can look to what other cities such as Helsinki or Amsterdam have done within their local policy and framework to support circular economy initiatives. It is found that many of the social aspects of CE can be solved with policy changes and the availability of CE-related initiatives, as well as a societal push. The research concludes that policies and frameworks are being created in the city, such as a circular manifesto in its beginning phases and initiatives from the chamber of commerce. Things are beginning to pick up in Trondheim, and we can expect to see a circular increase in the next 3-5 years if the right policy and framework are put in place.

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List of Abbreviations

CE	Circular Economy
EU	European Union
NTNU	The Norwegian University of Science and Technology
UNECE	The UN Economic Commission for Europe
KPI	Key Performance Indicator
SDG	Sustainable Development Goals
EMF	Ellen MacArthur Foundation
U4SSC	United for Smart Sustainable Cities
5 R's	Reduce, Reuse, Refuse, Repair and Recycle
3 R's	Reduce, Reuse and Recycle

1 Introduction

In recent years the world has become more aware of the needed efforts to save the planet. More people have become aware of the 2030 Sustainable Development Goals, also known as the SDGs (United Nations, 2015). The SDGs lay out 17 goals for the world to become more sustainable by the year 2030. To reach some of the goals, there is a need to focus on Circular Economy (CE). A circular Economy, in simple terms, is the transition from a linear to a circular economy where products have a long life span and there is a limited amount of waste. CE can be demonstrated within the 5 Rs, reduce, reuse, refuse, repair, and recycle. These 5R's is a step up from the commonly known reduce, reuse, and recycle (3 R's). There are times where the Rs are expanded into 9 Rs, which is quite intensive (Kirchherr et al., 2017, p. 226).

Many cities and countries have begun to create a circular economy framework to introduce new policies and publish goals and roadmaps for becoming a more circular country or city. The EU in 2015 presented their CE goals, and many countries and cities followed in their footsteps. Norway is not a country in the EU, but they are close partners that often follow along with the EU's steps concerning climate and sustainability. Norway has no CE framework but has noted that they need to change because their current CE rate is only 2.4% (CGRI, 2020, p. 4). My research will look at what Trondheim is doing in terms of framework, policy, and city projects to contribute to improving CE. It will look at case studies of projects that are happening in Trondheim and the framework and policy at a municipal level. There is a lack of research on this topic in Trondheim, while there are intensive amounts of research on other cities. CE is a continuously growing topic of interest within city-level government.

1.1 Objectives of the study

This study's objective is to assess what is possible for the city of Trondheim to increase its circular economy. The study will look at what is embedded in present local politics and practices in the city of Trondheim.

1.2 Research Questions

During the research process, the following questions will be addressed:

1. What are the characteristics of Trondheim's Circular Economy?

2. Why is now the time for an increase in circular economy-related projects and initiatives?
3. What is needed for circular economy-related efforts/projects to be successful in Trondheim?
4. What is the present timeline for circularity projects, framework and policy in Trondheim?

1.3 Definitions of Key Concepts

The purpose of this section is to lay out the definition of relevant terms that will be used within this thesis. The descriptions will help one understand the use of the terms within the context of the research.

1.3.1 Circular Economy

There are many definitions of the term circular economy set in a variety of fields and theories. All the descriptions have the same general meaning rooted in a closed-loop system. For this thesis's purpose, we define the circular economy as a closed-loop system where production and consumption are based around the 5 R's, which are reduce, reuse, refuse, repair, and recycle to limit waste and to expand a product life cycle. This definition allows us to see the core of a circular economy without worrying about the technical details, which can lead to confusion. Circular Economy is at the center of this paper. Still, we are not looking into the technical details, just how it can be implemented at a city level.

1.3.2 Circularity

The terms circularity and circular economy go together. The Cambridge Dictionary defines circularity as "the fact of constantly returning to the same point or situation (Cambridge, n.d.). This definition is accurate, but for our sake, we need more clarification of how the term will be used through this thesis. For this thesis, circularity will be defined as the life of products from start to finish. The term can also be used to say a percentage of circularity. For example, we can say that Norway's circularity is at 2.4%, which means that 2.4% of things produced are put back into the economy while the other 97.6% are made into waste (The Circular Gap Reporting Initiative (CGRi, 2020, p. 4). There is a need for higher circularity, and therefore we are analyzing what the city of Trondheim is doing to increase its circularity.

1.3.3 Sustainable Development

Sustainable development was defined by Gro Harlem Brundtland, a former Norwegian prime minister, in the report *Our Common Future*. In the report, Brundtland defines sustainable development as "development that meets the present's needs without compromising future generations' ability to meet their own needs" (1987, p. 3). We will be using this definition within the thesis. Sustainable Development is an essential concept because creating a circular economy is not possible without sustainable development.

1.3.4 Sustainable Development Goals

According to the UN, the 2030 Sustainable Development goals are 17 Goals; within these goals are 169 targets that work as a call to action for countries to create a global partnership. Pictured below are the 17th goals.



Figure 1: SDGs

Source: <https://ied.eu/blog/sustainable-development-goals-and-the-2030-agenda-how-ied-supports-sdgs/>

The above goals should be understood as a basis for why circular economy is something that needed to be adapted in cities and countries around the world. Creating circular practices that align with reaching many of the SDGs. The relation between SDGs and circular economy is further discussed in section 2.3.1 under Norway, where the link between Agenda 2030 and circular economy is discussed.

1.4 Significance and Motivation

The goal of this research is first for the completion of my master's degree in Globalization and Sustainable Development. Circular Economy research on the city of Trondheim is also something that is needed. Cities around the world are developing circular strategies and frameworks. Trondheim has the resources being a diverse city with innovation hubs, a large international university, research centers, and the UNECE Centre title.

My research will be helpful for future innovation in Trondheim. It will lay out what is happening in the current times, 2021, and investigate what is needed for Trondheim to increase the countries circularity which is currently only at 2.4% circular while the global average is 8.4% (CGRI, 2020, p. 3).

Part of my motivation for this research comes from my internship at the Trondheim Centre For Sustainable Development. At the Centre for Sustainable Development, I saw how projects bloom in Trondheim and how innovation is happening all the time. At the internship, we focused on the circular economy by creating a circular SDG clinic in the tested local businesses and focusing on the circular economy.

This thesis will lay the ground for future research and analysis of how Trondheim is doing in the future. I will offer recommendations based on what other cities have developed to create a circular framework and policies at a city level. Finally, it is helpful to have insight into where Trondheim is currently and give an overview of what is being done since there is no existing literature on this blooming topic.

1.5 Structure of the Study

This study is divided into chapters that will lay out the research and relevant literature in a structured manner. Chapter 1 is the introductory chapter which lays out a brief introduction to the study. It also introduces the research objectives and the research questions, followed by key concepts that need to be understood to grasp the concept's use within the research context. The chapter ends with the significance of the study and what is driving me to complete this research.

The second chapter is the presentation of a literature review. The literature in this section is presented in a narrowing scope and was chosen based on if the research fits into the 5 R's. The content begins with the research on the concept of CE, then on to the policy and framework at a super-national level which includes the EU, then on to the following countries: The Netherlands, Finland, and Norway. It continues to narrow as it leads to analyzing the existing literature on framework and policy at a city level in Helsinki and Amsterdam.

In the third chapter, I will discuss the methods and methodology I used and conducted during my research. One will read that I completed a literature review, two case studies, and conducted interviews. During my research, I conducted ethical research, and I also present possible biases that could come from the interviews.

In the fourth chapter, my findings from my research will be presented. It will include topics mentioned in all my interviews and my case studies, analyzed within the framework of the 5 R's. The case studies of the SDG Clinic and Trondheim Sykkelkjøkken will be explored. Norway following the EU will be discussed and ending with an analysis of current projects and initiatives.

Chapter 5 will be an analysis section that is based on the social aspects of CE. The topics of current social aspects, societal change, and knowledge sharing will be analyzed. The concluding chapter, six will be a discussion and analysis of my research findings and the concluding remarks. The study will be presented in terms of my research questions. There will also be discussion points on what Trondheim can do to reach a better circular economy. In the end, there will be concluding remarks.

2 Literature Review

In this chapter, I will be discussing the relevant theory that is important to explain the background and what is currently being done with the circular economy around the world. This information will be structured in how it relates to my chosen analytical approach. The first research on the overarching concept of circular economy will be presented. Following CE will be the presentation of research related to policy and framework structured to fit into the 5 R's of the circular economy. After the presentation of global policy concerning the 5 R's will be presenting the EU literature. This structure is essential because it lays the way for why my research is relevant, laying out the connection followed by global strategies then narrowing down to what the EU is focusing on with examples from specific cities. This lays the way for the presentation of my research on the state of Trondheim's circular economy.

2.1 Circular Economy

Sources note that concepts related to the idea and images behind the circular economy have existed for some time. Some literature, such as Ghisellini et al. (2016), describes its origins in the ecological economy and dates it back to Pearce and Turner (1993). Pearce and Turner were adding to a previous study done by Boulding (1966), which presented that a circular system economy is needed to maintain human life. Boulding focuses on the concept of reducing what we consume to avoid having clean air and a better environment (1966, p. 13). Boulding's argument shows that the idea of CE was being presented before there was a word to put to why we need to cut back; in 1966, they were already researching the reducing aspect of CE. Pearce and Turner (1993), 27 years later, build upon Boulding's argument and explain a shift from and linear to a circular economy using thermodynamics in their arguments for degradation of energy and matter. Pearce and Turner bring the CE argument to a different level that requires an understanding of thermodynamics laws. For the sake of this research, we will not be focusing on the complexity of thermodynamic but the simplicity of reducing the amount of energy we use. Pearce and Turner's argument is essential to CE studies because it shows how complex CE can be. Still, I will argue that we can keep CE achievable and straightforward at a city level and that it does not need to be defined with words like thermodynamics that the average person would not understand.

Several researchers cite the Ellen MacArthur Foundation (EMF, 2013) for adding to the most recent CE theories like the blue economy, performance economy, cradle to cradle, and biomimicry (Kirchher et al., 2017; Ghiselli et al., 2016; Murray et al., 2017; Brennan et al. 2015).

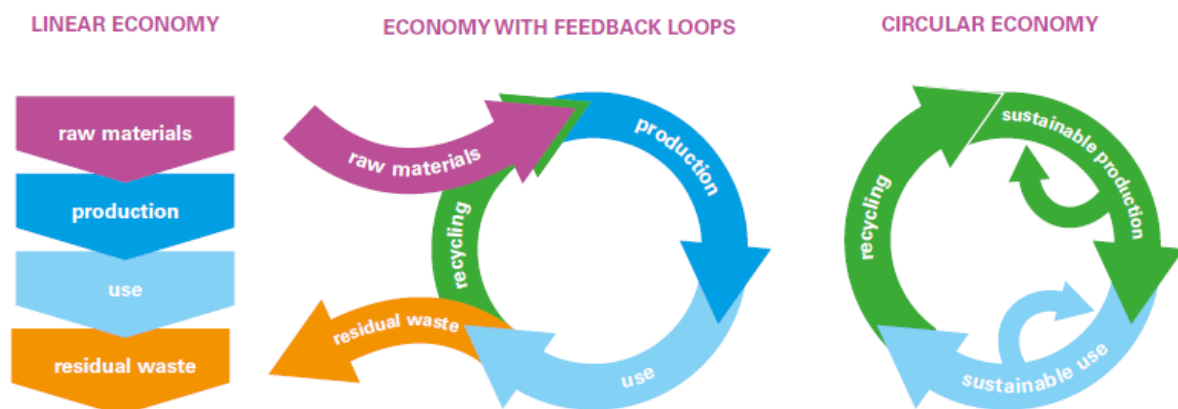
These more recent CE theories offer a less complex CE argument and demonstrate how CE is achievable in an understandable manner. The Ellen McArthur Foundation has played a significant role in the promotion and research on the circular economy. The EMF has produced a wide range of research and reports on CE, and the EMF even published a book in CE by Ken Webster (2015). The EMF lays out Cradle to Cradle theory as a "framework (that) focuses on design for effectiveness in terms of products with positive impact and reducing the negative impact of commerce through efficiency" (2020, para. 2). I will use this theory within my research as it plays a role in the reducing and reusing aspect of the 5 R's and promotes the elimination of waste by reusing a product for as long as possible. It will be presented through my analysis and linked withing the 5 R's to demonstrate how cradle-to-cradle theory is relevant and an approach that covers the overarching themes of CE in a manner that is easy to understand.

The EMF presents other theories as mentioned above (Performance economy, biomimicry, and blue economy). The idea of performance economy plays off research by Walter Stachel, the founder of the Product Life Institution, which focuses on creating a long-lasting product. (Stachel, 2016) While his work is relevant and the development of long-lasting goods does play a role in CE, I will be focusing on CE at a local level. This theory has a more significant focus on the global economy as a whole. Next is the biomimicry theory credited to Janine Benyus and focuses on innovation inspired by nature and presents three principles of nature that offer nature as a model, measure, and mentor (Benyus, 1997). Biomimicry is quite similar to the concept of Natural Capitalism which ties the business aspect into nature, showing where they overlap (EMF, para. 5). Biomimicry and Natural Capitalism focus on nature and do not play a role in my research's main points, so they will not be used within my research. Lastly is the blue economy theory, introduced by Gunter Pauli, which focuses on the notion that the local environment and physical characteristics can change and emphasize gravity as a source of energy (Pauli, 2010). While the local aspect is relevant to my study, as a source of energy opens up too much and would be too broad for the focus of my research, and because of that, I will not be using this theory within my research.

The term Circular Economy is a concept that has only seen an increase in research in the past seven years. In 2016 online there were over 100 scientific articles published on CE; before that, in 2014, there were only 30 articles published a year on CE (Kirchherr, Reike, & Hekkert, 2017). The shift in the research amount shows the growing wave of circular economy sweeping across Europe and China. The majority of the articles are written by people in China and the Netherlands. While there is a growing amount of research on CE, there is no set of simple definitions. Kirchherr, Reike & Hekkert's study points out that most CE definitions relate to the commonly known 3 R's reduce, reuse, and recycle, which they found in 40% of the 114 definitions (2017, p. 221). The 3 R's are what came before what we now know as the 5 R's, adding the repair and refurbish aspect, which plays an essential role in CE. Their results show that before 2012, recycling was the most common word used within CE definitions and stayed one of the most commonly used words in CE definitions. From 2012 to 2014, there was a growing increase in the use of the words reduce and reuse, while the word recover has stayed low (Kirchherr, Reike, & Hekkert, 2017, p. 226). Overall, this research shows that there are common themes through the 114 definitions they analyzed; an overarching theme in the definitions is the use of the 3 R's, which play a significant role in my work since I am using the upgraded 5 Rs within my analysis.

Using this visual below (figure 2) can be one of the steps taken to bring CE down to a practical level that is easy for the general public to understand.

Figure 2 Circular Economy loop



Source: https://www.researchgate.net/figure/Characterizing-linear-economy-economy-with-feedback-loops-and-circular-economy-RLi_fig1_325417234 [

The Circular Economy loop can further be used to explain why the 5 R's are relevant within the CE context. As one can see, recycling is shown in the loops, reducing and refusing is a general way to be more circular by not introducing new products into the loops. Repairing and reusing allows for goods to stay within the loop for a longer period before becoming residual waste.

2.1.1 CE and SDGs

While CE might not play a role in all SDGs, there is a clear connection between SDG 12, responsible consumption, and production. This can be demonstrated by the struggles within the construction industry shown at the clinic. There is also a relationship between CE and SDG 13, 8, 9, and 11. SDG 13 is on climate action, which goes hand-in-hand with CE because many CE initiatives also have a positive environmental impact, such as reducing carbon emissions. SDG 8 is on decent work and economic growth. While this connection may not be evident at first sight, but with CE initiatives come jobs. All of the EU and national reports and local government mention the number of jobs from CE initiatives. For example, the EU presented that an estimated 700 thousand new jobs can be created with the 2020 Circular Action Plan (2020, p.4). SDG 9 covers industry, innovation, and infrastructure have a clear linkage to CE because of its connection to the sector where CE plays a prominent role. Innovation is needed within industries and their current policy, and there is room to put in an adaptive CE-related approach. There has been a decline in manufacturing before COVID, according to the UN (SDG Goal 9). The decline in manufacturing demonstrates that we are reducing the number of goods we are using.

The reduced amount of manufacture can point to increases in trade tariffs and tension between countries. To further back my findings, Rodriguez-Anton et al., in their intensive qualitative study, collected information on the correlation between CE and SDG's results showing a strong correlation between SDG's 8,9,11,12 and partial acceptance with SDG's 13 and 12. (2019, p. 718). The correlation is significant and indicates that CE is essential to more than just a better business model. Some might argue that SDG number 17, Partnerships for the goals, does not relate to CE. I want to point out that SDG 17 is at the core of all 17 goals because a lot of change and progress is impossible without creating partnerships, whether they are local partnerships between the public and private sectors or associations at a national level.

2.2 Challenges and Critiques of Circular Economy

The CE approach to sustainability efforts is often critiqued. One of the first critiques is the unintended consequences of deforestation or reliance on precious environmental metals that can sometimes come when companies attempt to become more sustainable or circular. People assume that "circular solutions lead to circular outcomes." We would think this quote would be correct, but sources show otherwise (Murray, Skene & Hayes. 2017, p. 376; De Man & Friege, 2016, p. 93). In the article *Circular economy: European policy on shaky ground*, De Man & Friege (2016) point out three fundamental problems with CE. Their first point is that creating a waste-free economy or endless material cycles would use vast amounts of energy. The second is that there is an assumption that all-natural nutrients can be easily recycled back into the environment. This is not always the case, and they point out the scale problems within natural nutrients. There is also a problem with progress in lack of knowledge of substance flows into the environment. The experience is growing, but we continue to create beneficial products for the consumer but completed more hazardous waste disposal.

De Man and Friege argue that "The sustainability guarantee of 'circular' solutions is an illusion" (2016, p. 93). When creating products, things will seem to be more circular. Effects will be longer-lasting when products with a longer life cycle are more harmful to the environment due to the high energy-consuming production process. Often it can be better to use products that can safely be recycled back into the environment, like creating something with bamboo, even if it has a shorter life cycle.

Like most aspects of sustainability, there are positives and negatives to all actions. There need to be complete overviews of measures to avoid negative consequences like the points mentioned above. Many of the circular economy reports mentioned in the next section cover the challenges of adopting practices and list ways to overcome the present obstacles.

2.3 Framework and Policy

This literary section will provide an overview of the relevant literature and reports on the CE framework and policy. This section will be linked to my analysis using how the literature is relevant by linking it with the 5 R's. It will include an analysis of CE policy at a supernational level, including national policy/framework from the EU and national policies and framework in the Netherlands and Finland. I chose Finland and the Netherlands because, like Norway,

they are known for being forward-thinking in sustainability. Section 2.3.2 includes examples of CE framework and policy at a city level in Helsinki and Amsterdam. The analysis will work its way down, starting with supernational policy down to city level policy and to frameworks that are continually being used worldwide.

2.3.1 Super-National & National Policy and Framework

European Union

Closing the loop: New circular economy package presented actions planned and four new legislative proposals to be met by 2030 (Bourguignon, 2015). The report shows that municipalities' waste has decreased by 2% despite a household expenditure increase of 7% (Bourguignon, 2015, p. 3). These numbers are exciting and show the potential to reduce the number of products households are consuming. The report also lays out potential opportunities from circular economies such as innovation, growth and jobs, reduced environmental pressures, enhanced security of supply or raw materials, and increased competitiveness. The potential for opportunities is excellent, but one must also layout the room for challenges. The report does just that and presents the following challenges: financing, economic enablers, skills, multi-level governance, and consumer behavior and business models. These are all relevant challenges that must be addressed when coming up with circular and sustainable solutions. Many of these challenges will be addressed in my analysis because they are applicable at a national and city level when implementing circular strategies.

In 2020, the European Commission released "*Circular Economy Action Plan for a Cleaner and more Competitive Europe.*" The introduction of this plan states, "The Circular Economic Action Plan provides a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens, and civil society organizations" (European Commission, 2020, p. 5). The action plan begins with a study that shows that applying CE strategies can create 700,000 new jobs and create a GDP growth of 0.5% in the EU (2020, p. 4). This point is a driving factor into why it is essential to implement CE strategies and that it can bring both jobs and GDP growth which is a win for both the economy and the environment. One of the action plans main aims is climate neutrality, which directly coincides with the 5 R's. The policy framework organized within the action plan are as follows: (1) designing sustainable products, (2) empowering consumer and public buyers, and (3) circularity in production processes. Each of the frameworks comes with step-by-step

policies and ways to regulate circularity. Some of the key points include the reusability of products and the right to repair. This is one of the first times repairs have been mentioned as part of the EU strategy. The European Commission (2020) also points out the value chain in large industries such as electronics, batteries, vehicles, packaging, plastics, textiles, construction, and food waste. These are all significant points that have a lot of work needed to become circular. The report points to the challenges of recycling the different products, which is an important thing to note when presenting circular projects and policy.

Another large project that is happening in the EU is the European Green Deal. The European Green Deal was presented on December 11th, 2019. This deal's primary goal is "to make Europe the first climate-neutral continent by 2050" (European Commission, 2019). Simultaneously, it is not specifically about CE, many aspects such as resource efficiency and zero pollution. There are goals presented in the European Green Deal (2019), such as increasing climate ambitions for 2030 and 2050. Designing plans for the long-term leads to an increase in projects that relate to CE and sustainability. Being such a large force, the EU has an impact all over the EU, even on those who are not a member, like Norway. The EU policy and framework play a role in my research by providing support for what kind of policy is needed and can be achieved at a local level in Trondheim.

Netherlands

In 2016 the Dutch government created a government-wide program for a Circular Economy in the Netherlands by 2050. The program begins with stating its "promising prospects," which include changes in the broad sense, unifying theme in policy, and international contexts (2016, p. 6-7). These themes lay some background for what is needed for a successful circular economy platform and strategy. The Dutch program for a circular economy also promotes things like replacing property by use and easy to repair as a standard requirement for setting strategic goals and generic policy change that would remove obstacles (2016, p. 5-18). These initiatives lay within the 5 R's and set a path for a CE; one of the main reasons I choose to include the Netherlands within my research is because, according to the circular gap report, the Netherlands is at 24.5% circularity. (Circle Economy, 2020). The same publisher produced the report that made the Norway Circular Gap Report; the initiative is titled The Circularity Gap Reporting Initiative (CGRi). The report suggests that the Netherlands can get their CE rate up to 70% by adjusting the following, (1) advanced construction practice, (2) circular agriculture and food systems, (3) shifting from fossil fuels to renewable sources, (4)

repair, remanufacturing and high-value recycling (2020). The Netherlands provides an excellent example for showing what works since they are considered ahead of Norway regarding their circular rate. The research mentioned will give me backing for my analysis.

Finland

Finland and Norway are both Scandinavian countries similar in population size; this makes Finland a great country to add to my research and use as backing for my analysis. Finland, much like the Netherlands, has set ambitious goals for itself. Finland stated that they want to be the global leader in CE by 2020 (Sitra, 2016, p. 3). In 2016, the Finland's road map to the Circular Economy was published. It played out a way for Finland to implement strategic goals for CE. The roadmap lays out four objectives for Finland as follows: (1) Renewal of the foundation of competitiveness and vitality, (2) Transfer to low-carbon energy (3) Natural resources are regarded as scarcities, and (4) everyday decision working as a driving force for change (Sitra, 2016). The most striking point is the inclusion of everyday decisions because I have found that CE's social aspect is missing in most reports. Another critical part of this report is that it states key points and KPI's and the needed policy actions; this is important to see how change can be made with the right kind of policy. There has not been a circular gap report made on Finland, so we do not have the circularity rate to compare it with Norway and the Netherlands. So, we must look into what the city is doing in terms of framework and policy to gain insight into what Norway and the municipality of Trondheim can learn from Finland.

Norway

Currently, Norway has no national policy on CE in place. Still, with the release of the 2020 Circular Gap Report, Norway has drawn attention to the fact that Norway has a merger circular rate of 2.4% (Circle Economy, 2020, p. 11). This is a stark comparison to the Netherlands, which has a circular rate of 24.5%, as previously motioned. The Circular Gap Report also mentions that "Norway has some of the highest consumption per capita in the world" and that "if everyone on earth were to live like the Norwegian, we would require the resources of three and a half planets" (2020, p. 11). The point draws the actions that change is needed at all levels. At the 2020 Norwegian Circular Economy in Oslo, the Minister of Climate and Environment, Sveinung Rotevatn, gave a speech where he made important points and observations. Rotevatn first mentions that the circular economy is "hot stuff" and that there have been many meetings, seminars, and debates on the hot topic, yet there is still no CE

policy. In the speech, Rotevatn also mentions points similar to those already present in the Netherlands and Finland framework, including using fewer resources and reducing emissions. Towards the end of this speech, he mentions that regulations are essential, and that Norway has excellent cooperation between the public, private and educational sectors. The minister points could mean that a new framework is being worked on, but there is nothing a year later. There are no goals, small or large, set to improve the circular economy. In 2015, the EU commission pointed to the improvement made in Norway. The European Commission's 2015 action plan points out that in Norway,

"According to the European Environment Agency (EEA), between 2004 and 2012, waste generation from manufacturing and services sectors in the EU-28 and Norway declined by 25% and 23% respectively, despite respective increases of 7% and 13% in sectoral economic output" (2015, p.3).

That data shows that even though more were produced in Norway, less was turned into waste; this can point to the production of better, long-lasting products. The fact that Norway was being mentioned in terms of circular economy in 2015 makes me wonder why action was not started six years ago and has led to being one of the reasons I choose to do this research. Another essential thing to consider is that Norway in 2016 created the Agenda 2030. This 2030 Agenda is a roadmap set to align Norway's policies with the 2030 Sustainable Development goals. The goals of the 2030 Agenda are to help with challenges at a national level, increase national participation towards SDGs, a commitment to help eradicate poverty and protect planetary boundaries, and connecting peace and poverty (Ministry of Foreign Affairs, 2016). This roadmap is specific for the SDG, which plays a role in increasing CE. CE's relation to SDGs points out that there is a starting point, and that CE must be included within the current efforts.

2.3.2 City Policy and Framework

Framework and policy are essential when it comes to implementing circular city strategies. In the United for Smart Sustainable Cities (U4SSC) report on circular cities (2020), they point out four components needed to implement a circular framework. The first point is accessing city assets and products, followed by outcome-oriented actions applied to city assets, thirdly results of circular action items, and lastly, circularity enablers that support circular city outputs (2020, p. 5). The report points out specific city actions and leads to the presentation of four steps to implement the previously mentioned components. The four steps are discussed in the reports. The following are the four steps for circular framework: assessing current

circularity, determining the potential for future circularity and prioritizing circularity actions, catalyzing circularity, and assessing projected circularity impact (U4SSC, 2020). The U4SSC framework is relevant to Trondheim because U4SSC is one of The Centre for Sustainable Development, 13 UN partners, thus providing Trondheim with knowledgeable resources and partnerships to contribute to creating a new policy framework to boost the cities CE. While the U4SSC presents the framework that could work for cities trying to become circular, a few examples of cities and countries have already adapted their policy and created the framework for their city or country to be more circular. Next there we will look at the city framework in Amsterdam and Helsinki.

Amsterdam

A year before the government-wide circular economy strategy was presented in the Netherlands, Amsterdam's city was ahead of the circular curve. In October 2015, the Amsterdam city government and Circle Economic wrote a vision and road map for Amsterdam. The roadmap's goal was to set short- and long-term goals for the city that go along with seven principles based on no waste, renewable resources, return logistics, raw materials, and human actives (2015, p. 8-9). The main pillars followed by the city link very closely with the 5 R's of the circular economy. It is important to note that the city pays attention to the social aspect of CE. In a report published by Amsterdam's city government in 2020, they presented their 2020-2025 strategy for CE. The strategy is based on the people and shows CE as "Life in the doughnut" that displays how Amsterdam can be "a thriving city, socially just and ecologically safe" (2020, p. 6). The city has set small goals to hit each year and presents its progress thus far, such as "more than $\frac{3}{4}$ of Amsterdam residents are positive about the idea of buying fewer new products for the benefit of the environment" (2020, p. 14). It is clear that the city has involved its residents and that the residents have taken to the idea of a circular economy. I find it interesting that Amsterdam presents a primarily social side of CE while formal literature and research on CE's social aspect are missing. A recent case study on Amsterdam by Jacqueline Cramer (2020) presents how Amsterdam has successfully implemented and successfully increased its CE. The city begins with four stages: the drafting of a circular economy program, the second building circular initiatives, the third scaling up, and mainstreaming (2020, p. 5-6). Having steps set up for how your city will become a thriving circular city is vital and something that Trondheim could learn from.

Helsinki

Helsinki, similarly to Amsterdam has also set up a road map for a circular economy with goals set for 2020-2025. One factor that sets Helsinki apart is that they focus on both a circular economy and sharing economy. According to the City of Helsinki, Urban Environment Division (2020, p. 4), "Circular economy is also closely connected to sharing economy which focuses on using products efficiently instead of owning them, for example through renting and sharing." The sharing concept is exciting and relevant to my study since a social aspect of CE needs to be examined. I would take some dedication and motivation from the people to make these kinds of sharing efforts be sustainable. The city of Helsinki also looks at the European Commission as a Living Lab. They did a study to show the impact of cities investing in the circular economy to have sustainable cities. The study points out that national and regional policy influences the cities to move forward with CE projects and policy (Santonen et al., 2017, p. 8). The living Lab study focused on five cities, one of which is Helsinki.

Santonen et al. (2017) praise Helsinki for building a collaborative process with a municipal, state, academic and private organization, using the example of Östersundom's bioeconomy node. This industrial part generates energy, heat, and bioproduct (p. 32). Having working relationships between sectors is vital, and this is relevant to the city of Trondheim because many projects within the city work with NTNU, Trondheim Kommune, and other organizations on various projects. Another critical aspect of Helsinki is its involvement and implementation of circular economy projects. The Living Lab study found 14 different projects but point out the Helsinki business hub identified 48 development projects. (Santonen et al., 2017, p. 43). Having such a variety of projects is excellent, as long as they are managed and monitored to see that they positively impact. To monitor the city project, Helsinki city has appointed a contact person for each action to monitor the process. This is part of their Carbon-neutral Helsinki 2035 Action plan (City of Helsinki, 2020, p. 5). From the report and study on Helsinki, we can see the importance of a roadmap, goals, and tracking within city-level policy and framework.

Trondheim

Unlike the other two cities, Trondheim does not have a CE roadmap or CE-specific goals. While it does not have any policy or framework set up, the city has similar dynamics to the other two, such as a large student population and an active municipality. The city is home to the Norwegian University of Science and Technology, which attracts many international students worldwide. According to the Trondheim Kommune's website Trondheim has "a dynamic citizen population where one in five inhabitants are registered students and one in seven work within the knowledge and innovation sectors, heavily focused on green technology" (Trondheim Kommune, 2021). As of October 2019, Trondheim became a 5th Geneva UN Charter Centre of Excellence. Since Trondheim has many students and many innovators in the knowledge sectors, and a UNECE charter Centre of Excellence makes it a great city to analyze why the circular economy has only recently become a focus.

UN Centre of Excellence

According to a UNECE press release, the Geneva UN Charter Centre of Excellence on SDG City Transition in Trondheim is the fifth Centre created by the UNECE (2019, para. 1). Being a part of the Geneva UN charter shows that cities play a role in realizing the SDGs. According to the press release, the Charter Centre works closely with Smart Sustainable Cities, UN-Habitat, and 13 other UN organizations (2019, para. 5). Vital partnerships like these open up a world of possibilities and innovation for the city. The Centre is using the framework that was tested as part of the TRD 3.0 project. The press release notes the following as the main activities for the Geneva UN Charter Centre of Excellence on SDG City Transitions.

- Support UN's work and evaluate cities on intelligent, sustainable development at a local level using KPI's (Key Performance Indicators).
- Developing the testing of SDG City Transition Framework with a knowledge-based approach.
- Assist the UN and national partners in incorporating the SDG Transition Framework into their project.
- Promote the exchange of best practices within the National Network of Excellence on intelligent, sustainable development.
- Encouraging cooperation between stakeholders at all levels.
- Ensuring knowledge transfer to build and implement policies and actions to improve quality of life and efficiency of urban operations.

- Support achievement of SDGs at a local level.

Imagine the possibilities and opportunities that Trondheim can implement through a variety of outlets. There are only a few press releases on the UN Centre of Excellence, which is referred to as The Sustainability Centre or Bærekraftssenteret (Norwegian name). It is a new Centre, and the fact that it takes time to build and develop projects with the Centre's parameters.

Innovation Hubs

The public sector in Trondheim encourages increased innovation by partnering with academia and civil society to create a quadruple-helix city model. (Trondheim Kommune, 2021, para. 3). One of Trondheim's most significant innovation hubs that enable collaboration is DIGS. DIGS is a co-working space and the leading startup community in Trondheim, home to over 120 startups and has over 450 members (DIGS, n.d). DIGS has created space for people with like minds to have an office space, café, and open space to meet. Often Digs hosts events such as workshops, talks, pitch nights, and meetups. Trondheim is also part of what is called the "Trondheim Nordic City Lab." According to the Kommune, "The purpose of the City Lab is to be a test facility for Smart City solutions and a showroom for new innovative initiatives. The Trondheim Nordic City Lab functions as a playground for partners, a test facility for current and future EU initiatives, and a place where Trondheim can develop its digital citizenship, all the while creating a fun and exciting urban arena" (2021, para. 4).

Being a part of the Nordic City Lab has led to more connections with other city projects such as TRD 3.0 is an agreement between NTNU and the Municipality to work together on long-term goals to share knowledge, develop technology, and create sustainable societies. The project lays the ground for the interaction of networks at a university, citizen, and governmental level. The goal is that together they can promote research and solve complex societal, technological, and social challenges. The increase of innovation hubs lays the ground for more research and possibility within the city of Trondheim.

2.4 Analytical Approach

This conceptual section will discuss the analytical model used to show how I analyzed my findings. To simplify the circular economy concept's complexity, this research will be analyzed using the 5 R's, which are an addition to the well-known 3 R's of Reduce, Reuse, and recycle. The 5 R's are as follows, reduce, reuse, refuse, repair, and recycle. The 5 R's framework allows one to see how the presented literature on circular economy relates to my

study's analysis and conclusion. Using this method simplifies how the collected research was analyzed. The 5 R's are the thematic codes used when organizing what information, I would use from my interviews. This framework allowed me to find what is essential about circular economy in Trondheim and focus my research rather than having a broad picture. The 5 Rs also played a role in my case studies, where you can see in chapter 4 how all 5 play a role within each of the studies. By following this method, my research allowed me to keep an organized structure through my literature review. The 5 R's enable me to show a clear link between my research questions and my finding.

2.5 Chapter Summary

Within this literature review, we learn about CE from a top-down approach. First presented is the complexity of the term circular economy. I explain that the most mentioned term in CE definitions recycle, one of the 5 R's, which is part of CE's chosen definition within this study. For the theory aspect of CE, various theories were presented, many of which were quite complex and industry specific. For this study, we will be using the 5 R's approach within the analysis. The 5 R's approach will allow one to see a significant link between my findings and their relation to CE. Following policy and framework literature is presented, many of which are reports done with the EU, national governments, and city governments. The EU policy and framework presentation are vital because of their impact on countries all over Europe; even those not in the EU often follow in their footsteps. Following the supernational policy is the national policy in the Netherlands and Finland, similar to Norway. The presented countries provide examples of what is possible at a national level and a city level. Amsterdam and Helsinki present a city-level policy that has improved since their policy change towards circularity began in 2015. Both cities are comparable to Trondheim because of their city makeup, having large universities, and active municipal governments. The literature analyzed provides evidence that framework and policy are vital for a circular city economy and that more research is needed in terms of CE's social aspect. Using the 5 R's approach allows the research to be presented in a relevant framework. The introduced literature concludes that cities need a roadmap and policy to amplify their circular economy.

3 Methodology and Methods

This chapter will present the research approaches I have used throughout the research process. I will discuss the methods I used to carry out the research process, starting with semi-structural interviews, case studies, and resource analysis. Using these research methods allowed me to map out what is needed for Trondheim and what is currently happening in the city. I will also discuss the ethics and biases of this kind of qualitative research.

The interview process was taking place amidst the global COVID-19 pandemic. Partially due to the pandemic, it wasn't easy to get people to respond about attending an online interview. I would have liked to interview some politicians working with a sustainability-focused platform and local businesses, but I had no responses. Lack of response can be partial to people being overworked and fully booked with an online meeting. But it could also relate to people not feeling comfortable or feeling like they have enough knowledge of the circular economy concept.

3.1 Methodology

"Qualitative research focuses on understanding a research query as a humanistic or idealistic approach" (Pathak, Jena, Kalra, 2013, p. 192)

I choose to take a qualitative approach throughout this research process. Pathak, Jena, and Kalra (2013) are that qualitative is the best-used research method to understand people and their experience, attitudes, beliefs, behaviors, and interactions. Taking this approach allows me to use what I have found in my case studies and interviews and analyze what they believe can happen with a circular economy based on their previous experiences. Qualitative research "normally looks for patterns of the interrelationship between many categories rather than the sharply delineated relationship between a limited set of them" (McCracken, 1988, p. 16). Looking at the relationships between categories allows me to find the critical information within the content I have been researching.

There are examples throughout the field that use qualitative analysis to look at city framework and policy. Schöbel (2006), who writes on using qualitative research for urban planning, notes that using qualitative research allows for a "narrow regional context" (p. 1). Having a narrow

approach is beneficial for my research since I will be focusing on just the city of Trondheim. Another study by Tetit-Boix and Leipold (2018), looking at similar topics to my research at a larger scale, also uses a qualitative approach to look at CE initiatives and then uses quantitative research to back the environmental side of the study. I do not need quantitative data because I am looking more at the framework and policies currently happening. It is hard to have data for newer projects that are only recently being introduced to a city.

Qualitative is about the existing and current social world rather than statistics that come with quantitative research. Using a qualitative approach allowed me to look at the current social views on the circular economy. This approach also allowed me to hear what insight people had on what is happening in Trondheim currently and see what people think is needed for circularity to increase. It allowed me to analyze what people were saying during interviews. Pathak, Jena, and Kalra (2013) argue that people are often more comfortable in qualitative style interviews because they are less formal than if one were doing a quantitative study. Having people comfortable during an interview allows them to speak how they believe based on their experience contributed to my research.

During the research process, I completed an analysis of both primary and secondary sources. Using primary and secondary sources allowed me to gain an ample amount of research and information. This kind of research is common in social science fields where the research is qualitative. Using this kind of data is efficient for a master's thesis being written in one semester.

3.1.1 Primary sources

Primary sources are the heart of my research findings. I began with creating an interview guide where I listed the questions, I thought would give me the information I needed to answer my research questions. I also decided to focus on two case studies that are circular economy projects currently happening in Trondheim. I attended the events both cases hosted and took notes on what I saw and what people thought about the event/projects as a whole.

3.1.2 Case Study

I choose to do an exploratory case study to go into detail about my topic. If I had decided to analyze Norway as a whole, I would have had too much information, and this thesis would

not have been comprehensive. A case study is relevant because it allows you to discover what is happening at a local level.

I chose two projects in Trondheim (SDG Clinic and Sykkleljkjokken) as my cases because they help further my analysis of where Trondheim is at and going in terms of the circular economy. Zainal notes that "detailed qualitative accounts often produced in case of studies not only help to explorer describe the data in a real-life environment, but also help to explain the complexities of real-life situations which may not be captured through experimental or survey research (2007, p. 4). Using the details from the actual event's allowed me to see what is happening in real life and real-time on projects with a circular economy-related focus.

To conduct the first case study at the SDG Clinic, I was part of this clinic's planning through my internship. A clinic is a place where a business can come and learn something new and ask a question on how they can improve upon their circularity. The clinic aspect can change focus to other things such as education on SDG clinic that would have the same layout as the CE clinic. The planning process of the SDG Clinic allowed me to have prior knowledge and access to talk with others to get more insight. I attended one clinic as a participant and a second clinic as someone who just listened. Listening in on this allowed me to get a different view and provide a better analysis on how it will contribute to my research. During the clinic, I took notes on how things went and paid attention to how the participants acted and their questions. The clinic was in a mix of English and Norwegian since the interns were both Norwegian and international. The parts in Norwegian were then explained in English to avoid any misunderstanding. Using qualitative analysis to figure out how to use what I learned from this case study allowed me to gain insight into information to answer all of my research questions.

To conduct the second case study at the Sykkleljkjokken or Bike Kitchen in English. I used some information from two of my interviewees heavily involved with running the non-profit to contribute to the case study. I wanted to attended one of their weekly "Fix-It" nights where I took notes on what was happening, but Covid hit again and they had to pause their workshop due to guidelines. So, I used the comments and posts on their social media to improve my research. Through this exploratory case study, I gained more research on how circular economy projects are being initiated in Trondheim.

3.1.3 Semi-Structured Interview

To help answer my research questions, I created a research guide (Appendix A) that I would use during semi-structured interviews. I choose to do interviews to get information about what is happening in Trondheim directly from the people working on CE-related projects and initiatives. The questions I created each lead to one another, and each question had a distinct purpose.

The first step was finding people who were willing to participate in being interviewed. I emailed potential candidates in each category. From those who responded interested, we scheduled an interview on Zoom. First, I left them to know that the interview would be recorded, with permission and instructions on accessing their recorded interview. Then I laid out the following information.

- The use of their name and positions are optional. They would mark their preference on the consent form.
- Introduction to the purpose of my research
- How I would use the research
 - To answer my research questions.
- I asked if they have any questions before we started.
- I would send them any direct quotes before publishing.

After presenting the above information, we began the interview and started recording.

During the interview, I followed the interview guide with the occasional rephrasing of questions. I also asked follow-up questions when something needed a further explanation. I used non-verbal cues throughout the interview to show my interest, which is essential during online interviews. After the interview questions were finished, I asked if they had any additional comments or questions for me, then I thanked them for the talk.

After we ended the video call, I sent them an email with another thank you and a reminder to fill out the consent form. The form restated what I mentioned at the beginning of the interview and gave the interviewer the option to select if I can use their names for quotes or link them to projects, they are working on or if they wished not to have their name mentioned. There was no pressure on if they needed to be anonymous or include their name, which allowed them to answer honestly. Each interview lasted around 35 minutes.

During the interview, I took a few notes for myself, but for the most part, I was engaged with the Interviewee since I would be transcribing the interview myself. After the discussions, I took the time to transcribe the interviews myself, which allowed me to go back and listen to the details. The transcription process took about 4x the length of the interview, so it was time-consuming. The time spent doing the transcription was well worth it and helped me catch little details I might have missed if I was not transcribing. Doing the transcription allowed me to remember more of what was said, which helped me incorporate my research when discussing my research questions.

I decided that personal information, such as name and work title, would be optional because I can still use the research information without any personal data. I did want to allow those who wanted to share their projects to use their name for their project to be mentioned and linked to their work within the project. In other words, allow them to showcase their efforts towards circular economy within the city of Trondheim.

3.1.4 Secondary Sources

Various secondary sources were collected from government reports (national and city), formal research reports, academic journals, and articles focusing on the circular economy. One of the main focuses was on the Nordic Circular Gap Report and other reports that focused on the circular economy at the city level. Researching what other cities are doing or having a thriving circular economy allowed me to analyze how Trondheim is doing and where the city is heading. Many academic articles were beneficial in the analysis of the topic of circular economy as a whole. All of the documents analyzed contributed to helping to back up the information learned from my primary sources.

3.2 Analysis of data collection

The first thing I did when starting to research for this thesis looked at secondary data. I created a literature review where I grouped articles, papers, government briefs, and more relevant categories. To organize the literature, I grouped, highlighted, and took notes on each one allowed me to integrate the literature into my framework and throughout the discussion of my research questions.

Choosing to write this as an exploratory case study allowed me to have a direct focus. It was beneficial because I learned more about Trondheim, especially when looking at Norway,

where I would have had to look at information from 422 different municipalities. Since there is no national framework or guidelines for CE, it is up to the local cities to start projects and initiate action for the time being. Looking at the SDG Clinic cases and Sykklelkjøkken helped me contextualize what is currently happening in Trondheim from a primary source.

Having a specific focus also allowed me to collect secondary data on cities with a strong CE for some comparison. I believe that these case studies allowed my argument to be much stronger than it would have been if I looked at a broader spectrum.

The semi-structured interviews helped me get right to the source and learn what has already happened in Trondheim. Doing the interviews' transcription allowed me to see if I missed anything helpful and allowed me to mark pauses, which provided me with even more information. I selected what I would use from the interviews in my thesis using thematic coding. I went through the transcriptions and highlighted different themes and relevant information in different colors according to keywords such as SDGs, policy, framework, and the mentioning of specific projects. From there, I pick out what was relevant to my research and added it to my paper accordingly.

When completing my literature review, I sorted them concerning the 5 R's. began searching broad terms such as just the term circular economy, then found what was relevant in articles, looked at their sources, and continued reading and picking what was applicable from there using the 5 R's as my guide. Each source led me to more sources, so I needed to narrow down the relevant articles for my study.

3.2.1 Research Ethics

I followed research ethics to the best of my ability. I presented research that I held to a high standard and presented it to represent the data in the proper format it is intended to be used. According to Anne Ryen (2011), the most common issues surround research ethics are consent, confidentiality, and trust (p. 418). I was able to combat the present problems by using a consent form, allowing for confidentiality in our conversations. The interviewees were kept anonymous, and I asked for consent to use what department they work with. I was able to gain trust through communication and following my guidelines that NSD approved.

The option to be anonymous and have quotes approval allowed was presented to enable people to feel comfortable to answer honestly. I need to recognize that my findings do not represent the city. They are based on the sample of people who responded to be interviewed.

3.2.2 Challenges

Due to current times, being amidst a pandemic, it was hard to get a response. I could only get four people who worked directly with CE within the Kommune to agree to participate in an interview. I got no response from those in the MDG or local businesses. This also shows that there might be some hesitation behind the topic of the circular economy. It was interesting to see how things in Norway were a little different culturally compared to the United States. I noticed that people in Norway are less willing to talk to students than in the United States. In the U.S. I found it reasonably easy to get people to agree to be interviewed, especially when offering anonymity or space to highlight their work. While in Norway, it was pretty hard to get people to agree to speak outside of your network. This cultural difference was not a challenge I was expecting.

3.3 Chapter Summary

This chapter covered the methods and methodology that were completed through my research process. I conducted a qualitative analysis of my collected data, which allowed me to note the humanistic and idealist factors in this research. During the study, I began with a literature review of research related to CE, starting broad with theory, then on to CE at a supernational down to a city level. To add to the literature review, I dove further into the city of Trondheim by completing case studies on two projects that are currently being implemented in the city, the SDG Clinic and the Bike Kitchen. The case studies allowed me to see what is needed and the barriers they had when starting up CE-related projects. I also completed semi-formal interviews with people working within the Trondheim Kommune who work in various departments on projects that relate to sustainability. I tried to get other interviews from businesses and politicians to further my data but unfortunately got no responses.

4 Research Analysis

This analytical chapter will present an analysis of my research found within my interviews, and selected case studies. There will be a discussion on how the findings demonstrate the need for more policy and framework within the sections. The discussion will include points including key drivers and barriers within circular economy action at a city level. There will also be a discussion and on how the case studies fit into my research. The analysis will be placed within the contexts of the 5 R's to link the topics to CE. The presented research provides an analysis of the current state of Trondheim's circular economy and demonstrates that there is a need for more projects, policy and framework. The research presents a study on the city of Trondheim that has yet to be explored so it adds an analysis of what need to happen for the city to catch up to other cities in relation to their circular economy. Throughout the research process the 5 R's were brought up in a variety of ways and will be clearly presented throughout my analysis.

4.1 SDG Clinic

The SDG Clinic is a student-run initiative to share knowledge with businesses and promote ideas within a circular economy context. The clinic is driven by the need for companies to change and adapt to stay relevant and for Norway to have a better circular economy. Currently, the clinic focuses on business within the construction industry, where there is a significant need for improvement. Trondheim is not the only city where CE is a struggle within the construction industry. Both Amsterdam and Helsinki point to the construction industry when writing their city roadmaps. As time goes on, the goal is for the clinic to expand to present in other sectors.

The clinic provided the companies with first an overview of the SDGs. Then they dive into the circular economy, starting at a manageable level because many might not know what circular economy is at all. After the explanation puts everyone on the same page, a discussion begins, and here is where I found what is relevant to my research.

Within the discussion, we found a massive need for the spread of knowledge around the concept of CE, and many companies were aware that yes, they could recycle more, or the products could be made with better materials. One of the clinic's barriers is getting companies

to share their struggles; most do not want to admit them for fear of being critiqued. The people running the clinic worked towards creating a safe and judgment-free environment. The first thing to note is that these companies were all small to medium sized and some were family-owned, with 25 to 125 employees. So, these were not large Ikea-sized businesses, and smaller businesses are the ones who usually have the most challenging time changing their ways since there is very little room for risk-taking and potential profit loss. One person from the plumbing industry noted that they know they are a massive part of the issue and that they want to find more ways to contribute to being the solution.

When watching the clinic, I noted down some key points that were mentioned, such as: (1) designing out waste, (2) adaptability, (3) unsustainable material, and (4) customer expectations. Each of these points plays a significant role in the construction industry, and many have hoops that they need to jump through and posed many problems with making small changes. I noticed that many of the issues could be fixed with a change in policy and a shift in customer mindset, which is the most challenging part to overcome.

Designing out waste

Designing out waste within a construction project would be a great way to boost CE, but it is a complex task to conquer current building standards. One of the businesses mentioned how they are aware that there is much waste. They were sure to note that it is challenging to build in layers. There is no time to wait for other used materials. The strict building material codes in Norway were also mentioned. Change in the material codes could provide more sustainable options while still keeping material quality intact. That is just one place to start.

The process mentioned that the best place to start to design out waste was in the demolition process. One person said that there had been word of a “less gluing, more screwing” platform which would make more building material salvageable during the demolition or refurbish process. On the other side, frequently demolition takes more sustainable takes more time, so again we have the money aspect that comes into play. The government could offer benefits for a sustainable demolition process which could then offset the price.

Another barrier to designing waste is that the builder is often at the supplier’s mercy and the purchaser’s wants and needs. The businesses mentioned that sustainable practices and materials require new technology that is expensive, so small businesses cannot afford new

sustainable options. Again, this is something that can benefit from an increase in governmental incentives.

Adaptability

Adaptability can only be solved if businesses, suppliers, and purchasers are willing to adapt to change. In the construction industry, the idea of adaptability plays to reducing the number of new materials and building with materials that can be adjusted or built to last. One clinic attendee mentioned that designing for adaptability has been left behind because it takes more time to develop, and people want buildings quickly. Another person said that frequently when something fits into what you need to build now, the best option is not always available. So, you have to use what is available when the need for a product occurs. The comment points to having universal products ready to go when you need them. They noted that often sustainable or adaptable are not always easily accessible. With the limited flexibility on time and need of products, it is easy to see how adaptability is a barrier. Again, this is a barrier that can be overcome with similar policies to those mentioned in the previous section. Providing incentives for using sustainable and adaptive products makes it easier for smaller businesses to take this step forward, noted one of the clinic hosts. There also needs to be incentives for the producers to create more adaptable products and phase out what is not versatile or recyclable.

Unsustainable material

Like the points mentioned in adaptability and design out waste, there is a need to reduce the number of unsustainable materials used within the building process. There are factors such as the supplier and purchaser that play a large part in the continued production of unsustainable materials. There is a clear need to promote sustainable building materials, which, similar to those above, can be helped with incentives from the government. One point mentioned by the clinic's host was that virgin materials or raw materials used within the manufacturing process use more energy and are often not recycled, which is a problem when our national resources are depleting at an alarming rate.

The factors at play here are that we need materials that can be easily reused or easily recycled. The issue here is there still needs to be the same durability of the building materials that come with the non-sustainable materials. There is a need for technological innovation with materials that are tough and sustainable. Much like the previous points, the government could

guide whether funding for a startup is working on sustainable building materials or incentive for producers to change to sustainable options.

Customer expectations

The customer who is purchasing the materials controls what materials are used within the building process. Here, the obstacle to overcome is CE's social aspect; if consumers push for more sustainable options, for example, repaired and refurbished hardwood floors or lumber from a demolition project, then there is protentional for a smoother transition to the circular construction industry. A government incentive could help change the price of sustainable solutions. Price plays a significant role in purchasing decisions for both the builders and purchasers, so this is an essential factor that cannot be left out when creating a new circular economy policy.

Changing the wants of the consumer is not a simple process. People want to use what is affordable and what looks the best, so there is a need for construction companies to offer affordable, reasonable looking and sustainable solutions. There is a long production line of adaptations that need to happen to provide sustainable solutions that fit the mentioned criteria. One step that was mentioned was possible having more sustainable marketing being promoted, showing people how buying sustainably is "cool" and that it can be done. There should be easy solutions to keep the customer happy while promoting a better CE. If changes can be made within product choices, adaptability, and designing out waste, there should be potential for customers to expect to use sustainable material in the building process.

Summary

From the above points, we can see the complexity of change within an industry. The clinic host made it a point to note how change is possible and a need for government policy changes. A change in government policy would make it much easier for the business to become more circular in their daily practices and purchasing decisions. Concerning the 5 R's, there are clear links, first in reduce and refuse where business can reduce the number of new materials they are using to avoid depleting and using an excessive number of natural resources. There are also the aspects of reuse and recycle which go hand in hand, recycling the materials that cannot be reused then repairing what can be repaired so that it can then be reused. Using the 5 R's, we can see that there is potential to have a circular loop within the

construction industry. Adjusting to the mentioned 5 R's also points to the use of cradle to cradle, by using the resources until they cannot be used, once unusable they are then recycled. In a perfect world, the construction industry would reduce, reuse, recycle, repair, and refuse a more circular process. For this to happen, there is a clear need for updates in policy and framework at a local level. We could also see change by changing the consumers' mindset, but things must be taken one step at a time.

4.2 Trondheim Sykkelkjøkken

Trondheim Sykkelkjøkken in Norwegian, or as we will call it, bike kitchen, is a non-profit aiming to help more people repair their bicycles. At the bike kitchen, you pay 200 kroner (about \$20 USD) or 300 kroner (\$30 USD) a year to be a member. The membership allows you access to tools and volunteers to provide you with guidance on fixing your bike. The bike kitchen is open one day a week on Wednesdays from 5 pm until 8 pm at a local café. The central Trondheim location is convenient for many bike commuters, both students and others who live in Trondheim.

The initiative focuses on repairing your bike at the bike kitchen instead of buying a new one, giving people the opportunity to learn how to repair their bike independently. Another benefit of repairing your bike is that if more people ride their bike, fewer people are driving their car to work, which reduces CO2 emission. The initiative covers reducing and refusing to refuse or reduce the amount of driving a vehicle and reducing carbon emissions, reuse by using your bike for a more extended period, and the most obvious being repair by fixing your bike. They hope that people will become motivated to fix their bike on their own, and if they can fix a bike, they might be able to fix other things, maybe a button on their pants. The repair mindset plays into the social aspect of if the public sees that they can do something and have the proper perspective, they do it. Mindset is one of the first steps towards creating change for a more circular economy from a social standpoint.

Two of my interviewees happened to be founding members of the bike kitchen and provided me with insight into the barriers to starting up the bike kitchen. One of the first barriers brought up was funding. They mentioned the struggle to find financing and noted if similar projects cannot find financing, how can we expect them to be motivated to start. They said that people would not take their pocket money; with more financial support, there would be a

more significant possibility for more sustainability-related initiatives. They also pointed out that where there is funding, it is not allowed to pay rent. Rent is one of the most expensive aspects of starting a project like this, where physical space is needed to function.

Location is the next barrier; being a small non-profit that is open just one day a week, it would not make sense for them to pay rent for a space that would only be used for a short time. The interviewee mentions that there are not spaces that are set up for this kind of need and noted that “there should be some kind of shared space facilities where you can just use it for the time you needed it, and you could probably share the space with at least ten other initiatives.” While the city of Trondheim does not have this kind of space, there is a space in Trøndelag called Stokkøya that is called “Bygdeboksen,” which is a space that is open for a variety of events, a workshop, kitchen space, laboratory, and a large room for events.

(Byda2.0, para. 12). Having this kind of space is possible and having it in Trondheim could be the answer to the barrier of finding a location for an initiative. There are other possibilities to solve space; the founder mentioned empty buildings owned by the municipality they tried to use, but the municipality has strict regulations. They suggested that the creation of a flexible framework for working/workshop spaces would be great.

From the analysis of the bike kitchen, we can see that there are things links within the 5 R's. People can implicitly begin to realize that by riding their bike they are impacting the environment by reducing the amount of carbon they are producing. By reducing the use of their car, we could note that then people are refusing to admit carbon, implicitly, by making the decision to ride their bike. Repairing their bike, instead of buying a new one directly contributes to the circularity of the city because less products are being brought into the economy. In this case it is hard to link recycle, because it is not easily seen because my bike parts cannot be recycled, but they can be repaired.

4.3 Following the EU

In all four of the interviews, various EU policies and frameworks were mentioned. It was noted that Norway, and other non-EU countries, often follow in the EU's footsteps since they are such a large entity that plays a significant role in Europe. One of my interviewees and I would argue that in this aspect, Norway is falling behind since the EU began its CE framework and policy in 2015 with *the Closing the loop: New circular economy package* (Bourguignon, 2015). It has taken until recent years for CE to be recognized and

produce a manifesto on CE to be published. The “closing the loop” report and the newer *Circular Economic Action Plan: for a cleaner and more competitive Europe* both present a plan for reaching their set goals and their alignment with the 2030 Sustainable Development Goals. Much like Norway who it also aligns its policy with the SDGs through the 2030 Agenda.

Other points were mentioned that link Trondheim and the EU, such as EU policy that has regulated how much waste is allowed to be dumped in a landfill, said one of my interviewees. In sum, the policy means the municipality must comply; otherwise, they will have to pay fees to the EU. This policy has resulted in some changes, such as second-hand shops run by the garbage management to reduce waste. The interviewee notes that they see it as a direct result of the EU requirement. The regulation has a significant impact on reducing the amount of waste and the recycling and repairing products that still have life are sold within the second-hand store. While we cannot judge whether the policy is directly linked to the opening of the used stores, it is a step in the right direction.

With the 5 R's, the EU works explicitly with 4 of the 5 R's. The use and implementation of recycling is seen in their waste management regulations that were mentioned. The EU also has a focus on reducing carbon emissions, noted in one of my interviews when they said how the 2030 Agenda is excellent. Still, the focus has been chiefly on climate and carbon reactions, and that the goals are much bigger than just climate. The first EU action plan focuses on the product life cycle through recycling and reusing products. In 2016, *Closing the loop: New circular economy package* states that they base the circular economy on “sharing, leasing, reuse, repair, refurbishment and recycling” (p.1). Then the aspects are each described within the report. That covers the reuse, repair, and recycling aspect of 5 R's. What is lacking is the use of refuse. While it can be implemented in implying that people are refusing to do a certain thing to be more circular, refuse is not explicitly mentioned in EU policies.

4.4 Current Times

Centre for Sustainable Development

Trondheim is home to the 5th UNECE Center, so they should have an advantage and support from the UN within their sustainability efforts. It is evident that the creation of this Charter Centre of Excellence has benefited the city and pushed new projects. The Centre for

Sustainable Development is working on the knowledge sharing on CE and the development of the SDG Clinic project. They also have a multi-media team that creates easy-to-read and understandable web pages and videos on sustainability topics. Their goal is to make the topics more approachable you can see their spark page on CE in appendix 2. Progress is slowly coming along, at least from a student's perspective who are generally positive on sustainability and CE topics.

One of my interviewees is involved with the Centre for Sustainable Development, mentioned that there is a manifesto in the works covering local, national, and international stakeholders for circular societies. They drew upon the need for this kind of document, noting that it needs to be practical before it gets too technical. This draws back to my point on the market for terms and concepts to be understandable. At the recent signing of new partnerships (April 14th, 2021), there was a focus on circularity and mobility to connect the businesses with the work at the Centre.

The Centre for Sustainable Development added partners such as IKEA and COWI, both large international companies. Other companies joined, some international and some more local such as Nordic Circular Hotspot. This partnership should help in guiding a CE focus at the local level. Before the signing, the Centre has various partners who were mainly local such as Ducky, a company that works with the carbon footprint. They also have the support of NTNU and a few UN organizations like U4SSC and UNECE. The signing of new partners shows that there has been growth in sustainability and concepts relating to CE. The Centre for sustainable development demonstrates a desire to become more sustainable and that their partners can be more successful in having a partnership with the Centre. The goal of the partnerships is to increase mobility and put sustainable actions into practice in Trondheim. While CE is not the Centre's specific goal, their actions correlate with CE concepts and are set in the right direction towards creating a more circular city focusing on SDG 11 (Sustainable Cities and Communities). With the Centre being reasonably new (October 2019), many projects are in the testing phase, and guidelines are being written. The projects align with the SDGs and the 2030 agenda. The Centre's actions fit with the 5 R's context by partnering with companies that promote sustainability efforts like reducing carbon (Ducky), reducing and recycling building materials (COWI), and others who have similar actions.

Other Initiatives

During my other interviews with people from outside the Centre for Sustainable Development, I learned about a few new projects. I was surprised at the number of projects related to CE despite the lack of national and local policy and framework. One initiative that fits directly into CE is the initiative “Week of reuse” campaign launched in 2020 that encouraged people to upcycle, reuse, fix it, and other ways to take value in what you already own. Fitting well within the 5 R’s aspects of reduce, reuse, and repair. Another initiative that was also mentioned during an interview was Trondheim’s Chamber of Commerce (Næringsforeningen). The Chamber has produced time plans for adapting circular strategies within its network of business. There is massive potential with their projects, and it will be great to look back and see what kind of progress has been made in a few years. The Chamber of Commerce is currently in the beginning stages of its CE plan, so I cannot provide much insight into its progress.

During my interviews with a city planning department, they mention Powerhouse Brattørkaia, an energy-positive building. The positive energy building reduces the amount of energy needed from other sources, which reduces the amount of carbon created since it fuels the electric busses. Again, this fits within the 5 R's by reducing the amount of new energy needed and recycling what is already made into useful energy. The interviewee also brought up the current construction of energy-positive apartments built in the city, in the Lade area. Trondheim is a fantastic place that has many different resources and opportunities for innovation. As we can see from the projects that are being worked on, it is clear that progress is coming. We cannot yet estimate the approximate amount of progress we will make until we have more frameworks to measure CE and set goals in different sectors.

4.5 Chapter Summary

In this analytical chapter, we covered my findings from my research. We see links between the 5 R's within all the mentioned projects and initiatives from the analysis. The use of the 5 R's demonstrates how the projects are linked within the circular economy and play a role within the CE theory of cradle-to-cradle. We learn that the SDG Clinic presented the construction business with how to become more circular, noting the aspects of the 5 R's, many of which are not currently being implemented due to various barriers. Next, the Bike Kitchen presents as a place where people can, directly and indirectly, contribute to a circular economy

by reducing the number of cars on the road, refusing to drive, repairing their bikes, and recycling what cannot be used. It is noted that Norway is following in the footsteps of the EU to implement various strategies that fall into the circular economy category, just some years behind. The chapter concludes with an analysis of the current and new projects, so there is not much that can link with the 5 R's until the projects are further along.

5 Social Aspects

In this analytical chapter, there will be an analysis of the social aspects of CE. First, the current social standing around CE both globally and in Trondheim will be analyzed. Next, the need for societal change will be discussed. The section will conclude with how change can be pushed at a social level. Throughout these sections, the 5 R's will be addressed, and they are essential because each of the five words is well known by people in the general public. The original 3 R's, reduce, reuse, and recycle, are very well known. Now is the time for people to become aware that it's more aspect. We need to repair and refuse to use things that are not sustainable to create a sustainable future.

5.1 Current Social Standing

There is a need for the general public to be involved in CE initiatives. The literature points to an evident lack of research in the social aspect of CE. The lack of literature could be because CE is a relatively newly recognized concept in Europe. It only really came into government policy and framework within the last six years. I would argue that if they have had enough time to research the Living lab presented in Finland, there would be the ability to test out the social aspect and needed behind CE. One of my interviewees mentioned a tv program on NRK 1 (Norway's national broadcaster) related to climate and sustainability issues. They noted that these topics are not new but having access to a tv program on a popular channel would make it easier to increase the social awareness of CE-related issues. While TV programs are a start, I would argue that more is needed. During another interview, someone who is part of the city planning department mentioned that there need to be more social initiatives via social media and in schools. The initiatives should start early, noting that it would be cool if kids came home and saw their parents throw something away and say something like, "no, mom, we can fix that." Having kids start with that kind of mindset at an early age could significantly impact a more sustainable generation. If kids know that there are 5 R's, they can help drive their parents to repair more and repair things themselves. By pushing the next generation to refuse to make decisions that are not circular, the path can be paved to start a more sustainable generation. There is a lack of knowledge about CE, but we can assume there is increased recognition with topics that are intertwined with CE.

One interviewee pointed out an increased awareness in the SDGs and climate with the increased media we have seen on Greta Thunberg and the climate strike Fridays. People are often aware of the pressing issues, but they might not know of the connection of CE. One interviewee points out that people are probably not aware of what SDG stands for or that there are 17 goals, but they know the general aspects of being climate-friendly, like sorting out waste. They noted that people know what to do when they want to be greener. Another person states that circular economy may be a buzzword, but it needs to be brought more down to earth. They bring up a good point that people know the basics of sustainability. Still, concepts like CE can become complicated if they are not brought down to an understandable level for the general public. The term needs to be approachable and relevant to our daily lives, stated an interviewee.

I was surprised and pleased at how much the social aspects were included in the interviews. I was surprised because the analyzed reports and many articles mentioned lacking formal literature on social factors. One author said CE's social aspects are referred to as virtually silent on a social dimension (Murray et al., 2017, p.376). The same point is made that there is a lack of research on concepts such as gender, social opportunity, intra-generation equity, and other ethical issues left out from the CE literature (Murray, Skene, et al., 2017, 377). The second point stands true, and there is a need for research on more specific social aspects. Future research on this can provide insightful information on how society can change for a more circular economy.

5.2 Sociatal Change

One of the main issues that come with introducing social aspects to things is that people are doing what they are doing. In other words, people are used to how things are and are often unwilling to change their ways or be temporarily uncomfortable. The city of Amsterdam presents its data in terms of how it relates to the people. I found it interesting that they were able to get the public quite involved in their CE efforts. While in Helsinki, their main focuses are within the industry and in the concept of sharing economy. Sharing economy does have more of a societal priority. According to The City of Helsinki's Roadmap for Circular and Sharing Economy, "existing resources can be used efficiently, which will reduce the need for new products and the consumption of resources" (2020, p. 18). The comment refers to a sharing economy, which in theory is lovely, but it also requires people and businesses to want

to share. Trondheim has a few things that would be considered part of a sharing economy, like *bilkollektivet* (<https://trondheim-bilkollektiv.no/>). The car-sharing service is an app where people can go and rent a car and pick it up in a close location, and the vehicle is shared by the owner and others who rent out the car when the owner is not using the car, like when they are at work for example.

Another challenge is the need for more shared spaces that was pointed out during my interview with Trondheim Sykkelkjøken, who mentioned how great it would be to have a shared space where different groups could use it for a few hours each week. Again, the issue is getting people on board to start sharing. We can conclude that mindset and getting people to change their ways are among the most challenging aspects of any social issue. If we can get mindset moving towards the direction of the 5 R's, making it something known by the general public, we can potentially see more CE efforts at multiple levels.

5.3 Knowledge Sharing

For there to be any societal change, there needs to be the sharing of knowledge. Sharing the knowledge that is easy to understand by the general public can often be a daunting task, as seen within the various definitions, CE can become very complex. In reality, CE can be explained as something that everyone can understand, like with the 5 R's for example. With the SDG Clinic, the idea behind its creation is to promote knowledge sharing with local businesses on how they can make choices and adapt to CE. From the clinic, we also learned what barriers come up from the business side. Sharing this kind of information creates a space for more conversations on what can be done on both sides—looking into what the businesses need in terms of the policy to change and changes they can make without policy. Knowledge sharing is also a large part of The Centre for Sustainable Development, which is partnering with various businesses to create efforts towards a sustainable future. The sharing of knowledge points directly at SDG 17 with the partnerships for the goals.

A lack of knowledge or being comfortable with the topic could also be why I did not get any responses from businesses or politicians. Having someone wanting to discuss a topic that someone might not be familiar with could be daunting. It shows a need for knowledge sharing on the subject of CE and its role within sustainability. The information must be put into

relevant terms since often time the definitions and descriptions of things get too complex, and it's not easily understood by someone who is outside the field of sustainability.

I would also point out that the knowledge of the SDGs seems to be spreading, at least within Trondheim. Everywhere you look, you can see examples, blocks with the SDGs on them, signs at stores with how they have adapted to the SDGs. One interviewee even mentioned the growing amount of SDG pins you can see on people who work in the municipality's jackets. There have also been sustainability-based TV programs on NRK, like previously mentioned. So, there is progress in terms of knowledge that is being shared, but more is needed in order to start making a difference and increasing the CE rate.

Some barriers come with knowledge sharing, similar to sharing economy. There is a need for businesses and people to learn to become better and more circular. There is a need for a platform of some kind where people can learn from others who have similar problems. Together we can make the world a better place, but only if we share what we are doing with others. Who knows, there might be businesses in Senegal that are struggling to adapt their products in the same way a company in Norway is struggling. They would work together to figure something out or see if the other has already come up with a solution that could be adapted for the other product. We live in a world where the touch of an app connects us on your phone, so we have the technology, it just needs to be done, and the connections need to be made.

5.4 Chapter Summary

This chapter presents the findings of my research that are the social aspect of CE. I wrote on the social aspect, but it is essential to note a lack of social literature on CE. The 5 R's in this section are linked implicitly and can be used as a tool to share relevant knowledge. Within the current social challenges section, it is presented that in Trondheim, there are factors like TV programs and SDG visuals all over the city. Following the availability of sources to share CE and related topics, we note a need for social change. People need to have the right mindset for sustainability for things like social media and tv programs to implement change. Knowledge sharing is one way that the city can overcome social barriers. By educating people, we can potentially change the mindset, especially if it is started at a young age, we can have a more circular future.

6 Summary of Findings and Conclusion

This chapter will consist of a summary of the findings and discussion. The results will be presented within how they fit within the contexts of the research questions. Using the 5 R's in my analysis allowed me to link my finds to CE. The 5 R's helped differentiate what would be relevant to my finding and helped guide me when answering my research questions. Through this section, there will be references to the 5 R's both directly and indirectly, which shows why using the 5 R's for my analysis was relevant to enforcing the relevance of circular economy.

6.1 Characteristics

Research question: What are the characteristics of Trondheim's Circular Economy?

There are no striking and impactful characteristics at the current state of Trondheim's circular economy, but I found a few things that stood out. I discovered that CE specific framework is missing at the commune level. The answer to this question would be different if it looked at the characteristics of sustainability efforts in Trondheim. The finding that there are no positive defining characterizes is further backed by the lack of response from politicians and businesses. Lack of response shows that there might be a lack of knowledge on CE, so people were not comfortable discussing CE.

I saw a negative characteristic pointing to a lack of recycling sorting options is compared to other municipalities. The need for change here is backed by one point about the EU's standards for dumping waste. There have been some positive aspects from this: the creation of use stores run by the department that handles waste. Waste recycling can change, but there is a need for citizens to want to sort their waste for this kind of change to be valid. Another negative characteristic is that it is difficult to find funding and space for projects.

While there are no strong characteristics at the city level when analyzing CE, I found that I found that there are projects being worked on. The things that are being started can create defining characteristics. Many of the projects have not made it into the public phases yet but will be coming. In a few years, I believe that the answer to this question could be very different. This question leaves room for future research that could be beneficial to see how

much the city has progressed. By implementing CE strategies and implementing more aspects of the 5 R's would allow for CE to become a solid characteristic in the city of Trondheim.

6.2 Why now?

Research question: Why is now the time for an increase in circular economy-related projects and initiatives?

The findings for this question are interesting. I found that Norway often follows the guidelines and initiatives that the EU starts. Norway following the EU was mentioned during all of my interviews, yet the only one directly said that Norway is behind their Nordic neighbors. It is important to note that Norway is not an EU member, but they do have close relations. I found no specific reason why the city has not created CE policy, yet as mentioned previously, there is a manifesto that is being made.

Recognition of the SDGs was something I found mixed results about, so there is no conclusion that can be made to see if the SDGs are a driving force, at least at a social level. It is safe to say that the government having a mandate (Agenda 2030) to reach for the SDGs has been a helping factor. We can also point out that Trondheim was appointed the UNECE Centre of Excellence on SDG City Transitions in 2019. The recognition and partnership with the UN should help push the city to more sustainable actions. While the Centre for Sustainable Development does help develop sustainable options, there is currently no published initiatives with a direct focus on CE, except in student-run projects like the SDG Clinic, their published multi-media projects (appendix 2), and the circular economy manifest that is being developed with support from the Centre.

We can argue that now is the time because it should have happened sooner. Trondheim needs to catch up to our Nordic neighbors and other EU cities. Trondheim has the resources to put in place a CE framework. Resources such as a university, research facilities, and innovation hubs are available for the needed support to make CE efforts successful. We can conclude that now is the time to push for CE-related projects because Norway and the city of Trondheim are behind. Many of Norway's neighbors and the EU began their efforts six years ago in 2015. The push could also be brought to Sveinung Rotevatn's (Minister of Climate and Environment) speech, where he pointed out the need for change, at the 4th Norwegian Circular Economy Conference in 2020. Rotevatn even pointed to the specific industries that

need the most improvement, construction and real estate, retail, agriculture, forestry, aquaculture and fisheries, and the process industry (2020. Para 11). Rotevatn also pointed out that there are more questions to be answered a listed six questions for businesses to use to become more circular, see appendix 3. The posed questions could be the start of a roadmap for the country, which could trickle down to creating city-level roadmaps. Another point that it was the 4th circular economy conference. Why has there not been a change that has been brought up from the previous three CE conferences? According to SINTEF, the research institute, the first conference was on “what is a circular economy” in 2017. The second looked at potential value creation, and the third looked at tools for overcoming a Norwegian transition to a circular economy (sintef, 2019, n.p). While these conferences started in 2017, CE has taken four years to become a buzzword or hot topic in Norwegian efforts. Now Trondheim needs to pick up the pace and use its recourses to improve the circular economy.

6.3 Needs for Progress

Research question: What is needed for circular economy-related efforts to be successful in Trondheim?

There are many answers to this question, and the first is the need for a framework. As demonstrated in Amsterdam and Helsinki, they have created and updated comprehensive frameworks and policies on CE. Trondheim could be the city that sets the example for the rest of Norway by presenting a CE action plan. There could also be a push from the national government if they also implement the CE framework. If the national government would start CE-focused initiatives, then often cities follow in their footsteps. The national government has begun some CE-related policies, such as banning single-use plastics, in July of 2021. The banning of single-use helps create less waste and demonstrates cradle-to-cradle theory. Sustainability efforts are on the rise and often coincide with CE, so there is positive change happening, just lack of recognition in labeling it to CE or improving the countries circularity.

Recycling is another point that came up thought all my research that needs improvements. It was mentioned by everyone in each of my interviews and was found as a tactic used through a variety of CE policies and frameworks. The popularity of the word recycle could be why it is used thought the CE literature, and it is something that is understood by the general public. It was no surprise when recycling came up within my interviews several times. Recycle was mentioned within the contexts of EU waste regulations and within local recycling policies. I was surprised to find that the Trondheim Kommune has four bins to sort their waste, three

outside plastics, trash, and paper, with the 4th bin usually located in the basement for hazardous waste. I have lived in neighboring Stjørdal Kommune, and we had five different ways to sort our waste and recyclables. Recycling is something that everyone knows how to do, people realize the importance of shorting out waste from recyclables, but it is in the cities hands as to what can be recycled. One of my most significant surprises was that the Trondheim Kommune does not have a food waste bin. It was interesting to see that different communes have such differences in sorting out waste and recyclables.

Social understanding needs to be broader than just the previously mentioned loop. There is a need to share how to be more circular and how easy things can be without too much change. People do not want to make changes that impact their daily lives. CE does not have to make a considerable change. The public needs to know that little things can make a difference, like small steps with the 5 Rs- for example, awareness of the cradle-to-cradle concept of products having a circular life. Social media could promote projects like the bike kitchen that promote the repairing of your bike, which reduces the number of new bikes being brought. Then the more people who have a working bike means the reduction of people who are driving. There are a large number of things that could be used to push the social efforts of CE; they need to be put into action.

6.4 Timeline

Research Question: What is the present timeline for circularity projects, framework and policy in Trondheim?

As I expected, each interviewee presented a different timeline when asked the question, “What kind of timeline do you believe is respectable to see an increase in the CE rate in Trondheim? “. Two of the interviews stated that it was a tricky question and point to the idea that it would depend on how fast policy can change. Another person said they have no specific answer but thinks that they will look back in five years and see a change in business on Olav Tryggvasons Gate, one of the main streets in Trondheim. The final person points to three years as an expected period to see change and adaptations for a better CE, noting that policy and framework are being created and scheduled to be posted in the next few months to a year.

This question has no solid answer, and there is potential for a lot of change in the next few years with a variety of projects and initiatives that are upcoming or recently started. This question could have benefited from the input from business and politics, who could have provided a different perspective to compare CE with other kinds of sustainability efforts that have previously been a push for and adapted. Without that information, I can only base my findings on what was learned from my interviews and case studies: they are hopeful to see the change in the next 3-5 years and see a new and improved Trondheim.

This question leaves room for future research. Someone could look at the differences and improvements that have been made in the next 3-5 years. Looking at how CE initiatives got started and how much progress has been made since the creation of the manifesto that is coming, and the results from the efforts by the Chamber of Commerce. Who knows, there might even be more significant projects in the works.

6.5 Concluding Remarks

From this research, we can conclude that there is progress on the horizon for Trondheim's circular economy. It is safe to say that Trondheim maybe is behind other cities such as Amsterdam or Helsinki. While they are behind, the city can take this time to catch up and improve upon what CE methods and frameworks have already been tested in other cities. Another step is getting the public more involved and increase the social side of CE efforts. We can see that the characteristic of Trondheim's circular economy is that there is a lacking policy and framework. Still, projects are being started, and a manifesto is in the works. The slowing booming CE shows that now is the time for CE to increase because the city is six years behind compared to other EU countries. Many EU countries have already set up frameworks and policies that fall within the lines of the 5 R's, such as recycling policy, efforts to push repairing, and various measures on reducing carbon emissions.

There is a clear need for an increase in social efforts to get the general public on board in different initiatives to see a change in CE. Social aspects add to the need for framework and policy. Social media or TV programs that promote CE-related efforts can kick off a change and encourage people to change their ways. We cannot conclude how much of an impact social media or tv programs could have because people are human and cannot 100% predict human behavior. For my last point, since we cannot predict human behavior, we do not have a

solid answer for when there will be an increase in CE in the city of Trondheim. We know that change is on the way and being worked on, yet we cannot say how much or even have a standard to reach a goal because a goal has yet to be set. Before we see change and improvement in the circular economy in the city of Trondheim, we need the right kind of policy and framework.

Appendixes

Appendix 1. Interview Guide

1. Introduce yourself and your relevant job or volunteer experience that relate to the topic of sustainability.
2. Have you heard of the term, circular economy? If so, can you tell me your definition of it?
3. Why do you believe that now is the time this “circular shift” has started?
4. The circular economy of Norway is currently at only 2.4% and according to the Circular Gap Report Norway, Norway can reach a circular Economy of 45.8%, what role do you believe Trondheim could play in possibly reaching this prediction?
5. What do you think are the characteristics of Trondheim’s circular economy in the present?
 - a. How about changes in characteristics in the future?
6. What kind of timeline do you believe is respectable to see an increase in the CE rate in Trondheim? (2 part)
 - a. Barrier that can slow
 - b. What needs to happen for the
7. If any, what has your role been in projects that relate to circular economy?
8. Do you have any current circular economy projects that are in the works in Trondheim that you would like to mention? Or final comment on CE

Appendix 2. Circular Economy Multi-media

<https://spark.adobe.com/page/AtSgsNTr76B90/>

Appendix 3. Rotevatn Questions for business

From his speech at the 4th Norwegian Circular Economy Conference:

- How are the products designed?
- Are they easy to reuse?
- Is it easy to utilize the waste as a secondary raw material?
- What can we use the by-products from industry for?
- How can we strengthen the markets for secondary goods and raw materials?
- Can we replace products with services, not to mention digital services?

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